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Digital Transformation in the Labor Market for Disabled Persons (Case Study: an Industrial Company)

V.A. Lipatov[a], A.A. Solomakhin[b], I.I. Nekrylov[c], K.K. Sirbiladze[d], A.A. Ivanov[e]
[a,b,d] Financial University, Moscow, Russia;
[c] Ivan Fedorov Moscow Publishing and Printing College, Moscow, Russia;
[a] Moscow Technical University of Communication and Informatics, Moscow, Russia;
[e] Evaluating and research company "INVEST5", Moscow, Russia

ABSTRACT

The impact of digital transformation of industrial enterprises on the labor prospects of people with disabilities is examined by this publication. Distance or hybrid employment and education are effective tools for providing this category of population with highly paid and prestigious jobs in industrial enterprises. Innovative digital technologies, products, resources, and services make it easier for enterprises to adapt workplaces to the unique needs of people with disabilities, which, in turn, contribute to successful economic inclusion. The authors explore microeconomic incentives for enterprises and their impact on corporate HR policy in the context of integrating such workers into the field of employment. Modern industrial enterprises cannot be fully competitive without considering the principles of business social responsibility and an inclusive corporate culture. Microeconomic methods are the main ones to evaluate the effectiveness of labor integration programs in the context of digital transformations. Such approach makes it possible to consider the interests of all stakeholders: employers, employees, and the state, as well as to analyze in detail the possibilities of increasing employment and reducing the unemployment rate of people with disabilities.
Keywords: disabled people; digital transformation; automation; distance and hybrid learning; distance and hybrid employment; industry; labor productivity; corporate HR policy; inclusive corporate culture; microeconomic research method

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INTRODUCTION

In our country, people with disabilities (hereinafter referred to as PWD) remain a marginalized group, with very limited publicly available information about them. However, according to estimates from the World Health Organization, they account for approximately 10% of the global population.[1] Data from the Ministry of Labor and Social Protection of the Russian Federation indicate that in 2017, there were 12 million officially registered individuals with disabilities in Russia. When including their family members, social workers, and other stakeholders, it becomes evident that between 25 and 40 million people in the country are directly affected by issues related to PWD on a regular basis [1].

Although business leaders across various industrial sectors are implementing inclusive HR policies and corporate cultures [2], career orientation, access to education, professional development, retraining, and employment for this population remain significant challenges. The industrial sector, which encompasses power generation, extractive industries, and manufacturing, spans across all regions of Russia, with over 50,000 enterprises [4]. The digital transformation (or digitalization) of this economic sector presents new employment opportunities for people with disabilities.

The primary **goal of this study** is to analyze the impact of digital transformation in industrial enterprises on labor market opportunities for PWD. The authors seek to address the following **research questions**: What labor market and professional education trends enable PWD to fully realize their potential? How are industrial enterprises leveraging digitalization to implement new technologies, resources, products, platforms, and services? Which professions in the process of industrial digital transformation are becoming more accessible to PWD?

The focus of this study (**object of the study**) is EBIS LLC (hereinafter referred to as EBIS or the Enterprise), a chemical industry enterprise within the manufacturing sector that specialized in processing various types of plastic packaging waste (crates, bottles, containers, and films) from 2015 to 2022. Although this market segment is relatively small, it holds significant growth potential. The market structure is characterized by monopolistic competition, with key competitors including EcoTechnologies, Komiteks, Fantastic Plastic, and Plarus. EBIS held a leading position in this sector and employed 198 workers, 10% of whom worked remotely.[2]

In 2022, the crisis in Russia's debt market negatively impacted many industrial enterprises. By 2024, TechnoNICOL Corporation, the largest consumer of EBIS products, acquired its production facilities with the intention of implementing strategic plans and investing in this promising market.[3]

This study focuses (**subject of research**) on the digitalization of industrial enterprises, using EBIS as a case study. The analysis is conducted in two key areas: new data processing tools and artificial intelligence (AI) applications, and innovative communication technologies [5]. The successful implementation of EBIS's strategic and investment plans is contingent upon these developments, along with the adoption of both proven and cutting-edge digital resources, products, and services. The benefits of these advancements are particularly evident in industrial facilities, where business process automation plays a crucial role in enhancing efficiency and improving labor productivity.

