


Developing Digital Competencies and Skills for the Economy of the Future: International and Russian Approaches

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Abstract: Digital transformation is radically reshaping the economy, education, and the labor market. Technological advances — including artificial intelligence, big data, and automation — are creating new demands for worker competencies. This article analyzes international (EU DigComp, UNESCO ICT Framework, OECD Skills Outlook) and Russian initiatives (Digital Professions, Digital Department, corporate universities) aimed at developing digital competencies as a strategic resource for human capital and sustainable development. The results show growing demand for both technical skills (programming, data analysis, cybersecurity, cloud technologies) and social digital competencies (critical thinking, creativity, digital communication). Forecasts by the World Economic Forum and McKinsey confirm structural changes in the labor market: increasing demand for digital and “green” professions alongside a decline in routine roles. However, key challenges remain, including digital inequality, insufficient teacher training, ethical concerns related to AI implementation, and dependence on international platforms. The study concludes that a multi-level strategy is required, involving the government, educational institutions, and businesses. Recommendations are proposed for harmonizing standards, developing infrastructure, integrating digital competencies into curricula, retraining teachers, and expanding corporate micro-qualifications.

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1 INTRODUCTION

Today, digital transformation is one of the key factors shaping socioeconomic development. It drives changes in business models, public administration, education, and the structure of the labor market. In the context of the knowledge economy, digital technologies have become not only tools for improving efficiency but also a fundamental basis for national and organizational competitiveness. Developing digital competencies — a set of knowledge, skills, and attitudes that enable the effective use of digital technologies in professional and everyday activities — is of particular importance. Unlike narrowly defined technical skills, digital competencies are a comprehensive category encompassing technical literacy, critical understanding of digital content, communication and collaboration within digital environments, and the ethical and legal aspects of working with data.

The need to develop digital competencies is driven by several factors. First, the accelerated introduction of artificial intelligence, big data, robotics, and virtual reality is radically changing the nature of work. Second, lifelong learning and reskilling are now essential for maintaining professional competitiveness. Third, developing human capital is a strategic objective directly linked to the Sustainable Development Goals (SDGs), particularly SDG 4 “Quality Education” and SDG 8 “Decent Work and Economic Growth.”

International organizations such as UNESCO, the OECD, and the European Commission have created several frameworks for defining and assessing digital competencies. In Russia, government initiatives such as Digital Professions and Digital Department are actively implemented, while corporate universities and online platforms — including SberUniversity and Yandex.Practicum — form key components of the national digital education ecosystem. Nevertheless, several challenges persist, including regional disparities in access, a shortage of qualified educators, and the absence of unified standards for digital skills certification.

Therefore, this study aims to compare international and Russian approaches to developing digital competencies, identify their shared and distinctive features, and determine future directions for the digital economy.

2 METHODOLOGY AND SEARCH METHODS

This study is based on secondary data analysis and employs qualitative methods to examine international and Russian practices in developing digital competencies.

The analysis draws on the following sources:

- International frameworks: DigComp 2.2 (European Commission, 2022), UNESCO ICT Competency Framework for Teachers (2018), OECD Skills Outlook (2019);
- Analytical reports: World Economic Forum, The Future of Jobs Report (2025), McKinsey Global Institute, A New Future of Work (2024), reports by the World Bank and National Skills Coalition;
- Russian programs and research: the national project Digital Economy of the Russian Federation, Digital Professions (Ministry of Digital Development, 2022), Digital Department (2021), research by the NAFI Center (2021–2022), and academic publications (Ivanova & Petrov, 2021; Karavai & Soloviev, 2021).

Research Methods:

1. Comparative analysis — used to compare international and Russian digital competency frameworks and identify differences in their integration into educational and professional systems.
2. Content analysis — conducted on strategic documents and analytical reports to identify key labor market trends and in-demand skills.
3. Structural analysis — applied to educational practices (e.g., Google Digital Garage, IBM SkillsBuild, SberUniversity, Yandex.Practicum) to explore their organizational and methodological features.
4. Predictive analysis — based on WEF and McKinsey data to assess expected changes in demand for professions and competencies by 2030.
5. Qualitative synthesis — combining the findings into a coherent model that reflects the main trends and challenges in developing digital competencies.

The study does not include empirical sociological surveys or quantitative experiments; it focuses on secondary document analysis and comparative examination of international practices. However, this limitation is compensated by the breadth of the source base and the relevance of the selected cases. precariat’s evolution and human capital implications.

