

Driving industrial innovation with open science

Martin Thomas Horsch

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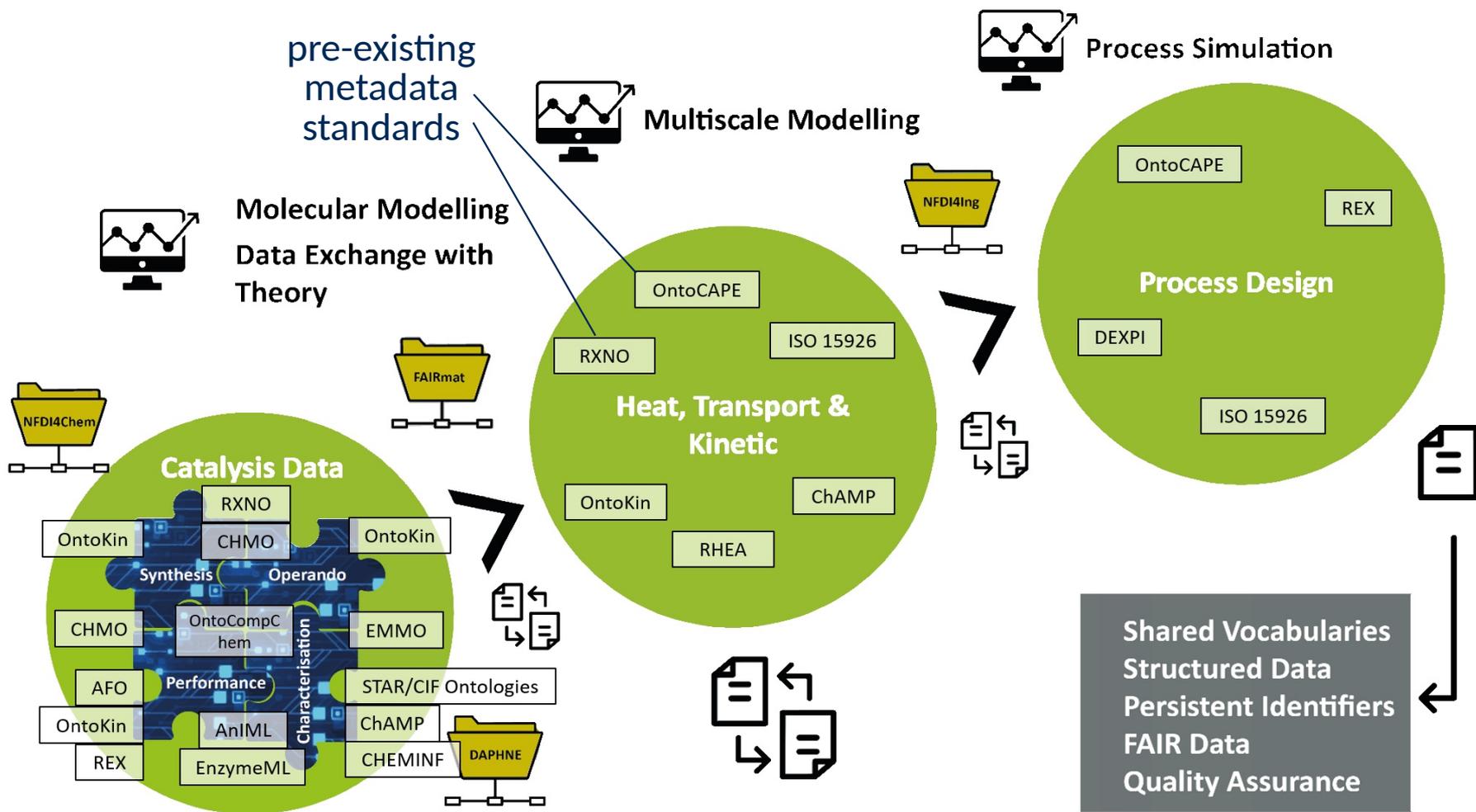
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Applying FAIR principles to open science and industry
to drive innovation: challenges and opportunities

