UNESCO Open Science framework for sharing data in times of crisis

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Abstract

This science-policy brief presents work of the UNESCO and ISC CODATA Working Group on Data Policy for Times of Crisis Facilitated by Open Science (DPTC). Key policy considerations on data in crises situations are addressed:

- the strong open science framework presented by UNESCO's Recommendation on Open Science (2021);
- the need for effectively communicating the challenges and complexities of collecting, analysing, and sharing data among scientists, policymakers, and affected communities; and
- the opportunity presented by robust data policy facilitated by open science for improving the science-policy-society interfaces and building public trust in science and policy when confronted by times of crises.

Crises, including disasters and health emergencies on a large scale, exact a heavy toll on the safety and well-being of persons, communities, and countries. Over recent years, evidence indicates that the impact of crises on persons and assets in all countries has increased faster than vulnerability has decreased.[1]

This science-policy brief presents innovative and urgently needed solutions for better science-policy-society interfaces addressing crises in the context of the SDGs, particularly directed to delivering reliable, sustainable, and resilient impacts on the SDGs: SDG 1, SDG 2, SDG 13, SDG 16, and SDG 17. The brief is developed in the framework of the UN STI 2024 Forum. It emphasizes the need to reform science within open science systems that are adapted to the needs for the uses of data in crisis situations. As the Covid-19 pandemic and subsequent natural disasters and geopolitical conflicts have revealed, deficiencies in the capacity of science to integrate data readily and efficiently into crisis preparation, response, and recovery policy and actions significantly limits the capacity of scientists and policymakers to have full information.

Open science contributes to new governance models around data, insisting on the need to re-balance human dignity with economic benefits as well as ensuring fundamental human rights are maintained even in crises. Policy, methods, and tools need to be facilitated by open science if we are to achieve fair data, transparent algorithms, and trustworthy digital architectures.

> In the perspective of developing a collective intelligence for problem solving, including through the use of transdisciplinary research methods, open science provides the basis for citizen and community involvement in the generation of knowledge and for an enhanced dialogue between scientists, policymakers and practitioners, entrepreneurs and community members, giving all stakeholders a voice in developing research that is compatible with their concerns, needs and aspirations.[2]

Within the context of policy, there is a clear need to adopt systematic approaches that dynamically respond to disruptive environments presented by crises. Policy is critical because it sets out the specific goals to be achieved in preparing for and responding to crises,

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[1] See Marzi, S., Mysiak, J., Essenfelder, A.H., Pal, J.S., Vernaccini, L., Mistry, M.N., Alfieri, L., Poljansek, K., Marin-Ferrer, M., & Vousdoukas, M.I. (2021). DOI: https://doi.org/10.1016/j.gloenvcha.2021.102393. See also Groeschl, J., Noy, I. Poverty, Inequality, and Disasters – An

Introduction to the Special Issue. *EconDisCliCha* 4, 1–3 (2020). https://doi.org/10.1007/s41885-020-00063-2.

[2] UNESCO's Recommendation on Open Science 2021. Pages 13-14.

while also establishing the framework of the response. Thus, policy in times of crisis establishes the overall objectives that should be shared by scientists, policymakers, and citizens, while also shaping the actions needing to be taken and how those actions are carried out, conducted. In short, data policies provide a governance framework for why and how data is managed within data science as well as for the use of data science. In doing so, they establish the roles and responsibilities of the different parties, contributing to crisis management that acknowledges the challenges associated with large scale and complex systemic interdependencies that involve a multitude of disciplines and sectors and often are transnational.

The work of the UNESCO-CODATA DPTC focuses on developing tools that foster a science-policy-society dialogue firmly rooted in the frameworks of the Cape Town Global Action Plan for Sustainable Development Data, The Hangzhou Declaration: Heralding the next era of human development, the Dubai Declaration: Supporting the Implementation of the Cape Town Global Action Plan for Sustainable Development Data, the Global data community's response to Covid-19: Data for a changing world, the Bern Data Compact for the Decade of Action on the Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction, the WHO International Health Regulations, the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts (WIM), the Santiago Network, WorldFAIR Project, and the ISC Protecting Science in Times of Crisis.

