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TRANSFORMATION OF THE UNIVERSITY IN THE AGE OF ARTIFICIAL INTELLIGENCE: MODELS AND COMPETENCES

Igor Kabashkin[1], Boriss Misnevs[2], Aliaksandr Puptsau[3]

[1,2]Transport and Telecommunication Institute
1 Lomonosov Str., Riga, LV-1019, Latvia
[3]European Humanities University
17 Savičiaus Str., Vilnius, LT-1127, Lithuania
[1]Kabashkin.I@tsi.lv
[2]Misnevs.B@tsi.lv
[3]Alexander.Puptsev@ehu.lt

The article considers the possible concepts of the university of the near future considering the real emergence of special artificial intelligence applicable in the field of higher education. The authors propose a new university model (5th generation university) based on rethinking the use of the concept of competence and applied results in the field of cognitive sciences. It is proposed to revise the existing classical set of professional and social competencies, which will consider the redistribution of responsibilities in society between a person and intellectual systems. The technical readiness of society is assessed to significantly expand the scope of the use of IT technologies and free up human resources for creative activity.

Keywords: University Model, Artificial Intelligence, competences, digital transformation

1. Introduction

This article appeared as a natural result of the systematic work of the authors on the problems of the development of higher education, both in the technical field and in the social and humanitarian fields.

This article stems from the authors' dedicated research on the challenges facing the advancement of higher education, covering both technical and social, and humanitarian fields. In the mid-20th century, Hannah Arendt, a German-born American philosopher, pointed out that "Whereas the often mentioned "lag" of the social sciences with respect to the natural sciences or of man's political development with respect to his technical and scientific know-how is no more than a red herring drawn into this debate; it can only divert attention from the main problem, which is that man can do, and successfully do, what he cannot comprehend and cannot express in everyday human language" (Arendt *et al*., 2007). Perhaps today, with the rise of artificial intelligence, experts from various fields of knowledge must work to grasp and express this new development and its impact on university management and education.

And if previous research was mainly focused on improving individual structural and functional components of existing universities, such as administration, technology, teaching technology, methods and forms, pedagogical design of educational materials, control, and assessment of competencies, today it has become necessary to reconsider the concept of the university model.

This became possible in connection with the real creation of special Artificial Intelligence (AI), which combined the solution of most of the problems of higher education. All this has become real in connection with the creation of a developed IT infrastructure of universities and the achievement of a significant level of digitalization in society. In other words, conditions have been created for the emergence of the university of the future, the structure of which and the main ones must be redefined.

The paper consists of 5 parts: Introduction, Historical Review, Artificial Intelligence, and new competencies, University Model, and Conclusion.

A historical review helps us understand the key features of a university and rebuild the new structure. The section is dedicated to AI educational facilities with a focus on new digital competencies required by contemporary society. The next section is reflecting the authors' vision of a new university model for the modern digital society. The Conclusion summarizes discussed results and draws our attention to related issues.

2. Historical Review

In fact, we should talk about the human development ecosystem and the role of educational institutions in it (Barnett, 2018; Misnevs *et al.*, 2021a; Misnevs *et al.*, 2022). We are on the verge of a significant transformation of the university in its established form. This is primarily due to the main role that he played at different stages of society. The emergence of new workable tools that implement the functionality of artificial intelligence creates the prerequisites for a more rapid change in the role and mission of education in the new society.

The brewing revolutionary transformation of universities, the need for which is actively discussed in the academic environment, with the advent and lightning-fast spread of the application of AI forces us to talk about a new generation of educational environments (Garrison, 2017; Rovai *et al.*, 2008; Baker, 2016; Popenici and Kerr, 2017; Seo *et al.*, 2020; Cruz-Benito *et al.*, 2019; Hwang *et al.*, 2020). If several authors (Steinbuch, 2016; Steinbuch, 2021; Asgari *et al.,* 2021; Kuzu, 2020; Wissema, 2009; Lukovics and Zuti, 2013) talk about the observed transformation of universities and the transition period to universities of the third and fourth generations, the beginning of the mass practical application of AI, at the level of an ordinary computer user, creates real opportunities for a jump-like transition to this new generation of the educational environment, which the authors for simplicity in this article will call the university of the fifth generation.