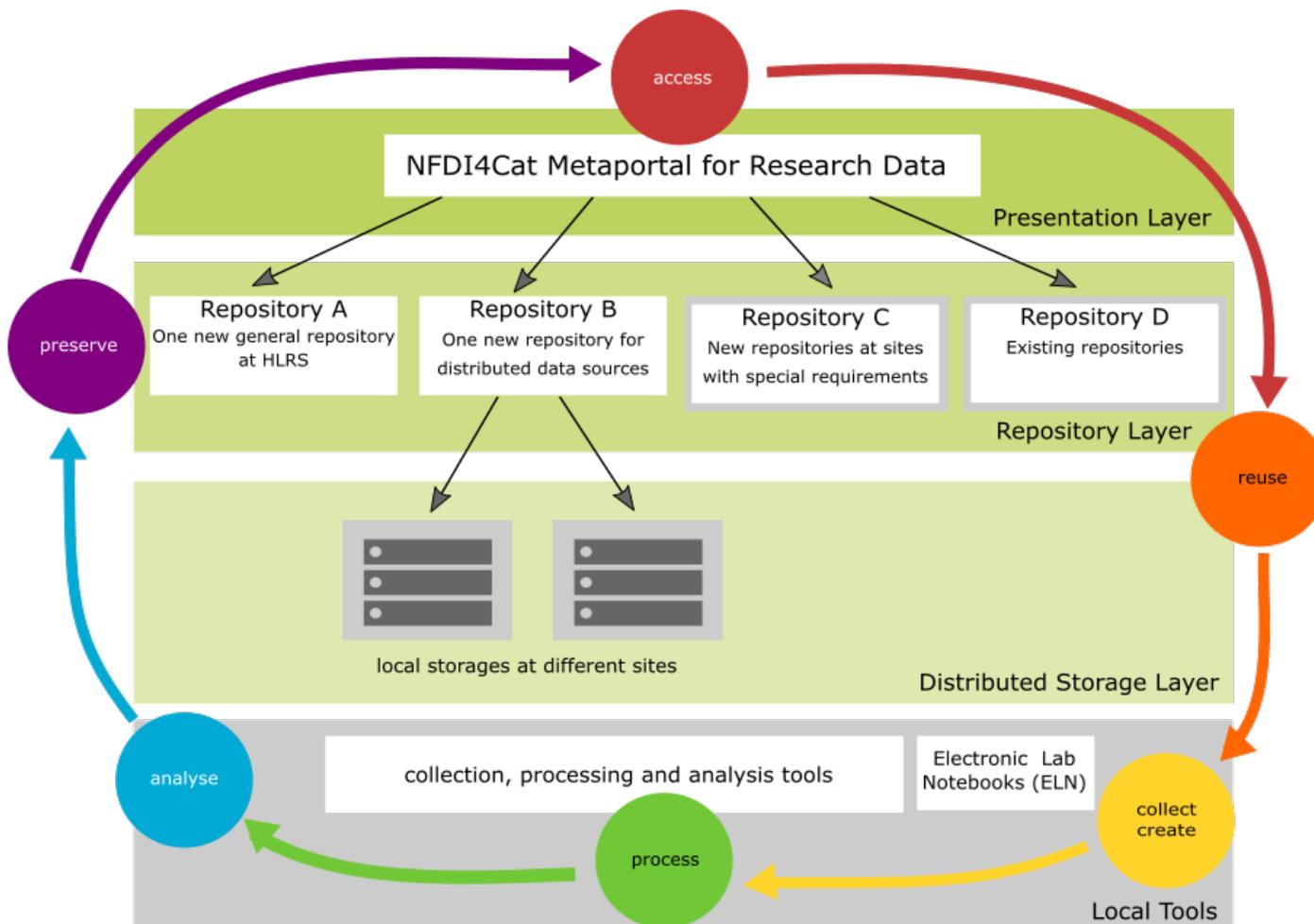
Joint Workshop



Digital value chains and research data infrastructures



National Research Data Infrastructure (NFDI)



NFDI4@t
Catalysis-Related Sciences

NFDI4ing
Engineering Sciences

Hype or realistic objectives?