Background and Context

Under the World Health Organization (WHO)'s International Health Regulations (2005), each UN member state's ministry of health has reported data to WHO on COVID-19, where available, following the declaration of a Public Health Emergency of International Concern (PHEIC) in January 2020 by WHO. As a result, the WHO created a frequently updated COVID-19 dashboard of data on the number of cases, deaths, and vaccinations. UNESCO has linked this to The right to information in times of crisis: access to information – saving lives, building trust, bringing hope! (2020), Access to Information in Times of Crisis (updated in 2022), and the Global Framework for Open Science in the Face of Pandemics (September 2022).

The UNESCO-CODATA Working Group investigated recent pandemics/epidemics (such as COVID-19, Ebola, and MERS), natural hazards (such as droughts in Europe, Africa, China, USA; floods in Europe, USA, Pakistan, and Bangladesh; earthquakes in Türkiye, Syria, Papua New Guinea, Peru, Japan), and geopolitical conflicts (such as Ukraine, Israel-Palestine, Afghanistan, Syria, Yemen, Burkina Faso, Haiti). Its findings point to the need for increased data comprehensiveness, integrity, and transparency alongside better governance for the use of AI and more robust ethics and scientific frameworks supporting data and AI policies, methods, and tools for addressing crisis situations.

These crises repeatedly demonstrate why the scientific community needs to be expeditious in data collection and processing so that robust and trustworthy evidence-based frameworks can be developed to detect and respond to the crises quickly, with alacrity, and with confidence. The speed with which scientists can define objectives, implement data management plans, and curate and share reliable data is crucial to the success of the response. New developments in science and technology brought a range of actors to crises management who provide, process, curate and/or use data during crises. Private companies, academic institutions, global online volunteer networks, local and regional authorities and even citizens (via social media platforms). Therefore, a data policy for crises should take into account all these players and their range of impact on data flow into consideration.[3]

Values and principles

For the purposes of aligning the role of data policy in time of crisis with the UNESCO *Recommendation on Open Science*, data policies are here defined as "a set of guidelines or rules for data collection, analyses, and use that determine the course of action vis-à-vis the crisis situation and in the context of well-defined objectives."

Data policies should provide interoperable, high-quality data, and easy to communicate information for crisis management. The preparation and response to crises relies on having reliable data and actionable information. This can only come about if we have an underlying systematic approach to how data is collected, shared, and managed such that it enables flows of information to support the decision-making process in a networked manner.

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[3] See Clark, N., & Albris, K. (2020). In the Interest(s) of Many: Governing Data in Crises. *Politics and Governance*, 8(4), 421-431. DOI: https://doi.org/10.17645/pag.v8i4.3110

Within UNESCO's open science framework, this requires data to be employed within a context of values. The figure below is drawn from UNESCO's Recommendation on Open Science and presents a summary of open science values and principles on which data policies, methods, and tools for crises needs to build:

Figure 1.
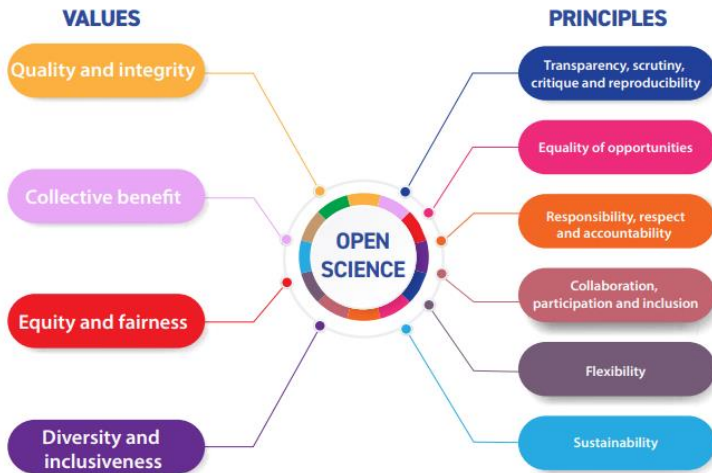
Overall, data policy in times of crisis is required to support the collection and use of data in a responsible, ethical, and effective manner, while also promoting human rights, robust and reliable science, and ethics.