In this case, the proposed in (Steinbuch, 2016) the university's generation classification system can be expanded (Table 1). In the (Steinbuch, 2016) four generations of universities are described. The authors propose the fifth generation of universities with AI as a core element of the new ecosystem.

Table 1. Generations of Universities

	1st generation (Steinbuch, 2016)	**2nd generation** (Steinbuch, 2016)	**3rd generation** (Steinbuch, 2016)	**4th generation** (Steinbuch, 2016)	**5th generation** *(proposed by authors)*
Objective	Education	Education, research	Education, research, know-how exploitation	Education, open innovation (research)	Innovation, creativity. critical thinking
Role	Defending the truth	Discovering nature	Creating value	Enabling value creation	Forming the basis for creative competencies
Method	Scholastic	Modern science, monodisciplinary	Modern science, interdisciplinary	Multi-actor innovation	Holistic
Human capital development	Professionals	Professionals, scientists	Professionals, scientists, entrepreneurs	Professionals, scientists, entrepreneurs, customers, ecosystem participants	Creator
Orientation	Universal	National	Global	Ecosystem	Universal
Language	Latin	National languages	English	English	Multilingual
Organization	Colleges	Faculties	Institutes and centers	Innovation spaces	Hybrid (physical and virtual) education environment
Management	Chancellor	Part-time academics	Professional management	Disruptors	Support of AI-based decision making

One of the main functions of universities has always been the generation and provision of knowledge to a person for adaptation to new conditions generated by his information, technological and sociocultural environments. At the same time, if for the universities of 1st generation (U1G) and 2nd generation (U2G), the university itself and its environment were practically the only sources of knowledge (Figure 1a), the formation of the university of 3rd and 4th generations of universities (U3G and U4G) was associated with the development of information technology, the exponential growth of knowledge (Figure 2) (Epi, 2018) and the emergence of publicly available tools for individual access to information resources, such as search engines (Google, etc.), social and professional networks, etc., which not only expanded but also began to replace the capabilities of universities in terms of providing knowledge (Figure 1b).

