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IMPLEMENTATION OF MODERN TECHNOLOGIES IN PERSONNEL MANAGEMENT AT THE ENTERPRISE

ВПРОВАДЖЕННЯ СУЧАСНИХ ТЕХНОЛОГІЙ В УПРАВЛІННЯ ПЕРСОНАЛОМ НА ПІДПРИЄМСТВІ

The article explores the peculiarities of utilizing multifaceted approaches to personnel management that complementarily impact the performance of enterprises. It outlines the directions of activity of human resource management specialists supported by HR technologies and investigates modern technologies that are actively developing today and are the most promising for enhancing personnel management efficiency in enterprises. The research presents the results of the analysis of the activities of enterprise personnel management specialists, the market of HR technologies, technology startups in the field of personnel management technologies, and the level of implementation of modern technologies in personnel management in enterprises. Modern HR technologies: automation of HR functions; HR analytics; artificial intelligence; cloud HR technologies; global HR system; blockchain technologies; employee self-service systems; virtual assistants; mobile HR services; machine learning; gamification.

Keywords: *personnel management, HR technologies, modern technologies, enterprise performance efficiency, enterprise activity optimization.*

У статті розглянуто особливості процедури використання різнобічних підходів до управління персоналом, що комплементарно впливають на результативність діяльності підприємств. Окреслено напрями діяльності фахівців із управління персоналом, що підтримуються HR-технологіями та досліджено сучасні технології, що активно розвиваються сьогодні та є найбільш перспективними для підвищення ефективності управління персоналом на підприємстві. У дослідженні наведено результати аналізу напрямів діяльності фахівців із управління персоналом підприємств, ринку кадрових технологій, компаній-стартапів у сфері технологій із управління персоналом, рівня впровадження сучасних технологій в управління персоналом на підприємствах. Наведено найбільш актуальні сучасні HR-технології, до яких відносяться: автоматизація HR-функцій, що використовується в управлінні персоналом; HR-аналітика, яка є важливим інструментом у роботі відділів кадрів; штучний інтелект, який вже вбудовано в більшість сучасних програмних систем; хмарні HR-технології, які потребують наявності спеціальної операційної системи, доступу до хмарних сервісів; глобальна HR система, яка використовується для управління персоналом підприємств, які мають філії у кількох країнах; технології блокчейн, що знаходиться на початку шляху до широкого застосування у кадровій сфері; система самообслуговування співробітників, що дозволяє перевести частину функціональних обов'язків HR-фахівців; віртуальні помічники, які можуть брати на себе багато ролей; використання віртуальної реальності/метавсесвіту в кадровій сфері, яке може забезпечити нові перспективи у процесі набору співробітників; мобільні HR послуги, які розроблені для малих та середніх підприємств; машинне навчання, яке дає комп'ютерам можливість навчатися без явного програмування; гейміфікація як HR-технологія інтегрує ігрові елементи.

Ключові слова: *управління персоналом, HR-технології, сучасні технології, ефективність діяльності підприємств, оптимізація діяльності підприємств.*

Problem statement. The active integration of digital technologies into the operations of enterprises is a global trend today, practically for all countries worldwide. Digital technologies not only change the technological processes of production and service delivery but also impact management processes within enterprises. Personnel management strategies should be formulated based on a unified accounting system grounded in information about socio-economic trends, changes in the labor market, and data about employees and job seekers.

In the decision-making process, a significant amount of information from various databases is taken into account. To form management decisions, it is necessary to consider the feasibility of organizational changes within the enterprise, changes in work schedules, workplaces, employees' family circumstances, and other personnel-

related data. In addition to the mentioned factors, non-standard data that become relevant in unstable situations, such as during restrictions caused by epidemiological situations or in periods of mobilization, wartime, and post-war recovery, should be taken into account. When making predictive assessments of labor market trends, HR professionals must consider possible labor shortages and employees' expectations regarding a safe working environment.

The efficiency of enterprise activities increasingly depends on employee productivity, timely organizational changes, internal mobility development, job transformation, and the effectiveness of every aspect of personnel management processes. This, in turn, relies on the personnel technologies employed within the enterprise. In such conditions, the implementation of modern technologies becomes a guarantee for choosing an optimal management strategy to achieve defined performance indicators.

Analysis of recent research and publications. The issue of improving the efficiency of enterprise operations, particularly optimizing employee work through the implementation of scientific labor organization and production technology rationalization, has been the subject of studies by classical economists of the 20th century such as F. Taylor, G. Emerson, and H. Ford [1–3]. According to Max Weber, the highest efficiency of enterprise activities was possible only through strict adherence to job instructions, rigorous bureaucratic rules, and procedures [4]. The success of management strategies, according to N. Winner and D. Forrester, depended on decisions made by creating algorithms and modeling the functioning of production systems based on quantitative characteristics of personnel [5; 6]. Incorporating the qualitative components of employee characteristics, their motivations, and needs were considered important in personnel management according to A. Maslow, E. Mayo, and G. Munsterberg [7–9].