CHALLENGES IN CAREER GUIDANCE, EDUCATION, AND EMPLOYMENT OF PEOPLE WITH DISABILITIES IN INDUSTRIAL ENTERPRISES: HISTORICAL CONTEXT AND MODERN REALITIES

Employment opportunities for people with disabilities are closely linked to their social

[1] URL: http://www.who.int/topics/disabilities/ru/; http://www.who.int/mediacentre/news/releases/2011/disabilities_20110609/ru/

[2] URL: www.abis-rcl.ru; https://www.e- disclosure.ru/portal/company.aspx?id=37232

[3] URL: https://www.interfax.ru/business/983381

rehabilitation, which includes retraining, professional reskilling, and the continuation of education in their previous fields while considering any lost functional abilities.

Approximately a century ago, Henry Ford, the founder of modern management theory and a pioneer of industrial enterprise, analyzed the potential for employing PWD. He argued that if industrialists were to hire them at lower wages while expecting reduced productivity, it would contradict the fundamental principles of business. The best approach was to place PWD on an equal footing with other workers. Business and charity should not be intertwined, as the primary goal of business is production [6].

Ford also noted that people often assume working at full capacity is the key to maximizing productivity. However, a detailed examination of industrial workflows can help confirm or refute this assumption. For instance, what is the nature of the physical labor required — is it light, moderate, or heavy? Is the workspace damp or dry, clean or dirty? Does the job require two hands or just one?

Labor standardization in a typical industrial enterprise of the 20th century was structured as follows: there were 7,882 distinct job functions, with 949 specifically designed for individuals in peak physical condition and 3,338 for those with normal physical strength. The remaining 3,595 tasks could be performed by men with lower physical strength, women with average strength, and teenagers. Additionally, 670 jobs were accessible to individuals without legs, 2,637 to those with one leg, 715 to individuals with one arm, 10 to blind workers, and 2 to those without arms.

This demonstrates that a well-developed industrial enterprise is fully capable of providing high-paying jobs to a large number of PWD. From an economic standpoint, efficient labor division within factories and manufacturing plants can reduce the financial burden on social welfare programs while allowing PWD to obtain prestigious, socially valued professions — far superior to the historically common yet low-income handicraft work, such as basket weaving [6].

Consequently, enhancing professional qualifications, retraining, and integrating PWD into the workforce not only boosts overall labor productivity but also expands employment opportunities and contributes to overcoming widespread poverty [7].

DIGITAL TRANSFORMATION OF INDUSTRIAL ENTERPRISES: EMPLOYMENT AND WORKFORCE TRAINING

In today's industrial landscape, fully automated enterprises with integrated production and logistics chains have emerged as tangible examples of digital transformation. These businesses successfully implement the paradigms of "Industry 3.0" and "Industry 4.0" in practice [8].

In this study, digitalization is understood as the process of integrating advanced data processing methods and artificial intelligence (AI) technologies, including digital solutions such as "1C: Enterprise", "Project Expert", "Consultant Plus" (a legal reference system), GIS technologies, Deductor, Bizagi Modeler, Designer, MS SharePoint, and MS Power BI. Additionally, the study highlights the significance of enhanced communication technologies via global computing networks, fostering collective intelligence across the planet (1C: Bitrix, Mind42, Coggle, MindMeister, and XMind).

Cloud-based solutions, particularly "1C: Enterprise", are gaining widespread popularity (see *Fig. 1*). This platform enables employees to work remotely and in hybrid formats, providing significant flexibility. It also simplifies self-paced learning of various software tools and enterprise solutions, including "1C: ERP Enterprise Management", "1C: Small Business Management", "1C: Accounting", "1C: Payroll and HR Management (PROF and CORP)", 1C: Bitrix, and "1C: Trade Management".

