Challenges of higher education in Russia and their impact on the digital transformation of the forestry industry

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Abstract. Higher education plays a pivotal role in shaping qualified professionals and determining the development directions of various sectors of the economy. However, it faces a multitude of issues that diminish its effectiveness and contribute mismatching between graduates and demands of the modern labor market, particularly in the era of digital transformation, where the demand for digital competencies is on the rise. This study delves into the key challenges of higher education in Russia, assesses their impact on the forestry industry, and proposes avenues for their resolution. In the concluding sections of this article, we present the most favorable model for addressing the issue of the shortage of digital competencies among the personnel in the forestry sector, the scarcity of higher-educated workforce, and the absence of necessary IT solutions.

1 Introduction

Today, digital transformation effects on various aspects of life, including education. To prepare competitive professionals, the process of obtaining higher education must align with the 'digital' age. This necessitates a continuous update of educational programs and the introduction of new specialization profiles, enabling the graduation of specialists equipped with the competencies required for future employment.

The authors identified the following obstacles for the digital transformation of forestry industry [1-5]:

- Industry monopolization.
- Outdated regulatory framework principles.
- Limited access to information.
- Shortage of necessary specialists and competencies.
- High implementation costs and a lack of financial resources.
- Uneven distribution of digitization.
- Insufficient infrastructure development.
- Resistance to change.

The issue of information inaccessibility is specific and exists only in the forestry industry. Forest users do not have access to information about the state of Russian forest resources due
to data unavailability. The existing system is unstable and prone to failures, rendering the data published on official websites unusable [5].

Today, the challenge of competence shortage among the workforce is pressing, as confirmed by various domestic and international studies. For instance, in 2020 a survey among Russian companies revealed that the primary obstacle to enterprise digital transformation is the absence of competencies among employees [6]. This phenomenon is also noted in another research works [7-8]. Therefore, this problem can be considered a major hindrance for digital transformation of industrial enterprises.

For the effective operation of the forest complex and the sustainable development of the forestry sector we need competent and highly qualified specialists. Issues in higher education can significantly hinder the process of digital transformation in the forestry industry. The absence of professionals with digital skills and outdated educational programs leads to challenges in implementing digital systems in enterprises, and impact on the overall industry digitization.

Let's outline several fundamental aspects regarding the terminology we used in our paper. Digital transformation is the process of an organization transitioning to the use of digital technologies across all aspects of its business [9-13]. The digital era is a period characterized by the shift from traditional industry to the widespread using of digital technologies in a computerized industry [14-16]. The pre-digital era is the period preceding the widespread use of digital technologies and the emergence of digital era. Education during this period was primarily conducted using non-digital means of communication, information storage, and data processing [16-17]. In contrast, digitization has increased the accessibility, speed, and convenience of acquiring knowledge through the opportunities it offers for effective and flexible learning.

2 Materials and methods

During our research we used different general scientific research methods such as analysis, synthesis, comparison, and observation. Scientific works, reports, and publications in the field of higher education in Russia and the forestry industry were analyzed. The information base required for the research included scientific journals, internet resources, and data obtained through observations within the scope of the research topic.

3 Results

Digital technologies are developing rapidly and introduced late into the educational process, that leads to gap in the education sector between the competencies developed during education and the real needs of the sector. As a result, there is a shortage of professionals with the required digital competencies for the digital economy in the labor market [18].

Let's compare higher education across two periods. Higher education in the pre-digital era:

- Competency requirements: Traditional competency and skill requirements for graduates.
- Teaching technology and methodology: The educational process takes place in classrooms and consists of traditional in-person lectures and practical sessions.
- Access to information: Students used libraries and physical textbooks to access information.

Higher education in the digital era:

- Competency requirements: Increased demands for the competencies of graduates; the necessity of possessing 'digital' skills.
Teaching technology and methodology: Introduction of online courses, distance learning, e-learning platforms; education has become blended.

Access to information: Students use physical textbooks less frequently to access information; electronic textbooks, online libraries, and internet-based databases have replaced traditional resources, providing a wider range of information sources. Today, higher education is characterized by the utilization of various technologies, increased demands for graduate competencies, and widespread access to data and information. Let's consider the current challenges in higher education in Russia:

1. Lack of Modern Educational Resources and Materials [19]: The quality of education suffers from the absence of updated educational materials, modern equipment, and laboratories, which hinders the process of innovation. Solution: Attract sponsorship for the implementation of new technologies; development and implementation different collaboration programs with research universities and other partners to ensure access to modern technologies, materials and resources.

2. Insufficient Funding [19-20]: A lack of finances is the primary obstacle to improving the quality of education, resulting in difficulties with scholarship disbursement, upgrading the educational infrastructure, and conducting research. Solution: Strengthen state funding for higher education and attract investments from industrial partners.

3. Shortage of Practical Training [19-20]: The absence of opportunities for practical student training and limited cooperation with enterprises restrict students' real-world experience and application of knowledge. Solution: Strengthen ties with companies to organize practical training; provide students with access to software and technical facilities for practical learning.

4. Irrelevance of Educational Programs [20]: Rapid obsolescence of educational programs and a lack of curriculum updates. Solution: Update educational programs to reflect new industry trends; implementation of new technologies and digital learning; training students in digital tools.

5. Lack of Digital Competencies among lecturers [21]: A shortage of lecturers with modern knowledge limits students' ability to acquire current knowledge necessary for the digital transformation of the economy. Solution: Invite industry professionals to deliver lectures to students in higher education institutions; create online courses to update knowledge; provide training for lecturers to enhance their digital competencies.

