Reuse and guidance for generative AI solution development and implementation: knowledge management perspective

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Co-funded by the European Union

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Agenda

1. Motivation
2. Related work
3. Knowledge management perspective for GenAI solution development and implementation
4. Preliminary vision of the open toolkit for knowledge-focused GenAI solution development and implementation
5. Conclusions

Motivation

GenAI has huge potential to transform knowledge work.

BUT

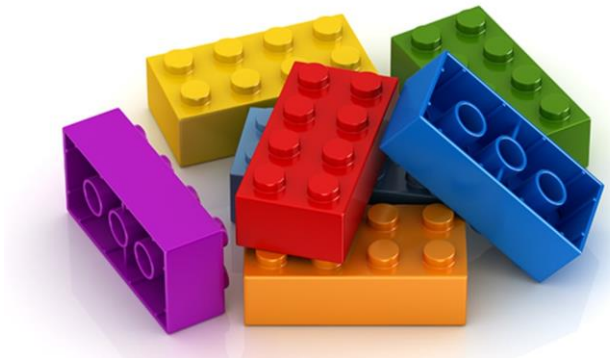
- Most companies lack the technical expertise and capabilities to implement GenAI solutions effectively, especially SMEs
- The pilot to production chasm
- Business value from GenAI implementation is still limited

Sources:

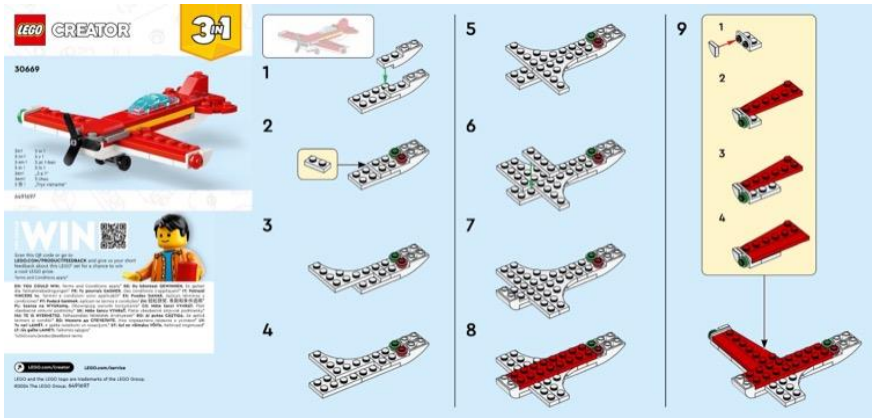
- Literature analysis
- Previous research: 20+ companies interviewed (Kudryavtsev et al, 2024)
- Our experience from AI needs analysis and advisory sessions within the Finnish AI Region (FAIR) EDIH project 100+ companies, 50+ GenAI implementation (Khan et al, 2025)

