



How to conceptualize the AI-driven transformation in higher education institutions

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Abstract

Artificial intelligence (AI) is driving a transformative shift in universities and universities of applied sciences, affecting research, education, and societal engagement. As AI rapidly evolves, HEIs must navigate its impact on all their core missions, research, education, industry collaboration, societal interaction, and administrative tasks. While previous studies have explored AI's role in specific areas, a comprehensive framework for managing AI transformation across all HEIs' tasks has been lacking.

To address this, we introduce the AITO Framework (AI in Innovation, Research, and Education), designed to help HEIs conceptualize and analyze AI's effects on their core activities. The framework, developed through collaborative training sessions and workshops with Finnish universities and universities of applied sciences, consists of four layers – technical base, application, change, and impact – and organizes AI-related changes within HEIs' four activities: research, education, collaboration and partnerships, and support functions. The framework draws significant inspiration from discussions held during the 2024 training series for rectors of universities of applied sciences and from the AI workshop series for university rectors in 2025. As a use case of the implementation of the AITO framework, a training concept is implemented to support HEIs in structuring AI-driven changes.

By integrating the AITO Framework into AI management, HEIs can enhance decision-making, support strategic development, and strengthen their role in shaping AI-driven innovations. The framework can also be applied in other research and education institutions, public administration, and even other industries, with minor modifications. Future assessments will evaluate the long-term impact of AITO framework on AI transformation and innovation creation within HEIs.

1 Introduction

The core missions of higher education institutions (HEIs) – research, education, and engagement with society and business – are facing a new transformation as artificial intelligence (AI) radically reshapes the operating environment.

Higher education institutions – universities and universities of applied sciences (UAS) – navigate a complex landscape of requirements, constraints, and opportunities. They must assess how AI, legal regulations, and existing capabilities shape their operations, what new possibilities AI creates, and how to manage this holistic transformation.

The use of AI varies greatly depending on the context, and in discussions around AI, various perspectives often overlap. For instance, guiding staff on how to use the common AI tools in their everyday tasks is more approachable than anticipating entirely new research fields enabled by the use of AI. Technological, ethical, societal, economic, and practical questions are interconnected, making it challenging to focus discussions. It is difficult to discern which challenges are genuine and transformative for the future and which are merely short-term or trivial changes that will be resolved soon.

A fundamental longer-term question is how AI will change humans' abilities and methods for learning and analyzing information. How people's work practices are changing, what everyday tasks AI is changing and how people's time use is changing? What revolutionary innovations will be achieved and what new research fields will emerge?

One of the challenges is that technological development is happening so rapidly that understanding and grasping the impacts of AI is perpetually lagging. HEIs must continuously update their expertise and reassess the role and possibilities of AI. This is not limited to technology-related disciplines but affects all fields of research.

The effects of AI in higher education institutions have been researched and framed from various perspectives, such as AI in changing practices in studying and pedagogical aspects (Katsamakos, 2024; Michel-Villarreal et al., 2023; Neumann et al., 2023; Johnson et al., 2024; Chiu et al., 2023; Pelletier et al., 2024), ethical aspects and academic integrity (Lähdesmäki, 2024; Gulumbe, 2024), governance (Birkstedt et al., 2023), and in certain research fields (Pinto-Coelho, 2023), but a comprehensive overview on AI transformation and its management in HEIs' all activities is lacking.

When examining how HEIs have addressed the changes brought by AI, we identified the need to conceptualize and structure the transformation in the academic and higher education context. Universities and universities of applied sciences play a significant role in AI development – not only through research, development, and innovation (RDI) but also in preparing students to meet the demands of the future workforce. This requires a clear structuring of how AI impacts various areas – research, education, societal interaction and partnerships, and the supporting functions alike. In this paper, we present the AITO framework that can be used within HEIs to analyze the effects of AI on their key activities, focus discussions more effectively, and bring new perspectives and ideas.

