

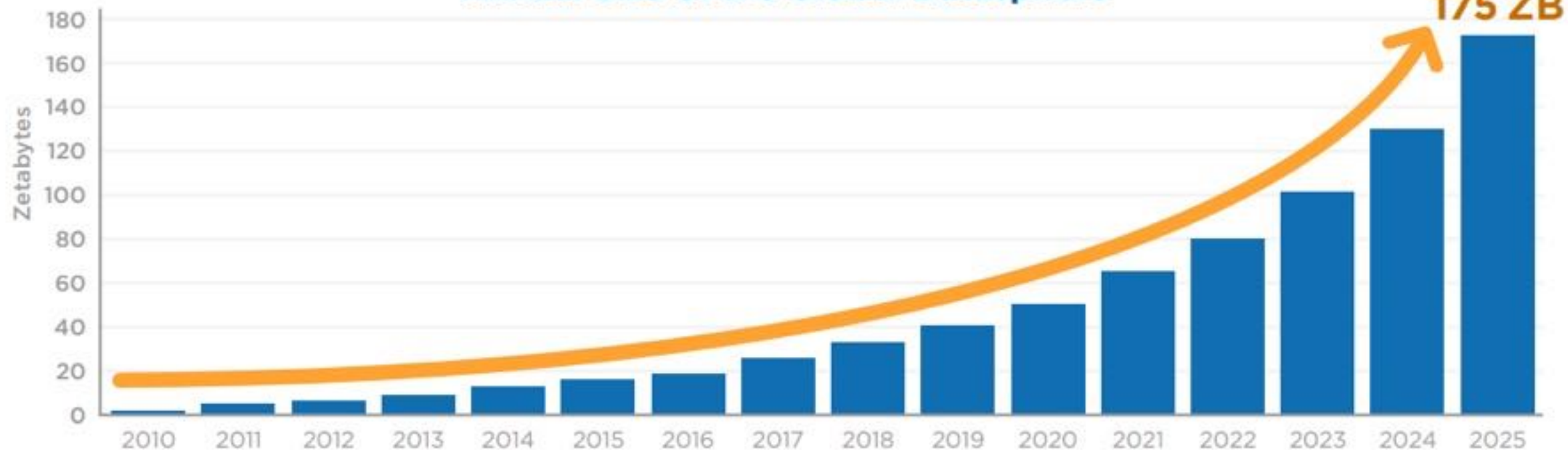


Interoperability for SEEA EA: The problem, solutions, and paths forward

December 2022

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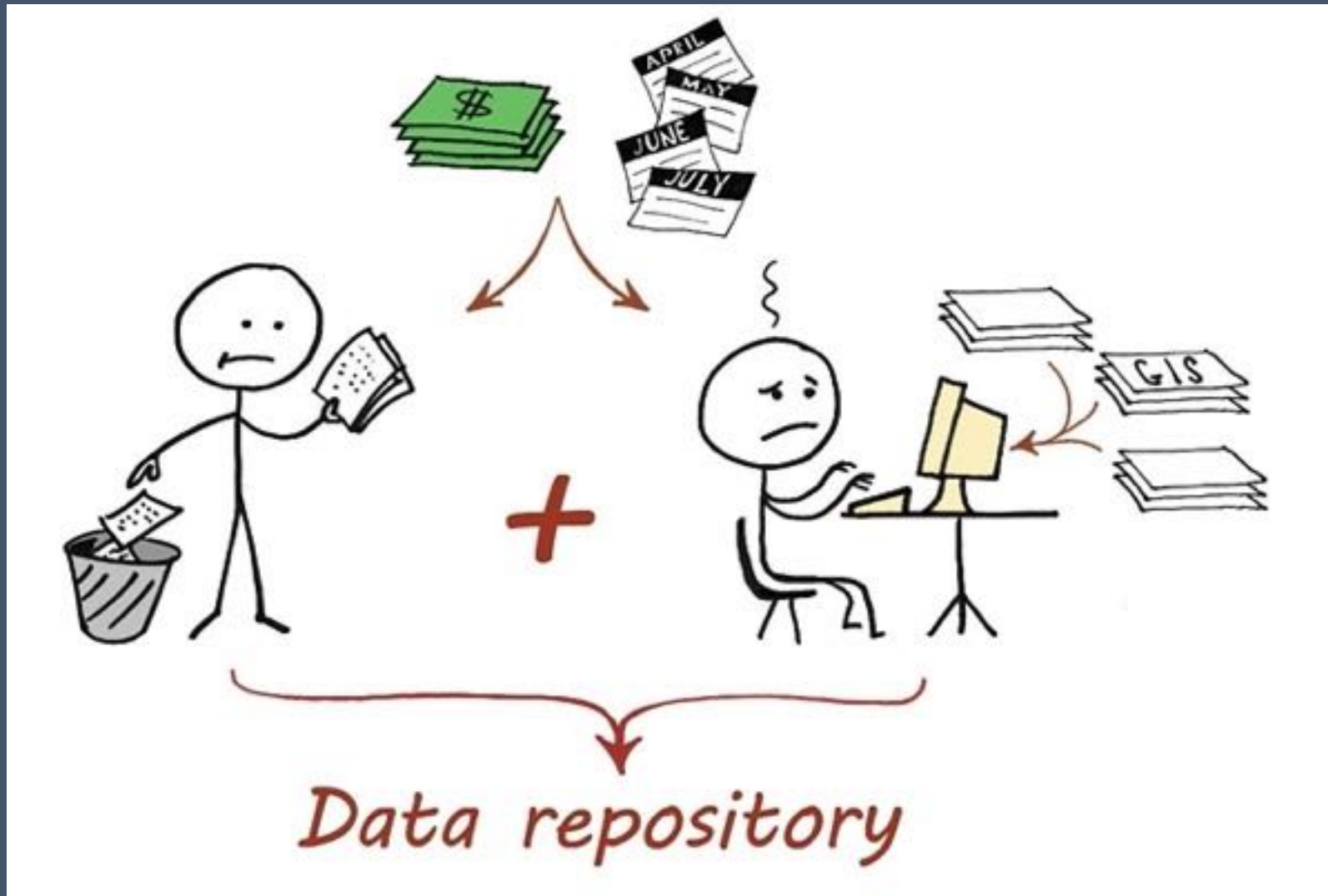
Annual Size of the Global Datasphere



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

<https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf>

How reusable are SEEA data & models?



Consequences of non-reusable science

- Borczyk & Carroll 2020:
 - Individual scientists have lost the ability to read and understand all the knowledge produced in a given field – expensive, high-quality research fails to be reused
 - Many scientists don't care about data sharing unless they get credit; many don't feel they can trust others' data (younger scientists do better)
- ES assessments are time-consuming, incomplete, with less real-world impact
- Fundamental equity issue – Global North scientists have significant advantage; how does a country from the Global South compile their first national ES assessment or SEEA account?
- Will the status quo ever take us beyond this?
 - “Insanity is doing the same thing over and over and expecting different results”
- Einstein (possibly apocryphal)

FAIR Principles: A 21st-century science solution

FAIR Principles



Findability

Resource and its metadata are easy to find by both, humans and computer systems. Basic machine readable descriptive metadata allows the discovery of interesting data sets and services.



Accessibility

Resource and metadata are stored for the long term such that they can be easily accessed and downloaded or locally used by humans and ideally also machines using standard communication protocols.



Interoperability

Metadata should be ready to be exchanged, interpreted and combined in a (semi)automated way with other data sets by humans as well as computer systems.