Potential solution

Building blocks



Guidelines

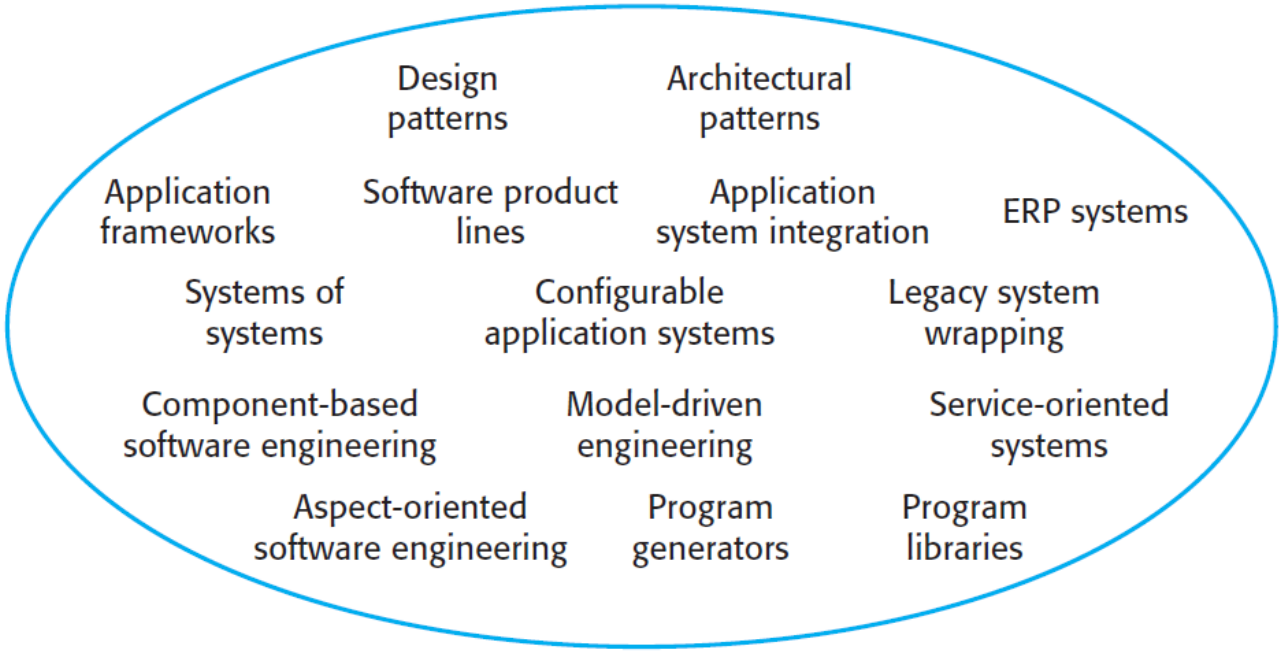


Real results

Benefits:
Quicker implementation, Less risks, Less resources, Higher solution quality

Existing approaches for software and knowledge reuse

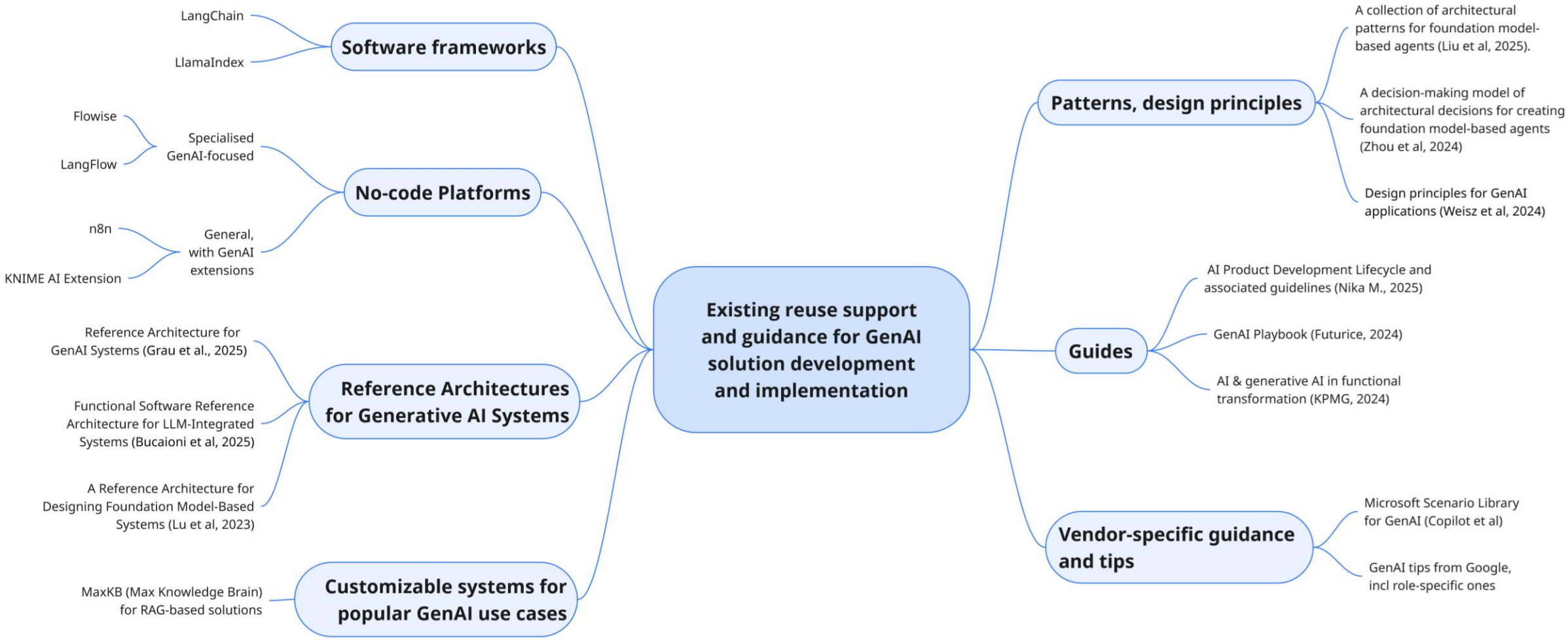
Software reuse landscape (Sommerville, 2010)