2 Management of AI transformation in the Finnish higher education institutions

According to a recent review on Finnish AI landscape (Business Finland; AI Finland, 2025), Finland's research is seen internationally respected and serves as a foundation for significant innovations, while established companies focus on efficiency and optimization through AI. Although research does not always aim directly at commercial applications, its impact is evident across various sectors, supported by strong infrastructure and high-level expertise. The largest-scale example of this

is the Finnish company SiloAI, which was acquired by semiconductor giant AMD. Built on top university AI expertise, SiloAI has developed Finnish-language language models with a research group from the University of Turku (Luukkonen, 2024).

A strong academic tradition, top universities, and a robust national AI infrastructure – featuring the LUMI supercomputer and the LUMI AI Factory, the ELLIS Institute, and key organizations like AI Finland and FCAI – continue to drive AI expertise. Finland’s strong AI expertise is seen as emerging from the long-term academic research conducted by universities. HEIs are a vital part of the ecosystem, which also includes companies, public administration, and other stakeholders and the circulation of people between academia, industry, and different sectors is key to competitiveness and innovations (Business Finland; AI Finland, 2025).

The rapid development of tools like ChatGPT has forced HEIs and other educational institutions to quickly address how to prevent cheating in academic settings and how to identify AI-generated answers. Most HEIs have made their own AI policies and instructed their staff and students to use AI tools considering copyright and data protection. For example, the Rectors’ Conference of Finnish Universities of Applied Sciences (Arene, 2024), produced a joint broad recommendation where UASes are encouraged to ensure staff and students can use artificial intelligence responsibly, while teachers are urged to promote its ethical and purposeful use in teaching.

The management of AI development in HEIs, however, is a much broader and long-term issue, and to be able to manage the change, a solid and shared understanding of the global changes and their reflections to European sovereignty, the European Education Area, and changes in the legislative framework are needed along with the influential management of people and capabilities in HEIs.

2.1 AI training series for rectors of the Finnish universities of applied sciences

During 2024, an AI training series for rectors of universities of applied sciences was conducted as a joint program by Arene, and CSC – IT Center for Science. The program was introduced and concluded during Arene’s Annual Meeting of UAS Leadership. The participants were primarily rectors and vice-rectors responsible for RDI. The training comprised seven workshop days and featured both keynotes on AI development and its societal promises, as well as co-working sessions among the participants. In addition, the participants performed homework assignments that showcased inspirational examples from their respective institutions.

The systematic approach of the training included group discussions and assignments, encouraging participants to find and showcase their concrete examples from various fields in RDI, teaching, learning, and other processes of HEIs. These examples were intended to highlight tangible changes in the core business of HEIs, considering the diverse and constantly evolving nature of HEIs’ activities. Although many of these examples were somewhat fringe or small-scale, their purpose was to foster a broader understanding of the big picture and to cultivate a shared vision regarding the transformative potential of AI for HEIs. The concrete examples were in turn used in iterative group work and discussions to further develop possible next steps for AI implementation in the field.

The concrete examples were grouped into verticals representing different subject fields, such as medicine and healthcare, engineering and smart cities, pedagogy and teaching, business administration and support services. The objectives for the joint discussions – focused on future trends and societal impact – guided towards more emphasis from applications and technology to the HEIs capacity to drive and adapt to change starting from the possible impact of the concrete examples. In the series midpoint review, it was concluded that the ability to change depends on the inspiration, courage, skills, responsibility, and adaptability of both individuals and organizations in leveraging AI. This humane aspect was used in connecting different perspectives of research, development and innovation to education and learning. Competence and attitudes of the HEI staff were identified as critical in all aspects.

As the result of the training, the participants proposed key measures to support UAS future collaboration in AI transformation, including e.g. personalized AI-driven study paths, agile curricula, and an expert RDI AI network. Additionally, they emphasized collecting SME AI data, supporting SMEs in AI adoption, and collectively ensuring ethical, socially sustainable AI solutions. (Puuska, 2024)

The discussions in the Arene AI training series inspired us to conceptualize the AITO Framework (AI in Innovation, Research, and Education) to act as a tool to help HEIs understand and analyze the effects of AI on their key activities.