The listed problems limit students' opportunities to acquire the knowledge and skills necessary for working in the forestry industry. To address these challenges, collaborative efforts are required from the government, forestry enterprises, and higher education institutions. The importance of possessing digital skills increased during the COVID-19 pandemic. Companies and educational institutions were forced to switch to remote work, revealing the issue of insufficient digital preparedness among students, employees, and instructors. According to a research study conducted by Ancor with the support of Microsoft and AmCham Russia, as of today, 44% of employers in Russia encountered insufficient digital technology proficiency among their personnel [21].

According to researchers from ITMO University, the forestry industry lacks employees with the ability to work with software solutions based on digital technologies. This skill is essential for every sector within the forestry complex, as it forms the foundation for the implementation of digital technologies. Digital solutions that are crucial to work with in the forestry industry include ERP systems, MES systems, CAD systems, GPS systems, the 1C program, and cross-platform applications [22]. For successful digital transformation we need a workforce with a strong technical foundation and expertise in information systems. Such professionals work with SAP and are involved in the development and implementation of MES systems.
According to the Ministry of Industry and Trade, as of September 2023, there is a shortage of around twelve thousand personnel with higher and secondary professional education in the forestry sector. The industry particularly needs highly skilled engineering professionals [23]. According to data from Rosstat, 47% of forestry university graduates do not work in their field of study, further exacerbating the situation [24].

In 2021, 39% of the industry's workforce had a higher education, but by 2022, this figure had decreased by 4.8 percentage points to 34.2%. Employee turnover in 2022 increased by 7.5% compared to the baseline period, reaching 26.9% [25].

In addition to the existing challenges hindering the digital transformation of the forestry industry, economic constraints have added the problem of equipment and certain software, such as ERP systems, lacking replacements. Companies like 1C are not particularly interested in working with forestry enterprises. For new projects, it will be necessary to seek domestic solutions or substitutes from friendly countries [26]. Higher education does not have answers to this challenge because forestry universities lack digital competencies, and universities with expertise in software development and digital solutions do not have knowledge of the forestry sector.

As a result, the forestry sector is facing a shortage of digital tools and enterprise management solutions. Let's compare the challenges in higher education with the challenges the forestry industry is facing. The irrelevance of educational programs in higher education leads to a lack of competencies in the forestry industry because the programs do not consider the modern trends in the industry and labor market requirements.

Let's explore models that can be used to address the problem of a shortage of digital competencies among personnel, a deficit of personnel with higher education, and the absence of software solutions:

- **Collaboration between a specialized forestry university and a technical university, implementing joint programs.** Pros: the combination of knowledge and experience in forestry and digital technologies, the expansion of professional networks. Cons: outdated educational programs due to slow responsiveness of universities to external changes, resulting in the accumulation of outdated knowledge.

- **Collaboration between a technical university and an industrial partner.** Pros: close collaboration allows for a more precise determination of the forestry industry's digital competency needs, access to real forestry cases, opportunities for student internships and employment with the partner company, joint project implementation, the updating of educational programs, strong technical resources for students. Cons: dependency on the direction and highly specialized needs of the industry partner.

- **Establishment of a corporate university within a forestry company.** The main drawbacks of creating a corporate university are significant investments required to establish and maintain the system, resistance to change from company employees, and a lack of interaction with traditional universities. The latter problem affects educational programs that cannot be updated in line with business environment requirements. Graduates from corporate universities may lack the skills for scientific research taught at traditional universities. Pros: control over the educational program and its adaptation according to the company's needs.

Based on the provided options, it is recommended to use the model of collaboration between a technical university and an industrial partner. Such a partnership can address most of the higher education issues for the forestry sector, including the problem of outdated educational programs. Consequently, the primary obstacle for digital transformation of the forestry industry will also be resolved. The educational program "Business Informatics in the Forestry Industry" will meet the needs of forestry companies for professionals with digital competencies and contribute to solving the problem of the lack of necessary software solutions in the forestry sector.
From all the information presented, it can be concluded that the forestry sector requires IT specialists with forestry competencies rather than foresters with digital competencies.

4 Conclusion

Higher education plays a pivotal role in the development of any country as it shapes the workforce for all sectors of the economy. In the context of digital transformation, the demands for employee competencies are rising due to the rapid development of technologies and changes in work processes. A lack of competencies in employees can have a negative impact on a company's functioning in the new digital environment.

The study examined the main challenges faced by higher education institutions. The analysis revealed that the educational programs used in universities often do not reflect the current requirements for professionals, limiting students' acquisition of necessary skills and knowledge. Students often lack practical experience due to insufficient collaboration between universities and businesses. Many universities face a shortage of modern equipment and laboratories, which affects the quality of education. There is also a shortage of lecturers with up-to-date knowledge, which impacts the quality of education received by students. Higher education faces funding challenges, which limit opportunities for upgrading educational facilities, conducting research, and more.

To enhance the quality of education and align it with the demands of the modern industry, it is necessary to:
- Update the educational programs to meet current industry requirements.
- Strengthen ties with industry businesses to facilitate internships for students.
- Attract sponsors to refresh educational resources and improve the quality of education.
- Invite industry professionals to serve as lecturers in the university.
- Develop courses to enhance teachers' qualifications with a focus on digital skills.
- Increase funding by attracting investments from industrial partners.

The research has shown that the problems of Russian higher education have a negative impact on the digital transformation of the forest industry. Modern approaches to education need to be adapted to the digital era.

Based on the analysis, a model of collaboration between an industrial sector partner and a non-specialized university has been chosen. This interaction will enable joint development of new products and technologies, provide students with real industry work experience, facilitate the exchange of expertise and knowledge, address the shortage of higher education graduates, and solve the issue of the forest industry's lack of digital competencies on the path to digital transformation.

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