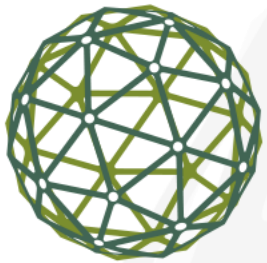


8th International Conference on BIG DATA & Data Science for Official Statistics

BILBAO 2024

Informing Climate Change and Sustainable Development Policies with Integrated Data

BILBAO. SPAIN | 10-14 JUNE 2024 | #UNBigData2024

An interoperability strategy for the next generation of SEEA accounting

Ken Bagstad[1], Ferdinando Villa[2], Stefano Balbi[2], Alessio Bulckaen[2]

[1]U.S. Geological Survey, [2]Basque Centre for Climate Change

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

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

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

Types of interoperability

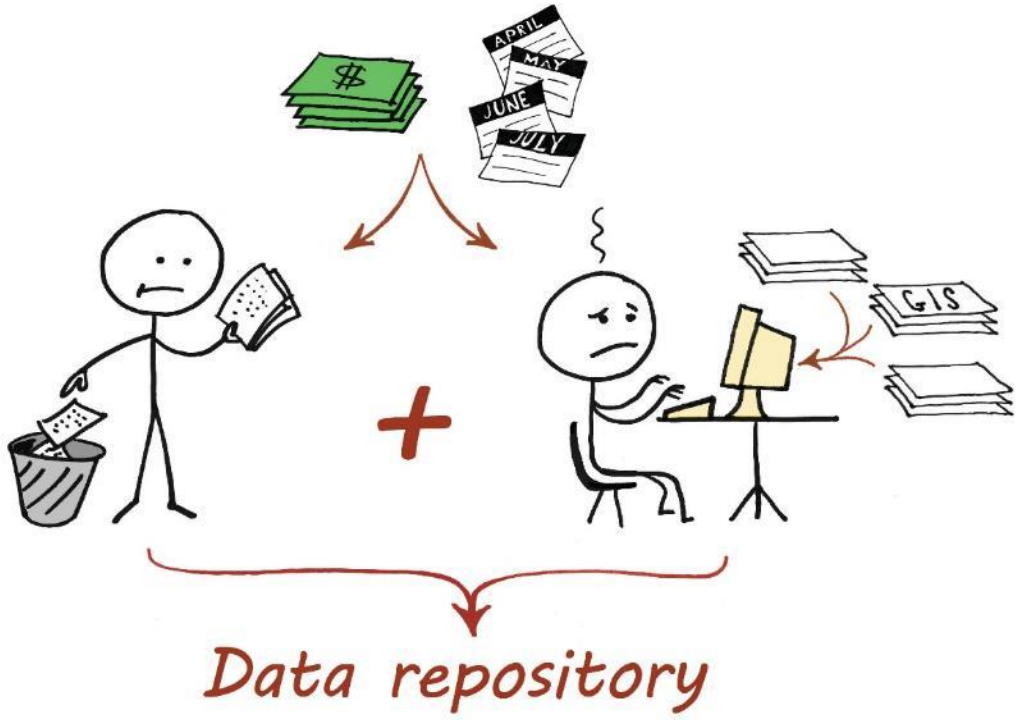
Syntactic interoperability
Use of compatible data formats and communication protocols.
Low bar, more limited advantages.

<

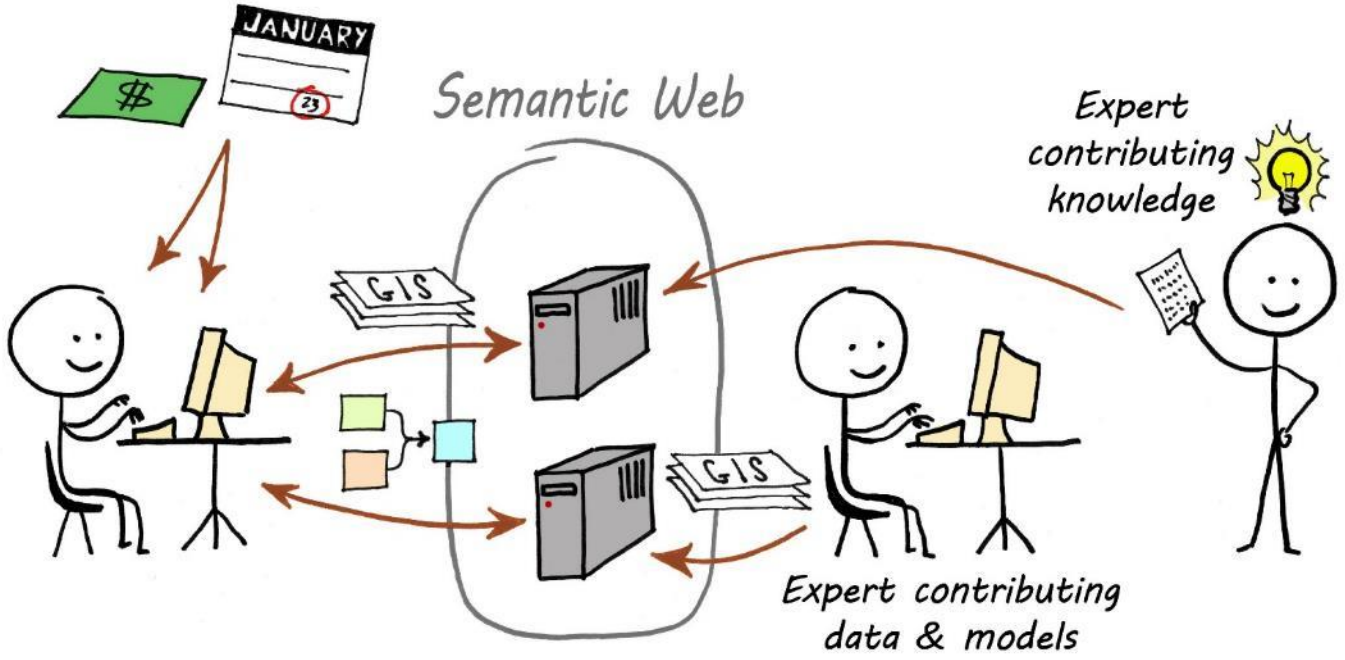
Semantic interoperability
Data transfers where a receiving system can understand the meaning of exchanged data, reusing it appropriately.
Higher bar, greater potential for automation & data/model reuse.