Knowledge reuse landscape (Sandkuhl, 2015)

- Semantic patterns [18].
- Knowledge patterns [28].
- Ontology modules [20].
- Ontology design patterns [29].
- Knowledge engineering macros [25].
- Task patterns [22].
- Information demand patterns [23].
- Knowledge architecture [30].
- Ontology architecture [21].
- Knowledge formalization patterns [19].
- Active Knowledge Architectures [3].
- Active Knowledge Models [3].
- Interaction Patterns [32].
- Knowledge prioritization templates [33].
- Knowledge Transformation Patterns [24].
- Workflow patterns [31].

Existing reuse support & guidance for GenAI solution development and implementation, overview



Limitations of existing frameworks, methods and tools for GenAI solution development and implementation

- Some of them provide lower-level building blocks, which require AI expertise
- Some of them are too general, while others support only fragmented solution types (e.g. customer support chatbots);
- Some of them are vendor-specific – e.g. for Microsoft Copilot and Azure.
- They address only one of the business or technical levels, while successful AI implementation requires efforts at both levels;
- Not publicly available - proprietary solutions from IT and consulting companies.

Knowledge management (KM) perspective may help to improve reuse support and guidance

Knowledge processes
as the basis for scoping and structuring GenAI services and solution development

Knowledge services
as an approach for specifying the role of GenAI in KM

GenAI solution development & implementation support

Leveraging organizational knowledge
using GenAI

All the KM enablers should be addressed
human capital, processes, technology and infrastructure, governance and culture

Generative AI-enhanced Knowledge Management (GAIK) project – the implementation of this approach

The primary project goal:
Creation of the open toolkit for knowledge-focused GenAI solution development and implementation

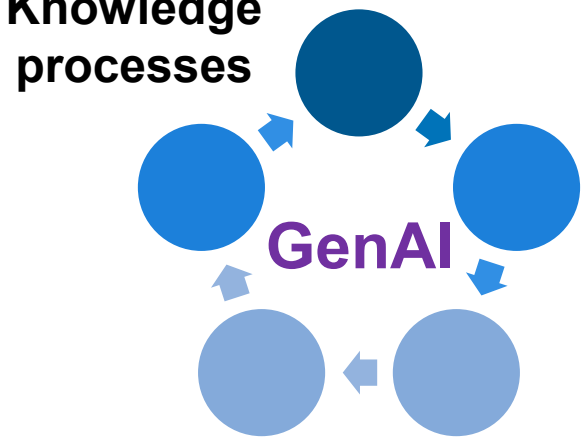
Target audience: Small and Medium-sized companies (SMEs)

University-Industry cooperation

Project consortium:
3 universities and 5 companies.
We also have partnership extension plans

