

Adoption Determinants of Open Hardware Across Industries

Seckin Celik

Department of Economics and Management
University of Trento

Davide Serpico

Department of Philosophy
University of Milan

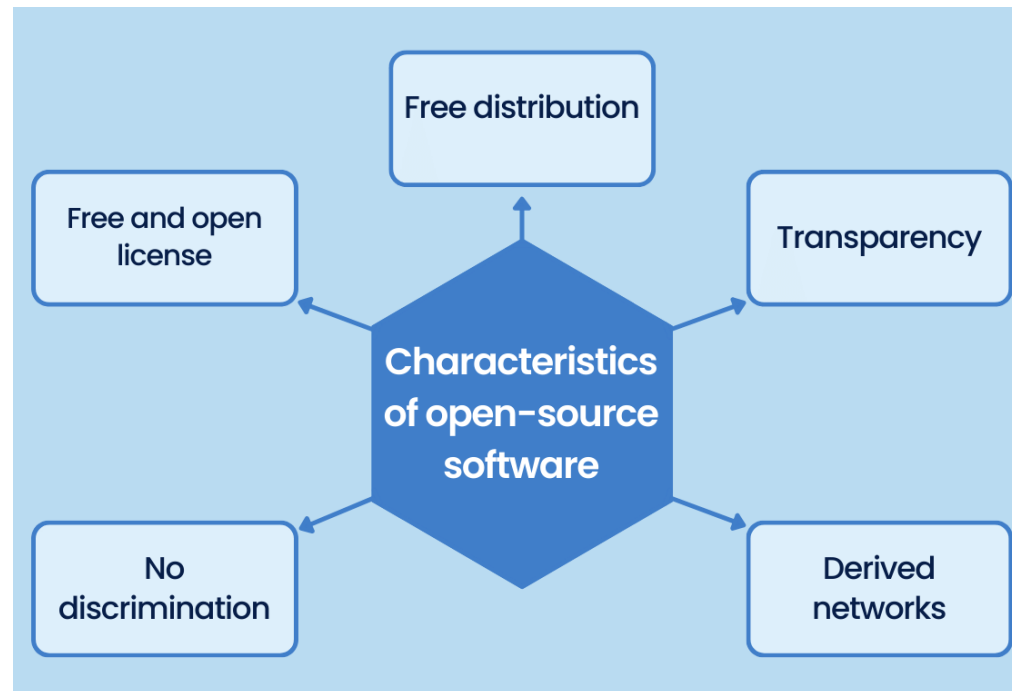
SFSCON 2024

Introduction

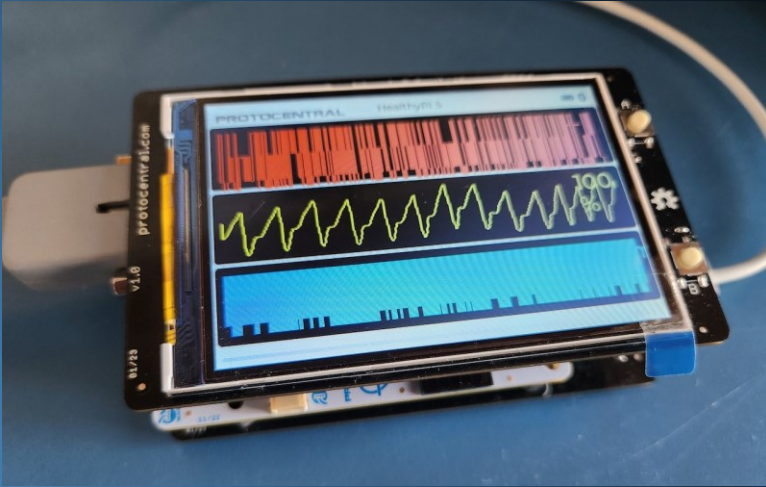
OSS versus OH

Open-Source Software (OSS)

- Distributed under a **unique copyright license** that permits **unlimited usage, free redistribution**, access to the **source code**, and the production of **derivative works** (*Androutsellis-Theotokis et al. 2011*)
- Recently started to be seen as **high-quality, safe, and dependable** which leads to a gradual **increase in adoption** (*Ro et al. 2024*)



Introduction



ProtoCentral IoT Patient Monitoring



Acorn Rover OH in Precision Farming

Open Hardware (OH)

