ONTO COMMONS | ONTOLOGY-DRIVEN DATA DOCUMENTATION FOR INDUSTRY COMMONS

OntoCommons

ROADMAP

https://ontocommons.eu/roadmap

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OntoCommons Roadmap

A number of topics contributing to an Ontology Commons Ecosystem for ontology-based data documentation:

1. Ontology Foundations: Top Reference, Middle, Domain and Application Levels
2. Integrated Development Environment (Tools) and Infrastructures
3. Industrial Impact including Marketplaces, Standardisation, Education and Human Resources

The Roadmap presents:

Needs, State of the Art, Gaps, Definition of Success and Recommended Actions

Roadmap Chapters

- **TOP Reference Ontology**
- **Industrial Domain Ontologies**
- **Ontology Commons EcoSystem Toolkit**
- **Infrastructure**
- **Industrial Application**
- **Standardisation**
- **Knowledge Management Translator for Industry Commons**
- **Ontology-based digital-marketplaces cooperation**
- **Innovation and perspectives**

Needs
State-of-the-art
Gaps
Definition of Success
Recommended Actions

Top Reference Ontology

As requested by the call text, a single apical ontology, called the *OntoCommons* **Top Reference Ontology (TRO)** will be provided to enable a common foundation for data interoperability between TLOs and lower level ontologies.

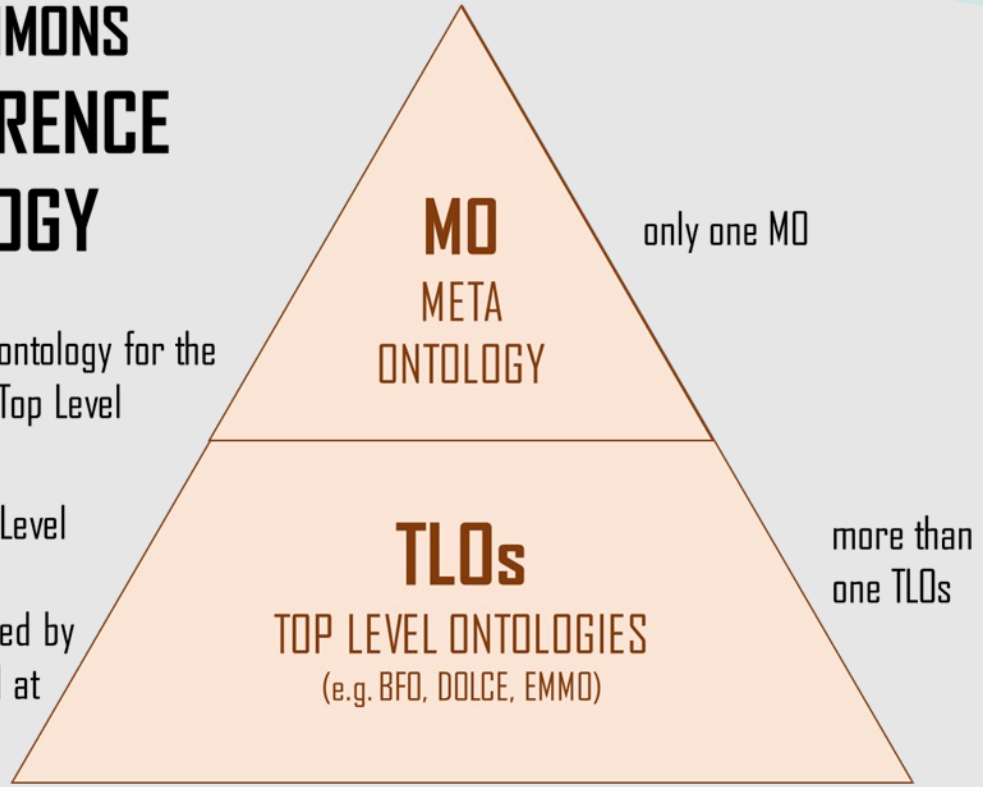
The structure of the TRO is designed in order to provide:

i) a **pluralistic perspective** in the choice of a TLO for lower level ontology development or harmonisation, and at the same time

ii) allow **TLOs comparison and interoperability** as foundation for harmonisation and data sharing between ontologies based on different TLOs.

ONTOCOMMONS TOP REFERENCE ONTOLOGY

- a Meta Ontology, i.e. an ontology for the alignement of available Top Level Ontologies
- a set of well known Top Level Ontologies whose interoperability is granted by the alignement provided at Meta Level



Domain Ontologies

Data integration and sharing

- There is a unanimous understanding in the industrial stakeholders that they will be benefited from an improvement of data integration, sharing and format conversion, while 70% of the respondent of a survey conducted responded that they have started or already adopted such standards in their practice.

