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Intelligent Management Systems and Universities in the Transport Industry: Trends and Prospects

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ABSTRACT

The article is devoted to identifying the most probable prospects for the use of intelligent systems in universities of the Russian system of transport education.

The methodological basis of the study is built within the framework of the system functional and program-targeted approaches using the postulates of the concept of the digital economy in its modern interpretations. The methodological apparatus of the study is represented by a set of general logical methods (analysis, synthesis, analogy), theoretical methods (classification and hypothetical method), empirical methods (observation, modelling, measurement, description) and specific methods (modern methods of analytics, interpretation and visualisation of data, including PowerBI).

The study systematises priority trends and tendencies in development of intelligent technologies in management of universities, and also shows that correct identification of the direction of development should not be limited only to the analysis of megatrends, but also supplemented by taking into account the specifics of the material and technical support of the educational process in transport universities.

As a result of the study, the most significant prospects for intellectualisation of management systems in educational organisations of the transport industry were determined.

Keywords: intelligent management systems, university, transport education, megatrends, digital transformation, cyber-physical simulators.

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INTRODUCTION

The relevance of the problem under study is due to the fact that intellectualisation of transport management systems, accelerated by development of the digital economy, requires identifying trends and prospects for the use of intelligent management systems in universities of the transport industry. Transport is a system integrator of the entire economic system, which has a significant impact on formation of added value in the country. The use of artificial intelligence and intelligent systems in management has become a megatrend of global market development. This in turn entails the emergence of a need for training personnel with the appropriate competencies. Loyalty and receptivity of transport employees to the latest technologies should be formed at the level of an educational organisation.

Higher education in the field of transport is a specific subsystem of the Russian education system. The originality and uniqueness of the system of training personnel in the transport industry is determined by high requirements for the level of training of graduates, since the fulfilment of fundamental requirements for the transport system – for its safety and reliability – depends on the development of competencies. Modernisation of the institutional and legal foundations of functioning of the Russian system of professional education is caused, first of all, by increasing requirements for the level of practical training of graduates, which is dictated by the objective need to train specialists capable of ensuring the transition of the Russian economy to a new technological structure. The system of transport education is distinguished by a high level of technologization of the educational process, which, in turn, predetermines a forced high level of adaptability of educational organisations to the challenges of the external environment [1; 2]. The established trend of intellectualization of management systems in the economic system requires additional research from the standpoint of choosing optimal trajectories for development of universities within the transport industry.

RESEARCH METHODOLOGY

The study was conducted using the following open and verifiable sources:

• Data on the use of intelligent systems in education, aggregated within the framework of the Global Education Landscape project; open data is presented on the official website of Holon IQ and represents the results of machine processing of metadata on educational technologies used in the global environment, as well as the results of predictive analytics based on them.

• Data on the state, trends and development prospects of the global transport education market, presented in scientific and applied publications included in the Scopus and Web of Science bibliometric databases for the period 2015–2024 [3–6].

• Data on the state, trends and development prospects of the Russian transport education system, presented in scientific and applied publications included in Russian Science Citation Index for the period 2015–2024.

• Data on educational programs of professional education that provide training of specialists in the field of transport of various skill levels, presented on the official websites of educational organisations of the EAEU.

• Data of the Ministry of Science and Higher Education of the Russian Federation, including monitoring data.

• Data of the Ministry of Transport of the Russian Federation.

• Data from openly published rankings of educational organisations.

The methodological apparatus of the study is represented by a set of general logical methods (analysis, synthesis, analogy), theoretical methods (classification and hypothetical method), empirical methods (observation, modelling, measurement, description) and specific methods (modern methods of analytics, interpretation and visualization of data, including PowerBI).

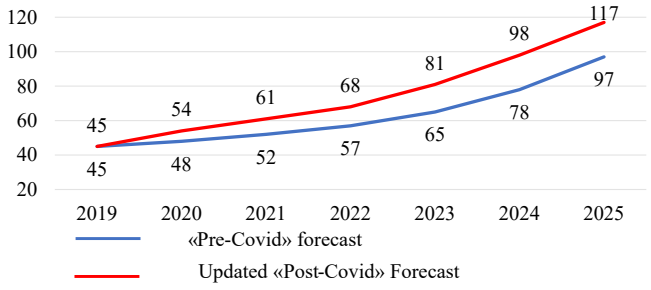
The methodological base of the study is built within the framework of the system functional and program-targeted approaches using the postulates of the concept of the digital economy in its modern interpretations.