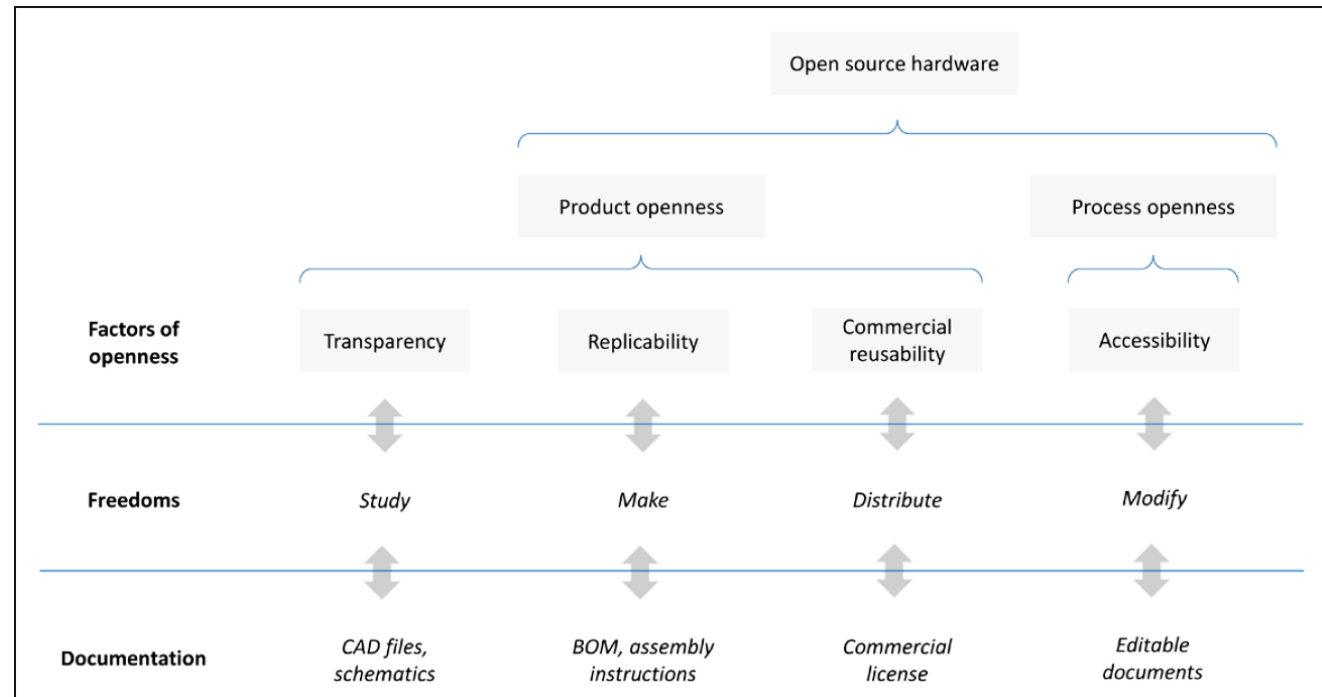
- A “hardware whose **design** is made **publicly available** so that anyone can **study, modify, distribute, make** and **sell** the design or hardware based on that design" (*Open-Source Hardware Association, 2020*)