Timeline: 01.02.2025 – 31.01.2027

Methodology: Action Design Research



Co-funded
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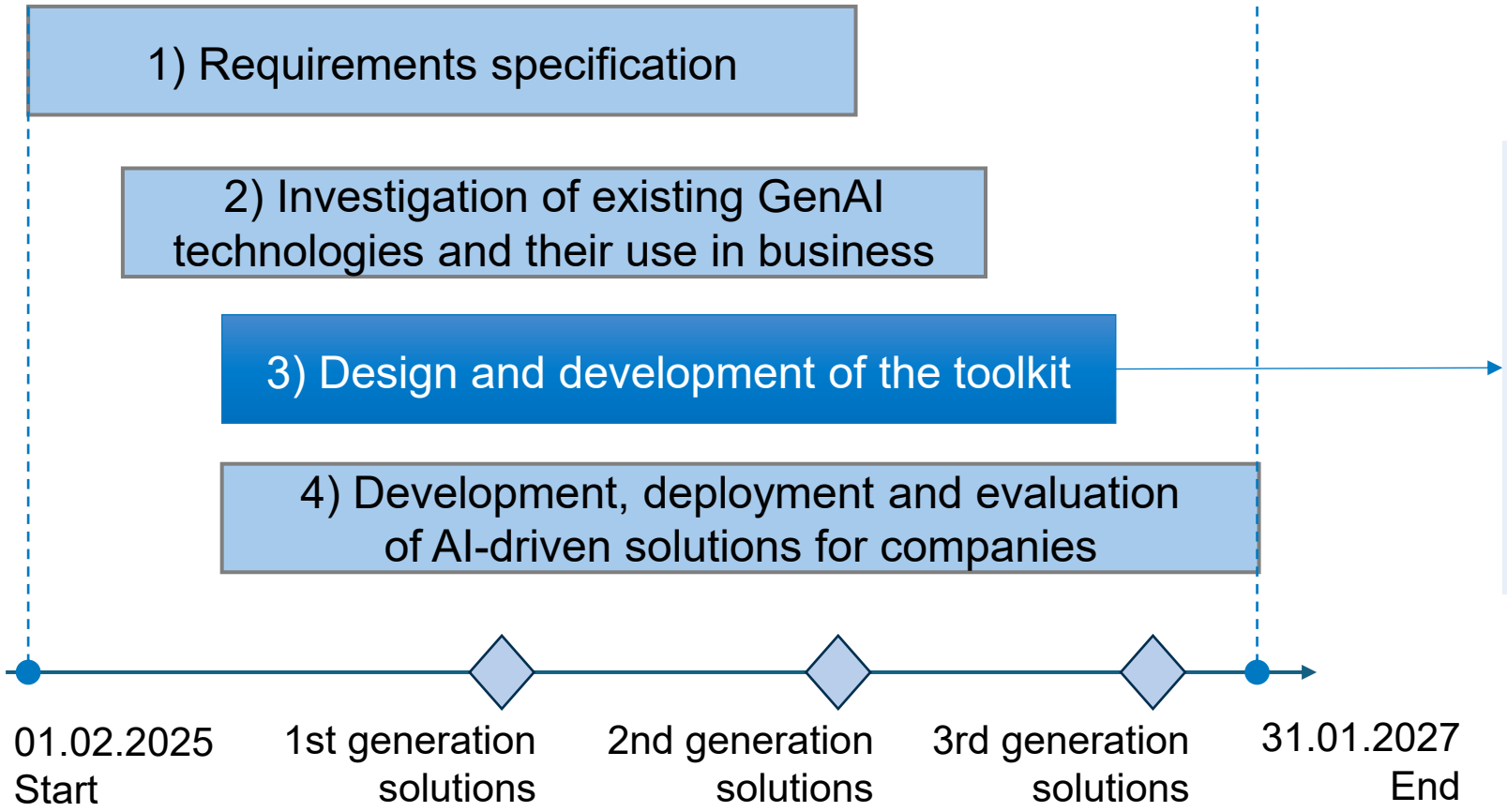
Creation of the open toolkit for knowledge-focused GenAI solution development and implementation



Intermediate results:

1. Requirements specification for a GenAI toolkit
2. Design principles for GenAI toolkit development
3. Preliminary architecture vision of the toolkit

Requirements specification for the GenAI toolkit

The target audience:

A. **Managers and/or domain experts with digital skills** (no-code development, vibe coding, GenAI application skills)

B. **IT specialists** with software development and coding skills with limited GenAI experience

Requirements:

1. **Holistic support of knowledge processes**
2. **Business-level support:** GenAI solution should generate value for the company and provide reasonable return-on-investments, so business-level guidelines and building blocks are needed,
3. **Technical guidance and reuse are needed:** how to develop GenAI-based software system? What components can be reused?
4. **Support for the complete life-cycles:**
   - **AI product life-cycle (business focus):** ideation, opportunity, developing a concept/prototype, testing and analysis, and rollout,
   - **AI system life-cycle (technical focus):** requirements analysis, design, development, testing, implementation & operation,
5. **Suitability for SMEs with low AI maturity and limited tech expertise**.