Example from a Horizon 2020 call¹ on „Open Science“ and „Open Innovation“

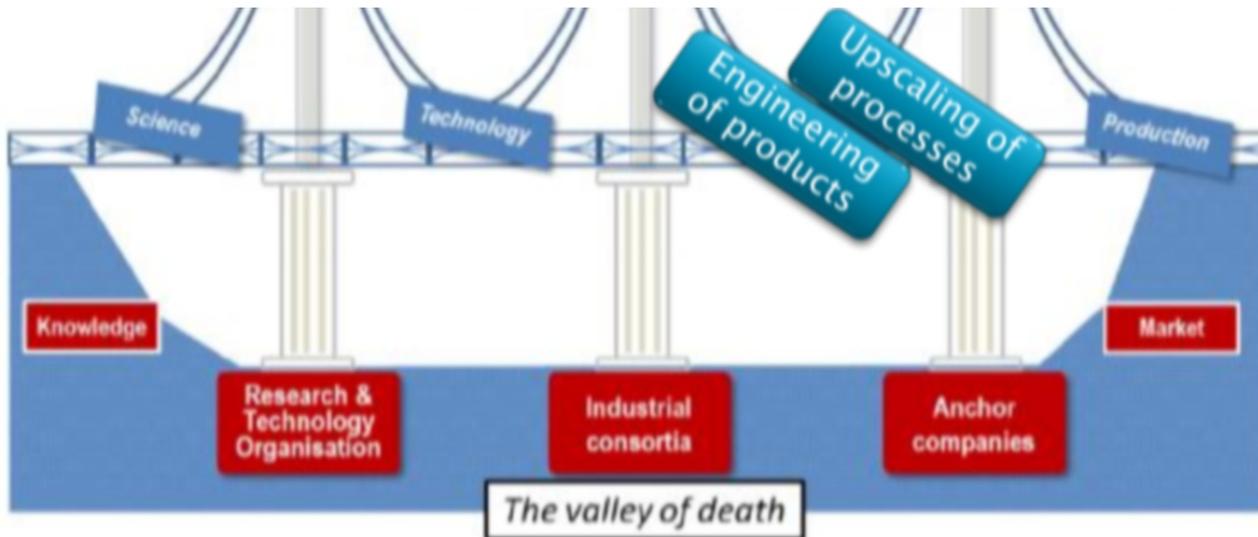
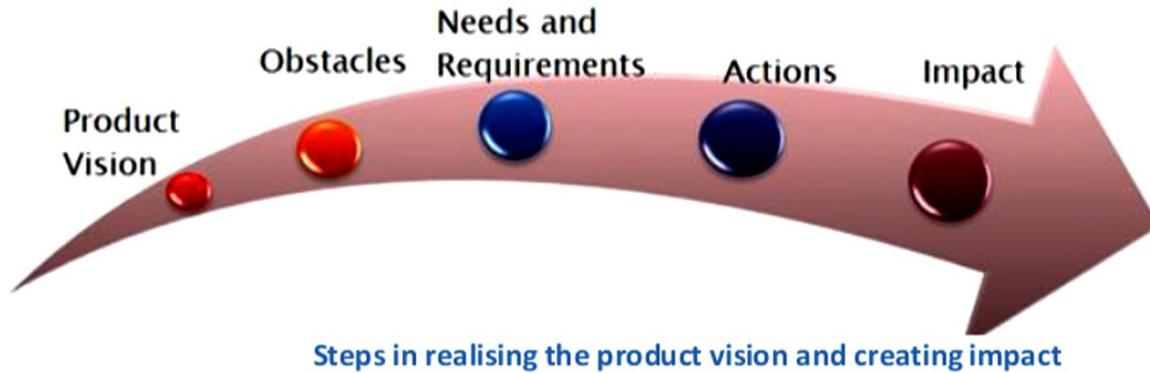
The Commission considers that proposals requesting a contribution from the EU around EUR 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected impact:

- Remove barriers to the use of materials models by lowering the learning curve, increase the knowledge-base of European industry and the total cost of ownership leading to an industrial user base of companies increased by a factor 2;
- **Increased speed of material and/or product development time and rapid design from concept to market by factor 5** and allow industry to react to changing market and regulatory demands;
- Change the operational practice of companies by making them more data driven, agile, light and competitive and thus support the Digital Single Market (DSM) objectives and thus **drastically reduced development costs for industry by a factor 2;**

¹Horizon 2020 call no. DT-NMBP-10-2019

Hype or realistic objectives?



Technology uptake

First, nerds talk of it.

Decision makers project expectations into it.

Then everybody starts talking of it.

Finally, even decision makers understand it.

Figures from Fantechi *et al.*, *Towards a Roadmap for Engineering & Upscaling*, technical report, 2015.