Standardisation

- Though there are many standards available for the domain of material and manufacturing, there is a general lack of consensus among these standards. while in some of our domains we have standards at the level of ISO (as per 2/3 of respondents being in favour), in others we are very far from that (e.g., a CWA). Though there is no doubt that standards are key, they are very hard/impossible to be produced within the timescale of a typical EU project, unless the project is really about just producing the standard.

Various domain Perspectives

- Regarding domain ontology development a major problem is how to combine various views and domains. According to industry, it is still an unsolved problem in engineering.

Interface domain ontologies with TLOs

- The interface to TLO is more relevant from the point of view of developers of domain ontologies but not the intricacies of the TLO. In other words, we should "isolate" the domain ontologies from the TLO's theoretical and technical details.

Link domain experts to Ontologists

- The domain experts and ontologists complement each other's role where the former brings the domain level requirements and help in characterising the ontology terms from domain's point of view and the latter provide formalisation in the ontology model using theoretical grounding and ontology engineering best practices.

OCES

Ontology Commons EcoSystem (OCES) Toolkit consists of

- Methodologies
- References and specifications for tools
- Guildlines for implementation

For industry-oriented ontology development, maintenance, and application

Infrastructure

Infrastructure: set of systems and services,
basic and necessary for an entity to function

- Limit to *Research Infrastructure* (as defined by art. 2 of the EU Regulation 2021/695 - Horizon Europe)
- Components:
  - Hardware, physical networks
  - software stack, services and API definitions
  - Organizational aspects:
    - rules of participation,
    - Financial regulations
    - Human resources

Industrial application - Needs

Need #	Need Description
People	
1	**Ease of interoperability and communication between different stakeholders**
2	**Best practices for data model governance as well as modelling tools**
Data	
3	**Easy to use and to understand ontologies**
4	**Improved reusability of (meta-)data and processes**
Processes	
5	**Time savings in industrial processes**
6	**Avoidance of physical testing**

Industrial application - Gaps

GAP #	GAPS
People	
1	**Learning barriers for semantic technology in the industry**
2	**High cost of ontology development**
3	**Ontologies are difficult to maintain**
4	**Company internal/partner interaction should be optimised**
Data	
5	**The ontologies are not well documented**
6	**Lack of comprehensive domain ontologies in NMBP domains**
7	**Arguments for using FAIR principles**

Industrial application - Gaps

Data	
8	**Dealing with content protected with IPR**
9	**The ontologies should follow higher level ontologies**
10	**Interoperability between TLOs**
Processes	
11	**Lack of standards and guidelines**
Tools	
12	**User interfaces can be incomprehensible, particularly for non-ontology experts**
13	**Tools for ontology engineering are not complete**
14	**Maturity of the (collaborative) ontology development tools**
15	**Lack of easy to use tools to put ontologies in production**

Industrial application - Recommended Actions

Action #	Recommended Action
People	
1	**Knowledge engineering education**
2	**Demonstrate examples on saving time and cost**
3	**Networking events where people share their experience with ontology adoption in industrial settings**
4	**Highlight advantages of ontology usage**
Data	
5	**Data sharing and standardisation**

Industrial application - Recommended Actions

Data	
6	**Demonstration of FAIR benefits (using concrete examples)**
7	**Apply FAIR principles also for metadata**
8	**Close cooperation with FAIR communities**
Processes	
9	**Follow good ontology development practices and provide a comprehensible methodology**
Tools	
10	**Increase user-friendliness of tools**
11	**Support development of collaborative, modular and open tools for ontology development**

Standardisation - Industrial Needs

Need #	Need Description
1	European industrial strategic autonomy through better integration of materials and manufacturing standards and standardisation
2	Stronger integration of multi-domain stakeholder clusters with streamlined, digitally-supported workflows
3	Agile and market responsive SMART standards
4	Widely recognise standardisation as a channel of technology transfer from science to industry and a way to valorise those results
5	Engineering software systems need to be reusable

- Standardisation processes require **stronger integration** of **multi-domain stakeholder clusters** with streamlined, digitally-supported workflows for greater **efficiency**;
- Standardisation should be promoted as a key enabler for **industry** which can also reinforce links between **research** and **innovation**.