2.2 AI workshops for rectors of the Finnish universities

In 2024, the Council of Rectors of Finnish Universities (Unifi) and CSC began developing a workshop series for university rectors that would focus on the role of AI in research, education, and innovation. The first workshop in October 2024 concentrated on reviewing the draft of the AITO Framework. Based on it, a list was created outlining the perspectives that rectors want to collectively shape their vision on and use to plan future actions. The observation was that the framework was indeed able to help in understanding the many interconnected and fast changing phenomena under the wide topic of AI in the HEIs domain, the research, learning and innovation. The rectors' intent was to put more emphasis on the goal of understanding the ability to drive change on different fields of research in the long term. The series will be implemented during 2025.

The lack of benchmarks and literature on the potential impact and development opportunities offered by AI in RDI and the future workforce needs served as the starting point for further discussions. The first perceptions on AI were primarily technical, focusing on technology-related disciplines and practical applications – from Copilot tools to examples of translation capabilities. The identified insights generally focused on student counseling and learning analytics, ethical, legal, and compliance issues, such as copyright and data protection, and measures to prevent cheating in academic settings.

3 AITO framework as a tool for conceptualizing the AI transformation in higher education institutions

We designed the AITO Framework (AI in Innovation, Research, and Education) to act as a tool to help HEIs understand and analyze the effects of AI on their key activities. It was developed through input from various forums and events, offering a structured approach to examining how AI influences research, education, collaboration, partnerships, and support services, while accounting for changes of varying scales and timelines.

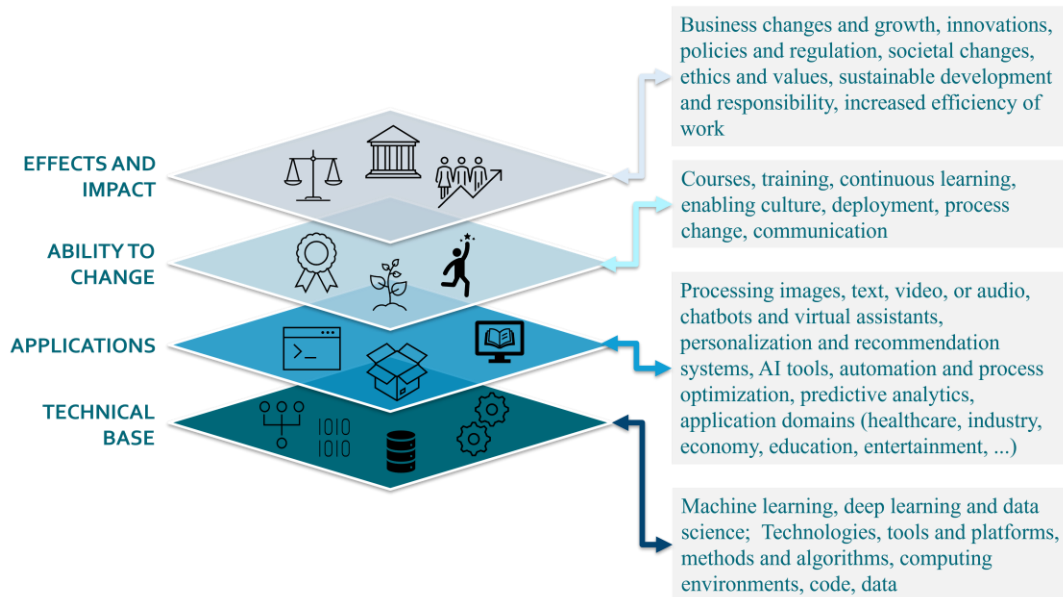
The AITO framework consists of two dimensions: The different layers (subsection 3.1) represent the maturity and time perspective of the transformation, while the elements (subsection 3.2) describe how the AI-driven changes can be structured from the perspective of the core missions of HEIs.