Semantic interoperability: EOSC recommendations¹



Problems

Lack of (or overabundance of)

- P1: explicit definitions
- P2: common semantics (general or
- P3: reference repository
- P4: common metadata scheme ac
- P5: metadata models



Recommendations

- R1: definitions of concepts, metadata and data schemes
- R2: creating semantic artefacts with open licenses
- R3: associated documentation for semantic artifacts
- R4: repositories of semantic artefacts
- R5: minimum metadata model and cross walks discovery
- R6: extensible options for disciplinary metadata
- R7: apply a broad definition of data (datasets, workflows, lab protocols, software, methods, hardware design, etc.)
- R8: clear protocols and building blocks for catalogues



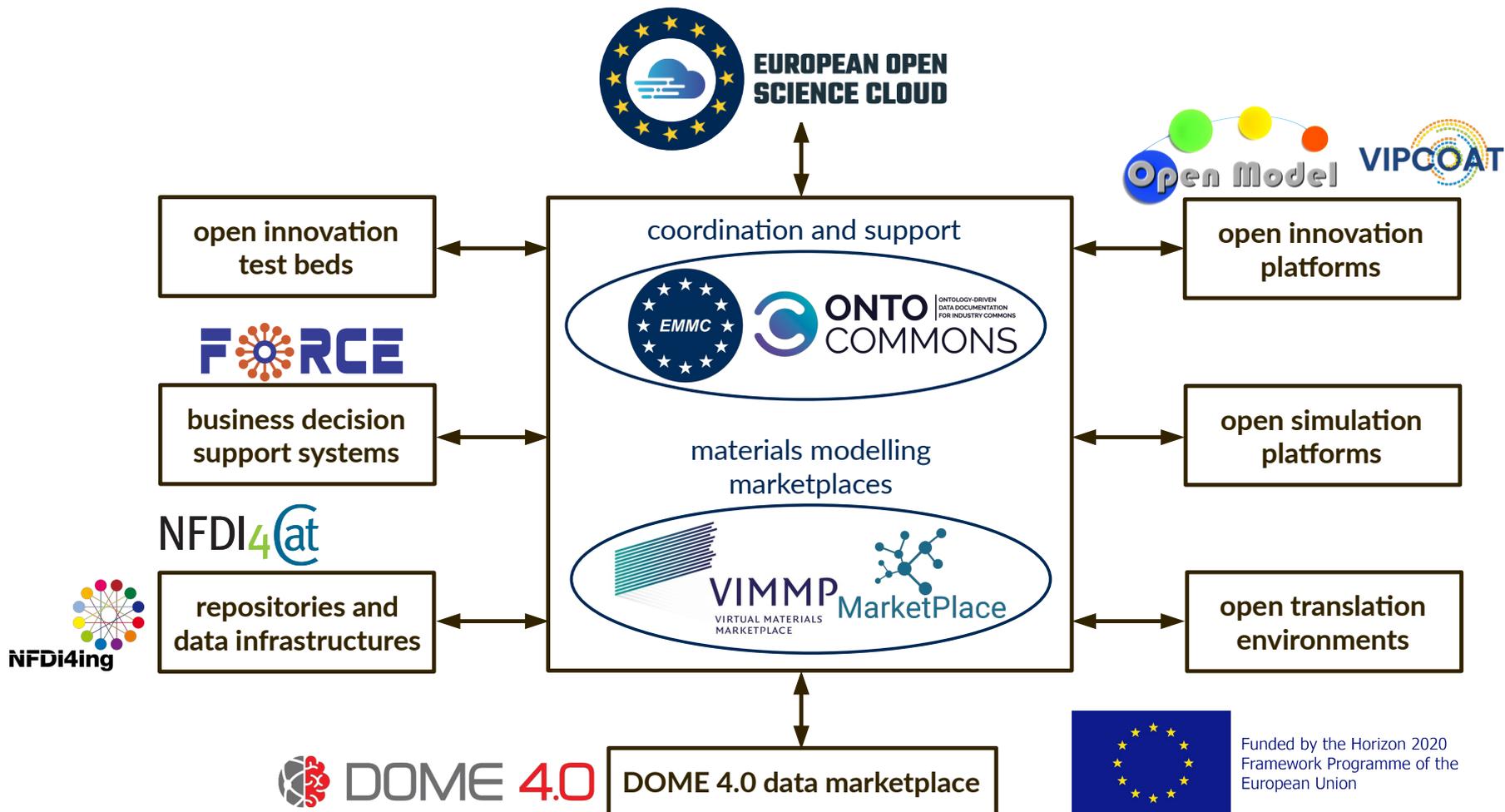
Needs

- N1: principle approaches/tools for ontology and metadata schemes
- N2: harmonisation across disciplines
- N3: harmonisation of data of the same type
- N4: federated access to existing research data repositories