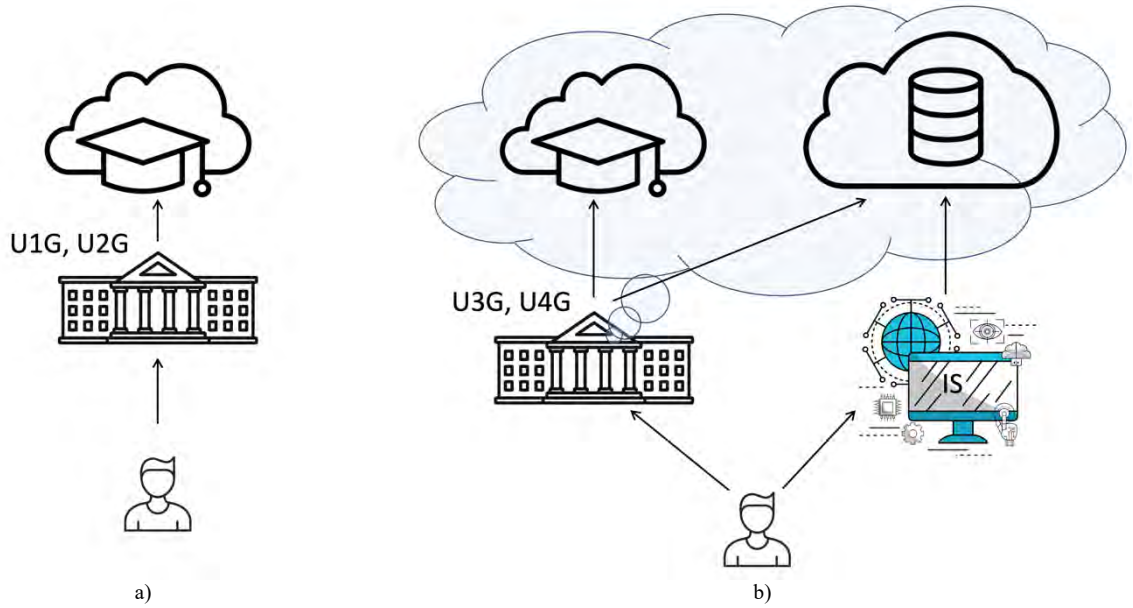

Figure 1. University as the source of knowledge:
(a) 1st and 2nd generations of university, (b) 3rd and 4th generations of university

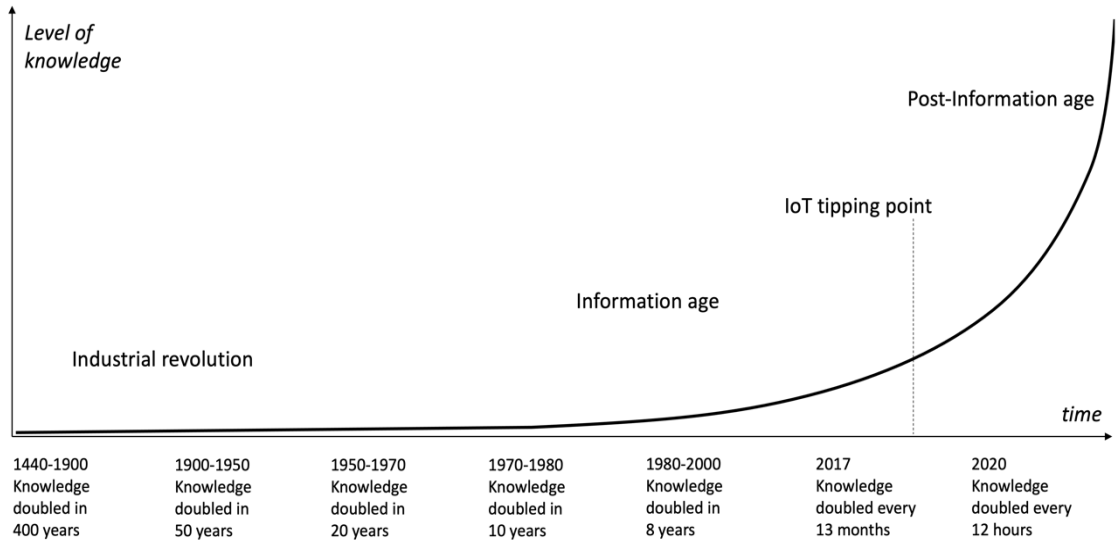

Figure 2. Acceleration of Knowledge Growth (Epi, 2021)

The emergence of AI tools that are also available for mass use further changes the possibilities for the user, providing him not only with access to information resources but also with the ability to generate and select concentrated knowledge in various professional fields. In such conditions, the niche of the university is shifting primarily to the field of the formation of human competencies that cannot be provided by artificial intelligence or are required for the development and application of this AI in new areas and areas, i.e. for the development of creative and emotionally oriented competencies, taking into account the individual characteristics of the individual, which in the future will allow him to use the capabilities of AI to build and go through an individual learning path to achieve personal goals and objectives formed by this individual (Figure 3).

Here we can expect that the Kantian "contest of faculties" will be overcome by a global solution using AI (Kant, 1991).