OntoCommons.eu adopts ontologies and standards to build its **demonstrators** and aims to cooperate with National (NSBs) and International Standards Bodies (SDOs) for proper industrial implementation of standards

Standardisation - Recommended Actions

Action #	Action Description
1	Europe to ensure the efficient and effective functioning of its standardisation system improving speed to market
2	Focus on the achievement of a well-functioning standardisation system
3	Demonstrating SMART standards with end-users through dedicated interoperability test-bed frameworks
4	Promote standardisation as a key enabler for industry
5	Reinforce links between research, innovation and standardisation
6	Improve the connection between National (NSBs) and International Standards Bodies (SDOs)
7	Embed digital capabilities in operations of competitive industries and services
8	Focus on the use of ontologies to contribute to standards inclusivity, harmonisation and interoperability, offering better categorisation of information and process efficiency

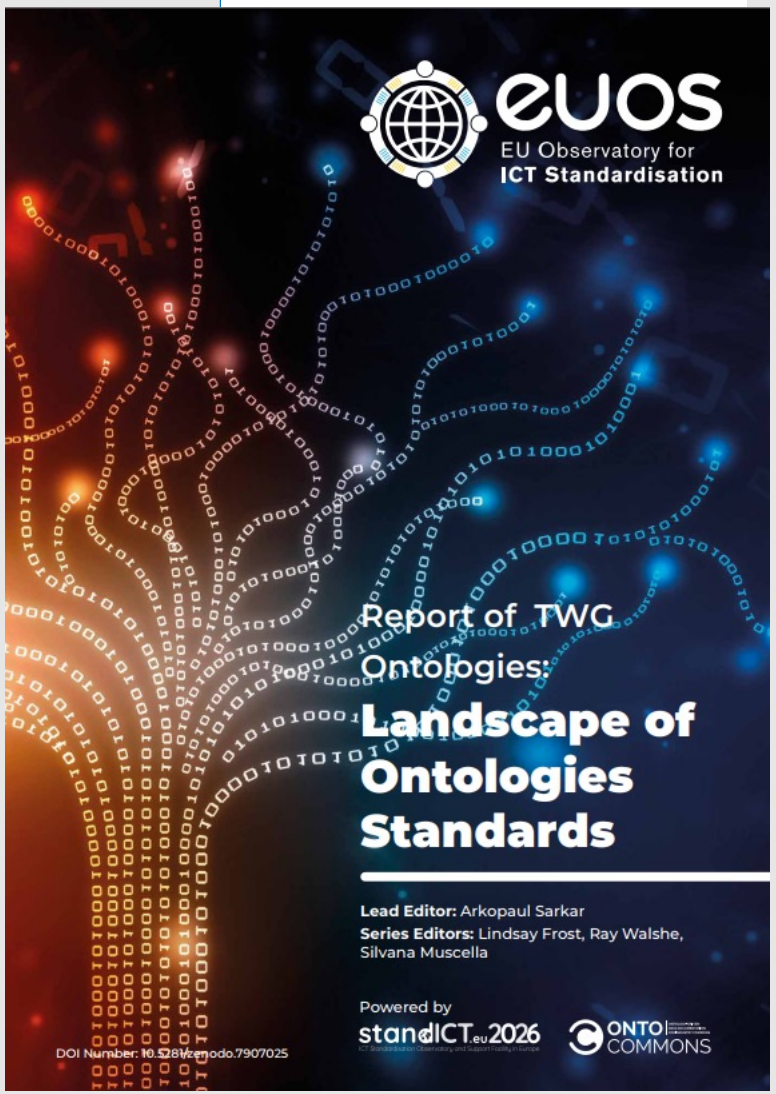
Improving the inclusivity and interoperability of standards will strengthen Europe's worldwide innovative technologies competitive position

Further Reading & Projects

Landscape of Ontologies Standards

The captures several standard ontologies, both foundational and domain-specific, published by international standardisation bodies such as ISO, IEC, and ETSI in the past few years. It serves as a tool for understanding standard ontologies and identifying priority areas for future development, which can inform policy proposals. Additionally, it acts as a guide for standardisation in the ontology landscape while emphasizing the need for the sustainability of existing ontologies to benefit communities.