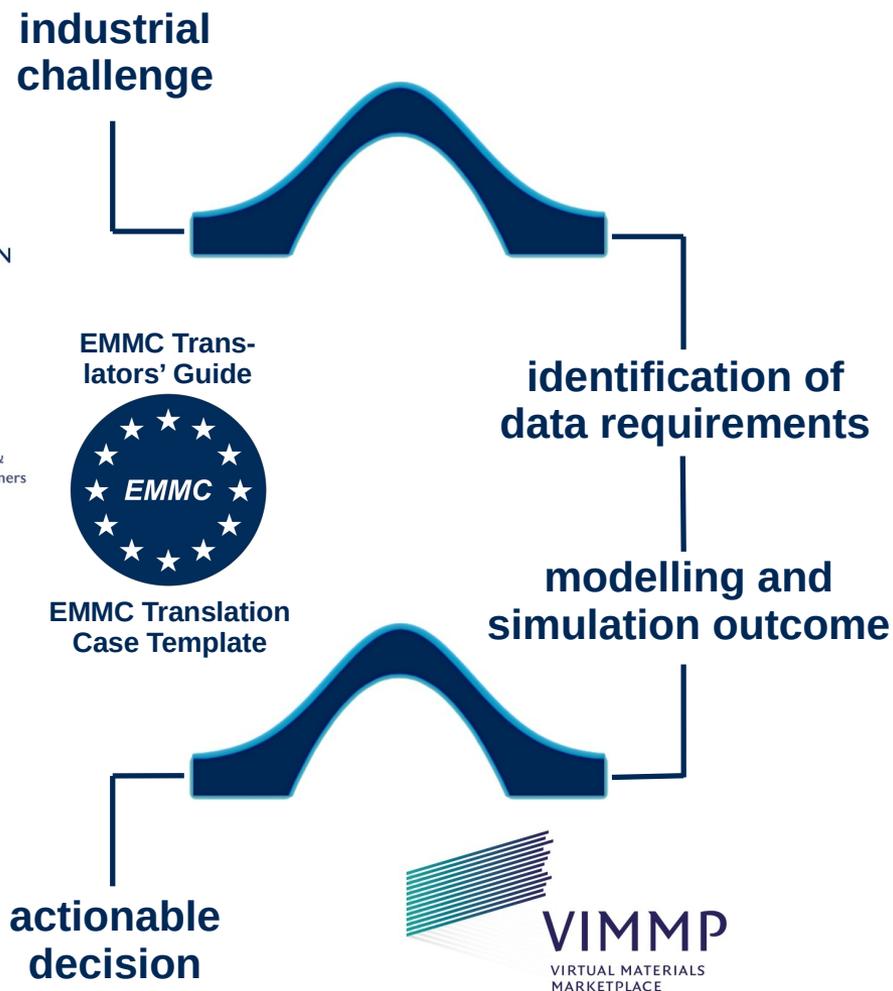
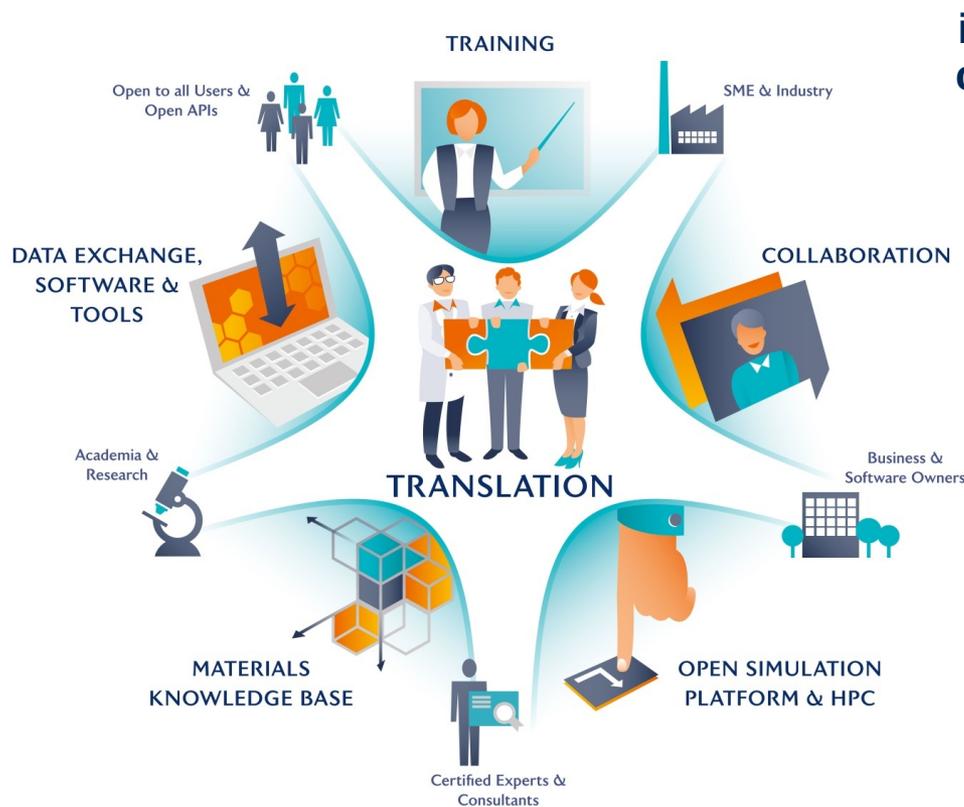


