



WG 20: Open Science

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unesco

United Nations
Educational, Scientific
and Cultural Organization

UNESCO Recommendation on Open Science

In 2021, 194 countries adopted the UNESCO Recommendation on Open Science, the first global framework of its kind. Since then, UNESCO has been putting this international roadmap into action to bridge scientific knowledge and technology gaps worldwide. This ongoing effort promotes transparency, collaboration, and accessibility, through open science to accelerate scientific progress and ensure that knowledge benefits everyone.

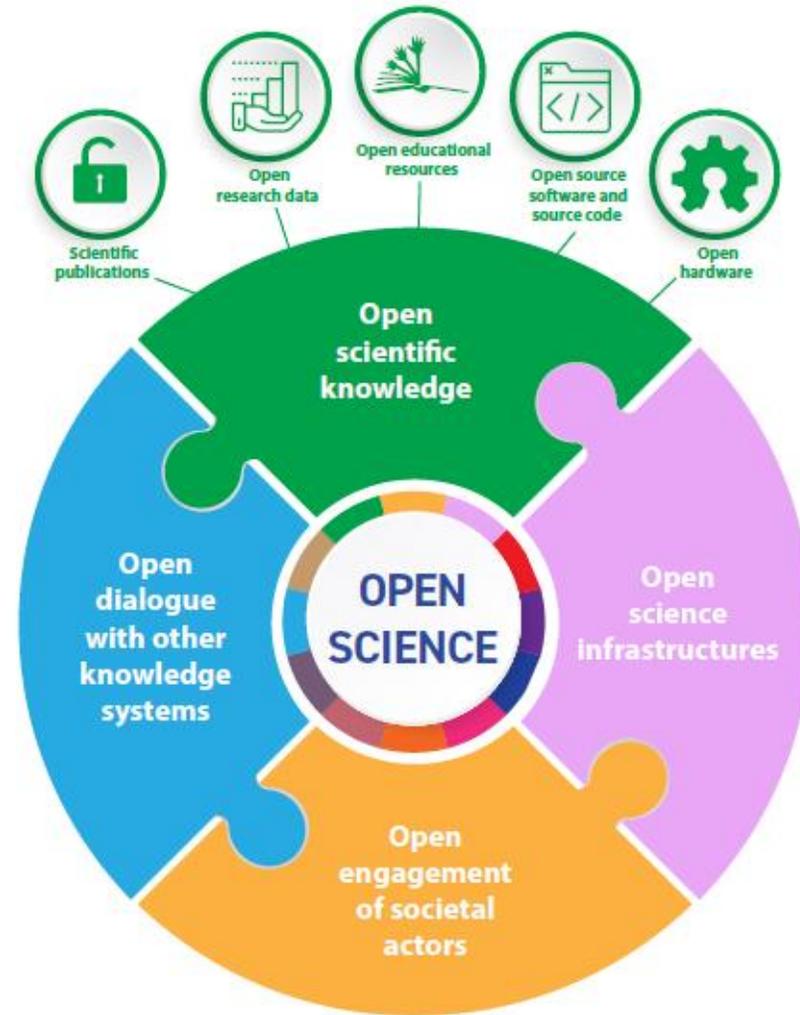
WG20 – Working Group on Open Science

- Make a recommendation for a strategy to foster a culture of open science and aligning incentives for open science across all disciplines of physics—in particular, lay out the requirements to be put in place, with regards to open science, for IUPAP sponsored and endorsed conferences.
- Closely follow the implementation of the UNESCO Recommendation on Open Science and take part in relevant UNESCO Open Science Working Groups to advocate the interest of physics.
- Survey open science practices in physics and share the findings with the IUPAP commissions.
- Establish a resource for physics of open science infrastructures, tools, and techniques. Organize a big event on Open Science in the framework of IYBSSD, possibly in Honduras (June 2023).

