

EU research priorities

Future trends and innovations in data spaces

INPACE workshop

Tuomo Tuikka (VTT)

4th April 2025



BDV

BIG DATA VALUE
ASSOCIATION

- VTT Technical Research Centre of Finland
 - Lead, Data Space Solutions
 - Associate professor at University of Oulu
- Big Data Value Association
 - Member of the Board and Technical Board
 - Data Spaces Task Force co-lead
- I have been working on data space topics about 10 years
- Project experience in Horizon Europe, Digital Europe, Eureka and national projects - coordination and partner
- EU critical digital technologies expert group member



Go-to place for the future of Data and AI in Europe

Industry-driven research and innovation Data/AI community with **240 members** all over Europe.

12 Cross-sector task forces, e.g. Data Spaces, Generative AI, Standards and **12 sectoral**, e.g. Automotive, Manufacturing, Energy...

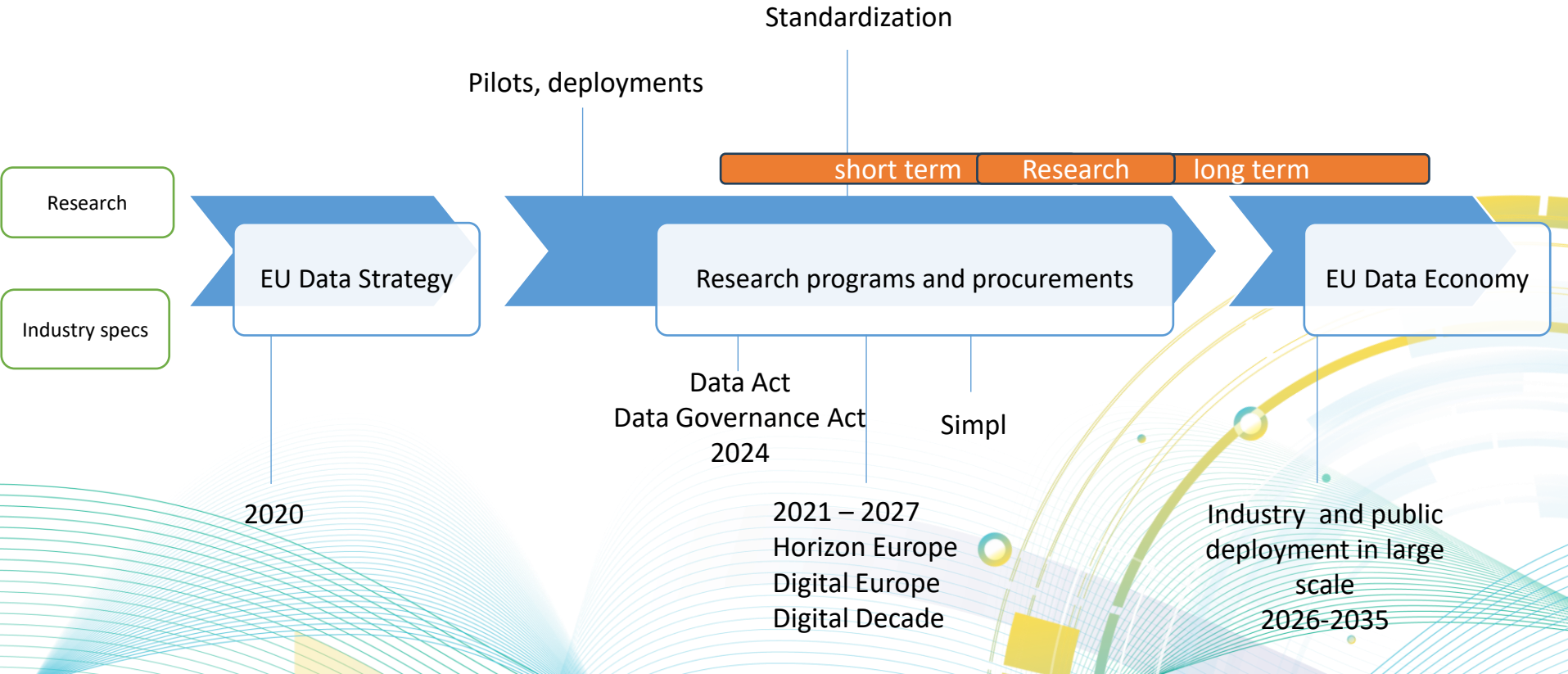
Collaborations with **Data Spaces Business Alliance, EuroHPC, ADRA**, etc.