Requirements specification for the GenAI toolkit

Scope of the GenAI toolkit

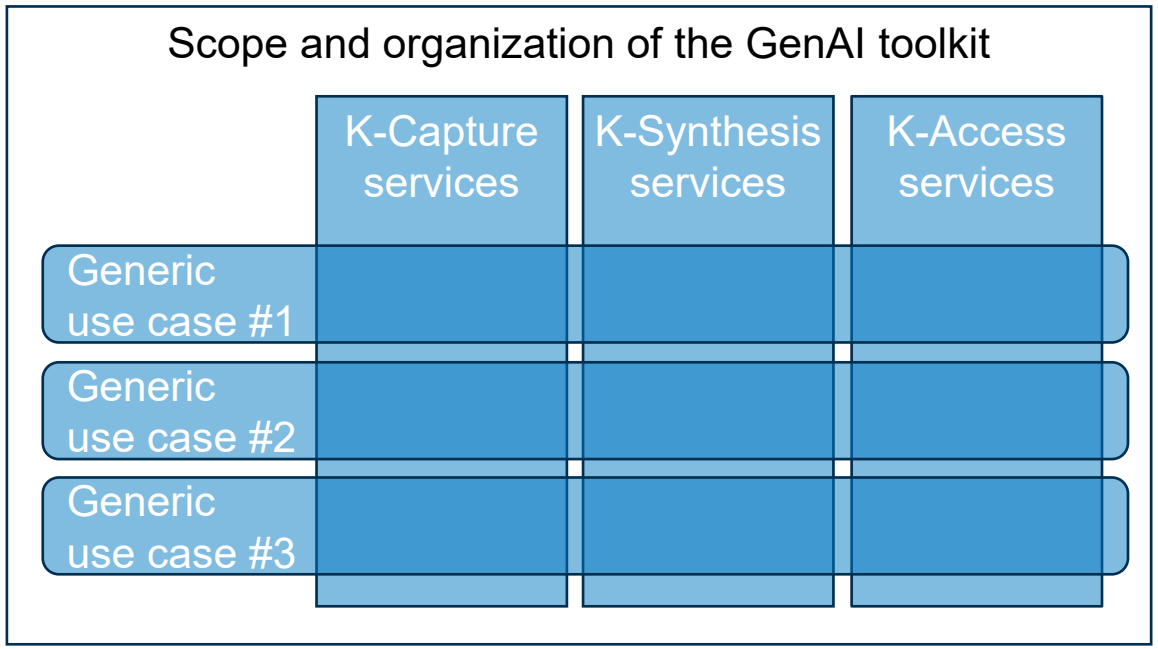
Knowledge process	Generic use cases	Company-specific use cases
Knowledge access	Intelligent access to organizational knowledge (document repositories, databases, wikis, CRMs)	• Search and recommendations for audio and video content library • Sales and customer onboarding assistant for a complex, customizable software product
Knowledge synthesis	Automatic generation of business reports and documents	• Sales proposal generation • Purchase order processing • Incident reporting • Customer experience reporting
Knowledge capture	From speech, images and texts to structured documents	• Creating construction site diaries from speech, images and text • Building inspections report preparation • Creation of closed captions in various languages for instructional videos and podcasts