RESULTS

Intelligent Management Systems are a Megatrend in Development of the Global Education Market

Processing of data presented within the framework of the Holon IQ Global Education Landscape project[1] allowed clustering all

[1] Global Education Landscape 2024 Handbook. Global Learning Landscape. HolonIQ, 2024. [Electronic resource]: https://www.holoniq.com/notes/2024-global-education-outlook. Last accessed 22.01.2024.



Pic. 1. Global education market, 2019–2025 (forecast), billion dollars.
(Global online education market during the pandemic. Resource data Liberty marketing.
[Electronic resource]: https://express.liberty7.ru/blog/global-online-education-during-pandemic. Last accessed 18.02.2024).

Table 1

Experience of using AI systems in various EdTech clusters [compiled by the authors based on[1]]

№	EdTech Cluster	Application of AI
1.	Knowledge and content	+
2.	Staff and talent	+
3.	International education	+
4.	New models of education	+
5.	Assessment	+
6.	Support for the educational process	+
7.	Practice-oriented learning	+
8.	Traditional models of education	-
9.	Employment and vacancies	+
10.	Education management	+

existing educational technologies into ten main clusters. As part of this study, more than 300 educational technologies were considered to determine the degree of intellectualization of machine data processing procedures. As a result, it was established that in nine out of ten clusters it is already possible to use artificial intelligence (hereinafter – AI) (Table 1).

Since artificial intelligence systems have enormous potential in terms of scale effect, it can be assumed that the use of intelligent management systems in educational activities is only a matter of time. It should be noted that a separate study is required on the issue of training personnel for the upcoming changes in terms of developing the necessary competencies. However, it is absolutely obvious that the use of the functionality of AI systems is becoming a prerequisite for ensuring the necessary level of transition from educational products to educational services, ensuring real individualisation of the educational trajectory and coordinating labour market demands and systems of «fine tuning» of specialists.

In the study of megatrends, an analysis of the financial capacity of the global educational services market and the pace of its development seems to be of no small importance (Pic. 1).

The highest growth rates are predicted in the online education segment. By 2025, a 2,6-fold increase is predicted: from 50,7 billion dollars to 130,3 billion dollars. This allows us to talk about the highest importance of modern readiness of transport universities to enter the international educational services market. At the same time, starting in 2021, the emphasis is shifting from the global to the regional level: the main pole of economic growth is now confidently forming in the EAEU countries. In this regard, the unification of intellectual capital and digital technologies to ensure a «seamless» educational environment naturally acquires a priority rank in formation of development strategies for transport universities. This makes it possible to ensure proactive («advanced») updating of the educational, laboratory and simulator base, and, considering the designated megatrend, in the direction of expanding the practice of using AI systems and cyber-physical simulators. The «seamless» nature of the educational environment creates a solid foundation for the possibility of building «seamless» transport corridors in the context of the emergence of a new world order – a multipolar global world.

Institutional and Legal Foundations for Intellectualization of Elements of Material and Technical Support of the Russian Transport Education System

The latest stage of development of the Russian transport education system is most clearly characterised by the following.

• Firstly, requirements for mandatory availability of developed material and technical

support in terms of «training and simulator base, including vehicles and simulators»[2].

• Secondly, the implication of a proactive approach in a program document that predetermines priority trajectories for development of the sectoral education system[3], in particular, the use of cyber-physical simulators and development of educational programs for «professions of the future».

• Thirdly, the need to carry out an accelerated digital transformation of universities within the transport industry in the interests of ensuring the implementation of priority national goals.

The designated institutional and legal framework requires that universities within the transport industry have a balanced combination of human capital and technical and technological infrastructure. The human capital of a university is traditionally decomposed into management personnel (management team), faculty, researchers, and educational and auxiliary staff. The performance of all groups of employees is already determined by the level of development of their digital competencies and ability to use AI systems. Thus, the proctoring system used in conducting certification tests remotely is the most common of the intelligent systems that accompany the modern educational process.

AI-Transformation of the Material and Technical Support of the Educational Process in Universities within the Transport Industry

The task of unification in the context of the explosive development of intelligent management systems is no longer a super task only for human intelligence. The use of AI, including machine learning and big data analytics, can significantly facilitate the work of systematisation, clustering and studying the differences in the requirements for specialists employed in the transport industry. In addition, several countries already have successful experience in individualising a professional trajectory based on machine processing of data on the level of professional training of a specialist: after passing the assessment procedures, the educational trajectory necessary to ensure the required qualification level is formed automatically [7].

The level of development of the educational environment infrastructure and its provision with laboratory, training and educational and industrial equipment (or its virtual analogues) is decisive for the quality of practical and applied training of students. The infrastructure of the educational environment and training equipment require advanced technical and technological modernisation based on the latest research results. Thus, the availability and use of cyber-physical simulators has become an implied requirement for modern universities in the field of transport. Several Russian transport universities have already begun developing such simulators, since technological sovereignty is a basic factor in the strategy system in modern geopolitical conditions [8].

