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Adopting Semantic Web technologies as a backbone of future-proof software development

Vysoká škola ekonomická v Praze

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Problems definitions

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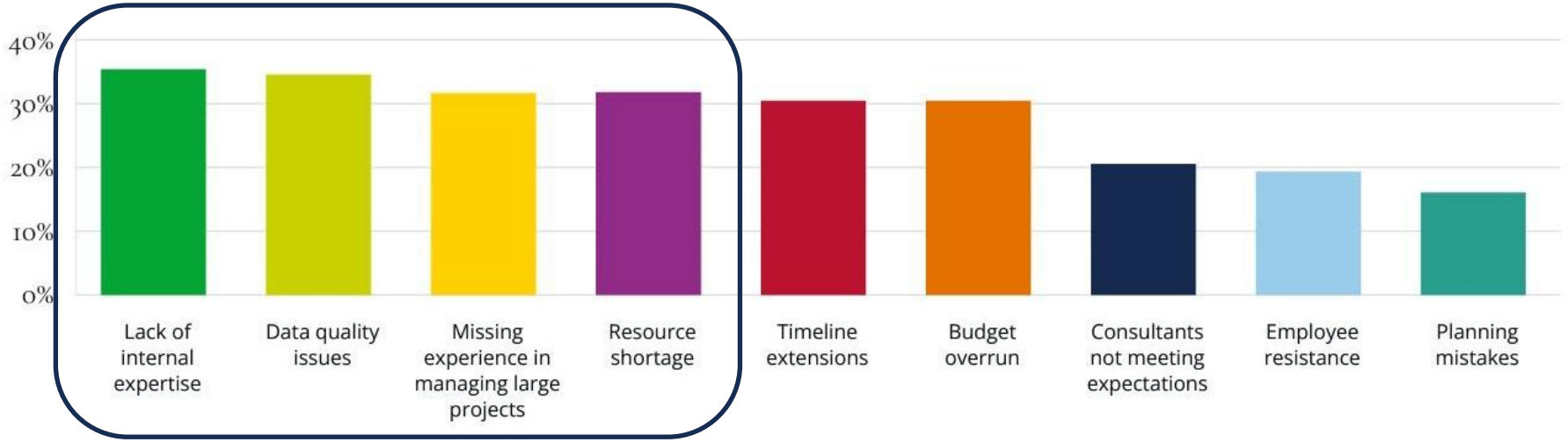
High demand for IT specialists

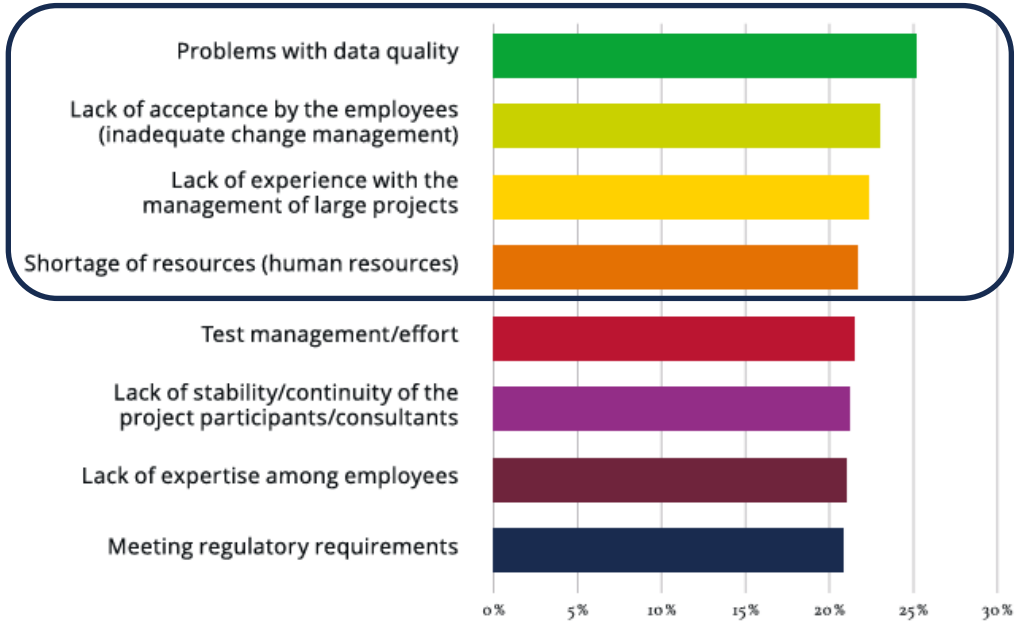
- During the last decade, the share of ICT specialists in total employment increased from 3.2 % in 2012 to 4.6 % in 2022. The trend was confirmed in 2024 with 5.0%.
- The number of persons employed as ICT specialists increased by 57.8 % during the period from 2012 to 2022.
- 57.5 % of EU enterprises had difficulties with filling ICT vacancies in 2023
- Source: ICT specialists in employment, Eurostat, ec.europa.eu
- The job in general that is the most in-demand on LinkedIn in Q2 2025 is the role of Software engineer, with no change in rank compared to the previous quarter.
- https://www.linkedin.com/business/talent/blog/talent-strategy/most-in-demand-jobs