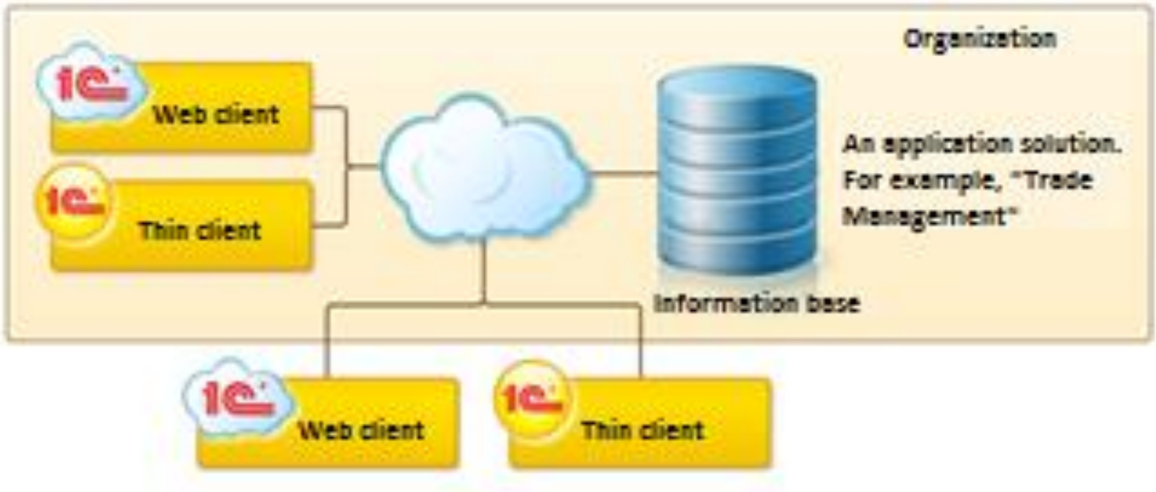

Fig. 1. **Cloud service "1C: Enterprise 8" inside an industrial enterprise**

Source: URL: https://v8.1c.ru/platforma/oblachnye-tehnologii

Essentially, digital transformation facilitates the creation of specialized employment and learning conditions for professionals such as accountants, auditors, business analysts, managers, economists, marketers, and logisticians. The only fundamental requirement for this approach is access to a personal computer (laptop, tablet, or another device) with a stable internet connection.

Another key digital solution, Project Expert, is designed to support remote and hybrid work for financial planners, investment analysts, and risk managers. It enables the development of economic calculations, business plans, financial reporting, and risk assessments that comply with the standards of the United Nations Industrial Development Organization[4] (UNIDO) and the International Accounting Standards[5] (IAS).

The application of geographic information systems (GIS technologies) in spatial planning, urban development, and real estate is also closely linked to the digitalization of industrial enterprises. For instance, cloud-based GIS platforms such as QGIS[6] allow for the creation of real-time thematic maps, which help visualize spatial models. One example is ranking districts in the Krasnodar region based on social vulnerability levels (see *Fig. 2*). Such data can be used to optimize industrial site locations and plan insurance costs for natural disaster risks.

The next phase of digital transformation in industrial enterprises will involve the implementation of technologies based on artificial intelligence (AI), neural networks, and expert systems, including the development of the AI-powered Waste Sorting System.

Currently, the development of such technologies involves a diverse team of IT specialists: a programmer-designer — responsible for design, application logic programming, server-side development, testing, and implementation of additional features; an application programmer for real-time video processing — focuses on developing software solutions for processing video content in real-time; an AI specialist works on neural networks, expert systems, and other AI-driven solutions; a frontend and backend developer handles mobile application layout design, programming of both frontend and backend logic, testing, and additional functionality integration; a system architect and analyst responsible for task allocation within the project, technical and software implementation analysis, architectural recommendations, product evalu-

[4] United Nations Industrial Development Organization.

[5] International Financial Reporting Standards.

