Open Source for Tech Transfer

Jason Fields
IEA Topical Experts Meeting #108- Tech Transfer
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Photo from iStock-627281636

Starting the conversation

- Professional Background
  - PI DOE Wind Energy Digitalization
  - Operating Agent- IEA Wind Task 43
  - Secretary IEC 61400-15 “WRA”

- Commercialization Background
  - Product Owner: OpenOA
  - ENTR Foundation: Board Member
  - Task 43 WRA data model
  - Alumni of DOE Energy icorps and TCF

Wind Energy Open Source Ecosystem

ExaWind FLORIS WISDEM SOWFA OpenFAST

wrag@groups.io

OSDU

OpenOA

zenodo

WRF

PyWake

CFARS

brightwind

ENTR ENTR ALLIANCE

WOMBAT

IEA Wind

System Advisor Model

WIND ENERGY DIGITALIZATION
IEA WIND TASK 43

SWISS WIND ENERGY R&D NETWORK

Turbine Design & Manufacture | Project Development | Construction | Operations & Maintenance | Life Assessment & Asset Transfer

Case Study: IEA Wind Task 43 WRA Data Model

PDF Format

JSON Format

Requires manual data entry or specialized tools like OCR

Sensor	Sensor 1	Sensor 2
Channel	1	2
Type	Anemo.	Anemo.
OEM / Model	Thies 4.3351	Thies 4.3351
Serial	9183000	9183001
Height	80.1	80.2
Orientation	315	135
Logger Slope	0.045	0.045
Logger Offset	0.25	0.25
Calibration slope	0.04573	0.04568
Calibration offset	0.2419	0.2487

```
[
  {
    "channel": "1",
    "type": "Anemo.",
    "OEM Model": "Thies 4.3351",
    "Serial": "9183000",
    "Height": 80.1,
    "Orientation": 315,
    "Logger Slope": 0.045,
    "Logger Offset": 0.25,
    "Calibration Slope": 0.04573,
    "Calibration offset": 0.2419
  },
  {
    "channel": "2",
    "type": "Anemo.",
    "OEM Model": "Thies 4.3351",
    ...
  }
]
```

Sensor information in PDF forms (left) and JSON format (right)

Can be processed with a few lines of code (Python or R)

Task 43 Data Model Industry adoption activities

- Data Model specified in commercial contracts
- Joint Offshore Industry Letter of Support
- Multiple Software Providers are adopting as an I/O format
- 20+ organizations contributing to development
- Startups/Products created around the data model

Key Discussion Points

- How do we support open source ecosystems better?
- What is the right TRL for open source that fosters a vibrant commercial ecosystem?
- As researchers, do we provide predictability and reliability for commercial partners?