Report available here:
https://zenodo.org/record/7907025



STAND4EU
Boosting the Exploitation of Standardisation Inputs from European Projects

- Understanding key bottlenecks in the standards development lifecycle
- development of recommendations and solutions,
- mutual support in communication of respective initiatives and events,
- Standards Academy

Winning Applications from StandICT:

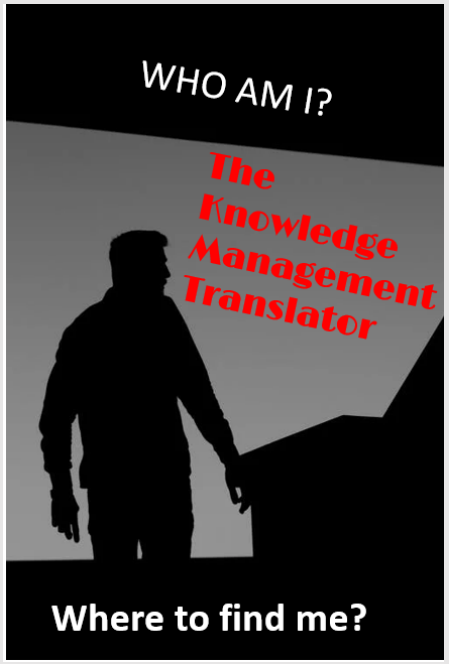
- Mark Schubert – iiRDS
- Marius Preda – ISO/IEC
- Antono Jara – IEEE
- Ulrike Parson – iiRDS
- Hedi Karray – ISO/IEC
- Nikita Lukianets – ISO/IEC (ISO/IEC AWI TR 5469)

KM Translator - “Job Description”

- Support building KM solutions to business problems ensuring that technical and business objectives are met.
- Ensure that the right KM approach is applied to the right business problem
- Support building a KM culture in the organisation
- Has and builds awareness of
  - Internal technology biases
  - Semantic trade-offs for all stacks
  - Mitigation strategies for all trade-offs and their cost
  - Bridges between Knowledge Engineering (KE) stacks
  - The landscape of tools, incl. maturity levels, costs, etc
  - FAIR semantics, re-use and collaborative workflows

Unbiased Project Management

A good ‘auditor’ and benefits advisor



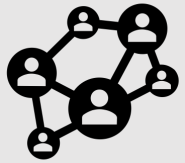
Technical skills in ontologies and knowledge engineering

KM Translator - Recommended Actions

- Establish “Translator Tools” for the comparison of different data processing technologies. Such a tool would point out the strong points and benefits of ontologies to organisations.
- A best practises guide to make KMT work transparent and FAIR, interoperable with existing standards, and trackable.
- Initiate Training schemes
  - Use a curriculum developed within OntoCommons comprising literature, training, forums, etc, to provide self-training.
  - Application for Marie Sklodowska Curie Action Nov 2023 (train new generation of KMTs)