[6] URL: https://www.qgiscloud.com/

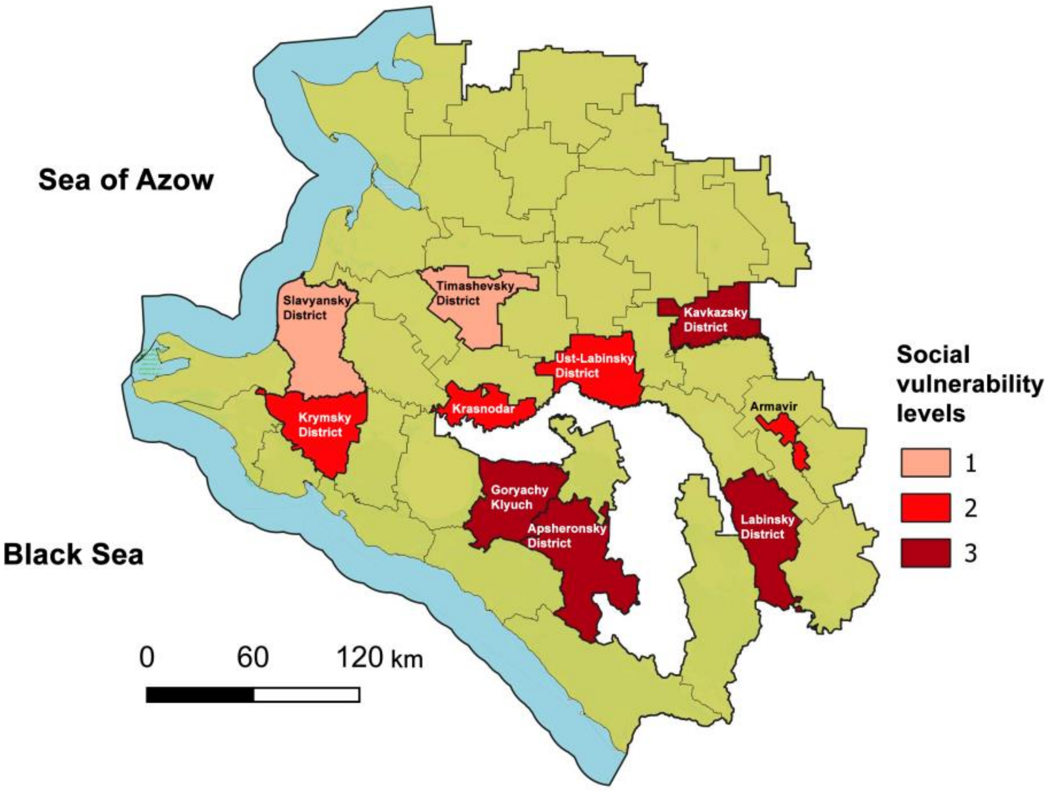

Fig. 2. **GIS-technologies for visualizing the ranking of Krasnodar krai's counties by social vulnerability**

Source: compiled by the authors.

ation, and technical specification development. Additionally, the development process involves a marketing analyst, who conducts usability testing of prototypes, assesses consumer ergonomics, evaluates actual costs, and ensures the final product aligns with technical specifications; a project manager who oversees task distribution, monitors and analyzes technical and software implementation, evaluates the final product, submits patent applications, and manages project documentation.

IMPACT OF DIGITAL TRANSFORMATION IN INDUSTRY ON CAREER GUIDANCE, EDUCATION, AND EMPLOYMENT FOR PEOPLE WITH DISABILITIES

The rapid expansion of digitalization has sparked a revolution in assistive technologies for PWDs. A significant achievement of this transformation is the increased access to quality education, acquisition of new professional skills, and employment opportunities in high-demand industries [9].

For individuals with visual, auditory, or motor impairments, various digital products, resources, and services offer new opportunities. However, their distribution remains uneven. Global university policies on equal access for PWDs classify countries into four groups, ranging from "beginner" to "advanced." Russia falls somewhere in the middle, as it is still in the early stages of implementing inclusive policies [10].

The experience of "advanced" nations demonstrates that the use of robotics, virtual reality, and supportive communication technologies significantly enhances the academic and social success of PWDs in colleges, universities, and professional development courses. This, in turn, positively impacts their participation in the labor market.

Close collaboration between PWDs, their families, educators, engineers, and inclusion specialists fosters the development of digital products based on universal design principles. These innovations include software and hardware solutions tailored to individuals with autism, cognitive impairments, blindness, and low vision [11, 12].