3 RESULTS AND DISCUSSION

3.1 International Models of Digital Competence

In international practice, several comprehensive models define standards for digital literacy and competencies:

- DigComp 2.2 (European Commission, 2022): a universal framework encompassing five key areas — information literacy, communication and collaboration, digital content creation, security, and problem solving.
- DigCompEdu and DigCompOrg: specialized versions designed for teachers and educational organizations, allowing systematic assessment of digitalization in education.
- UNESCO ICT Competency Framework for Teachers (2018): a widely used tool for integrating ICT into education, particularly relevant in developing countries.
- OECD Skills Outlook (2019): focuses on future skills and their connection to economic competitiveness.

These models share a holistic perspective: digital competencies are viewed not merely as technical skills but as an integration of cognitive, social, and ethical abilities essential for sustainable participation in the digital world.

3.2 The Labor Market of the Future

According to the World Economic Forum (2025), by 2030 up to 40% of workers will require reskilling. The most rapid growth is expected in professions related to data, artificial intelligence, cybersecurity, and sustainable development. Forecast of In-Demand Professions and Digital Skills to 2030. Current transformations in the labor market reveal significant shifts in professional priorities under the influence of digitalization, automation, and the greening of the economy. Based on forecasts by the World Economic Forum (2025) and McKinsey (2024), several long-term trends can be identified:

- Growing demand for data and AI specialists.

The most sought-after roles include Data Analysts and Scientists, AI and Machine Learning Specialists, Big Data Experts, and Cybersecurity Professionals. Key competencies for these specialists include data interpretation, machine learning application, cybersecurity management, and the use of cloud platforms for data storage and processing. The expansion of this segment reflects the rising importance of data as a strategic resource for

decision-making and business efficiency.

- The emergence of hybrid, interdisciplinary roles. A growing number of positions combine managerial, analytical, and digital skills. These include Digital Transformation Specialists, Business Development Professionals, and EdTech Experts. Such professionals integrate digital solutions into organizational processes and require advanced project management, communication, critical thinking, and adaptability to technological change.

- Integration of digital and green skills. Sustainability-related roles such as Sustainability Managers, Renewable Energy Engineers, and Circular Economy Specialists are becoming increasingly important. These professions require the ability to use digital modeling tools, analyze ecosystem data, and work with Internet of Things (IoT) technologies — demonstrating the convergence of sustainable development and digital innovation.

- Ethical and human-centered technology roles. The rise of artificial intelligence has generated demand for new professions such as Prompt Engineers, AI Ethics Specialists, and Human–AI Interaction Designers. These specialists need programming and AI training skills, knowledge of ethical AI design, and UX expertise focused on human–machine interaction.

- Decline of routine and administrative occupations. Roles such as Administrative Clerks, Data Entry Operators, and Routine Production Workers are gradually disappearing due to automation and digital management tools. This process underscores the declining importance of basic mechanical and clerical skills.

Overall, by 2030, the structure of labor demand will increasingly depend on hybrid competencies combining technical, analytical, and communication skills — alongside the capacity for continuous learning and adaptation. Developing a digital mindset and readiness for constant upskilling will become key factors of professional resilience in the evolving economy.

3.3 Comparison of International and Russian Initiatives in Digital Competency Development

The development of digital competencies has become a strategic priority for both international and national education and labor policies. While global frameworks promote harmonization and standardization, Russian initiatives aim to adapt

these principles to domestic institutional, economic, and cultural conditions. This leads to both convergence and divergence in approaches, objectives, and implementation mechanisms.

Regulatory Framework and Institutional Foundations.

At the international level, key regulatory documents shaping approaches to digital competencies include the EU DigComp and DigCompEdu frameworks developed by the European Commission. These models structure digital competencies into clear categories — information literacy, communication and collaboration, content creation, security, and problem solving — and ensure transparency in assessment and certification.

In parallel, the OECD Skills Outlook positions digital skills within a broader concept of “skills for the future,” integrating cognitive, social, and technological abilities. Such frameworks promote the cross-border recognition of qualifications and mobility of labor.

In Russia, the regulatory foundation is largely defined by the national project “Digital Economy of the Russian Federation”, which identifies the development of digital competencies as a state priority. However, the Russian system remains less unified and depends on the interaction between government, universities, and businesses.