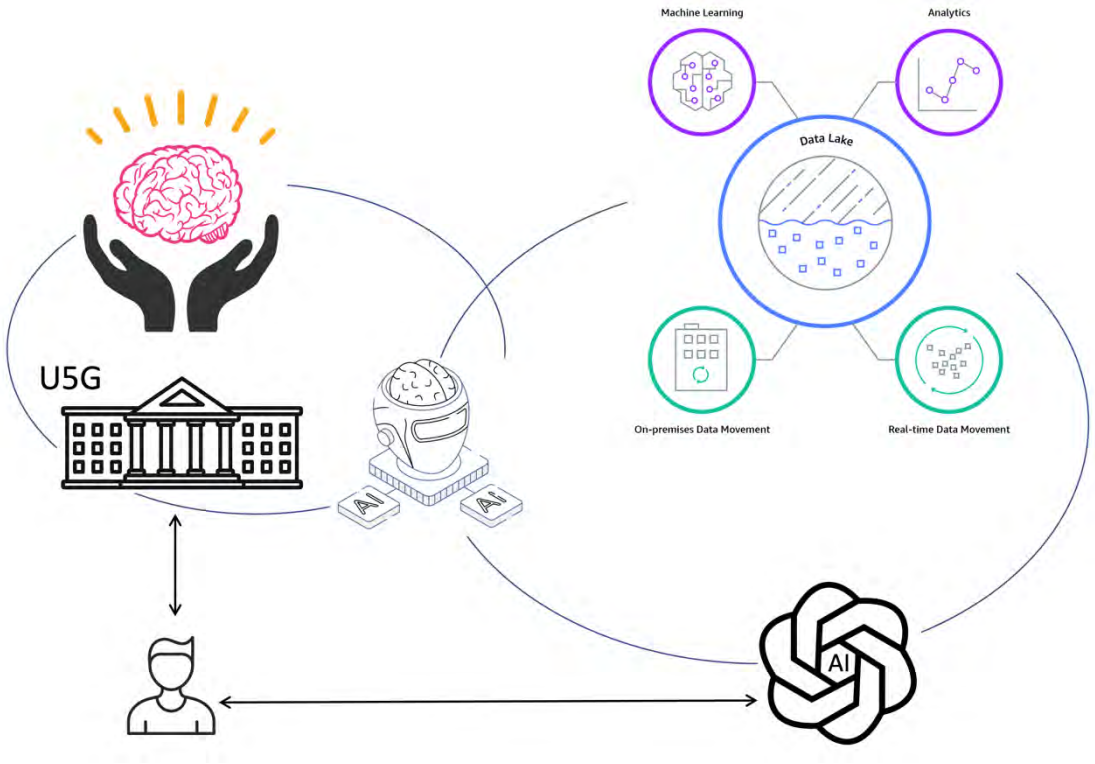

Figure 3. Artificial Intelligence as the source of Knowledge in the 5th generation of university

3. Artificial Intelligence and new competencies of university graduates

Discussing the use of AI, we need to look at the existing different viewpoints on the relationship between conscious thinking processes and the ability to calculate. Well known author Roger Penrose holds an approach that consciousness arises from certain physical actions of the brain, however, these actions cannot be computationally modelled correctly. He points out the "weakness" of this approach, implying that sooner or later the problem will be studied in enough detail. As a result, people will be able to identify the kinds of actions performed by conscious thought that are currently beyond "calculations" (Seo *et al.,* 2020). We believe that with the advent of artificial intelligence, which can model the actions of conscious thinking, we are entering a new era of solving many tasks that can be performed not by a person, but by artificial intelligence, including the possibility of using more complex forms of thinking.

Artificial intelligence will affect several important forms of activity, primarily society. Many areas of activity will be transformed, new competencies will be required, for example, an “AI operator”, who must train AI in relevant areas, ask the right questions in a dialogue, integrate individual patterns created by AI into a single picture, depending on the purpose and objectives of what caused the need for AI.

AI services will significantly change the requirements for professional competencies, and completely new competencies will become mandatory for university graduates to meet the demands of society.