Heiler 1995

Why? Faster, better integrative science

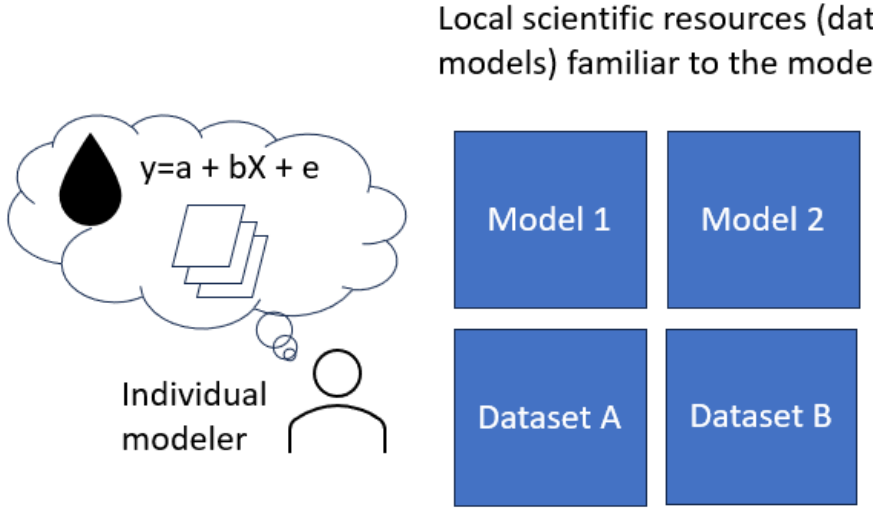


Status quo

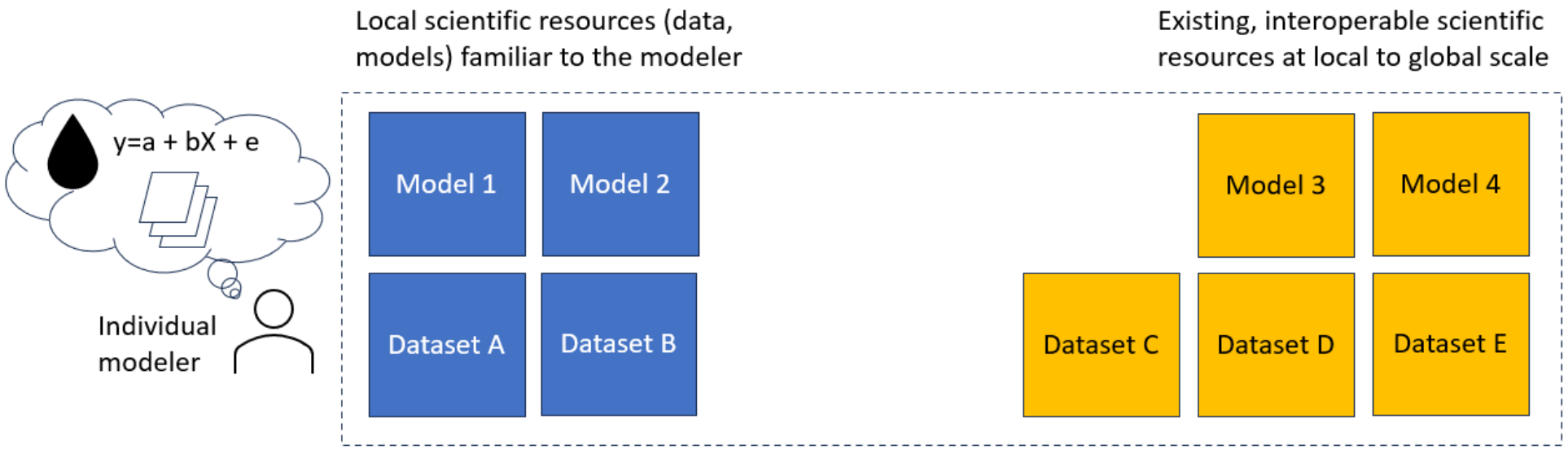


Linked, web-based collaborative modeling

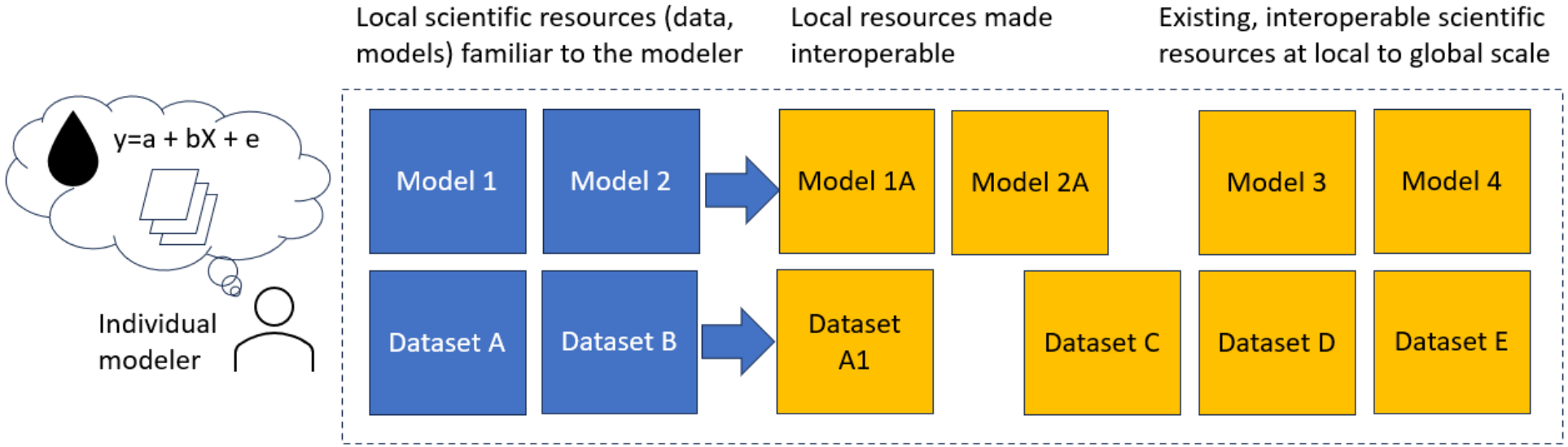
Why? Faster, better integrative science



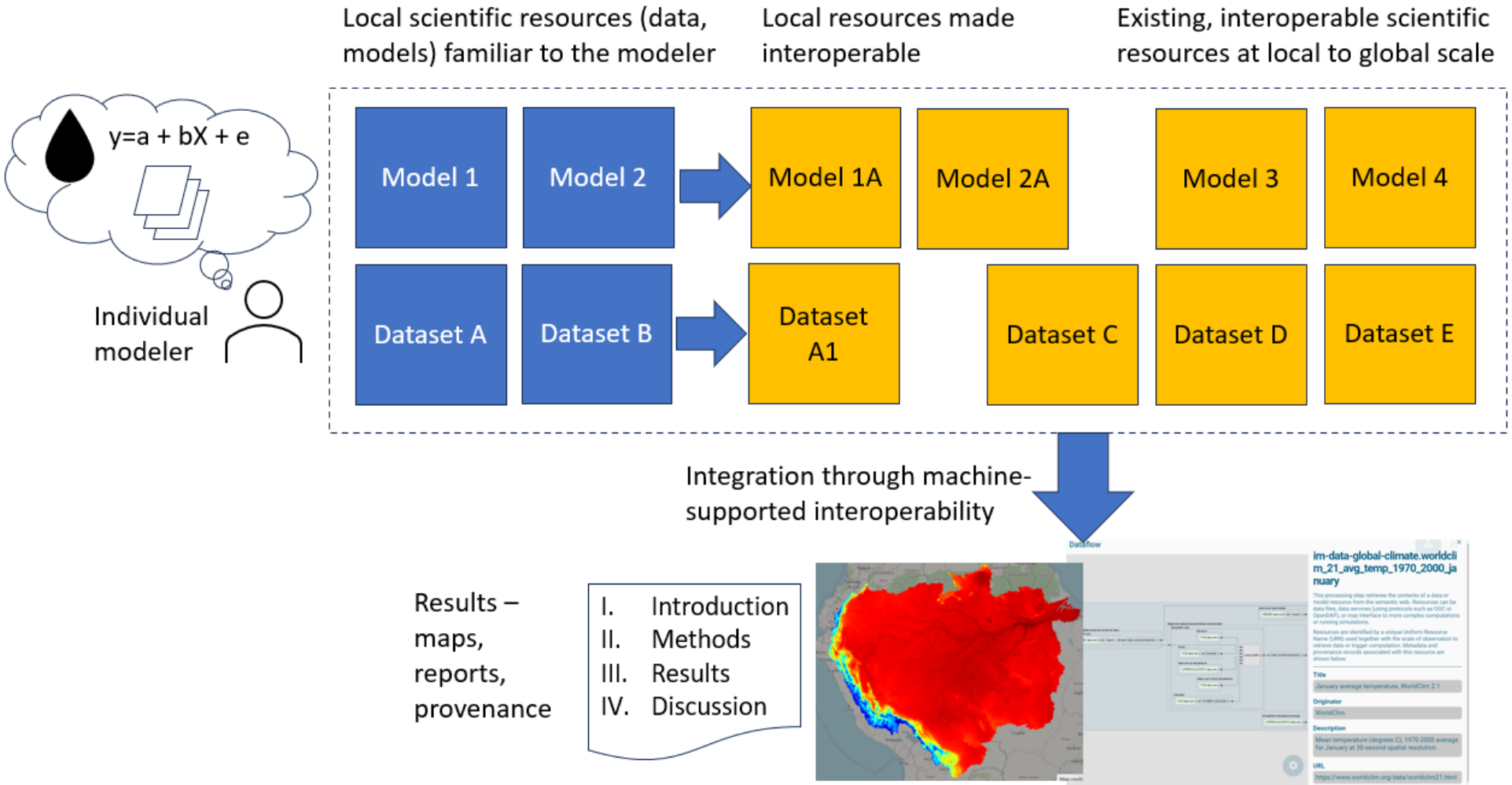
Why? Faster, better integrative science



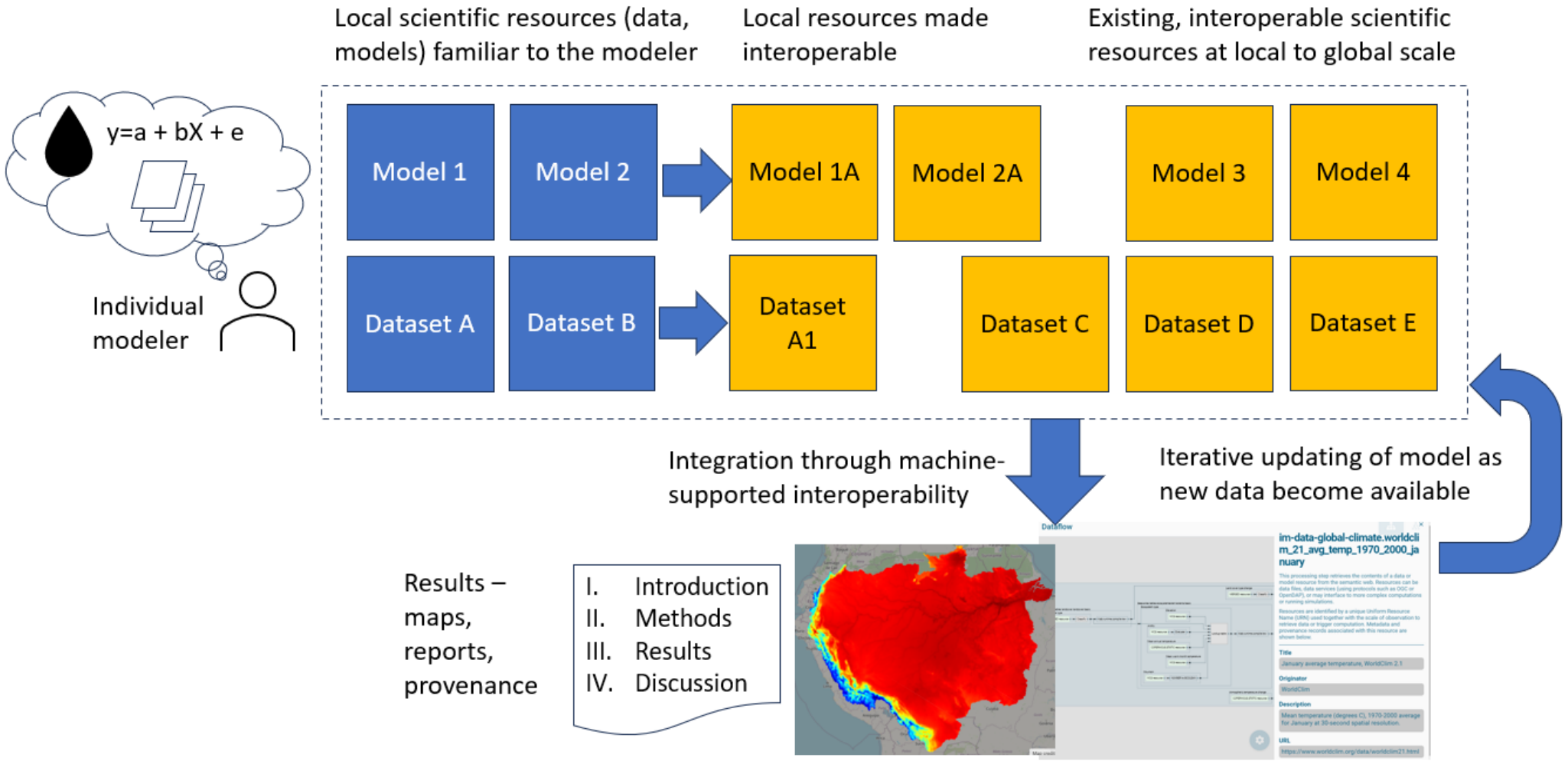
Why? Faster, better integrative science



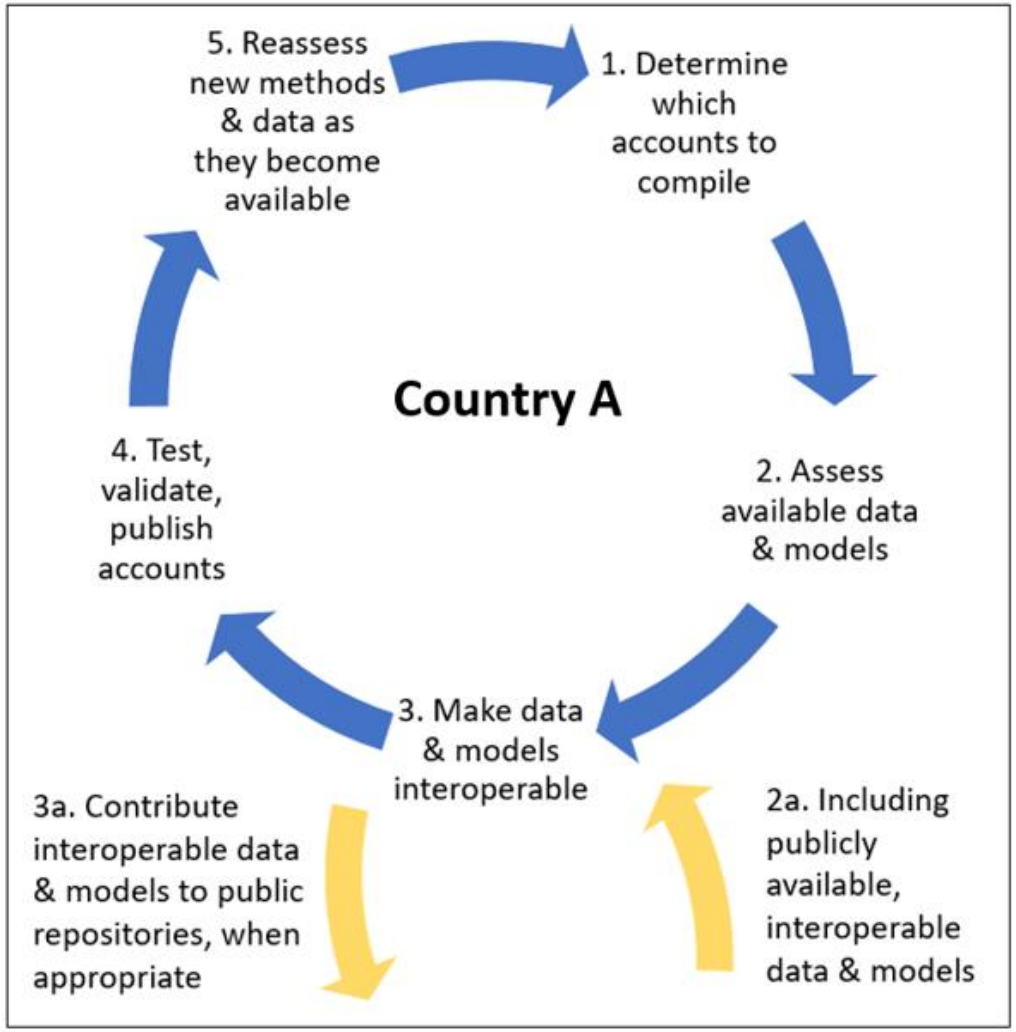
Why? Faster, better integrative science

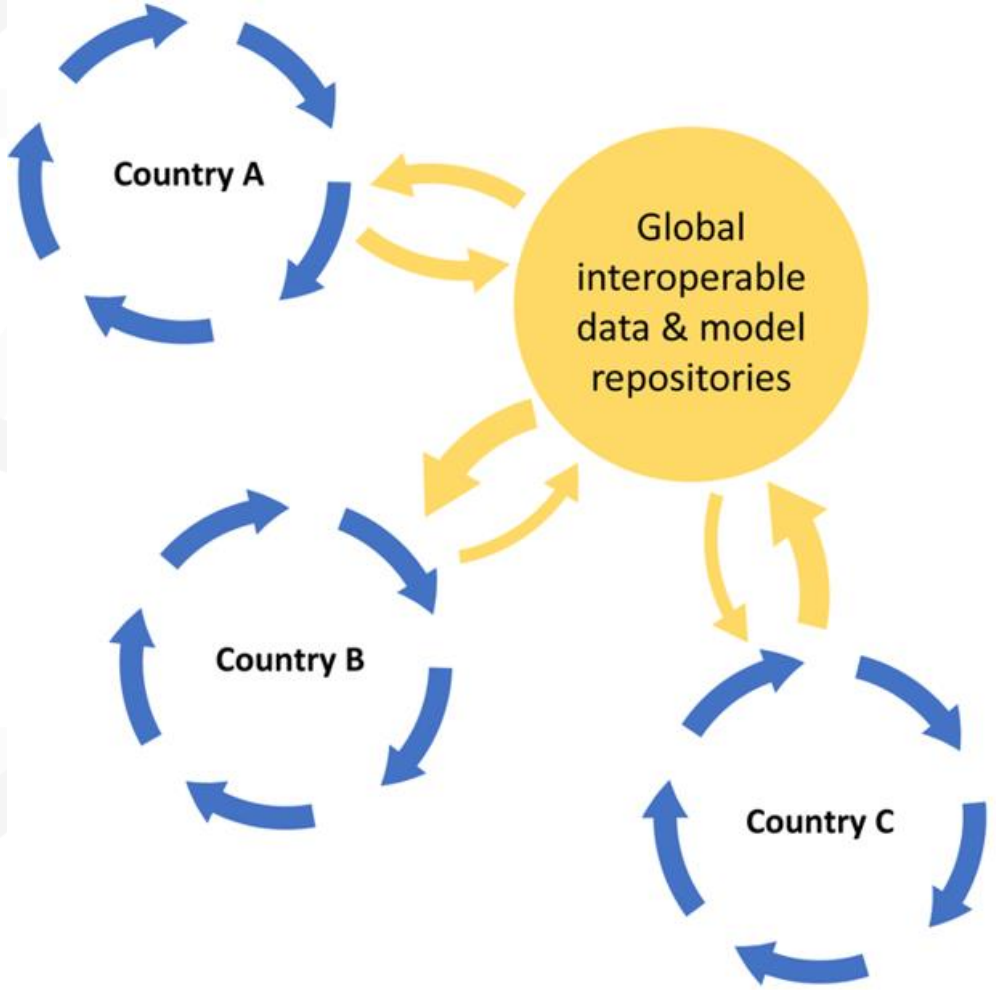


Why? Faster, better integrative science