Jason Fields
Jason.fields@nrel.gov

www.nrel.gov

NREL
Transforming ENERGY

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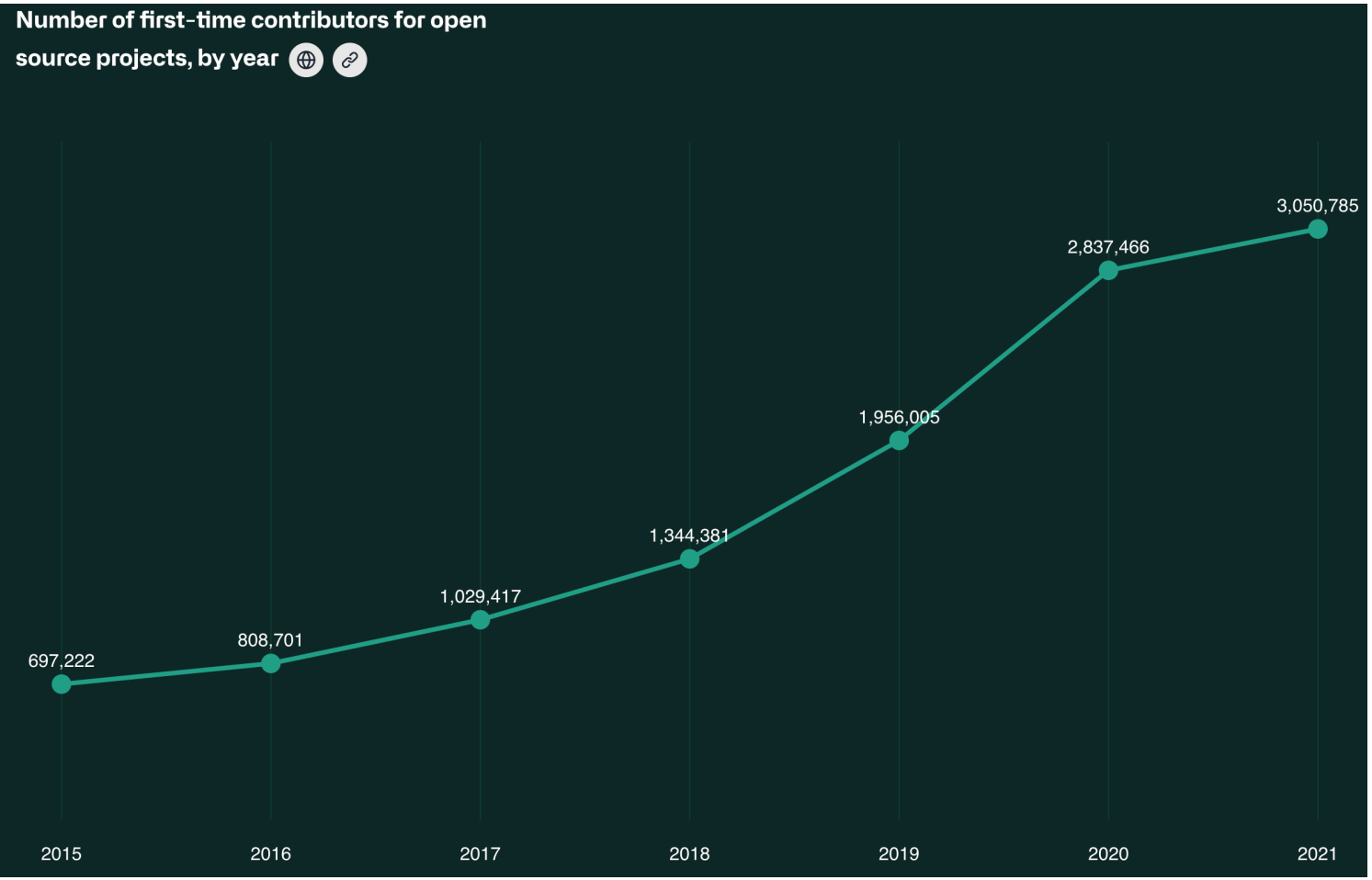
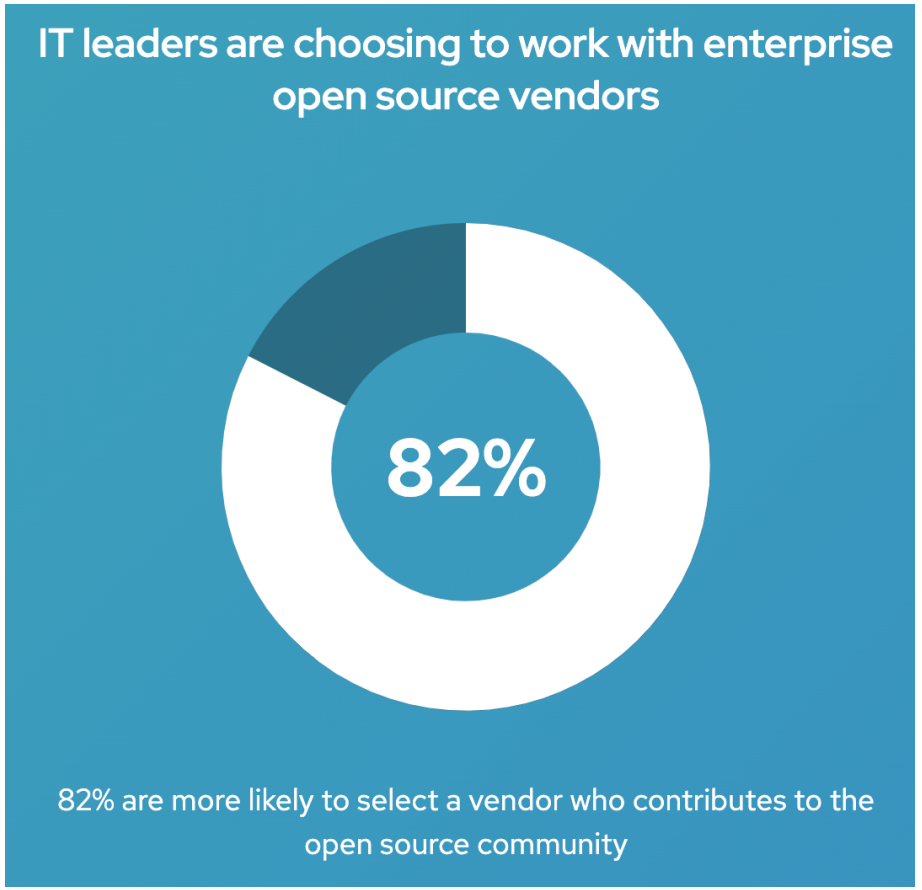
Backup Slides

Open Source is everywhere



Source: Octoverse, Github



Source: RedHat Open Source Report

What makes Open Source Software (OSS) so great?