¹EOSC Interoperability Framework

Interoperable platforms and the H2020 NMBP programme

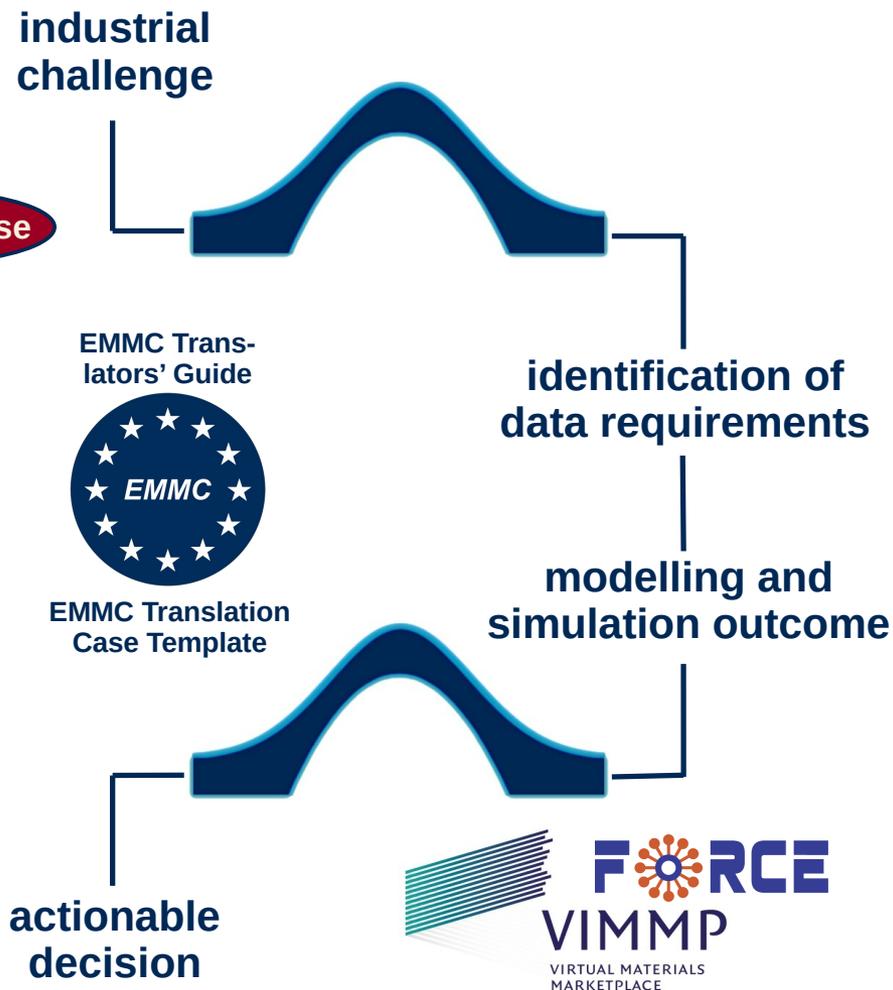
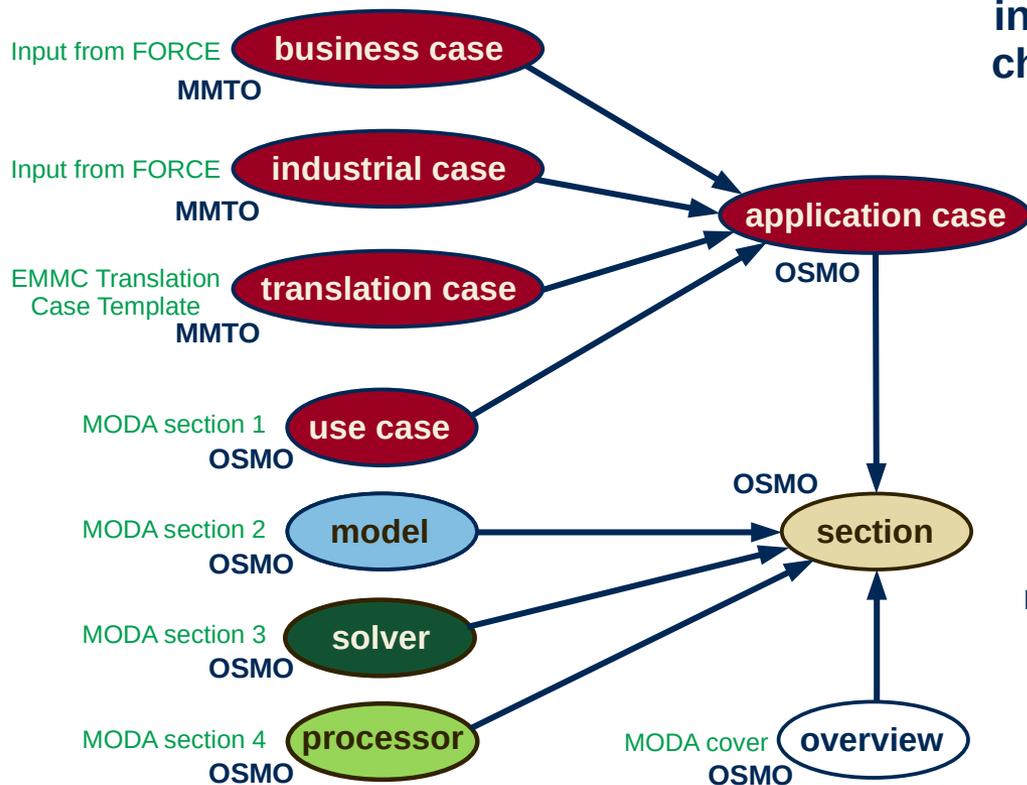