3.1 Different layers of AI

Discussions on AI-driven transformation is challenging to navigate due to the multifaceted nature of AI, covering aspects from technical advancements to societal consequences. To better understand different perspectives on change brought by AI development, we defined four interconnected layers that systematically address them: the technical base, the application, the change, and the effect and

impact, as illustrated in Figure 1. These layers are essential for framing the diverse impacts of AI in various contexts within HEIs.

Figure 1: Layers of AI-driven changes.



The first layer, technical base, focuses on technologies, methods, code, data, and computational resources that form the foundation of any AI system. Building upon these technical concepts, the application layer addresses the practical implementations of AI, including virtual assistants, recommendation systems, and domain-specific use cases. Moving beyond technical and applications aspects, the third layer examines the ability of individuals and organizations to adapt to AI-driven changes. This includes elements such as formal training, enabling culture, and the actual integration of AI technologies and process changes. This layer enables the practical deployment of the tools and use cases introduced in the previous layer. Without it, there are merely tools and applications but no real willingness or capability to utilize them effectively for meaningful changes, such as increased efficiency or improved learning outcomes. Finally, the topmost layer focuses on the broader societal implications, covering how AI influences society and business, regulation, and ethical considerations.

These layers provide a holistic view of the AI-driven changes that can be navigated from the bottom up or examined individually to focus on a specific aspect at a time. Changes in one layer can be examined in terms of their impact on upper layers, illustrating how transformations in one area influence broader systems. For instance, advancements in large language models and computing environments have enabled the development of personalized virtual tutors that provide tailored assistance to meet individual student needs. Educators and students then learn how to effectively use these tools and integrate them into their daily routines. The resulting impact may include improved learning outcomes, adherence to educational standards, and the fair and ethical use of AI. However, even the most advanced AI developments may fail to generate meaningful impact if they are not adopted or used during the implementation phase (the third layer).

3.2 Elements of the AITO framework

Based on various discussions, training series, meetings, seminars, literature, and news, we identified key changes related to the core activities of HEIs: research, education, social interaction and business cooperation, as well as the supporting functions. They form the elements of the AITO framework, and we structured the changes along a continuum of four layers. They are the issues that are seen in discussions and literature to change significantly with the development of AI.

The elements of AITO framework are listed in Figure 2 and their meaning and content are described in more detail in Table 1.

Figure 2: AITO framework (AI in innovation, research, and education).

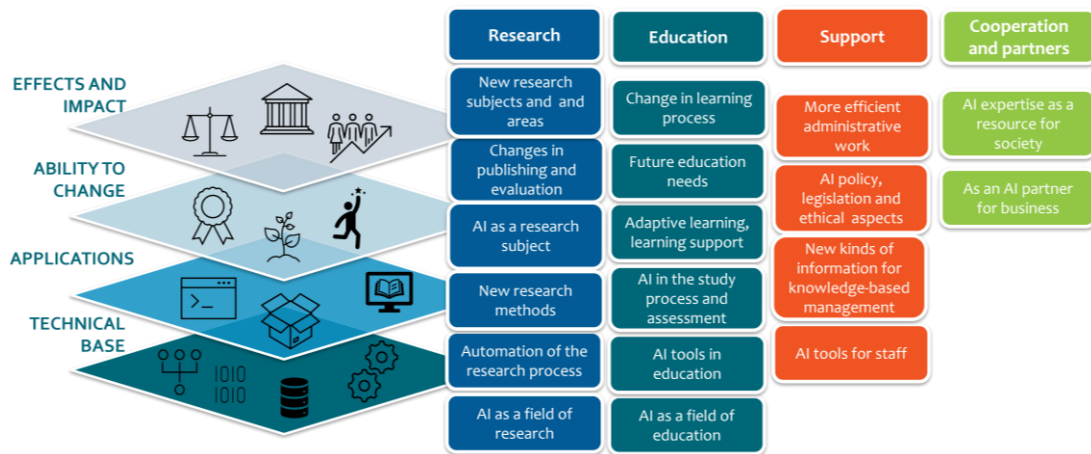


Table 1: Elements of the AITO framework. How will the development of AI transform research, education, cooperation and partnerships, and support functions in HEIs?