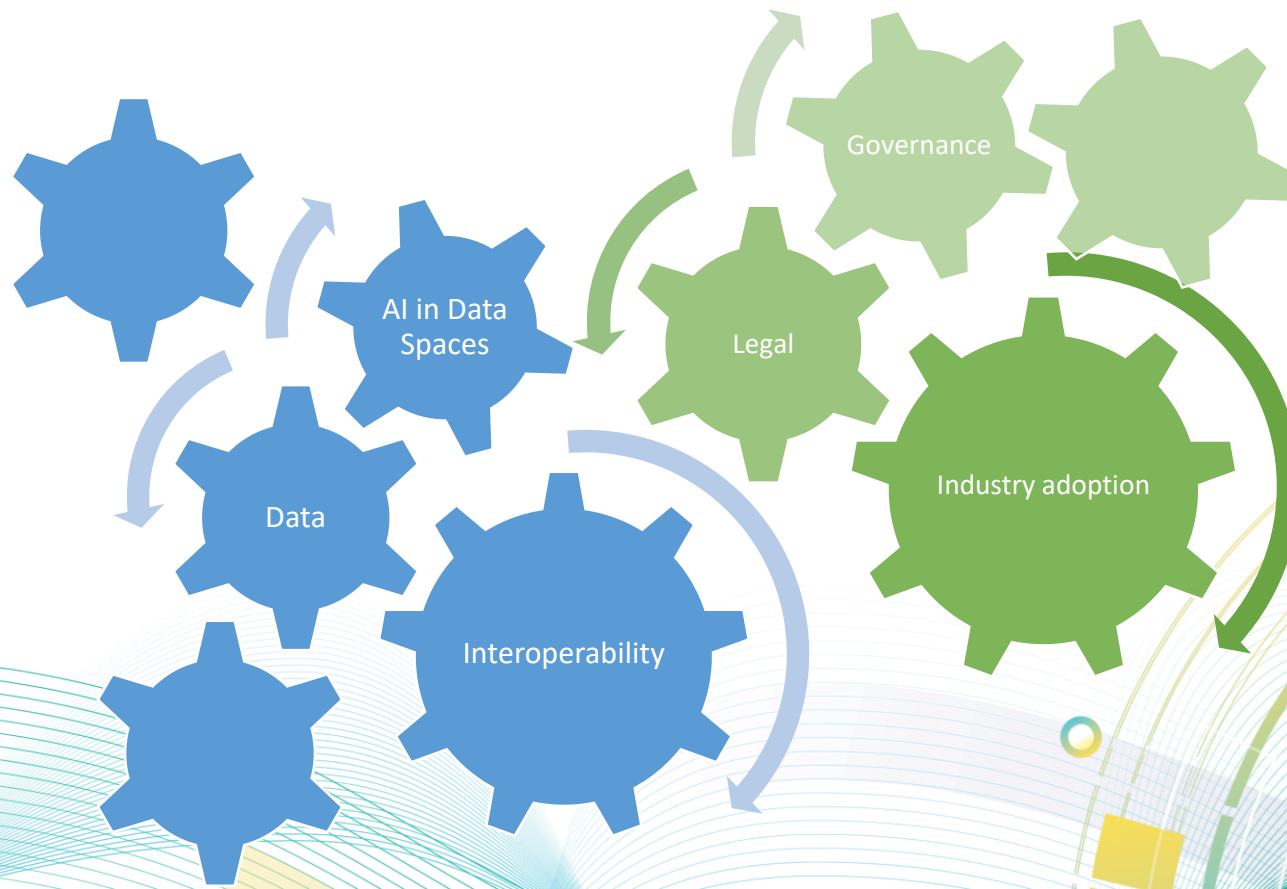
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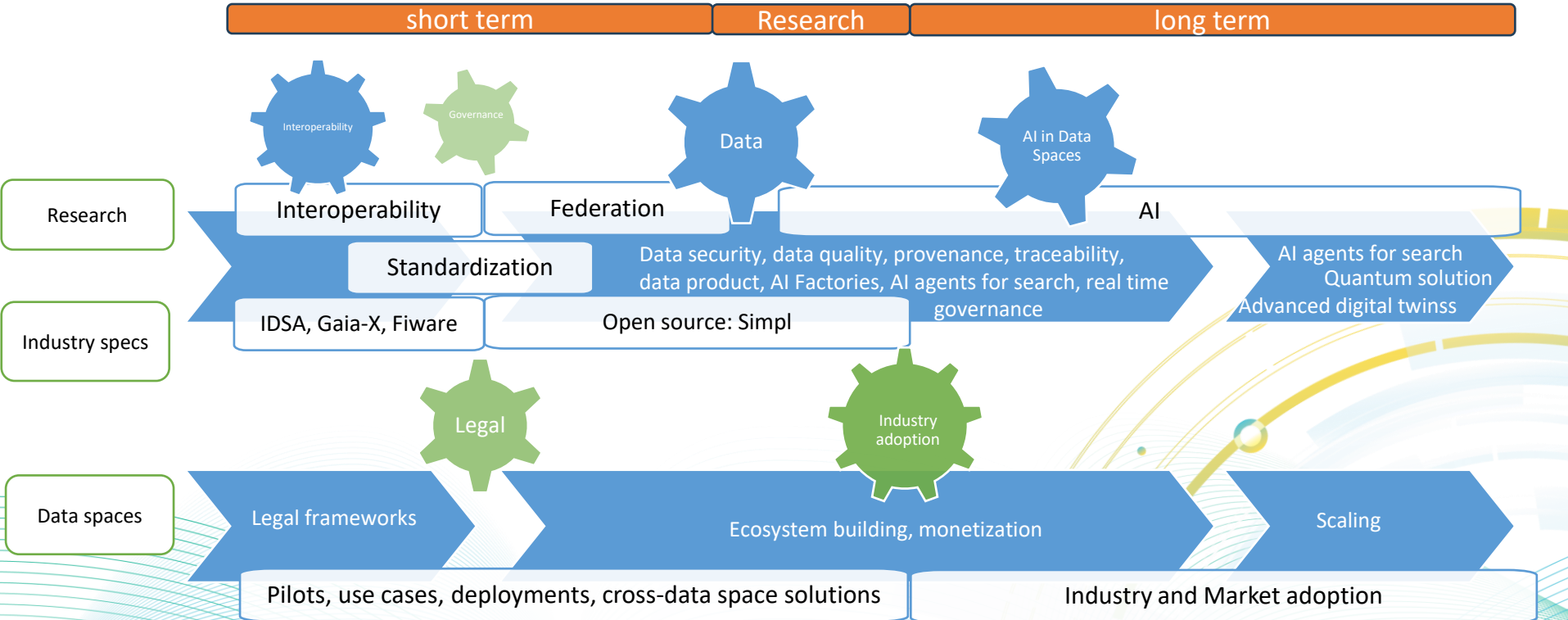
Towards European Data Economy



