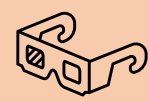


Human-in-the-loop form completion and reviewing through real-time AI-driven support

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Introduction

Flanders is currently seeing a **surge in research investment** (fig. 1), which increases the demand for effective and timely research data management. Researchers are required to submit a **Data Management Plan (DMP)** within the first six months of their project. However, completing these forms, especially for novice researchers, can be challenging, and the **Research Data Management (RDM) team** often spends significant time reviewing and giving feedback. This thesis investigates how **generative AI** can assist in this process. A **human-in-the-loop** system is proposed, combining **real-time support, researcher input, and expert review** from the RDM team.

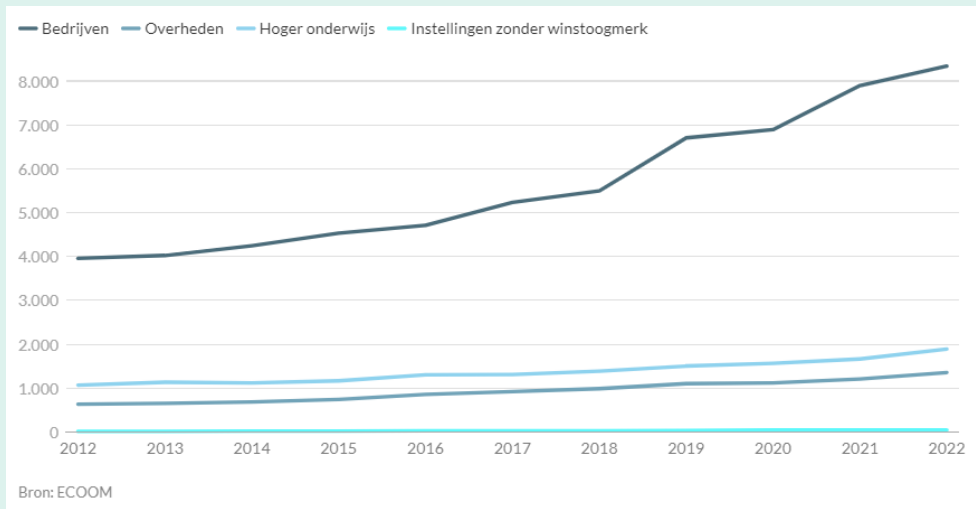


Figure 1: Evolution of research and development investments by the Flemish government since 2012 [1].



Framework Design

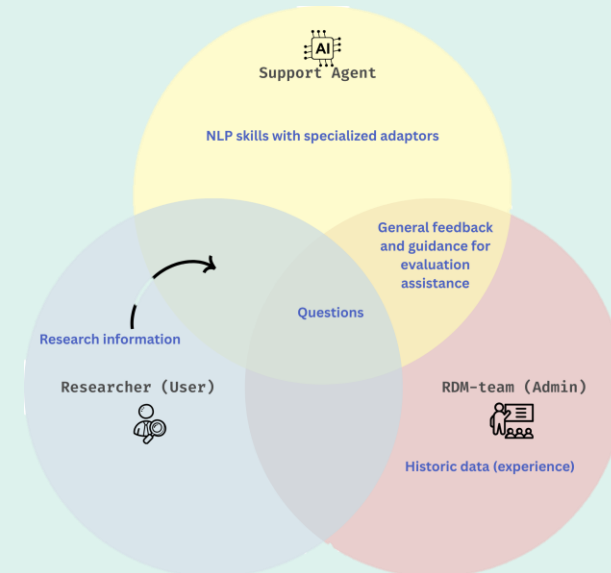


Figure 2: Graphical representation of data knowledge in AIDD4DMP framework

The AIDD4DMP framework operationalizes AI-assisted support for DMPs through a flexible, transparent, and iterative system. It transforms diverse data sources, such as partial answers, institutional guidelines, and research context, into structured prompts for a specialized AI agent, which then returns context-aware suggestions or refines answers based on researcher and staff feedback.

The framework is structured around four functional pillars (Fig. 2):

- **Assist** – Real-time AI support for researchers completing DMPs;
- **Integrate** – Aggregation of research data and context from sources like research proposals or (partial) research papers;
- **Dialogue** – Interactive loops between researchers, the AI, and RDM staff (human-in-the-loop), human oversight ensures quality and relevance of AI output;
- **Develop** – Iterative improvement of answers based on continuous feedback.

Key functionalities include:

- **On-Demand Feedback Regeneration** – Users can request AI responses at their convenience (Fig. 3);
- **Administrative Feedback Overwriting** – RDM staff can revise AI outputs, with edits logged for traceability;
- **Interactive LLM Communication** – Direct researcher-AI dialogue for clarification;
- **Question Flagging System** – RDM staff can flag issues related to compliance or policy (Fig. 3);
- **Feedback Rating System** – Users rate AI responses to guide iterative refinement (Fig. 4).



Results

User studies with novice researchers

User tests showed that the system can reduce DMP completion time and improved response quality. The UEQ-S score was **XX**, reflecting to a **XX experience**. Moreover, the **hybrid feedback tool** combining star ratings with various levels of details, scored **XX**, outperforming the **star rating-only** (XX) and **chatbot-based** feedback tools (XX) in user satisfaction and usability.

The overall system showed strong potential, with high scores on the **pragmatic quality** aspects of the UEQ-S test, including **efficiency** and **dependability**, indicating that users found the tool reliable and supportive in completing their tasks.

Cognitive Walkthrough with RDM Administrator

The RDM administrator responded **positively** to all core functionalities. They highlighted the usefulness of the **event log system** for tracking changes and reviewing AI-generated feedback over time. The **question flagging feature** was particularly valued for focusing attention on complex or compliance-critical sections, helping reduce review time. Administrators also appreciated having the ability to **overwrite AI suggestions**, reinforcing the **“human-in-the-loop”** design that ensures quality, traceability, and continuous system learning through expert intervention.

Figure 3: General overview of DMP form for researcher, with a section and its questions. The “Show Feedback” button and flag button are shown in each question block.

Figure 4: Expanded view for one question, with “adapt feedback” function activated, and original feedback shown.

Technically, the system was implemented using **various output improvement techniques**, such as:

- **Prompt Engineering**, which structures inputs with templates, that contain guidelines and examples to guide the model toward consistent, relevant outputs.
- **Retrieval Augmented Generation (RAG)** retrieves external content (e.g., guidelines, research proposals, ...) to ground AI responses in real-world context.
- **Facebook AI Similarity Search (FAISS)** enables fast retrieval of semantically similar text chunks using vector embeddings, improving relevance and precision.



Conclusion

This research demonstrates that a **human-in-the-loop system** powered by **generative AI** can effectively support researchers and RDM teams in completing Data Management Plans. By combining prompt engineering, RAG, and real-time functionalities, the system **improves answer quality, reduces completion time**, and supports more **independent workflows**.

The framework’s **modular design** and **feedback-driven architecture** can be adapted for other structured research workflows, such as grant writing, ethics applications, or protocol registration. By enabling real-time **collaboration** between **researchers, AI, and domain experts**, similar systems can reduce administrative load, improve document quality, and foster greater autonomy—especially for early-career researchers navigating complex academic requirements.

Promotoren / Copromotoren / Begeleiders

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[1]

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