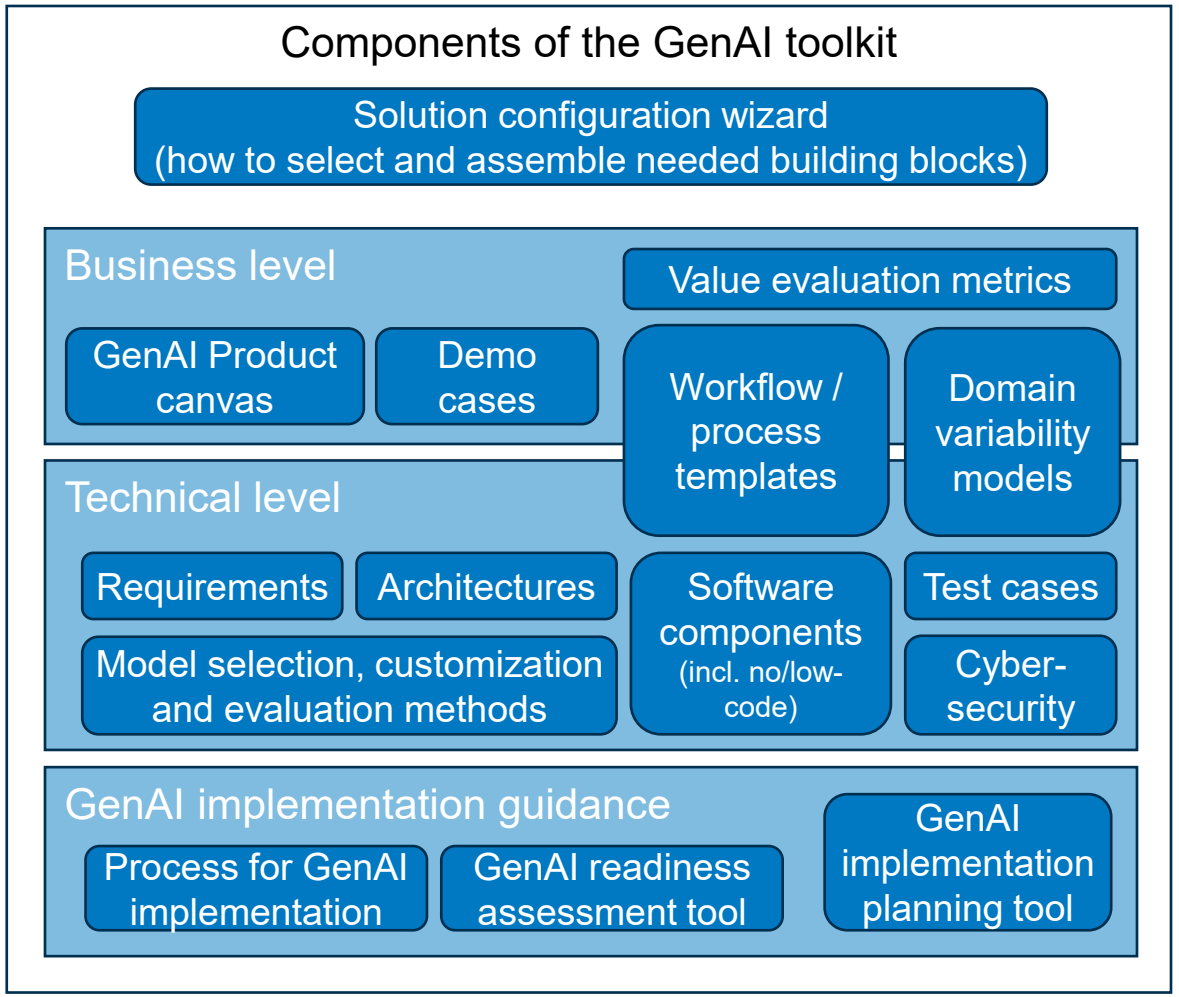
Preliminary design principles for GenAI toolkit development

To satisfy the defined requirements, we suggested a preliminary set of design principles for the GenAI toolkit:

1. **Knowledge processes and services are used for scoping and organizing building blocks** for GenAI solution development and implementation;
2. **Knowledge of the company, its customers and partners should be leveraged** by GenAI solutions (utilization of LLMs' general knowledge is insufficient),
3. **Value-based approach for WHY-aspect analysis** of GenAI solutions;
4. Core assets of a GenAI toolkit should address the **complete solution development life-cycle** and include requirements, architecture, components, testing and evaluation tools;
5. **Combination of Component-Based Software Engineering (CBSE) & Software Product Line (SPL) approaches**, which will also imply that components are not only grouped by knowledge process/service, but also assembled into typical solutions for generic business needs;
6. Guidance and reuse **address various GenAI solution enablers: human capital, processes, technology and infrastructure, governance and culture**.
7. **Combine no-code building blocks with code-based components**
8. **Generic implementation-independent architecture/blueprints specification with links to implementation-specific components**
9. **Unified language for specifying both business- and technical-level building blocks (workflows, software components), human- and machine-readable, "design-as-code"**
10. **Separate processes for component-based software development (CBSD) for reuse (1) and with reuse (2)**