- OSS can **reduce software development costs** by up to **90%**[1]
- OSS can **support Diversity, Equity and Inclusion** by making software and training barrier free[1]

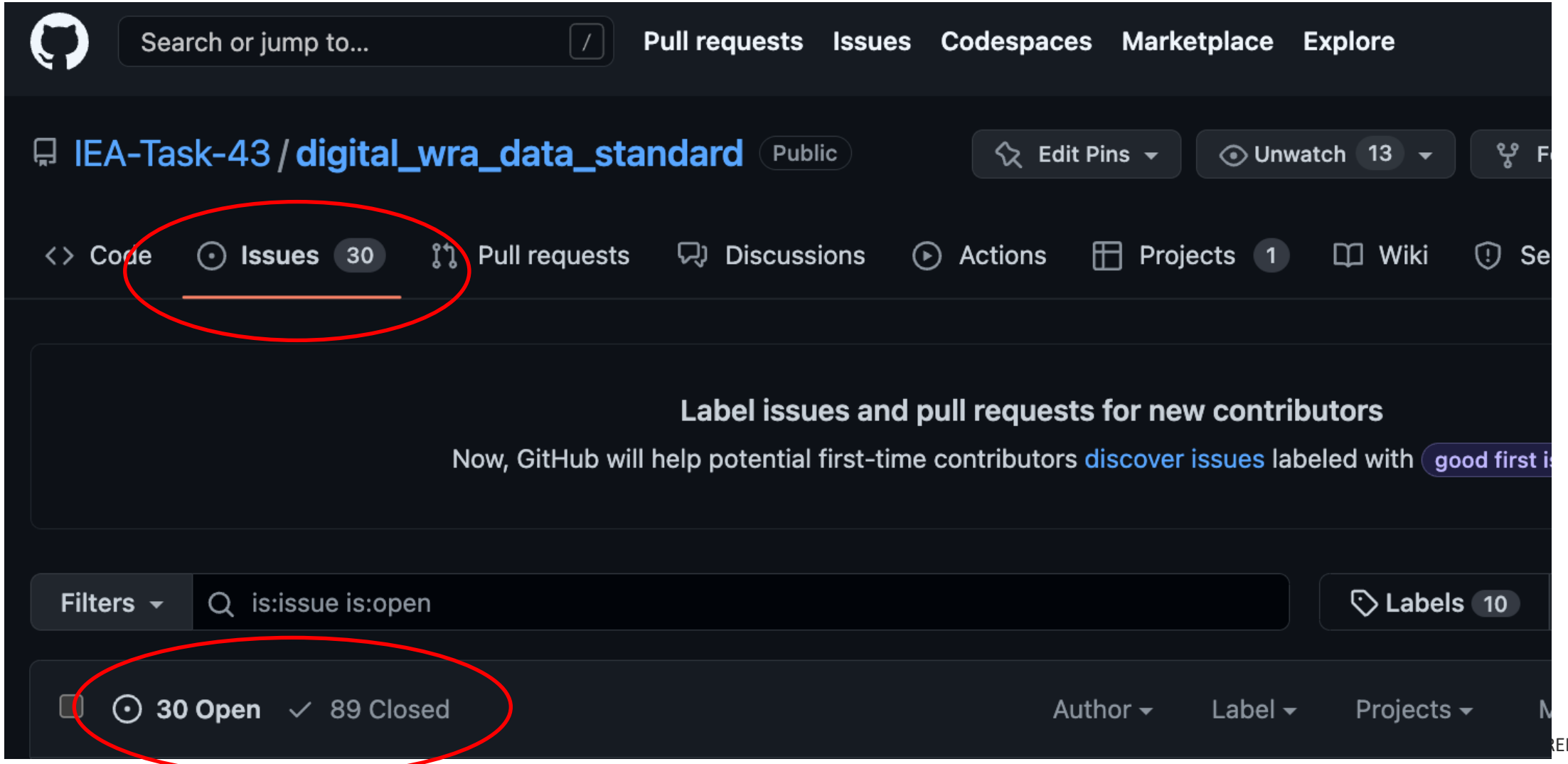
- **82%** of IT Leaders **more likely to select a vendor** that contributes to OSS[2]
- **80%** of IT Leaders expect to **increase their use of enterprise open source software** for emerging technologies[2]
- **89%** of IT Leaders see enterprise **open source as more secure** or as secure as proprietary software[2]

1:Source: Roads and Bridges:
The Unseen Labor Behind Our Digital Infrastructure

2:Source: Redhat the state of enterprise open source (2022)

Open Source is great but . . .