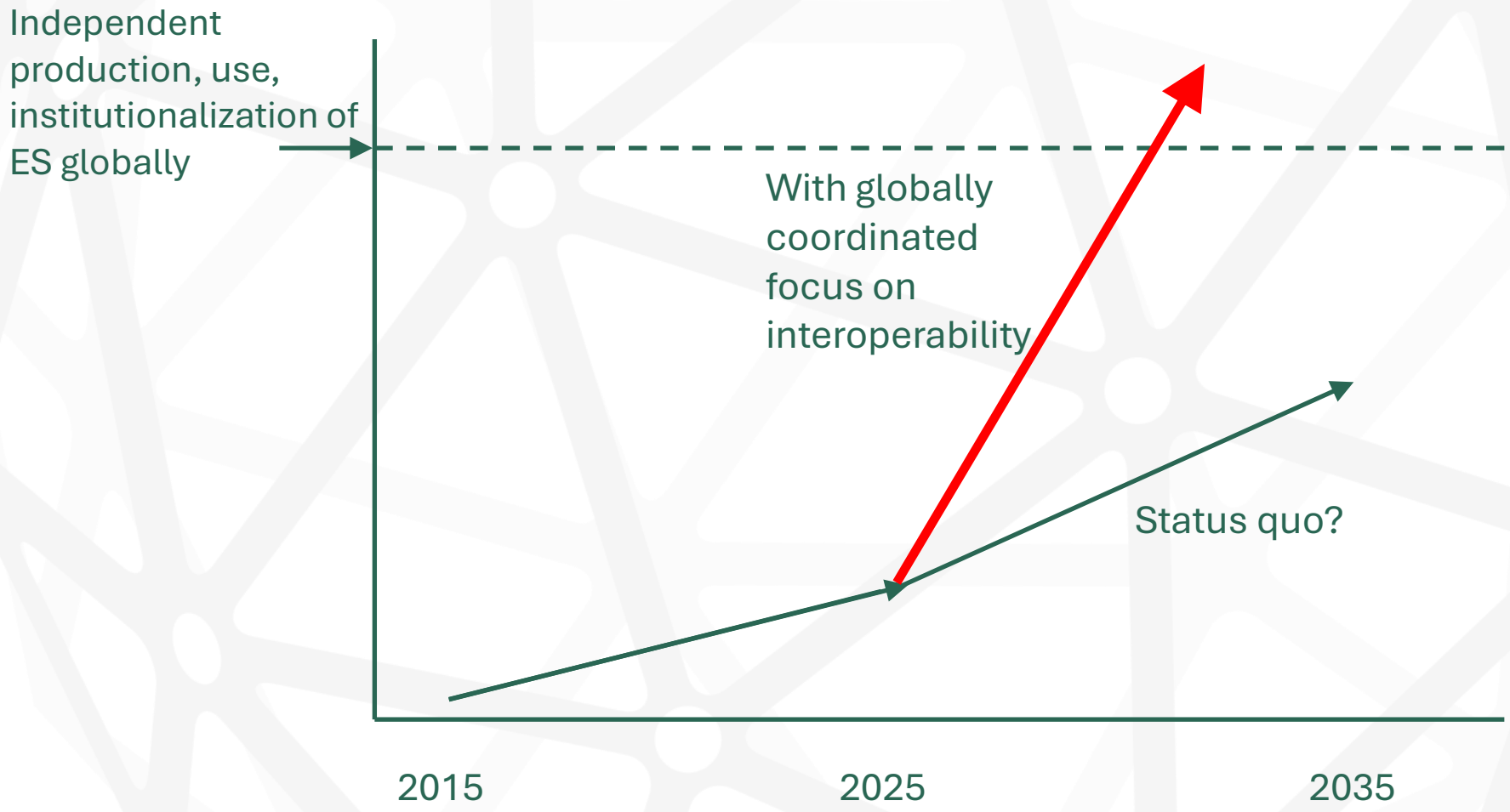


Why? Faster implementation of ambitious global monitoring





Why? Faster implementation of ambitious global monitoring



Major needs for interoperability

- Consensus & understanding of the need
- Platform-agnostic, machine actionable data & models
- Semantics (metadata descriptors) that can be navigated by AI to assemble data & models
- Reduce hidden costs (cloud egress costs, restrictions on private-sector use)

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

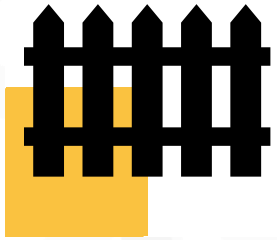