Research	
AI as a field of research	Research produces e.g., methods and language models for AI development.
Automation of the research process	AI speeds up e.g., collecting and analyzing data, identifying and analyzing sources, producing text, and translating language.
New research methods	The processing of large amounts of data with AI and new research methods (e.g., digitization, image analysis, diagnostics, smart laboratories, climate models) enable completely new kinds of research.
AI as a research subject	Decision-making concerning AI should be based on research-based information and require research on, for example, the safety, biases, ethical starting points, and impacts of AI on people and societies.
Changes in publishing and evaluation	AI is used both in the production and evaluation of publications and research plans, which can both reduce and improve their quality and reliability and may change the entire evaluation process.
New research subjects and areas	New kinds of data analysis opportunities give rise to new fields of research and may even change research paradigms.
Education	

AI as a field of education	The development and utilization of AI requires more experts, and its significance as a field of education is growing and developing rapidly.
AI tools in education	AI can be used to create, for example, learning materials, and produce new kinds of learning environments and various tools that facilitate learning.
AI in the study process and assessment	Learners independently use AI tools in their studies, which in turn poses challenges for assessment. On the other hand, AI can also be used in evaluation.
Adaptive learning, support for learning	Teaching content can be produced with AI according to the learner's needs. AI-based virtual assistants can support on the learning path. Learning analytics produces information to support one's own learning progress
Future education needs	AI will replace many skills and professions, which will affect which expertise is needed and should be educated now and in the future.
Change in learning process	With the help of AI, more and more of the remembering and processing of information will be outsourced. This can change the way deep understanding is generated, as well as affect people's learning and problem-solving process.
Support	
AI tools for staff	The range of tools to be acquired for personnel and their costs will increase. Training of personnel in the use of tools is essential.
New kinds of information for knowledge-based management	AI can be utilized, for example, in foresight, teaching planning, management of human resources and facilities, monitoring the progress of development projects and other applications.
AI policy, legislation and ethical aspects	Responsible use, legal and ethical framework conditions and risk assessment require policies and guidelines as well as joint discussion
More efficient administrative work	Staff use AI to streamline their daily work.
Cooperation and partners	
As an AI partner for business	Companies are at the very core of the development and adaptation of AI and AI-based applications, but they need the expertise and shared infrastructures of HEIs as partners.
AI expertise as a resource for society	There is a growing need for AI understanding and AI expertise in society. Research and higher education play a significant role, for example, in stimulating social debate and opening views on alternative solutions.

The AITO Framework can be applied in multiple ways to facilitate and enrich conversations among organizations, stakeholders, or networks about AI's impact on their operations. It acts as a reference tool to aid in strategic planning and discussions, emphasizing the sustainable integration of AI in future endeavors. The benefits of AITO framework can be gained most effectively when examined collaboratively within or among HEIs. It can be utilized, for example, for strategic plans, to collect concrete examples, and to create visionary ideas about the future which are used to foster a broader understanding of the big picture and to cultivate a shared vision regarding the transformative potential of AI.

4 Use case of the AITO framework: a training concept for HEIs

Technological development is occurring rapidly in the diverse and constantly evolving realm of RDI and higher education. We have adopted the AITO framework in developing an AI training concept for HEIs. This collaborative and continuously evolving framework, enriched with real-world examples, forms the foundation for the training concept. The aim is to enable HEIs to harness this knowledge base effectively.

The AITO training concept aims to engage individuals across organizations, networks, and various stakeholder roles. It is formed by three building blocks: 1) Target groups; 2) General modules; and 3) Activities for engagement.