Both asynchronous and synchronous courses in distance and hybrid learning provide PWDs with the opportunity to access quality education and secure well-paid, prestigious jobs. For example, the Financial University under the Government of the Russian Federation actively integrates digital tools to develop design thinking and professional competencies for PWDs in human resource management, marketing, advertising, and public relations.[7] To enhance learning experiences and optimize course delivery, universities increasingly rely on digital mind-mapping tools such as Mind42, Coggle, MindMeister, and XMind. These platforms help organize complex information, improve engagement, and facilitate knowledge retention.

Gamification should not be dismissed — many games are available through a web browser. For example, Kahoot! is a game-based learning platform and an effective educational technology. Its advantages include the ability to complete tasks of various formats remotely, the elimination of subjective factors in knowledge assessment, the option for educators to flexibly manage time for different questions, identify the most challenging ones, and evaluate the speed of correct responses.

What benefits do people with disabilities gain from the digital transformation of industrial enterprises? The use of the "1C: Enterprise" cloud service provides the following advantages. First, there is no need to purchase application programs for installation on a home computer, worry about their administration, configuration, and timely updates, or back up and restore data from information databases after unforeseen failures, power outages, etc. Second, the need for an expensive personal computer with high processing power is reduced; there is no longer a necessity to hire maintenance staff and qualified specialists. Various tasks can be performed

[7] Vasilyeva E. V. Design Thinking. Methodology of Creative Development. Textbook. Moscow: Knorus; 2023

Fig. 3. **Digital guide-dog: description**

Source: compiled by the authors.

remotely, and additional individual expenses are minimized. Third, there is the ability to pause and resume work or studies at any time — i.e., the rhythm is set by the individuals with disabilities themselves, who only need to submit a request on the website[8] to gain access to the service.

It appears that this method of professional development is of paramount importance for people with disabilities. Moreover, it is worth noting separately that the portal interface is fully identical to commercial solutions in the field of online tools, meaning that users will not experience any discomfort when transitioning to a work environment for future employment.

In the near future, AI, neural networks, and expert systems will be used to develop innovative products such as the "Digital Sign Language Interpreter," "Flood Alert," and "Digital Guide Dog" (see *Fig. 3*).

The implementation of the "Flood Alert" system at industrial enterprises will help ensure safe working conditions for employees with cognitive impairments, blindness, and low vision, reduce potential economic and environmental damage, and increase labor productivity. All of this will become possible through timely notifications about the occurrence of natural and related man-made disasters in the vicinity of the employer's location, which is especially relevant for PWDs [13, 14].

The use of the "Digital Guide Dog" will significantly improve spatial orientation for the aforementioned group of people, while the "Digital Sign Language Interpreter" will enhance the productivity of deaf and hard-of-hearing employees at industrial enterprises.

[8] URL: https://online.1c.ru/

RESEARCH METHODS

For an effective analysis of business ideas for the implementation of digital technologies, products, and resources at the company level, a standardized procedure is required, which includes all stages, starting from the needs analysis and ending with the evaluation of effectiveness (*Fig. 4*).

At the final stage, a reliable evaluation of the effectiveness of strategic and investment alternatives "before implementation" and "after implementation" is carried out through a "cost-benefit analysis" (**CBA**), as well as the concept of the time value of money and discounted cash flow analysis (**DCF**).

Since the movement of money adequately reflects economic processes, to determine the effectiveness of resources and products proposed for implementation during digital transformation, the industrial enterprise is considered as a generator of cash flows. The discount rate accounts for the time value of