The current GenAI toolkit vision

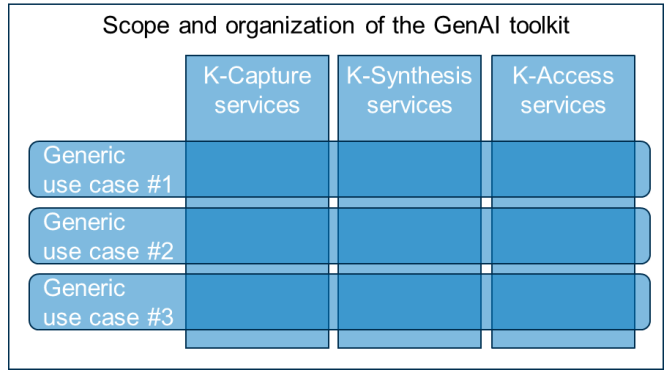


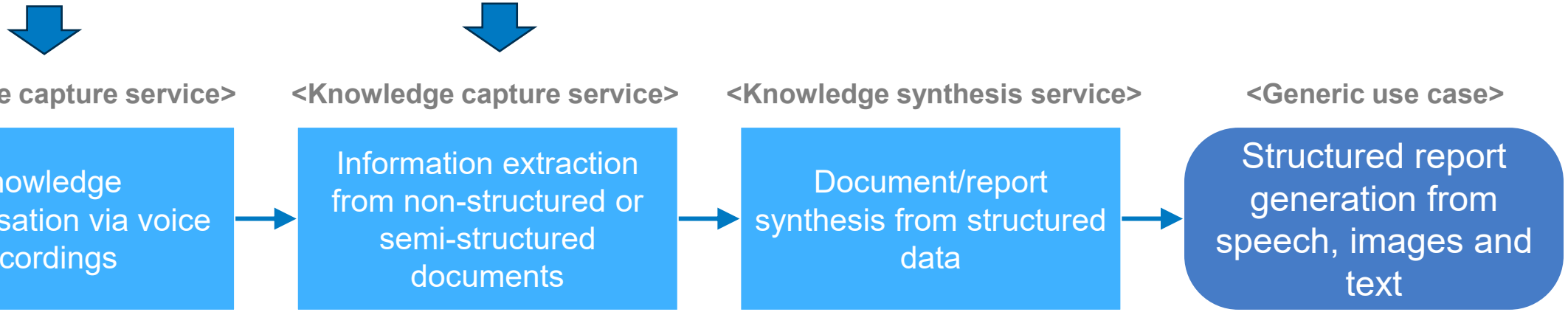


GenAI-based knowledge services for the toolkit organization (the preliminary list)

1. **Knowledge Synthesis Services**
   A. **Document/report Synthesis Service**
   B. **Idea Generation Service**
2. **Knowledge Capture Services**
   A. **Knowledge Externalization Service**
   B. **Information Extraction Service**
   C. **Automated Categorization and Tagging Service**
3. **Knowledge Access Services**
   A. **Conversational Interface (Chatbot) Service**
   B. **Advanced/Enhanced Search Service**
   C. **Personalised Knowledge Recommendations Service**

Example of addressing generic use cases by assembling knowledge services





Examples of knowledge service and their implementaion

Knowledge service	Knowledge process	GenAI-based process/workflow	Possible architectures	Software components
Document/report synthesis from structured data	Knowledge synthesis	1. Provide structured data 2. Specify the required document template 3. Produce the document	Option 1: Non-agentic Option 2: Agentic	Option 1: LLM node/function Option 2: Agent node
Knowledge externalisation via voice recordings	Knowledge capture	1. Optional: ask questions 2. Record audio file 3. Upload audio file 4. Transcribe the file using LLM		Voice recorder Data loader LLM node/functions
Information extraction from non-structured or semi-structured documents	Knowledge capture	1. Upload data 2. Define the schema 3. Extract the information via LLM	Option 1: Schema definition using code Option 2: Schema definition in natural language	Data loader Schema specification module LLM node/functions
…	…	…	…	…

Example of moving from generic to company-specific use cases and solutions

	Use cases	Knowledge capture	Knowledge synthesis
Generic level	Structured report generation from speech, images and text	Capturing needed information from speech, text, and photos	Assembling information from various sources into a report with the needed structure
Company specific level (for demonstration and evaluation)	Incident reporting assistant (Company A)	Captures voice-recorded observations and site photos from employees, then transcribes and processes them to extract information	Assembling a structured incident report
	Building inspections report creation assistant (Company B)	Captures voice-recorded building observations and photos, Extracts information from documents	Assembling a structured inspection report

Conclusions

- We reviewed the existing frameworks and tools for supporting and guiding GenAI solution development and implementation. Their limitations were identified.
- This study suggested and explored the potential of a KM perspective to enhance reuse and guidance in GenAI solution development and implementation, particularly for SMEs.
- We suggested the vision of a knowledge-focused toolkit for SMEs, which supports reuse and guides the development and implementation of GenAI.

Future work will focus on:

- elaborating the requirements, vision, and architecture of the GenAI toolkit;
- defining a comprehensive list of generic knowledge services to be supported;
- identifying and developing key reusable assets for the toolkit, including architectures, software components for solution development and implementation processes;
- applying, testing and validating the toolkit;
- establishing a community of the toolkit users and creators.

Thank you!

For more information, please join our hybrid event on September 17

https://gaik.ai/

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