- **Alex Hansen (Chair)**, Department of Physics, Norwegian University of Science and Technology. Professor of Theoretical Physics and Director of PoreLab. Dr. Hansen's research interest lay in the intersection between fluid dynamics and statistical mechanics. He currently holds an ERC Advanced Grant (AGIPORE) focused on constructing a statistical mechanics formulation of immiscible two-phase flow in porous media.
- **Xavier Bertou**, Irene Joliot-Curie Laboratoire de Physique des 2 Infinis, Orsay. Head of the Direct Dark Matter research team at the Astrophysics, Astroparticle physics and Cosmology Department of IJCLab. Current main scientific project: search for dark matter within the DAMIC-M experiment.
- **Chaomei Chen**, College of Computing and Informatics, Drexel University. Professor of Information Science. Dr. Chen's research interests include information visualization, visual analytics, scientific discovery theories, mapping scientific frontiers, quantitative studies of science, and digital libraries. His teaching interests include information visualization, visual analytics, human-computer interaction, programming, and other related topics.
- **Sean Hill**, Department of Physiology, University of Toronto. Dr. Hill is an American neuroscientist, Professor at the University of Toronto Faculty of Medicine, and inaugural Scientific Director of the Krembil Centre for Neuroinformatics in Toronto, Canada. He is co-Director of the Blue Brain Project at the École Polytechnique Fédérale de Lausanne located on the Campus Biotech in Geneva, Switzerland. He is known for the development of large-scale computational models of brain circuitry and neuroinformatics.
- **Sauro Succi**, Center for Life Nano & Neuro Science at Istituto Italiano di Tecnologia, Rome. Senior Research Executive and Research Affiliate at Harvard University's Institute for Applied Computational Science. Dr. Succi's research focuses on computational physics, particularly lattice Boltzmann methods for fluid dynamics, soft matter, and complex systems. He is a pioneer in mesoscopic modeling of fluids and materials and the author of several influential monographs.
- **Reina Coromoto Camacho Toro**, Laboratoire de Physique Nucléaire et de Hautes Énergies (LPNHE), French National Center for Scientific Research (CNRS), Paris. Experimental particle physicist and member of the ATLAS collaboration at the Large Hadron Collider. Dr. Camacho Toro earned her PhD in Physics from Université Blaise Pascal, Clermont-Ferrand, France in 2012, after undergraduate studies at Universidad de Los Andes, Venezuela. Her work spans data analysis, silicon detector R&D, trigger systems (e.g. gFEX), and educational/capacity-building programs for Latin-America. She is co-coordinator of the LA-CoNGA Physics project, promoting virtual European-Latin American collaboration and open science.
- **Cyrus Pan Walther**, TU Dortmund University. He a Past-President of the International Association of Physics Students (IAPS). Walther is also an elected member of the Executive Committee of CODATA (International Science Council), and Vice-Chair for Physics & Industry in IUPAP. His work focuses on promoting the voice, engagement, and resources for young physicists globally, particularly in areas of data science, astroparticle physics, sustainability, and AI/ML uncertainty predictions. He is a Fellow of the International Science Council.



- Scientific publications
- Research data
- Educational resources
- Software and source code
- Hardware



WG20: Place the UNESCO recommendations in a physics context

Scientific Publication: Open access

Revolution in scientific publishing

As big as the Gutenberg revolution in the 15th century.

Traditional subscription-based publishing

Business model that was made for publication on paper.