In the current stage of socio-economic development, in the face of rapid and irreversible transformations, it is crucial to realize the need for flexible utilization of various classical approaches to personnel management. This should consider both quantitative and qualitative factors that undoubtedly complement each other and influence enterprise performance in real circumstances. The implementation of modern technologies and the use of artificial intelligence (AI) provide opportunities for a comprehensive approach to personnel management within the enterprise.

Formulating the purposes of the article. of this article is to outline the directions of activities for personnel management professionals supported by HR technologies and to explore modern technologies actively developing today, which are the most promising for improving personnel management efficiency at the enterprise.

Methodology. The theoretical and methodological foundation of the research consists of works by domestic economists, periodic and specialized publications, and the authors' own investigations. The main methods of scientific inquiry used in studying this issue include scientific generalization (to identify key features and trends), scientific abstraction (focusing on specific indicators), and quantitative method (to present the dynamics of development).

Modern technologies used for attracting, hiring, retaining, and supporting employees, as well as optimizing personnel management within the enterprise, are referred to as HR technologies. The term "HR technology" is also auxiliary for denoting software and corresponding hardware used in human resources information systems to automate personnel-related work within enterprises and organizations.

The use of human resources information systems facilitates the processes of hiring and adapting employees, allowing for the selection of the best specialists, conducting a comprehensive reputation check, and speeding up talent search, engagement, and development.

Currently, the benefits of new technologies are well-known to HR professionals, and enterprises are increasingly using HR technologies. The focus of enterprise activities is shifting towards automating as many aspects as possible of employer-employee interactions to achieve maximum efficiency. Personnel management technologies provide opportunities to increase the productivity of HR professionals in various directions (Figure 1).

On one hand, the increase in the level of automation of personnel management operations and the development of hybrid employment models in enterprises of various ownership forms and in different economic sectors contribute to the growth of the HR technology market. On the other hand, the threat to the confidentiality of personal data hinders market growth.

According to the "Human Resource Technology Market" report, the HR technology market was valued at $32.58 billion in 2021 and is projected to reach $76.5 billion by 2031. The overall growth rate is expected to be 9.2% annually from 2022 to 2031 [10]. The increased adoption of human resource management systems with modern HR technologies stimulates the market, reducing costs for businesses and improving their operational efficiency. Additionally, HR technologies play a vital role in digital transformation, where rapid decision-making becomes a key factor for companies' competitive advantage.

The HR technology market is segmented into areas that cover all aspects of HR professionals' activities and are critically important for effective personnel management (Figure 2). The most well-known and widely applied technologies are those related to personnel management and employee payroll calculation, considering it is one of the areas that is easily algorithmized. Accounting software as an HR technical tool has quickly adapted into human resource management information systems. In 2019, personnel management and payroll calculation technologies accounted for 57.8% of the HR technology market. This segment continues to dominate the HR technology market, with personnel management and payroll calculation technologies expected to still represent over half of the market by 2025.

The second-largest market share is represented by recruitment and personnel hiring technologies, accounting for 26.4% of the market in 2019. Recruitment software increasingly utilizes social media schemes, developing platforms for connecting job seekers and employers and sharing experiences. The recruitment and hiring technology segment has significantly saturated the HR technology market.

The significance of recruitment and hiring technologies will decrease in favor of technologies that

Recruitment and Staff Hiring

- Talent Acquisition and Employee Recruitment are key functional responsibilities of HR professionals.
- This direction encompasses all actions related to the selection, verification, and final hiring of new employees.

Human Resource Management and Payroll Administration

- Human Resource Management involves the execution of routine tasks related to the formation and maintenance of documentation, monitoring regulatory and legal acts.
- This direction includes actions associated with day-to-day personnel management (document management, monthly salary calculations, processing of leaves, sick leave, etc.).

Employee Engagement and Interconnection

- The presence of motivated personnel and their informal connections among colleagues is becoming increasingly important for the effectiveness of the enterprise.
- This direction includes all types of activities related to supporting interaction and communication among employees, such as organizing joint events and gatherings.

Productivity and Rewards

- Measuring employee productivity remains one of the important tasks of the HR department, contributing to identifying the strengths and weaknesses of personnel activities.
- This direction includes all types of work related to the measurement and evaluation of employee productivity.

Education and Development

- The deployment of new technologies and practices requires employees to have the necessary skills and qualifications.
- This direction encompasses all types of activities related to organizing and conducting training and professional development for employees.