Unlike in the EU, where standards are embedded in education systems at all levels, Russian initiatives are often implemented through state programs and grants, which limits their long-term institutional consistency

Focus and Strategic Priorities.

International initiatives emphasize a comprehensive understanding of digital competencies — not only as tools for employability but also as components of civic and cultural participation.

The EU Digital Education Action Plan (2021–2027), for example, highlights digital literacy as a prerequisite for democratic engagement and sustainable development. Thus, digital competencies are viewed as part of social capital.

In contrast, Russian programs focus more narrowly on economic modernization and industry-specific professional training.

Educational efforts prioritize the acquisition of practical digital skills for key sectors such as IT, telecommunications, public administration, and education.

The development of critical, creative, and ethical digital literacy remains secondary. This reflects a

policy orientation that sees digitalization primarily as a driver of economic growth and industrial competitiveness rather than as a dimension of civic empowerment.

Educational Tools and Approaches to Learning.

International educational systems increasingly emphasize flexibility and lifelong learning through initiatives such as Erasmus+ Digital, massive open online courses (MOOCs), and national lifelong learning strategies. These mechanisms promote accessibility and inclusion, allowing individuals to continuously update their skills and adapt to technological change. The widespread use of micro-credentials and modular education supports horizontal career transitions and recognizes informal learning.

Within the European Union, extensive reskilling programs are being implemented for workers whose professions are at risk of automation. These programs combine online and offline learning formats and rely on partnerships between universities, public institutions, and technology companies.

In Russia, a similar digital education infrastructure is emerging. Programs such as “Digital Professions”, “Digital Department”, and “Digital Lesson” target diverse age and professional groups. However, Russian initiatives are typically state-driven and designed for short-term outcomes rather than long-term strategic integration.

A significant methodological gap persists between the academic and practical components of digital education. University curricula in digital technologies often remain poorly aligned with labor market needs, while in schools, digital literacy is still treated primarily as part of computer science rather than as a cross-disciplinary competency.

This creates challenges in developing holistic digital awareness and critical thinking skills among students and educators alike.

The Role of Business and Public–Private Partnerships.

In many countries, business plays a pivotal role in developing and updating digital competencies. Global technology companies such as Google, IBM, Microsoft, and SAP invest heavily in open learning platforms, digital certification programs, and professional retraining initiatives.

These projects are typically based on the principles of public–private partnership (PPP) and form dynamic ecosystems for continuous skill development.

For instance, IBM SkillsBuild and Google Career Certificates provide internationally recognized qualifications that help bridge the gap between formal education and employment. Such programs also promote inclusion by offering free or subsidized access to learners from disadvantaged backgrounds.

In Russia, corporate participation in digital education is growing but remains more dependent on state coordination. Major companies like Sber, Yandex, and Rostelecom have developed corporate universities and online platforms that provide professional reskilling and upskilling opportunities. However, their activities are often integrated into national programs rather than being independent private initiatives.

This dependency on state frameworks can limit innovation and flexibility compared to international models. Nevertheless, corporate universities are emerging as effective instruments for addressing skill shortages, particularly in regional labor markets where access to high-quality training remains limited.

Business involvement in education is thus a crucial driver of human capital development and an essential element of digital transformation strategies at both national and regional levels.

Problems and Challenges.

Despite notable progress, both international and Russian initiatives in digital competency development face persistent challenges. These difficulties are structural, social, and ethical in nature and affect the scalability and inclusiveness of digital transformation processes.

1. **Digital Inequality.** Differences in access to technology across regions and social groups deepen existing socioeconomic divides. According to NAFI (2021), digital inequality remains a significant risk factor for social exclusion, particularly in rural areas and among older populations.

2. **Shortage of Qualified Personnel.** A lack of teachers, trainers, and HR professionals with advanced digital skills undermines the effectiveness of educational programs. Continuous professional development systems often fail to keep pace with the speed of technological innovation, which leads to skill mismatches and outdated teaching practices.

3. **Ethical and Regulatory Issues.** The rapid adoption of artificial intelligence has generated complex ethical challenges. Problems such as data privacy, algorithmic bias, and transparency of automated decision-making remain unresolved. As

Mäkelä and Stephany (2024) note, the ethical dimension of digital transformation must become an integral part of education and labor market regulation.

4. **Psychosocial Effects.** Digital transformation also brings psychological and social risks — including digital fatigue, stress, and a sense of “forced retraining” among employees. These factors highlight the need to balance technological adaptation with mental well-being and workplace sustainability.