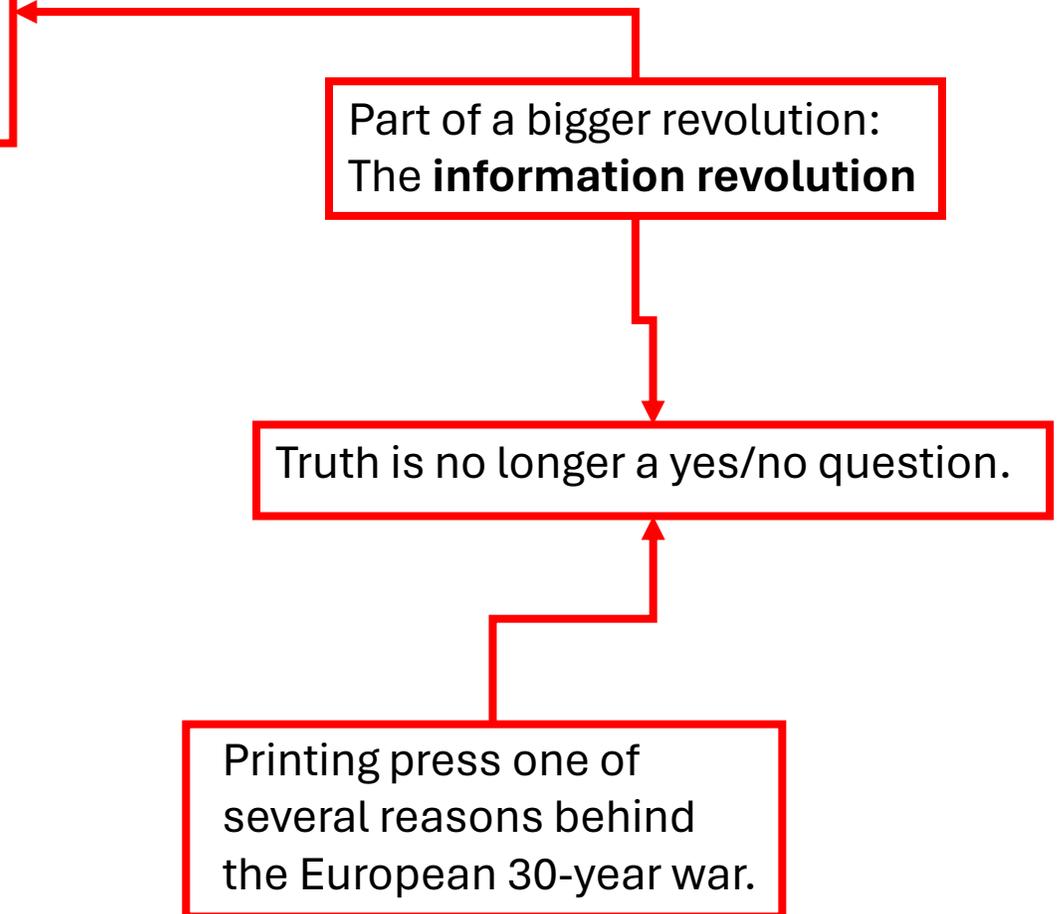
Not compatible with on-line publishing.

Giving the ownership of scientific work to the publisher in perpetuity.

Part of a bigger revolution:
The **information revolution**

Truth is no longer a yes/no question.

Printing press one of several reasons behind the European 30-year war.



Scientific Publication: Open access

Revolution in scientific publishing

As big as the Gutenberg revolution in the 15th century.

Traditional subscription-based publishing

How scientific publishing became big business.

Giving the ownership of scientific work to the publisher in perpetuity.

The Guardian:

June 27, 2017

Is the staggeringly profitable business of scientific publishing bad for science?

Scientific Publication: Open access

The scientific publication revolution:



Single cell organisms to multiple cell organisms.

No rules: All sorts of creatures developed.

Darwinian selection starts, only the well adapted survive.

Scientific publishing: Same revolution.

Predatory journals.

They will disappear.

New business model:

Gold open access: Shifting the cost of publication from reader to author.

Scientific Publication: Open access

Gold open access

Shifting the cost of publication from reader to author.

Publishing is part of the expense in doing science.

Trend: National agreements between publishers and libraries.

Problem: What about poor nations? How do they get to publish under this paradigm?

My solution: All publishers are mandated to create a publication fund.

Scientific Publication: Open access

Small journals with limited resources.

Typically based within a university department.

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Published: 2025-01-09

Articles

The Effect of Exchange Rate Fluctuations on Egyptian International Business Transactions: An Empirical Analysis

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Scientific Publication: Open access

Universitets- og høskolerådet

Rapport fra arbeidsgruppen, 14.06.2021

Arbeidsgruppen for felles publiseringstjeneste i UH-sektoren har utredet mulige alternativer til dagens institusjonsbaserte, desentraliserte publiseringsløsninger for vitenskapelige publikasjoner. Rapporten tar for seg utfordringer med dagens organisering, skisserer noen alternativer basert på lignende tjenester i landene rundt oss og diskuterer fordeler og ulemper ved forskjellige organiseringer og tekniske løsninger. Utvalget anbefaler at det opprettes en nasjonal publiseringstjeneste for fagfellevurderte publikasjoner basert på prinsipper om åpen lesetilgang og kostnadsfri publisering for forfattere. Løsningen skal være basert på eksisterende teknisk infrastruktur, eies av institusjonene og finansieres og oppbemannes basert på eksisterende kompetanse ved institusjonene, men med enkelte tjenester samlet på ett sted.