Figure 1. The activities of enterprise personnel management specialists supported by HR technologies

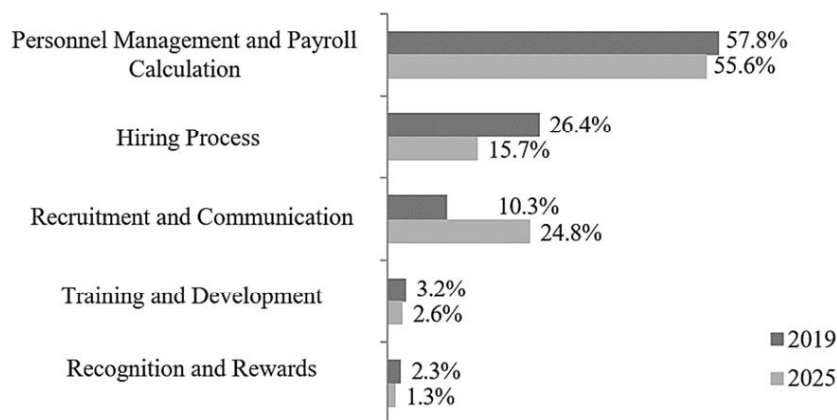*Source: compiled by the author based on [10]*

Figure 2. HR Technology Market by Segments in 2019, 2025

Source: compiled by the author based on [11, p. 9]

improve employee engagement and interconnectivity. The COVID-19 pandemic led to a rapid increase in the number of remote workers, prompting HR professionals to actively seek ways to ensure effective work and interaction among employees. These trends have driven significant and sustained growth in technologies that enhance employee engagement and connectivity. In 2019, the share of engagement and connectivity technologies was 10.3% of the HR technology market, and it is expected that these technologies will cover a quarter of the market by 2025 [11].

However, neither learning and development technologies nor productivity and reward determination technologies have gained widespread recognition in the HR technology market so far. Technologies that assist in employee training and development, facilitate performance assessment, and determine rewards for the most efficient employees have not crossed the 4% threshold in the HR technology market. Nevertheless, these areas lay the groundwork for the future development of the HR technology market.

As businesses continue to actively adopt new HR technologies in the post-COVID world, this opens

up prospects for innovative companies whose business models are oriented towards offering a broader range of technological HR solutions. It is predicted that by 2025, the HR technology market will grow due to the active development of new developer companies. Startups in this sector are expected to grow more than twice as fast as existing companies [11, p. 13].

Among companies specializing in HR technologies and the development of corresponding software for enterprises, global leaders include ADP Inc. (USA), Cegid (France), Ceridian HCM Holding (USA), Cornerstone OnDemand Inc. (USA), Hibob Inc. (USA), IBM Corporation (USA), Infor (USA), Oracle Corporation (USA), SAP SE (Germany), and Workday, Inc. (USA). Coverage of various market segments and the development of new products and technologies will allow these companies to strengthen their positions in the HR technology market, remain competitive, and gain an advantage over competitors. For example, in April 2022, Oracle launched Oracle ME (My Experience), a universal platform for working with employees, which is part of Oracle Fusion Cloud HCM. This comprehensive platform helps organizations increase employee engagement and enable self-realization. Oracle ME optimizes communication within the organization, considers individual employee needs, identifies employees' strengths, allowing them to accumulate experience to realize their talents, improve retention, and create a more favorable and reliable working environment [12].

New companies looking to occupy their niche in the HR technology market must actively implement innovations and seek unique specialization. Large market-leading companies mostly focus on services related to optimizing the hiring process, personnel management, and payroll calculation, leaving room for startups in other segments of the HR technology market.

In 2023, the IT Ukraine Association and the Ministry of Digital Transformation of Ukraine presented a catalog that included promising Ukrainian IT companies and products. According to Tech Ecosystem estimates, the Ukrainian IT industry in 2023 comprised about 2,300 companies, with 72% having their own IT products. Ukrainian HR-Tech companies in the catalog included names such as Effy, HURMA System, CleverStaff, Djinni.co, Jooble, PeopleForce, Skyworker, YouTeam, many of which specialize in personnel recruitment technologies [14].

For entering the HR technology market and having the opportunity to carve out your niche among recognized leading companies, it's necessary not only to offer a quality product but also to be attractive to investors. This involves developing new proposals and promoting potentially promising HR technologies that consumers need and for which demand is expected to grow.

A survey conducted by Sage Group, a British multinational enterprise software company, involved over 1000 HR managers and senior executives from various companies to assess the current state of technology implementation in personnel management and outline prospects in this field for 2024. The survey results showed that HR managers are simultaneously enthusiastic (91%) about the prospects of changes in personnel management and concerned (66%) about the future. Additionally, 83% of HR leaders stated that they currently lack the necessary HR technologies [15]. The survey results also identified the level of implementation of modern technologies in personnel management in enterprises (look Figure 3).