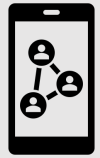
Digital Marketplaces - Industrial Needs

Better user-friendly platform



Interoperability based on common standards

Effective data exchange between simulators and databases



Integrating data generated by simulation and experiments

Improving transferring data between industries and marketplaces

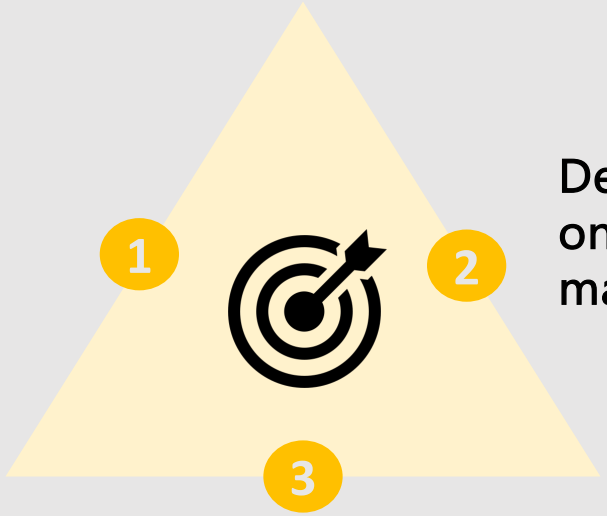
Access possibility

Digital Marketplaces - Recommended Actions

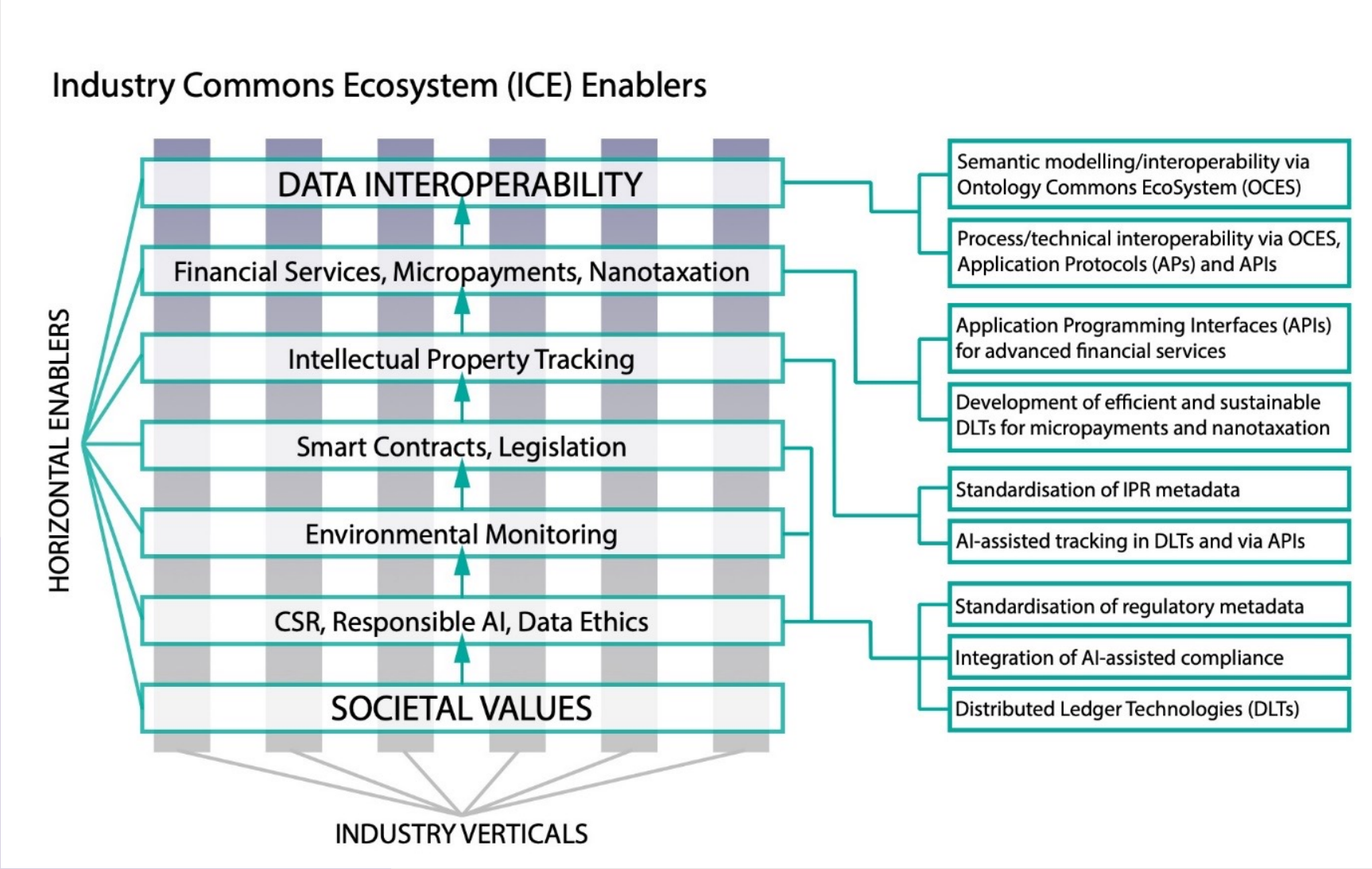
1. Well-defined demonstration for marketplaces

2. Developing a common “global” ontology framework for the marketplaces

3. Establishing link between marketplaces



Innovation - Industry Commons



Innovation - **Actions**

During the second half of the OntoCommons project several routes to innovation are being drawn from the analysis of the results from the OntoCommons Demonstrators, including:

- (i) best practice for expansion across domains;
- (ii) potential novel business models;
- (iii) the role of interfaces in supporting work with ontologies;
- (iv) positioning of the OCES within the cross-domain data-driven landscape.

Conclusions & Common thoughts

Industrial Needs

- Data integration and sharing.
- EFFECTIVE DATA DOCUMENTATION
- Standardisation
- Various domain Perspectives
- Link domain experts to Ontologists
- Training on ontology engineering
- Trustworthy data repositories and trusted computational

Gaps

- Lack of Generic and Application-specific Ontologies
- Lack of standardised methodology
- Lack of user friendly and collaborative tools
- The ontologies are not well documented and maintained
- Ontology Sustainability
- Lack of Standardised Method for Ontology Evaluation
- Lack of ontology experts
- Lack of understanding of FAIR

Recommended Actions

- Standardization of the ontology engineering steps
- Balance of Theory and Practice
- ONTOLOGY SCALABILITY (EXPRESSIVITY VS COMPUTABILITY)
- FAIRness by design
- Follow Domain related standards
- Classify domains (an ontology of domains)
- Bridging the gap between domain experts, IT and ontologists
- Reconcile Ontology Engineering and Exploitation through KG