Fast change management vs Missing or lost knowledge

- In 2022, more than 200 companies responded to a structured survey which investigated experiences from data transformation efforts.
- „Reducing **cost**, increasing **responsiveness**, and improving **future readiness** were the main reasons for the transformation.“
- „The biggest obstacle to overcome in the transformation process is the **lack of expertise within the own workforce**!“
- Source: Natuvion, Transformation 2022, The Study, http://www.natuvion.com/
- The survey took place also in 2025 with 909 SMEs managers, which confirmed the **need for fast change management**, with the **introduction of AI** being the main reason for the transformation, followed by **faster response to market requirements** and **increased ability to innovate**.
- Source: Natuvion, Transformation 2025, The Study, http://www.natuvion.com/



Natuvion 2022 vs 2025 Study - data and product transformation challenges



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Research questions

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Research questions

- Q1: Can **non-technical separation of concerns** in software development, meaning **assigning the ownership of data models solely to data experts**, help solving the technical problem of badly designed, not future-proof and unreliable software, as well as help solving the problem with knowledge loss within a business?

- Q2: What **methodologies** and **supporting tools** can provide sufficient foundation for such separation of concerns and effective long-term dynamic persistence of domain knowledge?

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Goals to be reached

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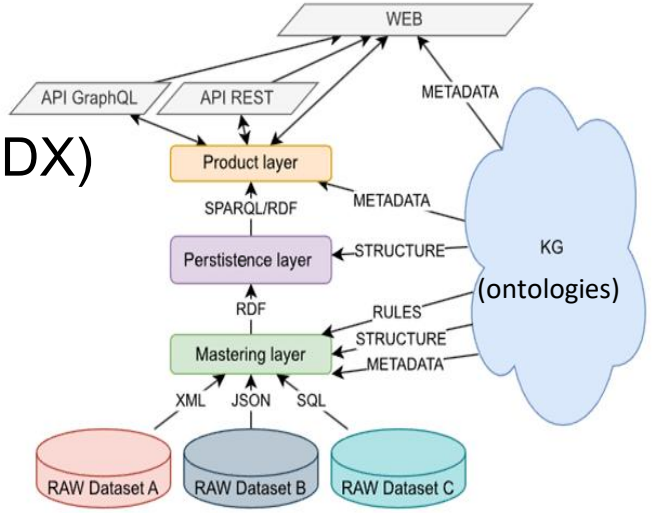
Goals to be reached

- The primary goal of the research is to either **confirm that using ontology** as a tool for non-technical separation of responsibilities during software development is **going to speed up the development process** and **reduce the number of possible errors** or **reject such a path for further research**. To answer the research questions, and therefore reach the primary goal, the following artifacts are to be created:

- Methodology and supporting tools for data experts
- Supporting tools with focus on developers' experience (DX)
- Prototype of data pipeline software
- Prototype of product software



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Current state

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Presenting the idea and collecting valuable feedback at conferences

- **ISWC 2023**
  - The 22nd International Semantic Web Conference, Athens, GR
  - Presentation at PhD Consortium
- **ISWS 2024**
  - International Semantic Web Research Summer School, Bertinoro, IT
- **EKAW 2024**
  - 24th International Conference on Knowledge Engineering and Knowledge Management, Amsterdam, NL
  - Demo: RDF2JSON-OM: Dynamic ontology serialization using ontology mapping paths

Qualitative research of Semantic Web technology adoption

- **Q2A: What methodologies and supporting tools are going to improve the level of adoption of Semantic Web technologies within the software developers' community?**

- QRQ1: What drives people to adopt hyped technologies?

- QRQ2: What factors affect the adoption of Semantic Web technologies as part of innovation initiatives in particular?

- QRQ3: What is the (perceived) level of inclusion of Semantic Web technologies in higher education institutions (HEIs) curricula?

Research and selection of best methodologies for data modeling across domains within the scope of Semantic Web technology

- Ontology Engineering Methodologies: **From Domain-Centric**
- *LOT: An industrial oriented ontology engineering framework [Poveda, M.; 2022]*

- **To Value-Centric**
- *BEAR: Value-First Ontology Engineering Framework for Business Ecosystem Analysis and Representation [Tüzün, A.; 2025]*
- *Accelerating knowledge graph and ontology engineering with LLMs [Shimizu, C.; 2025]*

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Thank you.

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