Here we publish the answer received from artificial intelligence OpenAI ChatGPT to the question: “What specific competencies for employees are directly caused by AI services?”:

“The implementation of AI services can lead to a shift in the skills and competencies required for employees. Some of the specific competencies that may be in high demand because of AI include:

1. Data analysis and interpretation: As AI systems generate large amounts of data, employees will need to be able to analyse and interpret this data to make informed decisions.
2. Technical skills: Employees will need to have a strong understanding of AI technologies, including machine learning, natural language processing, and computer vision, to effectively utilize and manage AI systems.
3. Project management: The integration of AI into an organization requires careful planning and coordination, and employees with project management skills will be in high demand.

4. Ethical decision-making: AI systems can have significant ethical implications, and employees will need to be able to make informed decisions about the appropriate use of AI, including considerations around data privacy, bias, and transparency.
5. Adaptability: As AI continues to evolve and new technologies emerge, employees will need to be able to quickly adapt to new tools and processes to remain relevant and effective in their roles.

In addition to these specific competencies, it's also important for employees to have a strong understanding of the broader business context and the strategic goals of the organization. This will allow them to effectively leverage AI to support the organization's mission and drive business outcomes."

AI will require new competencies that go more (probably) into the emotional cognitive area of human development. This will probably become a "top" level task for the university.

On the other hand, more down-to-earth AI service competencies for direct contact with AI will be required. This could become a "lower" level task for universities.

Today, AI cannot fully perform some functions necessary in the process of student learning. Without referring to narrowly subject-specific competencies, let's identify general functions that are problematic areas in AI-assisted learning:

- multicultural education organization: considering national and religious features and traditions of the subjects of learning and their gender differences.
- motivational support for learning: forming students' understanding of the need to complete work and its prospects; developing organizational and voluntary abilities; students' responsibility.
- cognitive development of students in some areas of knowledge: critical, creative thinking; students' understanding of the studied educational material; development of the ability to reason, draw conclusions and make decisions; spatial orientation training, etc.
- providing psychological and emotional support for learning: improving the ability to manage emotions both in the process of individual and group learning; organizing group work and distributing responsibilities among students.
- development of communicative interaction and abilities: presentation and public speaking; oratory and art, eloquence, dialogues, discussions, debates, brainstorming, etc.

The presented shortcomings in teaching with the use of AI do not allow us to completely abandon the role of a teacher in the educational process, even for example, such a task as drawing performed by AI causes controversy among specialists as to whether the picture presented by AI is a work of art.

4. Model of university with artificial intelligence

The first logical question appears as "what types of academic activities could be implemented by AI at a university?"

It's difficult to predict which specific administrative and academic units at a university may be replaced by AI, as the extent to which AI will impact different areas will depend on a variety of factors, including the level of technological advancement, the rate of adoption of AI systems, and the requirements of each unit.

However, it is possible that AI could be used to automate certain tasks and processes within administrative units such as finance, human resources, and student services, reducing the need for manual labour and improving efficiency. In academic units, AI could be used to grade assignments, provide personalized feedback to students, and support research through data analysis and visualization.

It's important to note that AI is unlikely to completely replace human administrators and educators, but rather augment their work and free up time for higher-level tasks and interactions with students and colleagues.

There are several areas within a university's digital space that could benefit from the integration of AI:

1. Student services. AI can be used to automate repetitive tasks such as answering frequently asked questions and providing personalized support to students.
2. Learning management systems. AI can be used to provide personalized learning experiences, including intelligent recommendations for course materials, adaptive learning paths, and realtime feedback.
3. Research support. AI can assist researchers with data analysis, visualization, and discovery of new insights and patterns.
4. Administration. AI can automate tasks within administrative units such as finance and human resources, improving efficiency and freeing up time for higher-level tasks.

5. Campus safety. AI can be used to monitor and analyse security cameras, detect potential threats, and respond to emergencies in real time.

For these transformations to be successful, universities will need to ensure that their IT infrastructure is up-to-date and capable of supporting AI systems and that they have a clear strategy for how AI will be integrated into their operations. Additionally, universities will need to invest in the training and development of their staff, to ensure that they are able to effectively utilize AI technologies and respond to any challenges that arise (Misnevs *et al.*, 2021b; Misnevs and Puptsau, 2018; Puptsau and Kazinsky, 2020).