Eight distinct target groups for the training have been identified (see Table 2). The first three of the target group – organization, organization’s function, and field of application – can also cover and involve people from the five other target groups.

Table 2: Target groups of the AITO training concept.

Target groups	Example objective for the use of the training concept
Organization	Under the leadership of the HEIs rector and executive team, the goal is to achieve an AI transformation that permeates all operations and serves as a strategic competitive advantage for the future.
An organization's function/domain	Under the leadership of the vice rector for RDI, the higher education institution is developing the impact and capabilities of its RDI activities by leveraging AI. Example: a development day designed for RDI personnel.
Field of application in research, education, and RDI	Leveraging artificial intelligence in social and healthcare education and in RDI activities in collaboration with the wellbeing region and its business ecosystem.
A joint function-specific network of higher education institutions	The network of research, development, and innovation leadership from universities of applied sciences is enhancing its members' understanding and fostering a culture of active sharing – exchanging ideas about what has been done elsewhere and what is being planned.
A joint national/international network for the field	Measures by the national IT education network for advancing the use of AI in revamping educational content and enhancing educational Collaboration
Local ecosystem	Leveraging AI within a joint network of higher education institutions, local chamber of commerce, and regional municipalities to enhance the competitiveness of ecosystem companies.
Research or development project, research group, or research ecosystem	The project's objective is to introduce the possibilities of AI to regional SMEs and to develop agile AI pilot projects that address the target group's needs, while simultaneously advancing the applied sciences university's AI expertise to a national level.
Expert group	Developing the competence of Machine Learning Experts

As the second building block, three general modules are used as the basis of the training concept: a) Shared understanding, b) Shared direction, and c) Transformation journey. These modules define the intended scope and level of ambition. The modules are sequential, with each module building on the one before it.

The first two modules form the backbone of the AITO training concept, effectively using the AITO Framework. The Shared Understanding module combines the framework and inspiring examples to deepen insight into how AI development can transform the operations of HEIs. Through an introduction to the AITO Framework and selected examples, concrete cases can be identified from the participants' interests. The Shared Direction module uses more examples that together with the AITO framework to create AI-enhanced operational visions and actionable plans. The outcomes are shared to broaden the knowledge base and guide further AITO Framework development. While the two first modules, Shared Understanding and Shared Direction, focus on harnessing the shared knowledge base, the last one, Transformation Journey, aims at fostering competitive advantage. Its outcomes and insights are reserved for the target group rather than shared broadly.

The third building block of the AITO training concept is a predefined set of activities that engage the target group in the chosen modules. The activities include, e.g. work practices, tools, and concepts of change management.

5 Conclusions

European higher education institutions play a key role in serving in the forefront of responsible and sustainable use of AI, competing in the global game both in the development and application of AI and other emerging technologies, and ensuring the competitiveness and sovereignty of Europe. Understanding and structuring the AI-driven changes requires time and resources, but it is essential for HEIs to stay relevant and maintain their position as sources of knowledge, education, literacy, and innovation.

The use of the AITO Framework can provide valuable insights for the management of AI developments within an organization, network or a local RDI ecosystem. It can also be utilized in other research or education organizations, public administration, and, with minor modifications, even in other domains.

So far, the AITO Framework and AITO training concept have been piloted in building shared understanding and shared direction among a few selected target groups. Based on initial feedback, the participants have gained valuable insights that are informing innovative practices and improved decision-making. Using the AITO framework as part of HEIs' management at different levels and in the discussion between HEIs and their partners can bring new perspectives, ideas and support the management in a concrete way.

Once the framework has been in practice, we can analyze what it led to, whether it influenced the AI transformation capabilities and whether new innovations were created. Using the AITO Framework as part of HEIs' management at different levels and in the discussion between HEIs and their partners can bring new perspectives, ideas and take management to a new level. The full implementation of the preceding modules will take time, and a comprehensive assessment of the AITO Framework and training concept will be possible in the next 1-2 years.

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