Forfattere

Gitte Kolstrup, Per Pippin Aspaas, Alex Hansen, Ole-Jørgen Haugen, Henrik Karlstrøm, Vidar Røeggen

Siter som:

Kolstrup, G., P. P. Aspaas, A. Hansen, O. J. Haugen, H. Karlstrøm og V. Røeggen (2021) Felles publiseringstjeneste i UH-sektoren. Rapport fra arbeidsgruppe utnevnt av UHR-Bibliotek. Universitets- og Høgskolerådet.

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UHR Universitets- og høskolerådet

Felles publiseringstjeneste i UH-sektoren

Rapport fra arbeidsgruppe utnevnt av UHR-Bibliotek

Juni 2021

The group recommends the creation of a national publication service for reviewed publications based on principles of open access and free publication for authors.

Research Data: Preservation and Open Access

www.nature.com/scientificdata

SCIENTIFIC DATA

OPEN

SUBJECT CATEGORIES

» Research data
» Publication
characteristics

Comment: The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson *et al.*[#]

Received: 10 December 2015

Accepted: 12 February 2016

Published: 15 March 2016

There is an urgent need to improve the infrastructure supporting the reuse of scholarly data. A diverse set of stakeholders—representing academia, industry, funding agencies, and scholarly publishers—have come together to design and jointly endorse a concise and measurable set of principles that we refer to as the FAIR Data Principles. The intent is that these may act as a guideline for those wishing to enhance the reusability of their data holdings. Distinct from peer initiatives that focus on the human scholar, the FAIR Principles put specific emphasis on enhancing the ability of machines to automatically find and use the data, in addition to supporting its reuse by individuals. This Comment is the first formal publication of the FAIR Principles, and includes the rationale behind them, and some exemplar implementations in the community.

Research Data: Preservation and Open Access

Findable

Accessible

Interoperable

Reusable

FAIR

Research Data: Preservation and Open Access

Sean Hill:

- 100 data sets generated
- 80 data sets are lost
- 20 data sets are made available
- 4 data sets are reused
- 2 data sets are fully FAIR compatible
- 1 data set is shared and cited.

Research Data: Preservation and Open Access

Introducing the FAIR² Open Specification

✓ FAIR

✦ AI-Ready

🛡 Responsible AI & Verifiable

🔗 Context-Rich

FAIR² (pronounced FAIR squared) formalizes the FAIR data principles into a verifiable, machine-actionable framework for AI-ready, responsibly governed data. It provides a context-rich structure linking methods, provenance, contributors, and governance in a form readable by both humans and machines —ensuring rigor, transparency, and reproducibility.

Built on open web standards and compatible with MLCommons Croissant, FAIR² integrates seamlessly with TensorFlow, JAX, PyTorch, Kaggle, and Hugging Face, enabling trusted, reusable, and interoperable data across disciplines.

Now online! The first public release of the FAIR² Open Specification — with thanks to all pilot participants for their contributions and insights.

Research Data: Preservation and Open Access

What is the FAIR² Specification?

The FAIR² Specification extends the FAIR principles by adding critical elements for modern science: **context-rich metadata, Responsible AI alignment, and AI-readiness**. It provides a structured framework for ensuring datasets are discoverable, reproducible, and ethically aligned. FAIR² bridges the gap between open science and emerging technologies by equipping datasets with the transparency and interoperability required for Responsible AI and advanced workflows.

New type of publication (Senscience): AI-written data article describing and containing the data making them FAIR-compatible.