As is clearly visible from the picture Figure4 the 5th generation of universities operated by AI and managed by external administration becomes a universal educational establishment as a part of a global information system supported by the Internet.

Let us clarify that in this model the term expert includes specialists in the design of training, the development of educational technologies, including methodological materials, the implementation of IT technologies, and issues of information security and law. The term administration conditionally includes both supervisory, and legislative bodies, and the main stakeholders of the university (for example, the founders).

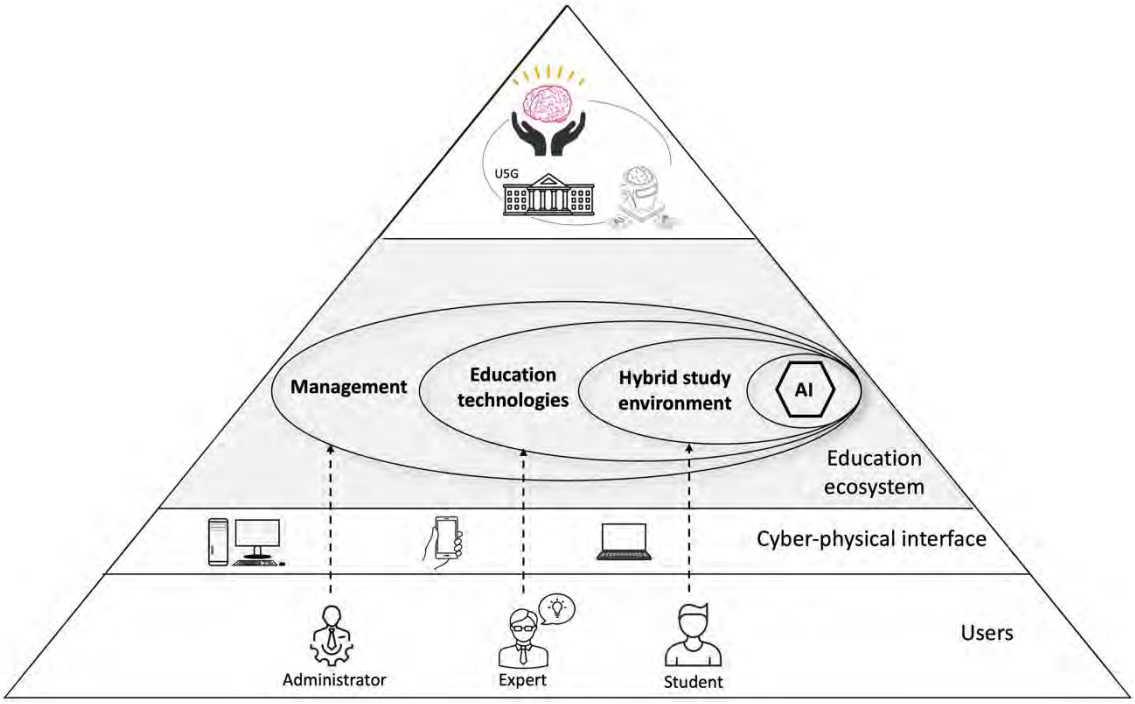

Figure 4. Suggested Conceptual Model of the 5G University

The educational environment of the university is hybrid (Figure 5) and includes both a real physical environment, focused primarily on experimental laboratory research, and a virtual environment in which AI can play a significant role.