Reusability

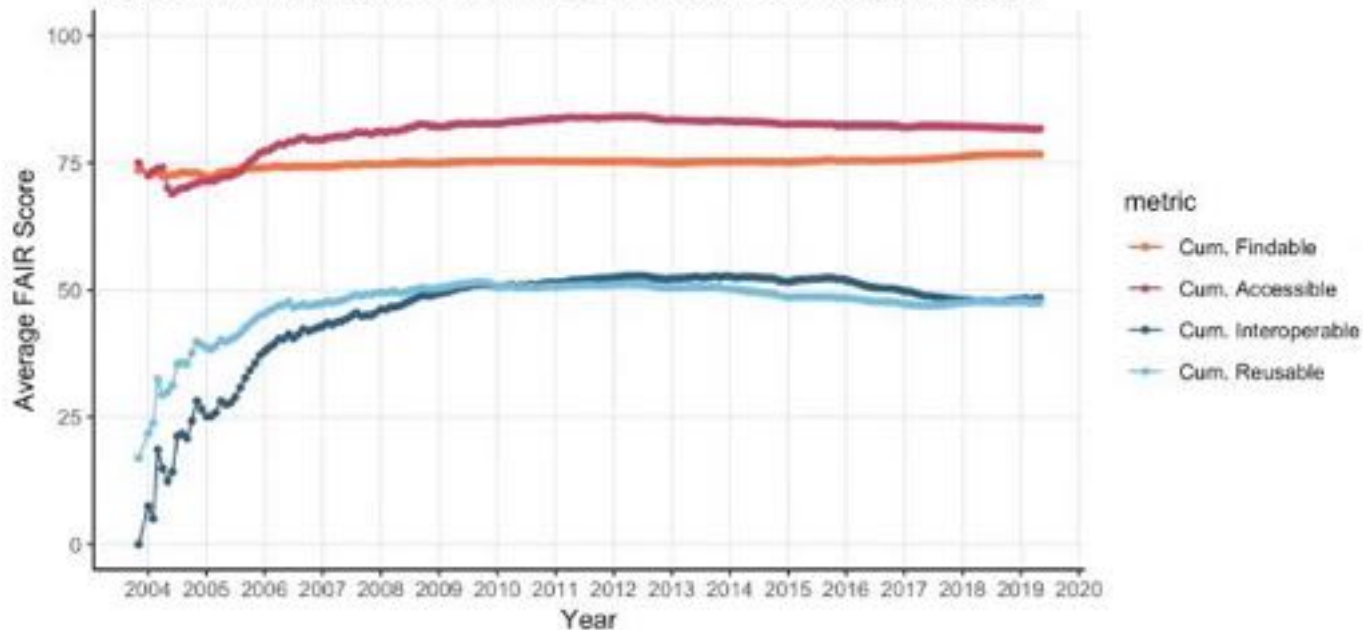
Data and metadata are sufficiently well-described to allow data to be reused in future research, allowing for integration with other compatible data sources. Proper citation must be facilitated, and the conditions under which the data can be used should be clear to machines.

DataONE

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DataONE: FAIR scores for 687,126 EML and ISO metadata records



<https://old.dataone.org/webinars/quantifying-fair-metadata-improvement-and-guidance-dataone-repository-network>

<https://go-fair.org/>

Interoperability:

The ability of independently developed data or tools to integrate or work together with minimal effort*

A core challenge to the global scientific community

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*for use in computational pipelines – models & workflows should support interoperability too

Types of interoperability

Syntactic
interoperability:
Use of compatible data
formats and
communication
protocols.
Low bar, more limited
advantages

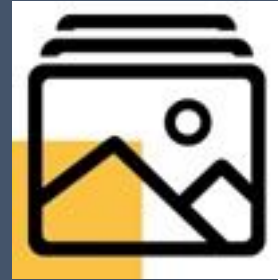


Semantic
interoperability:
Data transfers where a
receiving system can
understand the meaning of
exchanged data, reusing it
appropriately.
Higher bar, greater
potential for automation &
data/model reuse.

Needs for interoperable, reusable science



1. **SEMANTICS**, flexible, consistent, intuitive **language** to describe scientific observations



2. **MACHINE-ACTIONABLE DATA**, public or private as appropriate & semantically annotated



3. **OPEN, LINKABLE MODELS**, reusable by the wider community

Balbi et al. *Environmental Evidence* (2022) 11:5
<https://doi.org/10.1186/s13750-022-00258-y> Environmental Evidence

COMMENTARY Open Access

The global environmental agenda urgently needs a semantic web of knowledge

Stefano Balbi^{1,2*}, Kenneth J. Bagstad³, Ainhoa Magrach^{1,2}, Maria Jose Sanz^{1,2}, Naikoa Aguilar-Amuchastegui⁴, Carlo Giupponi⁵ and Ferdinando Villa^{1,2}

*Check for updates

Interoperability solutions must be trusted, user-friendly, equitable



Data that powers sustainable and equitable development

Why people are essential in data interoperability

By Steven Ramage, Jenna Slotin | August 25, 2021

<https://www.data4sdgs.org/news/why-people-are-essential-data-interoperability>

What you can do

- Learn more about interoperability & share with colleagues
- Practice the best open-science practices you can
 - Data & code repositories with common metadata keywords is a good starting point
 - Machine-actionable data, shared semantics, best practices for reusable code the next tier
- Find someone in your organization savvy about this who can engage in this at the highest possible level: not everyone has to or should be the expert



Toward faster global institutionalization of SEEA