Virtual Materials Marketplace (VIMMP)



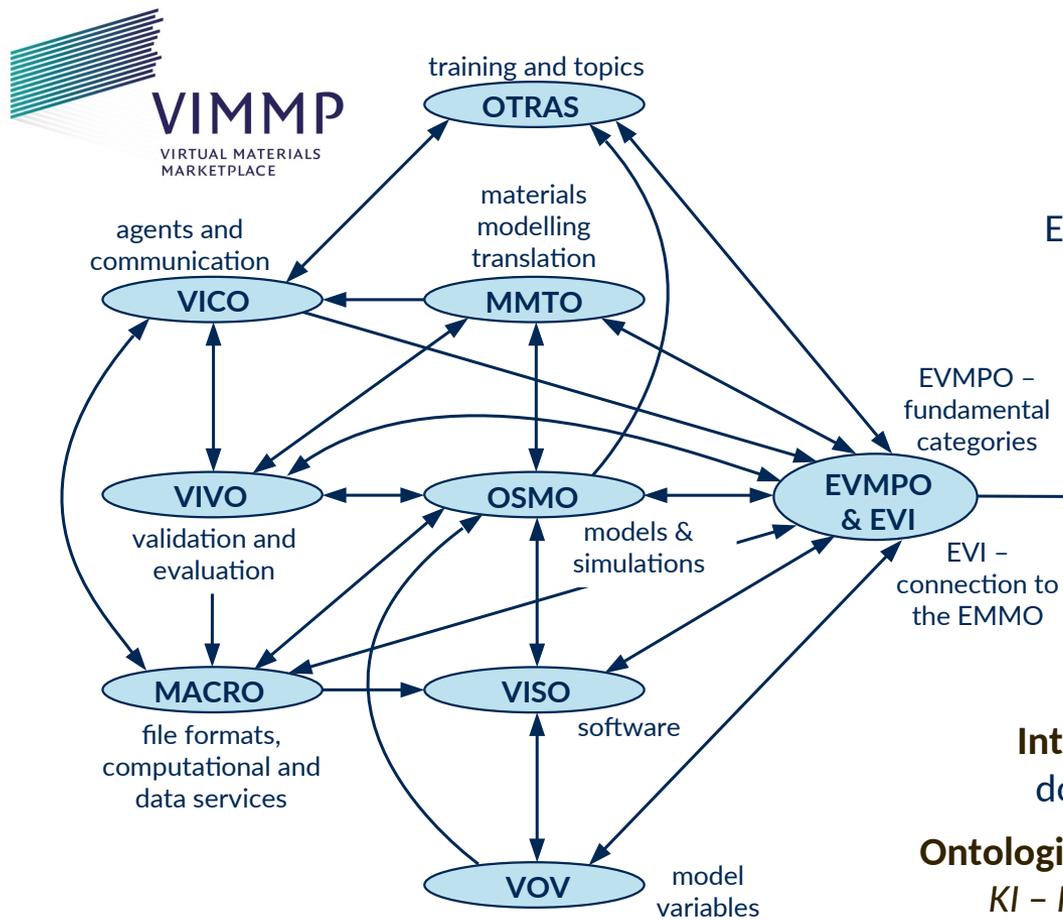
M. T. Horsch, S. Chiacchiera, M. A. Seaton, I. T. Todorov, B. Schembera, P. Klein, N. A. Konchakova, "Pragmatic interoperability and translation [...]," *Proceedings of DAMDID 2020*, 2021.

Materials Modelling Translation Ontology (MMTO)



M. T. Horsch, S. Chiacchiera, M. A. Seaton, I. T. Todorov, B. Schembera, P. Klein, N. A. Konchakova, "Pragmatic interoperability and translation [...]," *Proceedings of DAMDID 2020*, 2021.

H2020 LEIT NMBP and EMMC metadata standardization



The Horizon Europe CL4 work programme continues to mention EMMO compliance as a requirement.

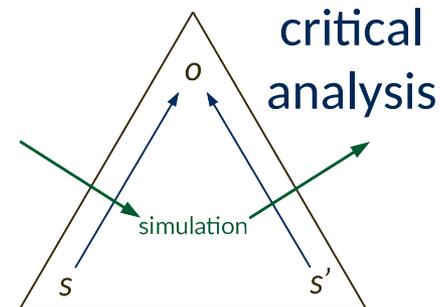
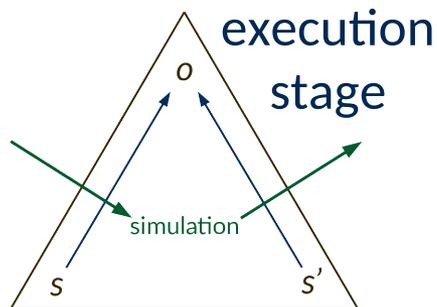
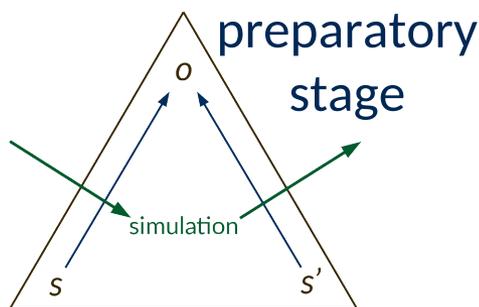


Introduction and most recent release
doi:10.5281/zenodo.3936795, 2021

Ontologies for the Virtual Materials Marketplace
KI - Künstliche Intelligenz 34(3), 423-428,
doi:10.1007/s13218-020-00648-9, 2020

Conclusion: Epistemic FAIRness and DORIC principles

Open science requires **epistemic FAIRness**, the opposite of epistemic opacity. Digital platforms must support documentation of **research data provenance**.



Priorities (“DORIC principles”) following doi:10.5281/zenodo.4571052



diversify
technologies



observe
practices



realistic
objectives



incentivize
open data



co-design data
and workflows

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