Healthcare

- First wave of OH adoption
- Specific Needs

Agriculture

- Maturity-Level of Projects
- Similar Input Materials



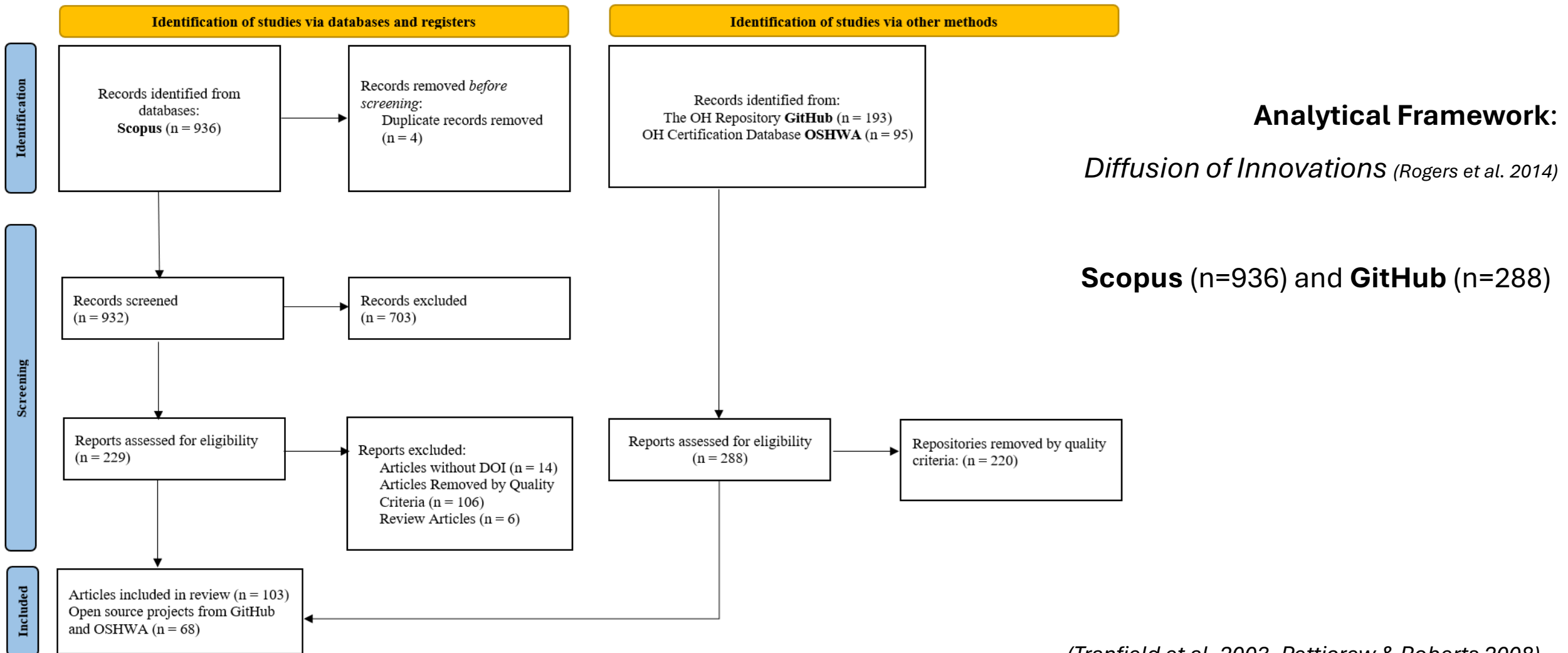
Forms of openness involved in OH (Bonvoisin et al. 2017)

Research Questions

- RQ1:** What are the primary **challenges** and **motivations** that influence the **adoption of OH technologies** across different sectors, particularly agriculture and healthcare?
- RQ2:** Do **real-world applications** of OH reflect the principles highlighted in the scientific literature, and what **factors drive** their successful implementation and diffusion?

Methodology: Systematic Literature Review

PRISMA guidelines for the study
(Page et al. 2021)