Research Data: Preservation and Open Access

 Frontiers in Ocean Sustainability Views 26K Downloads 87 Citations 0



Marine Biodiversity and Environmental Data: An AI-Ready, Open Dataset from the long term (1995–2023) Basque Country Monitoring Network

Ángel Borja, Idoia Adarraga, Juan Bald, M^a. Jesús Belzunce-Segarra, Igor Cruz, Javier Franco, Joxe Mikel Garmendia, Joana Larreta, Aitor Laza-Martínez, Alberto Manzanos, Mikel Aitor Marquiegui, Inma Martín, Julian Martínez, Iratxe Menchaca, Sarai Pouso, Marta Revilla, José Germán Rodríguez, José María Ruiz, Yolanda Sagarmínaga, Oihana Solaun, Ainhize Uriarte, Izaskun Zorita, Iñigo Muxika

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[Abstract](#) [Data Explorer](#) [Data Package](#) [Funding](#) [Certification](#) [Methods](#) [Data Dictionary](#) [Contributors](#)

Keywords:
Environmental Monitoring, Estuarine Waters, Coastal Waters, sediment, water, phytoplankton, macroalgae, macroinvertebrates, fish, Bay of Biscay

Abstract

This dataset provides 28 years of environmental monitoring data (1995–2023) from 51 stations in the estuaries and coastal areas of the Basque Country in the Bay of Biscay. Covering 130 variables across water, sediments, and biota, it includes detailed records of phytoplankton, macroalgae, macroinvertebrates, and fish. Compiled in collaboration with the Basque Water Agency (URA), the dataset supports analysis of environmental responses to human pressures and management interventions, identifying patterns of environmental quality improvement within a context of natural variability. Provided in a FAIR² Data Package, the dataset is structured to ensure Findability, Accessibility, Interoperability, Reusability, and Artificial Intelligence-readiness, facilitated by structured metadata and Application Programming Interface access. This resource is intended for researchers and policymakers examining anthropogenic and natural influences on aquatic ecosystems, contributing to sustainable management, conservation practices, and alignment with European directives, including the Water Framework Directive.

<https://sen.science/doi/10.71728/r1rj-f947/dashboard>

IUPAP: **Cyrus Walther** member of ExCom.





CODATA's vision is of a world in which science is empowered to address universal challenges through the transparent, trustworthy and equitable use of data and information.

CODATA's mission is to connect data and people to advance science and improve our world.



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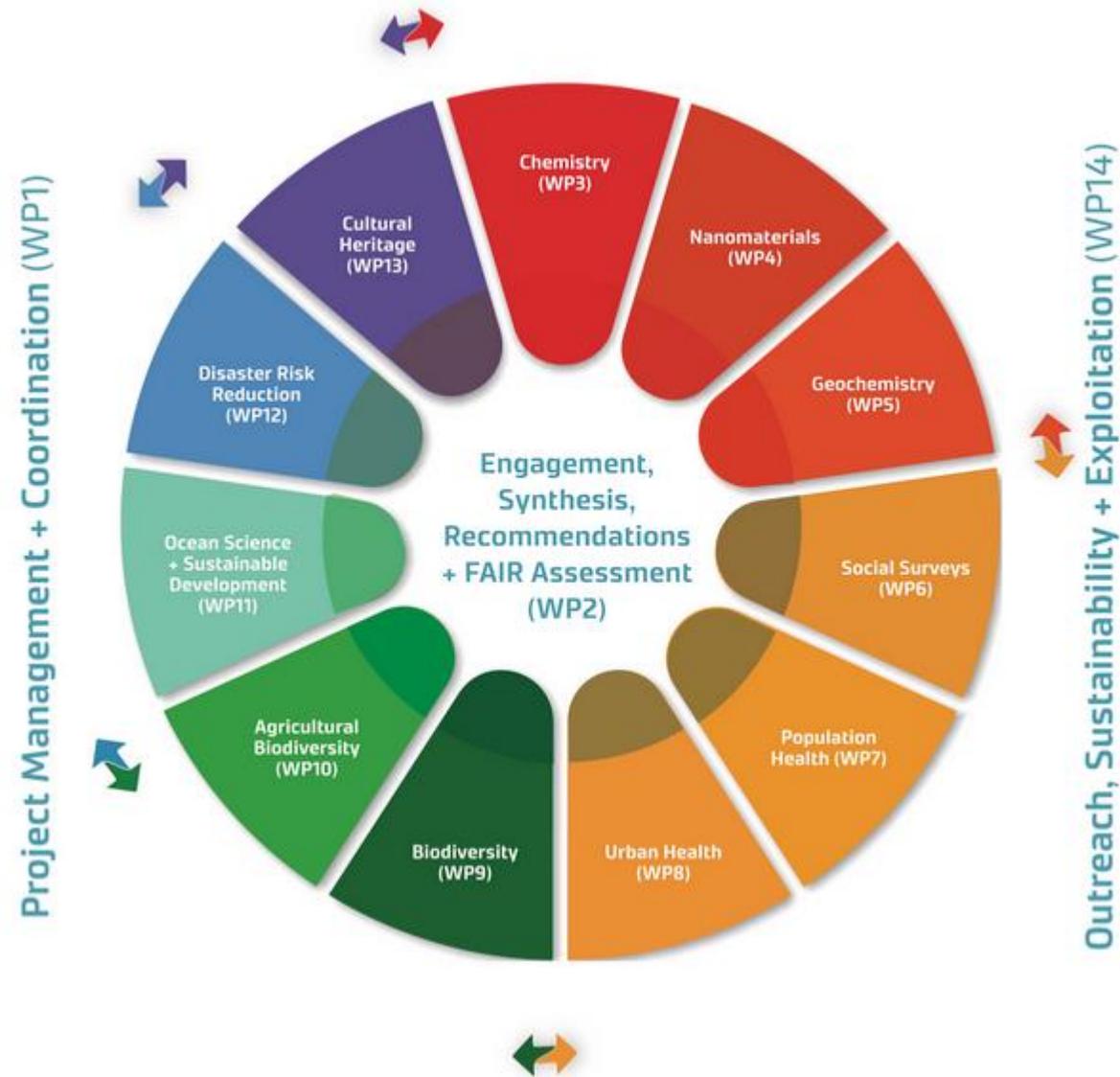
CODATA's mission is to connect data and people to advance science and improve our world.