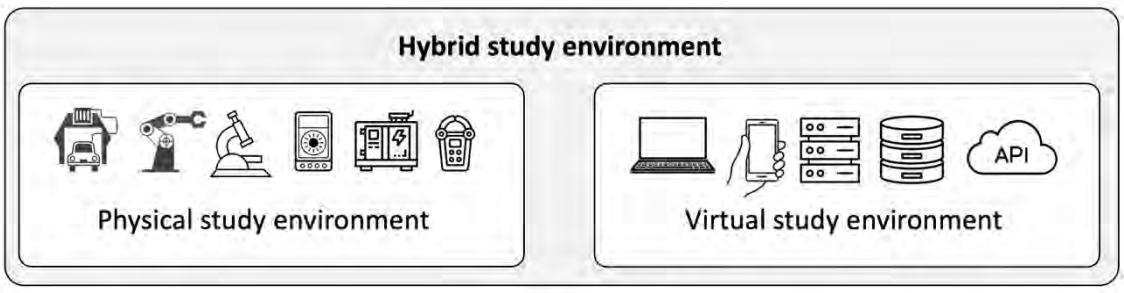

Figure 5. Hybrid study environment of U5G ecosystem

One more logical question appears “could we create a university as educational services supplier fully using IT Technology?”

And we have the clear answer “Yes for most areas of human activity!”. It is possible to create a university that provides educational services using IT technology. This is commonly referred to as an online or virtual university.

At present, despite the presence of weak points in AI in the learning process, with appropriate settings and preparation, AI can:

- develop the structure and content of educational programs and courses in various areas of study.
- organize online learning with the provision of up-to-date learning materials.
- evaluate students' work and provide feedback after preliminary training.
- analyse the learning process to develop recommendations for individual learning trajectories for students.

Thus, we can see that AI can take on significant functions of the teacher, which will undoubtedly be reflected in his or her work. The fading of certain functions that the teacher performs should be replaced by scientific and creative activities.

Already today students can access course materials and engage with their instructors and classmates through a variety of digital platforms, such as learning management systems and virtual classrooms. This model allows for flexible and accessible education, as students can complete coursework and earn degrees from anywhere with an internet connection.

However, it's important to note that creating a successful online university requires significant investment in technology, instructional design, and student support services. The university must also have a robust and secure infrastructure and a strong commitment to delivering high-quality educational experiences.

Additionally, while online education has become increasingly popular in recent years, there is still some debate about the effectiveness of online learning compared to traditional, in-person education. As a result, online universities must work to establish credibility and prove the value of their degrees to potential students, employers, and the broader academic community.

5. Conclusion

Summarizing the above, the authors argue that the quantitative changes in modern society associated with digitalization in general and with the success in the applied use of artificial intelligence (intelligent systems) have led to the need for a qualitative change in higher education. The article shows that to meet the changing needs of society in the training of its new members and the retraining of working people, it is necessary to create a new type of higher educational institution (new university). This new university will be based on IT technologies with artificial intelligence as the core element of management and education processes. The role of administration and academic staff will change dramatically. The authors of the article proposed a model of a new university and named its main functions. An essential element of the new university will be the focus on new competencies that members of the information society will need to learn. The changes will be so significant that they will be problematic for a long time to be perceived by the academic community and will call for discussions and objections. The article proposes the first steps necessary to form the acceptance of a new type of university in society and ensure a gradual transition to a new model of higher education.

The size of the article did not allow the authors to address all issues related to the topic under discussion. Therefore, on other related topics, the authors plan to publish several new articles and take an active part in the discussion of the proposals made.

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References

1. Arendt, H. (2007) *Between Past and Future: The Conquest of Space and the Stature of Man*. The Viking Penguin, New York.
2. Asgari, A., Taskoh, A., & Nodooshan G. (2021) The required specifications of a fourth-generation university to shape innovation district under anchor approach: a meta-synthesis analysis using text mining. *International Journal of Innovation Science*, 13(4), 539-562.