In this process, the conceptual role is played by establishment and institutionalisation of a system of continuous interaction between universities and scientific organizations, specialised research institutes and leading employers. Existing interaction systems are predominantly discrete in nature and do not allow for timely and prompt updating of the laboratory and simulator base. At the same time, for transport universities, the availability and technological effectiveness of the laboratory and simulator base are integral conditions for ensuring the competitiveness of educational products and services, as well as the satisfaction of employers with the quality of practical skills of young specialists.

The priority task at the state level should be the transfer of the latest technologies, hardware and software samples to universities for their active inclusion in the system of practical and applied training. A strategically significant accompanying process is the need for regular internships for faculty in organisations and enterprises of the transport sector, since the efficiency and productivity of the use of the material and technical base of the educational organisation depend on the quality of their operation [9; 10]. This task must be consolidated at the state level and at the same time provide tools and methods for stimulating the participation of employers in development of laboratory and simulator bases of universities. The development of functional organisational and financial instruments to support the innovative modernisation of laboratory and simulator complexes of transport educational organisations, including public-private partnership programs and tax preferences for employers participating in development of specialised laboratory bases, is the most important element of the mechanism for implementing the

[2] Part 6 Art. 85 of the Federal Law dated 29.12.2012, N 273-FZ, «On Education in the Russian Federation».

[3] Order of the Government of the Russian Federation dated 06.02.2021, № 255-p «On approval of the Concept for training personnel for the transport complex until 2035».

strategy for development of transport education and the export of educational services.

The acceleration of scientific and technological advancements and the transition to new technological paradigms pose the task of updating, modernising and innovatively transforming technical teaching aids for universities. For transport universities, the most urgent task remains to provide laboratories and training complexes with models or their high-quality virtual analogues [11].

The quality of practical and applied training of young specialists, the level and scale of using innovation-focused technical teaching aids in the educational process, the readiness and ability of young specialists to master innovations predetermine the level of dependability and safety of transport systems in the strategic perspective. Risk-orientation in the safety management of transport systems and complexes involves the development of systems for preventing the negative impact of the human factor on technical means and technological complexes, including through automation and reducing the level of on-job dangers. From this position, the development of targeted applied skills of transport industry specialists within the educational process is a fundamental condition for ensuring the main parameters of transport. i.e., dependability and safety [12].

The development of laboratory and training facilities of transport universities should be carried out simultaneously in all specialties and areas of training: in the field of railway transport and traffic management, transport logistics and international multimodal transportation, transport construction, maintenance and operation of transport production and supporting infrastructure, transport safety and ecology, as well as jurisprudence, finance, economics and management [13]. De-synchronisation of the levels of development of laboratory and training facilities creates the risk of insufficient practical and applied training of young specialists and leads to the reluctance of employers to involve students in industrial practices and internships.

The list of specific types, types and classes of training equipment, including cyber-physical, required by transport universities should be approved at the state level with participation of leading employers and specialised research institutes [14].

The profiling of transport universities by types of transport in the context of the need to ensure a model for the export of transport services and the development of multimodal transportation actualises the problem of using network forms of training to implement practical training of young specialists to increase the positive network effect from the modernisation of the educational and laboratory base and the innovatization of training complexes. This, in turn, requires the elimination of gaps in the legal regulation of the academic mobility of students and scientific and pedagogical staff. The formation of individual trajectories based on the analysis of the «digital footprint» seems to be the optimal vector for resolving this problem.

CONCLUSIONS

The conducted research has determined the most probable prospects for the use of intelligent systems in universities in the Russian transport education system. The most significant prospects for intellectualization of management systems in educational organisations of the transport system include:

• Development of microservices taking into account the potential for further integration of aggregated metadata within the framework of super services (industry, federal, international).

• Accelerated development of big data processing technologies for the use of «digital footprint» analysis technologies for the purpose of forming individual student trajectories.

• Implementation of AI systems for administering routine procedures in the educational process to optimise follow-up costs and to free up resources for development.

• Involvement of representatives of employers and partners from the transport industry in development of educational, laboratory and training facilities in the format of scientific, educational and scientific and production centres, in particular, for the introduction of the latest cyber-physical simulators into the educational process [15; 16].

• Active dissemination of the technology for formation of «digital twins» for creation of modern simulators and the possibility of their timely updating [17].

• The need for the fastest possible digital transformation of the sectoral education system to optimise the algorithms for its further modernisation and debugging in the context of achieving national goals.

• Designing individual educational environments depending on the target educational outcome and the level of the educational program.

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