Data Spaces research engine



Research themes



Scaling of data spaces

- Data spaces will be exploited in large scale
 - We are able to manage the complexity caused by scale
- Societies and international businesses are intertwined in a totally new manner
 - Cost savings and new business will emerge
 - Data market will be actual
- Digital twins::
 - Digital representation of a product
 - Cities, buildings, etc.
 - Processes
- We will have real time understanding of
 - Carbon emissions
 - Circular economy
 - Export/import
 - Manufacturing needs – small series small waste
 - Use of water resources and optimization
- Artificial intelligence supported analysis of production, use of resources ... society altogether
- Manufacturing, energy, logistics, health, mobility, sustainability ...

BDVA strategic agenda 2024 (bdva.eu)



- Interoperability, technical, semantic, legal, business, governance
 - Initiatives, use cases from domains as tangible examples

- Data provenance, traceability, and lineage
 - The process of tracking the flow of data over time, where data is originated, how it has changed, and its destination
- Data security and protection through value chains
 - How to leverage the benefits of combining data spaces and privacy enhancing technologies
- Data quality for sharing and AI
 - Data sharing between different ecosystems
 - AI applications impose new requirements for the data aimed to train their models
- Scarcity of data
 - Access to available relevant and easy-to-use data sets becomes a challenge for data ecosystems



BDVA strategic agenda 2024 (bdva.eu)



Global schemes for trust and governance

- The connection of ecosystems requires the definition of a common trust/governance framework

Legal barriers

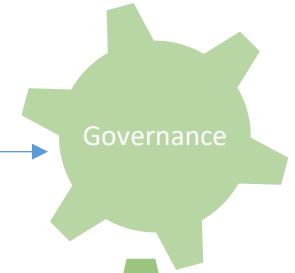
- Organizations operating under different legal frameworks, policies and strategies are able to work together. Clear agreements about how to deal with differences in legislation across borders.

Business value, adoption and engagement

- What is the tangible value to get out of participating data spaces

Sustainability and scalability

- How to make data spaces sustainable in the long run?



Scoping current research challenges for Strategic Agenda 2025 ->

◆ Data space interoperability

- Concrete use cases and piloting
- Aligning with standardization and Simpl

"User friendliness – no need to constantly to 'join' data spaces"

◆ Federation of data spaces

- Conceptual understanding, business, governance, legal
- Technical solutions development and their maturity
- Value added services and user interfaces
- Advanced search capabilities

◆ Semantic interoperability

- Semantic conversions between models vs. standardization
- LLMs for metadata extraction/knowledge graph generation



Scoping current research challenges for Strategic Agenda 2025 ->

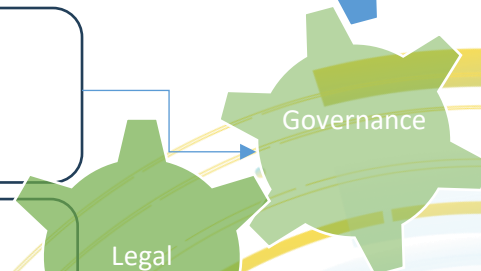
● AI in data spaces

- AI-driven data governance and automation
- AI agents for metadata-guided search
- Fitting of data spaces for new AI applications and requirements
- Retrieval Augmented Generation - RAG



● Governance

- Real time governance
- Standardized rules across major economies



● Legal

- EU Data Act enforcement
- Cross-border data sharing



● Industry and market adoption

- Multi-speed data space adoption
- Data product
- Adopt data contracts in data spaces.
- Monetization of data economy



Finally

- Vision is necessary to see the road but then again we need to work towards it – what is your vision?
- These topics act as 'hooks' for colleagues here in the room.
- BDVA has actual researchers behind the presented topics – so if there is interest we can find counterparts from BDVA community
- If you think something is missing, let's discuss about that, and find ways towards common effort, so:
 - Looking forward to hear your opinion on what are the most important research topics



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