Stefano Balbi[1,2*], Kenneth J. Bagstad[3], Ainhoa Magrach[1,2], Maria Jose Sanz[1,2], Naikoa Aguilar-Amuchastegui[4], Carlo Giupponi[5] and Ferdinando Villa[1,2]

Building blocks for interoperability

1. SEMANTICS: a flexible, shareable, easy-to-learn **language** to describe scientific observations.

2. OPEN, LINKABLE DATA: machine-actionable (e.g., STAC+COG/GeoServer; EPSG projected), semantically annotated data.

3. OPEN, LINKABLE MODELS: machine-actionable, "Wikipedia-like" shared, linked, semantically annotated models.



4. GUIDELINES ON DATA/MODEL REUSE: "guardrails" on when an AI-guided machine should reuse a particular data or model.

Semantics for complex data interoperability (Leadbetter & Vodden 2015, Villa et al. 2017, Stoica & Peckham 2019, Magana et al. 2021)

1. Use atomic concepts to compose more complex ones
2. Distinguish the phenomena & the property being measured - both needed to produce a complete observation
3. Optional roles for 1) Roles, 2) Matrix/Realm where measurement occurred, 3) measurement methods
4. (Obvious) need for underlying core/upper ontology to complement domain ontologies
5. Reuse existing semantic resources as authorities

https://socratic.org/questions/582d635611ef6b13ecb11fab

From model comparison to model interoperability

- Instead of “which model is better” (when “all models are wrong but some are useful”)
- Refocus on *when* to use different models (ecoregions, spatiotemporal scales, data availability…)
- While making them & their needed data open & interoperable
- So AI can navigate complexity & turn individual knowledge into collective intelligence

Ecosystem Services 5 (2013) e27–e39

Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser

A comparative assessment of decision-support tools for ecosystem services quantification and valuation

Kenneth J. Bagstad [a,*], Darius J. Semmens [a], Sissel Waage [b], Robert Winthrop [c]

[a] U.S. Geological Survey, Geosciences & Environmental Change Science Center, Denver, CO, USA
[b] BSR, San Francisco, CA, USA
[c] Socioeconomics Program, USDI–Bureau of Land Management, Washington, DC, USA

Interoperability solutions must be trusted, user-friendly, equitable, community endorsed

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. Bagstad[3], Ainhoa Magrach[1,2], Maria Jose Sanz[1,2], Naikoa Aguilar-Amuchastegui[4], Carlo Giupponi[5] and Ferdinando Villa[1,2]

2023

AN INTEROPERABILITY STRATEGY FOR THE NEXT GENERATION OF SEEA ACCOUNTING

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

A shared vision?