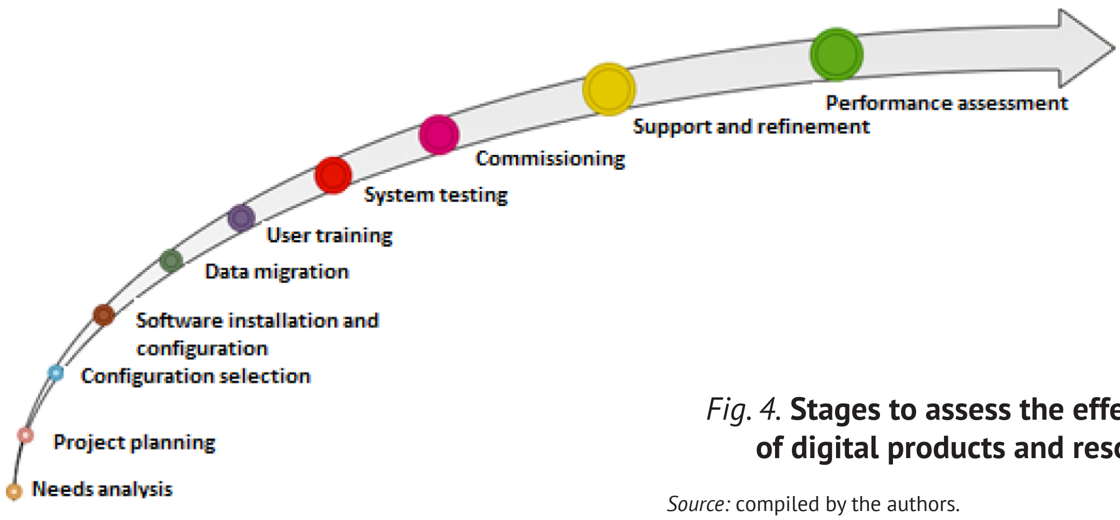

Fig. 4. **Stages to assess the effectiveness of digital products and resources**

Source: compiled by the authors.

money. As a result, performance indicators are calculated, which can be used to assess the effectiveness of the decisions made.

Economic calculations based on DCF involve the use of the following formulas [15, 16][9]:

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+i)^t}, \quad (1)$$

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t} - Io = 0, \quad (2)$$

$$PP = \min n, \ at\ which\ \sum_{t=1}^{n} CF_t \geq Io, \quad (3)$$

$$DPP = \min n, \ at\ which\ \sum_{t=1}^{n} \frac{CF_t}{(1+i)^t} \geq Io, \quad (4)$$

where *NPV* is the net present value of the project (net present value); CF_t is the net cash flow for a specific time period *t*; *i* is the discount rate or the return rate of alternative investments; *t* is the time index; *t* = 1, 2, ..., *n*; *n* is the project implementation period; *IRR* is the internal rate of return; I_o is the initial investment (the amount of initial investment); *PP* is the simple payback period; *DPP* is the discounted payback period.

[9] URL: https://financeformulas.net

RESULTS AND DISCUSSION

The first stage of the strategic development plan for EBIS until 2030, within the framework of digital transformation, involved the use of cloud services such as "1C: Enterprise," "1C: Bitrix," the legal reference system "Consultant Plus," Mind42, and Project Expert. The implementation of these digital products by the company's management significantly improved the efficiency of business processes, including the automation of integrated production-logistics chains, financial and management accounting, and resource management. As a result, employees' work was greatly simplified, and the time required to complete routine tasks was reduced by more than 30%. This allowed the management team to focus on more important aspects of the business and increased overall labor productivity.

In the second stage, the company's management plans to implement innovative digital products based on AI and GIS technologies to improve the efficiency of waste sorting, logistics,

Table

Annual savings in the production costs of industrial enterprise, million rubles

Parameter	Before introduction	After introduction	Savings (CBA method)	
			without discounting	with discounting (DCF method)
Outstaffing costs	198	123	75	61
Rent	152	121	31	25
Other operating expenses	651	564	87	71
Total	1 001	808	193	157

Source: compiled by the authors.

and internal personnel and social policies. After the successful pilot implementation of neural network technologies at one of the production sites, the plan is to scale these digital solutions to other sites.

The results of the evaluation of the first stage, conducted using the cloud service Project Expert, show that the implementation of digital technologies can lead to a reduction in operational costs by 15–20% (see *Table*).

With annual company expenses amounting to approximately 1 billion rubles, savings can reach 150–200 million rubles per year, including reductions in outsourcing costs (personnel leasing, hybrid work mode). These figures are made possible by process optimization and a decrease in errors in financial and management accounting.

The implementation of these innovations requires investments in server equipment, software, information systems, and their testing, as well as funds for organizing qualification improvement courses, training sessions, and workshops for staff, totaling 61 million rubles.

According to formulas (1)–(4), the net cash flow of the project, without considering discounting, is 132 million rubles, and with discounting (*NPV*) at a rate of 23%, it amounts to 107 million rubles. The simple (*PP*) and discounted payback period (*DPP*) are both less than a year, and the annual internal rate of return (*IRR*) is over 100%.