Key Messages

The UN system in partnership with its member states is of vital importance for the development of data open science frameworks for crisis, as identified in UN Landmark Contributions, such as the Sendai Framework for Disaster Risk Reduction 2015-2030, the Bern Data Compact for the Decade of Action on the Sustainable Development Goals (SDGs), the WHO International Health Regulations, the UNFCCC Paris Agreement on Climate Change, the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM), and the UNFCCC Santiago Network.

The further integration of data policy, methods, and tools facilitated by open science into these UN Landmark Agreements will contribute significantly to mitigating crisis situations by providing real-time insights, predictive analytics, and decision support tools that inform evidence-based decision-making, guide policy development, and enhance the effectiveness of crisis management efforts in line with the UNESCO's Recommendation on Open Science.

Effective data collection, analysis, and sharing alongside contribute importantly to the role of statistics in the UN responses to crises. Data alongside reliable AI

technologies enable the collection, aggregation, and analysis of vast amounts of real-time data from various sources, including sensors, satellites, social media, and government databases. By harnessing these data streams, statistical models can be used to identify trends, detect anomalies, and monitor changes in the environment or social dynamics during a crisis. The incorporation of AI algorithms can assist in analyzing historical data and patterns to generate predictive models that forecast the potential trajectory of a crisis, such as the spread of a disease outbreak or the impact of a natural disaster. By leveraging statistical techniques within AI models, policymakers can anticipate future scenarios, assess risks, and allocate resources proactively to mitigate potential impacts.

AI-powered decision support systems facilitated by open science can also provide policymakers with actionable insights and recommendations based on statistical analysis of complex datasets. These systems can help prioritize response efforts, optimize resource allocation, and evaluate the potential outcomes of different policy options, enabling informed decision-making in rapidly evolving crisis situations. This can be further extended to the statistical analysis of historical data, coupled with AI-driven risk assessment tools, that can enable policymakers to identify vulnerable populations, assess the likelihood and severity of potential hazards, and develop targeted risk mitigation strategies. By quantifying risks and uncertainties, policymakers can prioritize interventions, allocate resources efficiently, and strengthen resilience to future crises.

The UNESCO-CODATA Working Group finds that data and reliable AI technologies with a strong ethical base grounded in the principles of the UNESCO Recommendation on the Ethics of Artificial Intelligence (2022) have the potential to facilitate the continual monitoring and evaluation of crisis management efforts, enabling policymakers to assess the effectiveness of interventions, track key performance indicators, and identify areas for improvement. Statistical analysis of performance metrics and outcomes allows policymakers to iterate and refine strategies in real-time, enhancing the overall effectiveness of crisis response and recovery efforts.

Policy recommendations

This science-policy brief advocates for

- the adoption and implementation of open science principles and tools in crisis prevention, preparedness, response and recovery;

- the need for capacity development and investment in data infrastructure and technologies to support crisis management efforts has been identified; and
- for collaboration and knowledge sharing among scientists, policymakers, and affected communities.

In this context, this brief recommends the development of guidances for scientists and policymakers (supported by factsheets, and checklists) for data policy facilitated by open science for times of crises.

These guidances and their supporting factsheets and checklists will contribute to the [UNESCO Open Science Toolkit](#).

These outcomes incorporate innovative approaches to the use of data in open science policy contributing concrete recommendations that maximise the value of data for better decision making in disasters and other emergency situations. By means of the UNESCO Open Science framework, the UNESCO-CODATA working group advances data science for scientists and policymakers with improved data communication, helping to ensure data reliability for policy and avoid disinformation in media.

This science-policy brief is also preparatory for eventual contributions to the High-level Political Forum (HLPF) on 18-17 July having particular relevant to the HLPF 2024 theme: 'Reinforcing the 2030 Agenda and eradicating poverty in times of multiple crises: the effective delivery of sustainable, resilient and innovative solutions'. It helps prepare contributions to the UN Summit of the Future on 22-23 September 2024 regarding the development of the 'Pact for the Future' and its foreseen action-oriented in the 'how' of cooperation towards better preparation for the world and the international system to manage current and future challenges for the sake of all humanity and future generations. The UNESCO-CODATA Working Group plans to contribute its conclusions to the UN World Data Forum 2024 in Medellín, Colombia, on 11-14 November 2024.

Acknowledgments