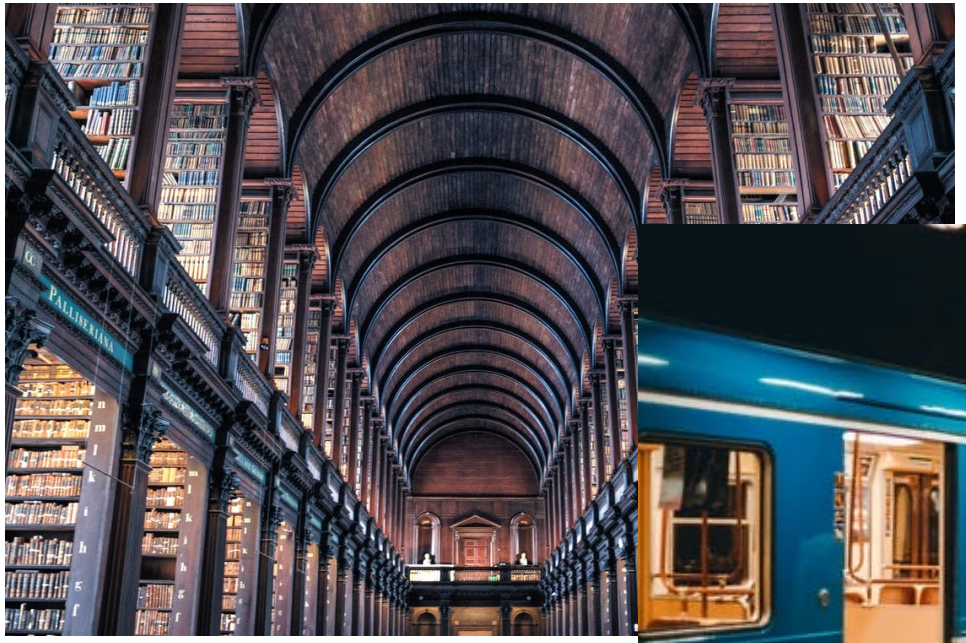
Projects need maintenance



Open Source is great but . . .

Project maintainers often suffer from burnout . . . Is this sustainable?

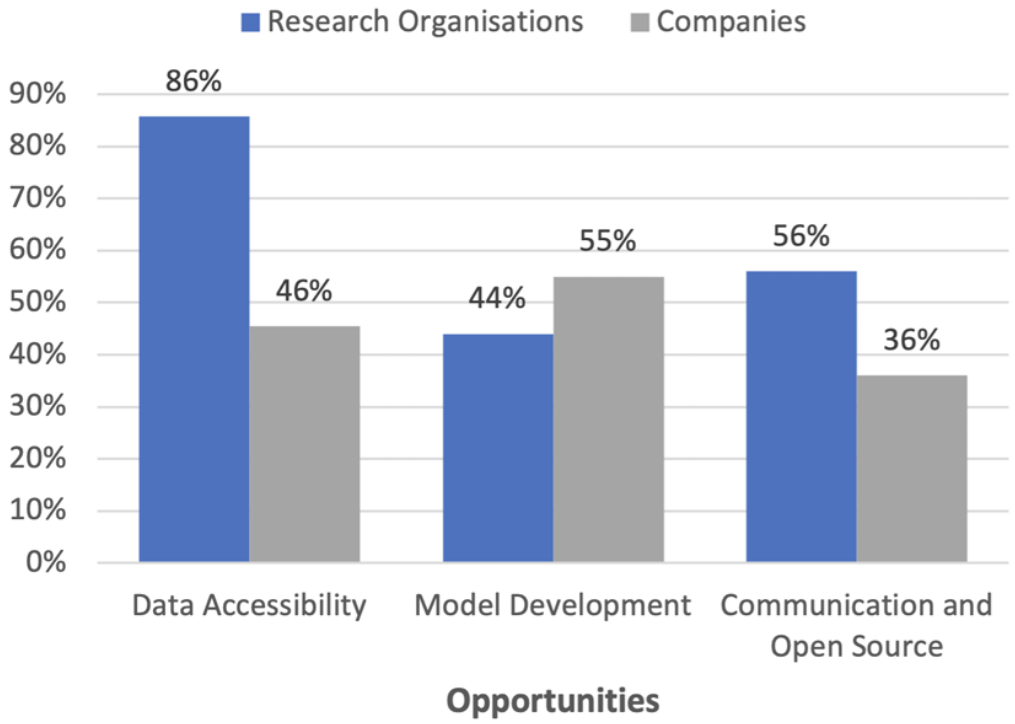
Open source infrastructure as a public good