Thanks to the use of digital technologies, the company's management has employed 14 highly qualified individuals with disabilities (PWD) for remote and hybrid work, who have lower salary expectations. This confirms the feasibility of such investment projects and emphasizes the importance of digitalization in achieving competitive advantages and conducting effective corporate human resources policies.

CONCLUSION

Digital transformation creates a solid foundation for the inclusive development of industrial enterprises. Modern technologies contribute to the transformation of traditional industries, improve human resource policies, and foster an inclusive corporate culture. New opportunities are emerging in the modern labor market for remote and hybrid work as well as professional education. For PWDs, new prospects are opening up in the fields of vocational orientation, education, and employment.

This population group now has the chance to secure well-paid and prestigious jobs in areas such as economics (accountant, financial controller, investment analyst, economic planner, marketing analyst, advertising and public relations specialist, risk manager), production and logistics (business analyst, logistician, supply chain specialist, manager), IT (programmer-designer, AI programmer, frontend developer, and architect-analyst), law (audit assistant, tax specialist, and legal assistant), and GIS technologies (spatial planning visualization specialist, urban planning, real estate location, and environmental safety specialist).

The novelty of this study lies in the description of a methodology for determining the effectiveness of the implementation of digital products, resources, services, etc., the application of which allows for the continuous improvement of business processes, automation of production, the introduction of digital innovations, and increased labor productivity.

Thanks to this methodology, professions have been identified where PWDs have the opportunity to study and work remotely or in a hybrid mode using cloud-based digital products. For instance, "1C: Enterprise" is necessary for accountants, financial controllers, economic planners, and business analysts; 1C: Bitrix is designed for professionals in advertising, human resource management, and corporate culture; the "Consultant Plus" reference and legal system can be used in the education and work of tax specialists, legal assistants, and internal auditors; Mind42 is ideal for marketing analysts and PR managers to develop professional competencies; “Project Expert” increases employment chances for investment analysts and risk managers.

Thus, taking into account that there are over 50,000 industrial enterprises in Russia, the macroeconomic effect of digitalization will be additional employment for those with limited mobility, blindness, and visual impairments, people with respiratory diseases, and other categories of PWDs. The total number of newly employed individuals could rise to 1 million people.

Further research should be conducted using both quantitative and qualitative methods. The latter, through expert surveys (including labor market and inclusive vocational education specialists), will allow for a more detailed list of relevant professions for remote and hybrid employment for people with disabilities.

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ABOUT THE AUTHORS

Viacheslav A. Lipatov — Cand. Sc. (Political Science), Associate Professor, Associate Professor of the Department of Business Informatics, Faculty of Information Technologies and Big Data Analytics of Financial University, Moscow, Russia; Associate Professor of the Department of Business Informatics, Moscow Technical University of Communications and Informatics, Moscow, Russia
https://orcid.org/0000-0003-2717-2833
Corresponding author:
VALipatov@fa.ru

Aleksey A. Solomakhin — Cand. Sci. (Econ.), Associate Professor of the Department of Business Informatics, Faculty of Information Technologies and Big Data Analytics of Financial University, Moscow, Russia
https://orcid.org/0009-0009-6150-8821
AASolomakhin@fa.ru

Ivan I. Nekrylov — Educator at the department of animation and information technology of Ivan Fedorov Moscow Publishing and Printing College, Moscow, Russia
https://orcid.org/0009-0007-8684-7200
ivnek@mail.ru

Ketevan K. Sirbiladze — Senior Lecturer of the Financial Technologies Department of Financial University, Moscow, Russia
https://orcid.org/0000-0001-5316-3485
ketisirbiladze@mail.ru

Alexey A. Ivanov — Senior Researcher of evaluating and researching company “INVEST5”, Moscow, Russia
https://orcid.org/0009-0001-7058-5150
ilexeyru@gmail.com

Authors' Declared Contributions:
A. A. Ivanov — drafting of design.
V. A. Lipatov — development of the general concept of the article.
I. I. Nekrylov — writing one of the sections of the article, drafting of design.
A. A. Solomakhin — writing several sections of the article, drafting of designs.
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