5. **Digital Sovereignty.** Dependence on international EdTech platforms and foreign technologies creates vulnerabilities for national education policies. Ensuring digital sovereignty — the capacity to develop and control domestic digital ecosystems — has become a strategic goal for many countries, including Russia. Overall, the analysis shows that despite significant achievements in developing digital competencies, both international and Russian systems still face numerous challenges requiring systematic, cross-sectoral solutions. The next stage of development must focus on harmonizing standards, enhancing teacher qualifications, addressing ethical concerns, and fostering inclusive access to digital infrastructure.

4 CONCLUSION

The findings of this study confirm that the development of digital competencies is a critical factor in strengthening human capital and enhancing the competitiveness of national economies. In an era of rapid digital transformation, digital skills are becoming a strategic resource that determines not only individual career success but also the overall sustainability and resilience of socioeconomic systems.

The research results allow for several general conclusions:

1. Digital competencies represent a multidimensional category that encompasses technical, cognitive, social, and ethical components. Their effective development requires a systemic, interdisciplinary approach integrating education, business, and government efforts.

2. International frameworks such as DigComp, UNESCO ICT Framework, and OECD Skills Outlook demonstrate a high degree of institutionalization and standardization. They embed digital competencies into educational standards at all levels and are supported by certification and monitoring mechanisms.

In contrast, Russian practice relies more on government and corporate programs. This ensures wide coverage and rapid implementation but limits flexibility and diversity in learning pathways.

3. The labor market of the future is characterized by increasing demand for specialists in artificial intelligence, data analytics, cybersecurity, and sustainable development, accompanied by a decline in routine administrative occupations.

Consequently, training strategies must be rethought to strengthen connections between education and employers and to build robust lifelong learning systems.

4. Challenges remain substantial, including digital inequality, a shortage of qualified educators, the absence of unified certification standards, and ethical and psychosocial risks associated with AI implementation. Addressing these challenges requires coordinated actions across multiple levels of policy and governance.

Overall, digital transformation is not merely a technological shift — it represents a human-centered transformation that redefines professional identities, learning models, and the nature of work itself. Ensuring that this transformation is inclusive, ethical, and sustainable will determine the resilience of economies in the coming decades.

Recommendations. Based on the conducted analysis, a set of recommendations is proposed for three main stakeholder groups: public authorities, educational organizations, and businesses.

1. For Public Policy:

- Integrate digital competencies across all levels of education, from general and vocational training to higher and lifelong learning.

- Develop national systems of teacher retraining and professional development focused on digital pedagogy and the use of modern technologies in the classroom.

- Encourage modular, hybrid, and micro-credential learning formats that allow for flexible educational trajectories.

- Harmonize standards for digital competency assessment with international frameworks (e.g., DigComp) to enhance cross-border recognition of qualifications.

- Promote digital inclusion policies, especially in rural and disadvantaged regions, to reduce inequality in access to infrastructure and educational opportunities.

2. For Educational Institutions:

- Embed digital competencies into curricula across disciplines rather than treating them as isolated subjects.

- Establish systems for continuous teacher training that emphasize digital literacy, online pedagogy, and the ethical use of technology.

- Adopt flexible learning models, such as blended and modular programs, that combine academic and applied learning.

- Develop partnerships with businesses to align educational outcomes with labor market needs and enhance employability.

- Encourage interdisciplinary projects that integrate digital skills with creativity, problem-solving, and social responsibility.

3. For Businesses and the Corporate Sector:

- Invest in human capital by implementing reskilling and upskilling programs that prepare employees for emerging roles.

- Establish corporate universities and digital learning platforms that support continuous professional development.

- Introduce internal certification systems for digital competencies and support employees' participation in external learning programs.

- Foster public-private collaboration in education to co-create innovative programs, especially in data analytics, AI, and sustainability.

- Support workplace well-being by addressing digital fatigue, ensuring healthy hybrid work environments, and promoting mental health initiatives.

The sustainable development of digital competencies depends on synergy between government, education, and business. A partnership-based ecosystem will enable the continuous renewal of skills and ensure that professionals are not only able to adapt to technological change but also to actively shape the future digital economy. In this context, digital competencies should be viewed as a core element of human capital, directly linked to innovation, social inclusion, and the achievement of the Sustainable Development Goals (SDGs). Their development represents a long-term investment in the resilience and adaptability of societies in an increasingly uncertain global environment.

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