THE LINUX FOUNDATION

THE APACHE SOFTWARE FOUNDATION

Standards & Data



Source: Grand Challenges in Wind Energy Digitalization Clifton, et al

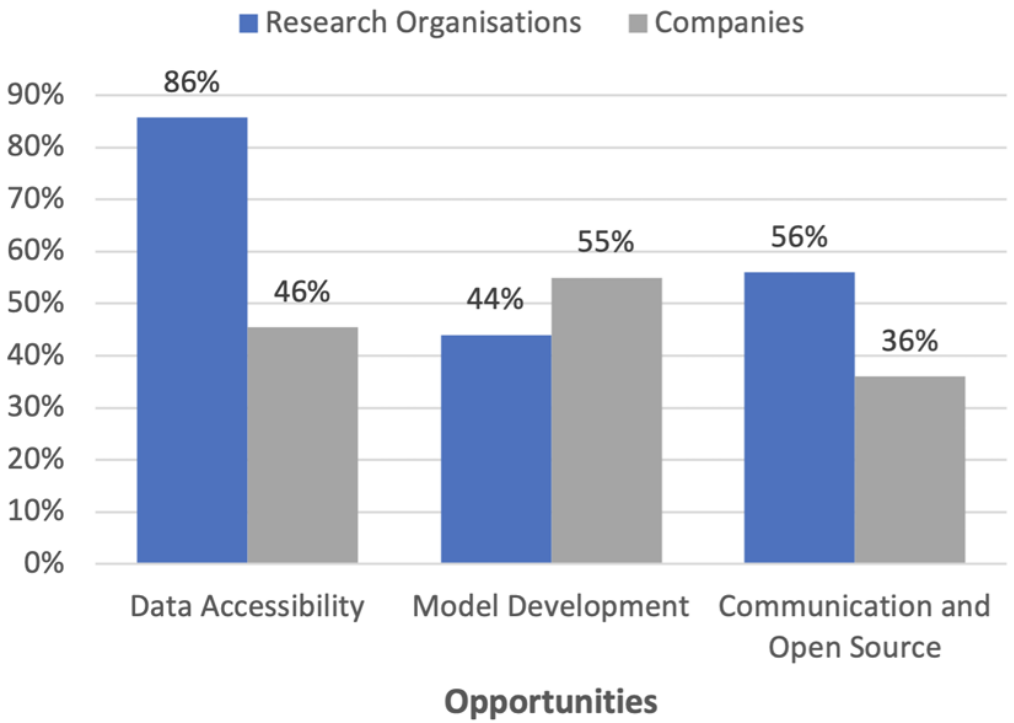
Gartner®

By 2023, organizations with **shared ontology**, **semantics, governance and stewardship** processes to **enable inter-enterprise data sharing will outperform** those that don't.

Through 2025, **80% of organizations** seeking to scale digital business **will fail** because they **do not take a modern approach to data and analytics governance.**

Source: Gartner 2021

Standards & Data



Source: Grand Challenges in Wind Energy Digitalization Clifton, et al

Pre-construction data standards

WIND ENERGY DIGITALIZATION
IEA WIND TASK 43

IEA Wind Task 43: WRA Data Model

IEA Wind Task 37: Wind Plant Ontologies

IEC

IEC 61400-15-1: Site Suitability Input Conditions

IEC 61400-15-1: Energy Yield Assessment Reporting

IEC 61400-16: Data format for power curves

ENTR Technology Stack

ENTR Runtime

ENTR Containerized Software Stack

jupyter

dbt

APACHE Spark™

PostgreSQL

Data Analysis — Data Engineering

Reference Implementations of Data Standards

- Tag Naming (IEC 61400-25 compliant)
- Status Codes and Alarms (IEC 61400-26 compliant)
- Reference Plant Hierarchy (RDS-PP compliant)

Data and Use Case Examples (e.g., wind, solar, storage)

Interface to innovative 3rd-party data analytics apps