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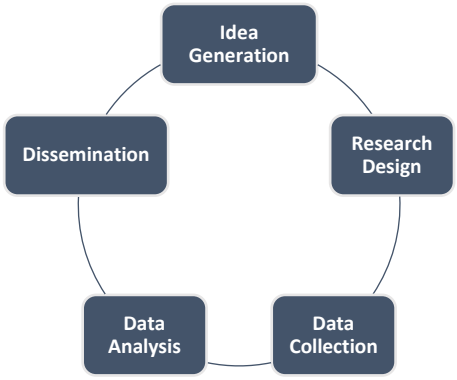
GenAI: Untapped Potential in Denmark

Generative artificial intelligence (GenAI) has been a central topic in the Danish research and innovation policy debate over the past year, including as the main theme at the Minister for Higher Education and Science's summit in April 2024. A new report by the Center for Research Analysis, commissioned by DFIR, highlights the potential and risks of using GenAI in various stages of the research process and reveals how researchers at Danish universities approached and utilized GenAI during the first half of 2024. DFIR concludes that there is significant potential for increased use of GenAI among researchers in Denmark and, in collaboration with DIREC, invites a debate on the use of GenAI in Danish research on January 27, 2025.

Following DFIR's debate series in 2023 and 2024 on artificial intelligence, the Danish Center for Research Analysis at Aarhus University, commissioned by DFIR,[1] has examined the use of GenAI across the five phases of the research process: idea generation, research design, data collection, data analysis, and dissemination. The report is based on an extensive literature review, expert interviews, and a survey of researchers at Danish universities.



Potential of GenAI Across All Phases of the Research Process

The report highlights the potential of using GenAI in all phases of the research process, referencing concrete cases and examples from the research literature:

Idea Generation & Proposal Writing: GenAI can accelerate idea generation by analyzing existing literature, including underexplored questions.

Research Design: GenAI can assist in designing experiments by simulating various scenarios and predicting outcomes. For instance, tools like Coscientist can design, plan, and execute complex chemical experiments based on simple text input from users.

Data Collection: GenAI can automate tasks such as certain types of information retrieval and data augmentation. It can also generate synthetic data, which can be valuable in fields like medical studies where data availability is limited.

Data Analysis: The use of GenAI in data analysis offers significant potential. Advanced models can perform sophisticated analyses on large datasets, such as studying human behavior patterns (e.g., pedestrian movements), mental health risk factors (e.g., suicide risks), and reconstructing cultural artifacts (e.g., design patterns).

Dissemination: GenAI can support researchers in linguistic communication, both for academic peers and broader audiences.

The relevance of these tools varies significantly across research fields and methods. For instance, research areas reliant on qualitative data analysis may find fewer advantages during the analysis phase.

Risks of Using GenAI

There are several risks associated with the use of GenAI. These relate to considerations such as research integrity defined by transparency and accountability, as well as the reproduction of bias, including the implicit assumptions of large language models, the underrepresentation of certain societal groups, and the interpretation of data. Risks also include the narrowing and lack of originality in new research ideas. Furthermore, there are ethical considerations related to data protection. Additionally, the resource consumption of GenAI models and their derived climate impact are risks that need to be addressed and managed in the development of responsible, transparent, and human-centered GenAI. This work is already underway in several research environments, networks, and private companies, many of which participated in DFIR's debate series on artificial intelligence. Moreover, a general proliferation and use of artificial intelligence will increase researchers' productivity, which will create even greater pressure on the current peer-review system for publications. A future with widespread use of GenAI will further strain the system and accelerate the need for change.

Great Potential and High Research Integrity

The report also sheds light on researchers' use and perception of GenAI based on a survey sent to nearly 30,000 researchers at Danish universities, with a response rate of 10.4%. The survey includes 32 potential application areas

for GenAI. Researchers were asked about their own use, their expectations regarding their colleagues' use of GenAI, and their assessment of how GenAI impacts research integrity.

Overall, the survey indicates that GenAI is used to a limited extent at Danish universities. Only eight out of the 32 application areas see more than 25% of researchers using GenAI. This often involves more routine tasks, primarily at the beginning and end of the research process, such as literature searches, drafting, and rephrasing smaller text sections, but also assistance with programming and statistical analyses. Relatively few researchers use GenAI for the analytical part of the research process, including identifying gaps in the literature, hypothesis development, theory development, research design, experiments, pattern recognition in data and text, or reviewing colleagues' research.

Researchers fall into three groups. The most skeptical group comprises 24% of researchers, who believe GenAI can only be used as a language assistant for drafting text. Researchers in the humanities, theoretical natural sciences, and qualitative social sciences are overrepresented in this group. A slightly less skeptical group comprises 35% of researchers, who believe GenAI can be used for pattern recognition and analysis, in addition to text processing. However, they are skeptical about using GenAI for developing research ideas and conducting peer reviews. The remaining 41% are generally positive about using GenAI but remain cautious about its use for generating synthetic datasets and identifying the ethical aspects of research projects. Researchers in technical sciences and medicine are overrepresented in this group.[2]

It is noteworthy that for almost all application areas, the percentage of respondents who rated a practice as good, very good, or excellent regarding research integrity was higher than the percentage who reported using GenAI in that area. This indicates a potential to increase the use of artificial intelligence among researchers in Denmark without compromising research integrity. It is also interesting that respondents perceive their colleagues to use these tools significantly more than they do themselves.

From Hype to Action: What Are the Next Steps?

DFIR assesses that there is a need to strengthen the use of GenAI in Danish research within scientifically relevant areas to remain globally competitive. At the institutional level, pragmatic, contextual, and open discussions are needed about how increased use of artificial intelligence can be implemented in local environments. Institutions must first identify local barriers. Beyond scientific relevance, barriers may include uncertainty about ethical and legal frameworks or a lack of inspiration on how to use GenAI. A critical barrier is the lack of skills, which can be addressed by drawing on broader competencies, such as among students, technical staff, and external collaborators. Local leadership must openly investigate and address these barriers.

In light of its broad potential, the government and parliament should, when allocating funding for artificial intelligence, prioritize a broader group of researchers rather than further strengthening elite research environments. Danish research environments need widespread upskilling to enable more researchers to use artificial intelligence where scientifically relevant. Using GenAI should become commonplace for a broader group of researchers.

Finally, the global research system will undergo changes in the coming years due to intensified pressure and increased researcher productivity. Discussions about the future framework for research should be a priority for Denmark's international engagement. These discussions are taking place in intergovernmental forums at the European and global levels, such as the EU, OECD, and UNESCO, as well as in more informal forums within international scientific associations and societies.

DFIR's next step is a debate event organized in collaboration with the Digital Research Centre Denmark (DIREC) on January 29, 2025, in Aarhus. We invite you to join the discussion on GenAI in Danish research. Sign up here.

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Notes

[1] CFA. (2024). Using Generative Artificial Intelligence (GenAI) across different Research Phases – Cases, Potential and Risks

[2] Andersen, J. P., Degn, L., Fishberg, R. et al. (2024). Generative Artificial Intelligence (GenAI) in the research process – a survey of researchers' practices and perceptions