3. Baker, R. (2016) Stupid tutoring systems, intelligent humans. *International Journal of Artificial Intelligence in Education*, 26(2), 600-614.
4. Barnett, R. (2018) *The ecological university*. Routledge, Taylor & Francis Group.
5. Cruz-Benito, J., Sánchez-Prieto, J., Therón, R., & García-Peñalvo, F. (2019) Measuring students' acceptance to AI-driven assessment in eLearning: Proposing a first TAM-based research model. In: *International Conference on Human-Computer Interaction*. Springer, Cham, 15-25.
6. Epi, L. (2021) *Unlocking Human Potential Via Crowd Collaboration & Co-Creation*. Retrieved from https://www.gigx.com/blog/unlocking-human-potential-crowd-collaboration-co-creation.
7. Garrison, D. (2017) *E-Learning in the 21st Century: A Framework for Research and Practice* (3rd ed.). Routledge.
8. Hwang, G., Xie, H., Wah, B., & Gašević, D. (2020) Vision, challenges, roles and research issues of Artificial Intelligence in Education. In: *Computers and Education: Artificial Intelligence*, Elsevier.
9. Kant, I. (1991) The Contest of Faculties. In: Reiss, H. (Ed.), *Kant: Political Writings* (2nd ed., pp. 182-183). Cambridge University Press. (Originally published in 1798 as Der Streit der Fakultäten)
10. Kuzu, Ö. (2020) Mission and vision analysis of tourism faculties in the context of the fourth generation university model: The case of Turkey. *African Journal of Hospitality, Tourism and Leisure*, 9(1), 1-16.
11. Lukovics, M., & Zuti, B. (2013) Successful universities towards the improvement of regional competitiveness: fourth generation' universities. Paper presented at the *Regional Integration: Europe, the Mediterranean and the World Economy Conference*, European Regional Science Association (ERSA), Palermo, Italy.
12. Misnevs, B., & Puptsau, A. (2018) The use of cloud services when teaching in universities natural sciences and humanities. *Educational Technology & Society*, 21, 432-444.
13. Misnevs, B., Kabashkin, I., & Užule, K. (2021a) A Model Describing the Required Digital and Green Competences of VET Educators for Practical Use. In: *Proceedings of the 6th South-East Europe Design Automation, Computer Engineering.*
14. Misnevs, B., Puptsau, A., & Jusas, V. (2021b) Methodology for constructing and using a mathematical model for assessing labor costs for the development of distance learning courses. *Mathematics*, 9, 3049, 1-12.
15. Misnevs, B., Kabashkin, I., & Uzule, K. (2022) Education Mobility as a Service: Model of the Ecosystem. In: Kabashkin, I., Yatskiv, I., & Prentkovskis, O. (Eds.), *Reliability and Statistics in Transportation and Communication. RelStat 2021. Lecture Notes in Networks and Systems*, 410, 598-607. Springer, Cham. Computer Networks and Social Media Conference (SEEDA-CECNSM), Preveza, Greece.
16. Penrose, R., Longair, M., Shimony, A., Cartwright, N., & Hawking, S. (2013) The large, the small, and the human mind. In: *Physics and Mind*. Cambridge University Press, New York.
17. Popenici, S., & Kerr, S. (2017) Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 22.
18. Puptsau, A., & Kazinski, A. (2020) *Modern Distance Communication Course: Design, Development, Training*. Latvian Transport Development and Education Association, Ciklonas, Riga/Vilnius.
19. Rovai, A., Ponton, M.K., & Baker, J. (2008) *Distance learning in higher education: a programmatic approach to planning, design, instruction, evaluation, and accreditation*. Teacher College Press, New York.
20. Seo, K., Fels, S., Yoon, D., Roll, I., Dodson, S., & Fong, M. (2020) Artificial intelligence for video-based learning at scale. In: *Proceedings of the Seventh ACM Conference on Learning Scale*, 215-217.
21. Steinbuch, M. (2016) *Towards the 4th Generation University*. Retrieved from https://maartensteinbuch.com/2016/07/23/towards-the-4th-generation-university/.
22. Steinbuch, M. (2021) *The 4th Gen University is starting in Eindhoven Engine!* Retrieved from https://maartensteinbuch.com/2021/11/14/the-4th-gen-university-is-starting-in-eindhoven-engine/.
23. Wissema, J. (2009) *Towards the third-generation university: Managing the university in transition*. Edward Elgar, Cheltenham, United Kingdom.