SEEA accounts & related indicators will be:

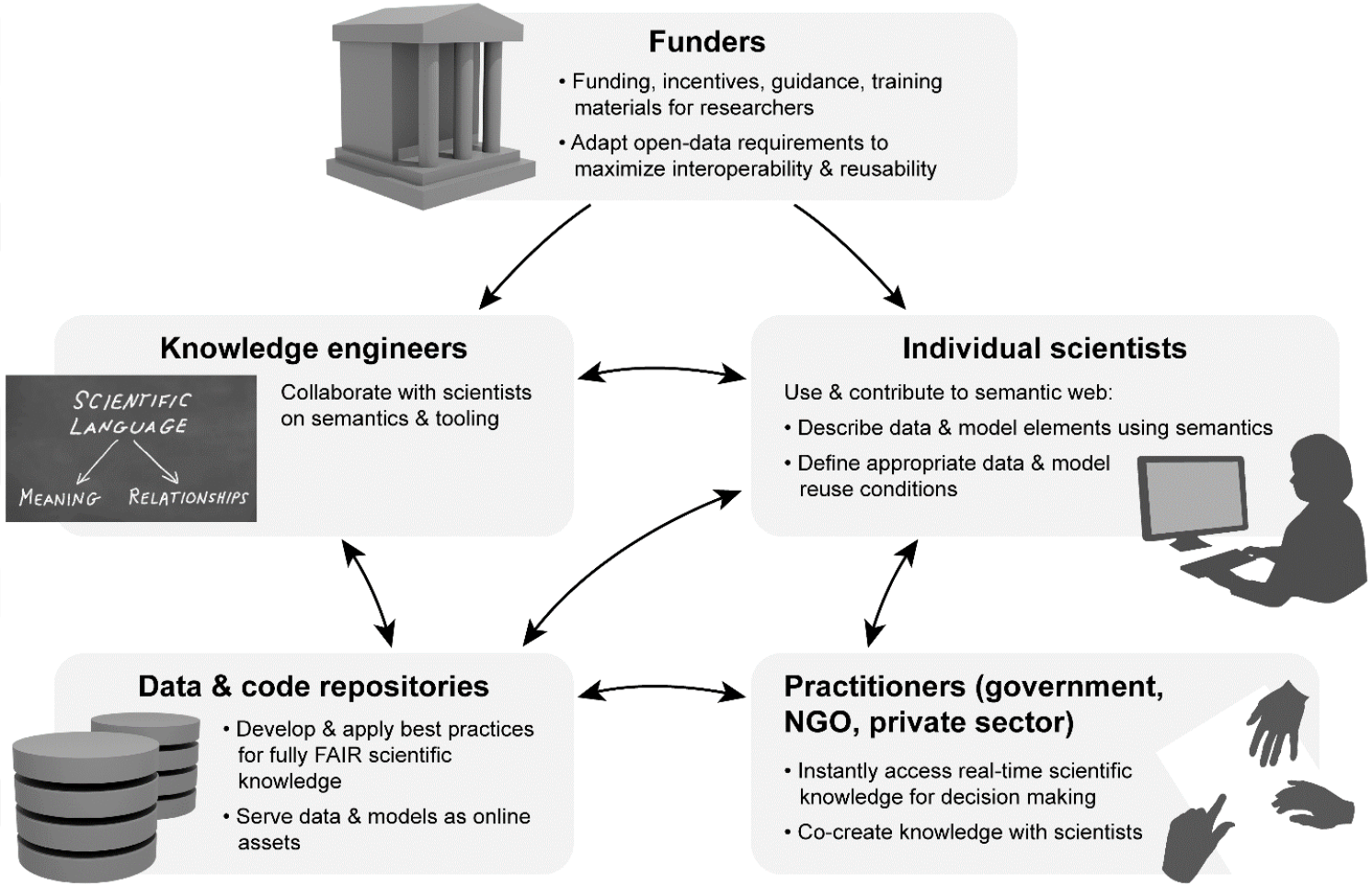
1. rapidly recompilable as new science emerges,
2. quickly produced to show the most recent trends as new annual data become available, with
3. robust international comparisons possible, while country-specific customization is still easily done.

This vision moves high-quality, meaningful information from scientists into the hands of decision makers, the public, and the media as quickly as possible.

2023

AN INTEROPERABILITY STRATEGY FOR THE NEXT GENERATION OF SEEA ACCOUNTING

What needs to change



Balbi et al. 2022

What you can do

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