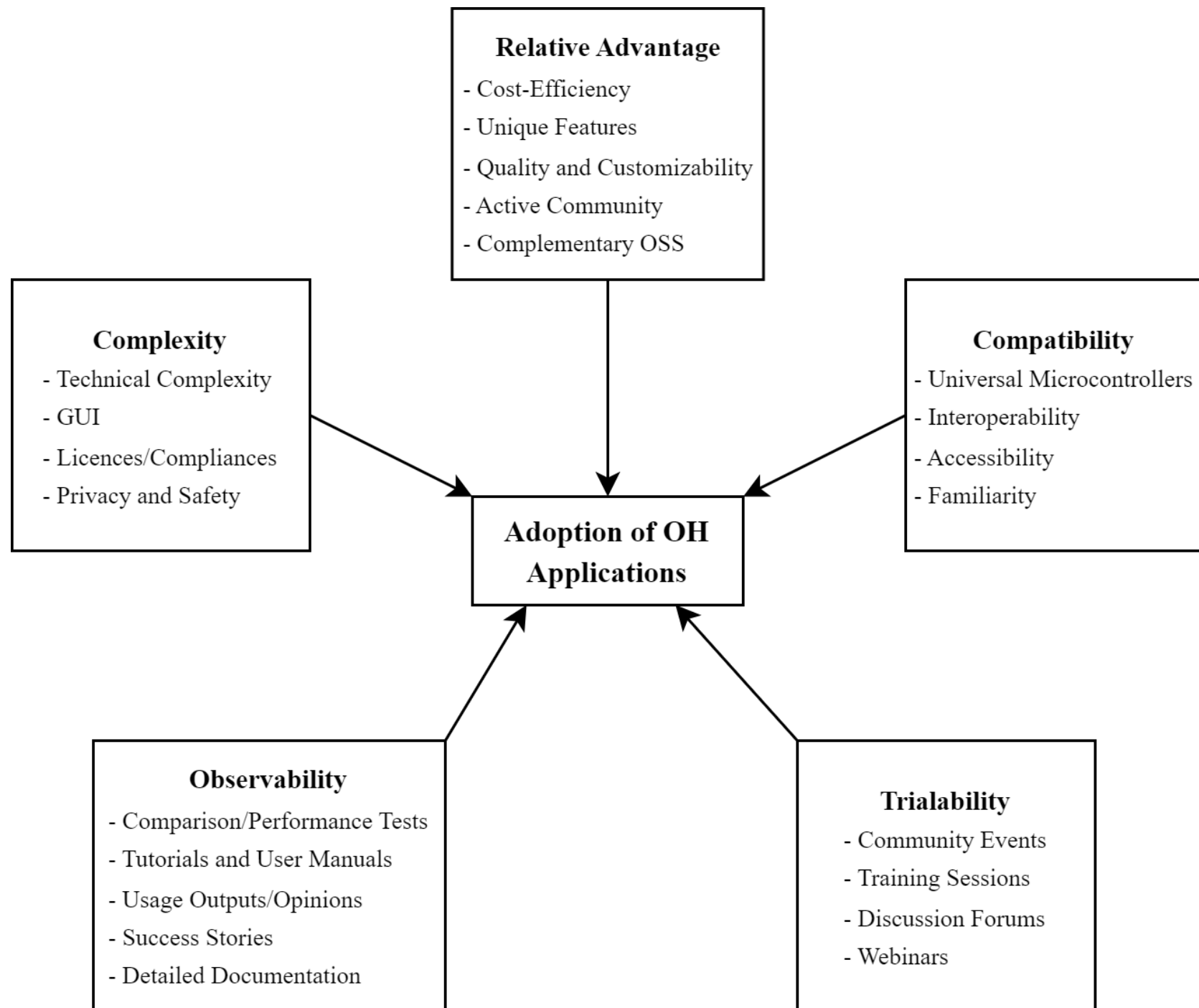


(Tranfield et al. 2003, Petticrew & Roberts 2008)

Findings (RQ1)

Five Main Constructs
Emerging from the SLR

Note: Little reference to
community management



Findings

(RQ1)

Industry-Specific
Adoption Characteristics

Healthcare vs. Agriculture

Healthcare

- Emphasis on **patient safety, legal compliance, efficacy** (*Moritz et al. 2018; Carpentier 2021*)
- **More strict regulatory requirements** (*Ruiz-Zafra et al. 2023; Farre et al. 2022*)
- **Centralized Supply Chain** (*Hildebrant et al. 2021*)
- **Government Funding** (*Vázquez-López et al. 2023*)

Agriculture

- **Cost-efficiency, compatibility** with existing farming devices (*Emmi et al. 2023*)
- **Fewer regulatory challenges** compared to healthcare (*Tzerakis et al. 2023; Da Cunha & Neto 2017*)
- **Decentralized Supply Chain** (*Mesas-Carrascosa et al. 2015*)
- **Private Investment** (*Da Cunha & Neto 2017*)

Real-world Impact of OH Projects (RQ2)

Comparative Analysis of GitHub Projects (n=68)

Impact is correlated with number of constructs

Difference-maker: Community management



- Most Stars vs. Less Stars (*Ariza and Pearce, 2022, Jarczyk et al. 2014*)
- Importance of trialability and observability

Conclusions

Recommendations for OH Adoption

Clearly reflected in the literature:

- **Relative Advantages:** Leverage complementary OSS and active communities
- **Complexity:** Simplify complexity with GUIs, license specifications, assemble tutorials, and training sessions
- **Compatibility:** Ensure compatibility via universal interoperability of devices
- **Trialability and Observability:** Showcase detailed documentation, comparison tests, and community engagement

Emerging needs also confirmed by real-world cases:

- Pay more attention to **community management**
- Having **only relative advantages** is not enough for adoption
- **Sides of actors** are muddy in OH projects

Thank you for listening!

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Seckin Celik

seckin.celik@unitn.it

Davide Serpico

davide.serpico1@unimi.it