- 1. Making data work for cross-domain grand challenges:** CODATA is leading a ground-breaking initiative, called WorldFAIR+, to provide practical guidance and technical recommendations to ensure that the data needed for interdisciplinary research is FAIR.
- 2. Promoting data policy:** CODATA encourages the adoption of principles, policies and practices for FAIR data and trustworthy, equitable and transparent science.
- 3. Putting data science and AI in service of science:** CODATA develops good practices and guidelines for the science of data, particularly to enable transparency and reproducibility in the use of computational methods in a world adapting to the challenges and opportunities of transformative technologies.

The WorldFAIR project sets out to produce recommendations, interoperability frameworks and guidelines for FAIR data assessment. The WorldFAIR approach, outputs and modes of dissemination will significantly strengthen international cooperation in order to increase and mainstream FAIRness of data and digital objects. Aside from CODATA and the Research Data Alliance (RDA), who are leading the work, the project consortium (including the associated partners and collaborators) includes a number of authoritative international bodies (e.g., the Global Biodiversity Information Facility, the International Union of Pure and Applied Chemistry, OneGeochemistry), or institutions and projects with international reach (e.g., the London School of Hygiene & Tropical Medicine, the 5-year Salud Urbana en América Latina or Urban Health in Latin America (SALURBAL) project, Tonkin+Taylor), such that there is legitimate confidence that the recommendations and outputs will be implemented and have significant impact.

FAIR and transdisciplinarity

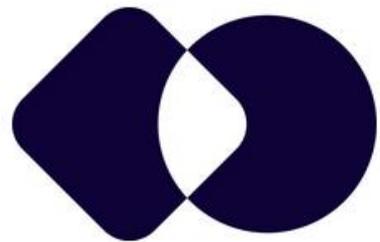


WorldFAIR+

CODATA is expanding and sustain sustaining the vision and methodology of [WorldFAIR](#) through the WorldFAIR+ programme. The purpose is to provide practical guidance and technical recommendations to help ensure that the data needed for interdisciplinary research is FAIR and has maximum utility.

CODATA is seeking partners around the world for this initiative, to explore case studies; to implement, refine and extend the CDIF, and to further improve the WorldFAIR methodology.

CDIF: Cross-Domain Interoperability Framework





WG20: Place the UNESCO recommendations
in a physics context

Scientific Publications

Research Data

Educational Resources

Software and Source Code

Hardware

**Final report in
time for IUPAP
GA 2027.**