The most relevant technologies today are those related to the automation of HR tasks, personnel analytics, and artificial intelligence. The adoption rate of these technologies in personnel management within enterprises has reached 59%. Technologies such as cloud HR, global HR systems, blockchain integration, and employee self-service are actively utilized. The implementation level of these HR technologies in surveyed enterprises is over 50%. Less implemented HR technologies include virtual assistants, virtual reality, mobile HR services, machine learning, and gamification.

Automation of HR functions remains a popular technology in personnel management, enhancing the HR department's efficiency by automating fundamental HR processes: collecting, recording, storing, analyzing, and disseminating information about a company's human resources [16]. For example, this technology streamlines the ordinary recruitment process by automatically sending rejection emails to unsuccessful candidates and scheduling follow-up interviews with potential new employees.

Table 1

Companies-startups in the field of personnel management technologies, 2023–2024

Company	Main office	Employee count	Market segment
Wave	Canada	101-250	financial services (payments, payroll processing) for small/micro businesses
SmartHR	Japan	251-500	cloud-based human resource management software
Personio	Germany	501-1000	personnel management and recruiting for small and medium-sized businesses and startups
Eloomi	Denmark	101-250	corporate training and development software platform
Glints	Singapore	251-500	talent development and recruitment platform in Southeast Asia
HR Path	France	251-500	human capital management software
Zenefits	USA	501-1000	personnel management and payroll processing
Effy AI	Ukraine	…	personnel management and employee performance evaluation based on AI
HURMA	Ukraine	…	automation of recruitment, HR, and OKR based on AI
CleverStaff	Ukraine	21-50	hiring through an embedded gamification system
Jooble	Ukraine	201-500	online recruiting
PeopleForce	Ukraine	51-200	optimization of personnel management processes
Skyworker	Ukraine	0-20	recruitment of technical personnel

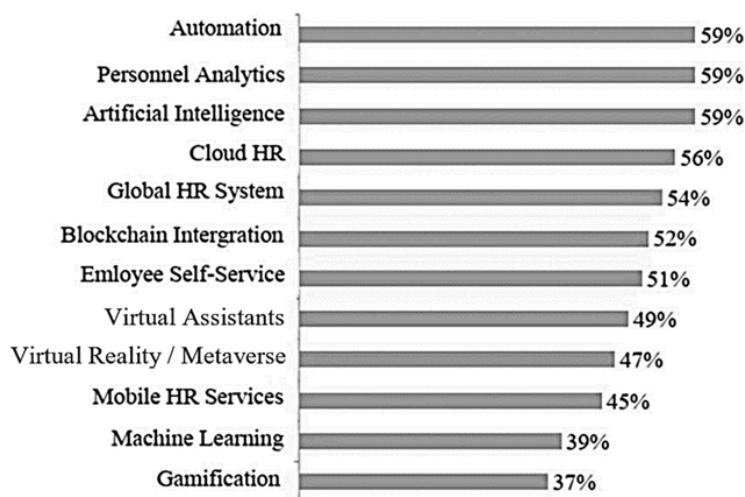*Source: compiled by the author based on [13; 14]*

**Figure 3. Implementation Level of Modern Technologies
in Personnel Management at the Enterprise**

*Source: survey data Sage Group «The changing face of HR in 2024». Available at:
https://www.sage.com/en-au/sage-business-cloud/people/resources/research-analyst-
reports/the-changing-face-of-hr-research-report/*

HR analytics continues to be an essential tool for HR departments, with personnel analytics having the highest priority in the interests of HR professionals worldwide. HR analytics can range from advanced predictive analytics to basic reporting statistics. Predictive analytics involves correlating factual information from various sources with planned indicators. Data transformation into timely, usable information is undeniably a critically important factor in supporting the competitiveness of enterprises. A study by the Hackett Group, a business process consulting company, revealed that digital world-class technological organizations were three times more likely than their counterparts to use advanced business analytics and HR analytics. As a result, the workload indicators of their employees are 27% lower, and expenses are 18% lower than in similar enterprises [17].

Artificial intelligence (AI) is confidently becoming a part of our lives, integrated into most modern software systems. The operation of an information system begins with a set of data; AI learns from this data, identifies patterns using specific assumptions, and provides recommendations.

Cloud HR technologies require users to be constantly connected to the Internet and have a specific operating system for accessing cloud services. Currently, the local segment of HR technologies dominates the global market and is estimated to reach $36.04 billion by 2031, with an average annual growth rate of 7.7%. However, market forecasts for HR technologies suggest that the cloud segment will grow faster than the local one [10].

The results of the 2019 Deloitte Global Human Capital Trends survey indicated that only 5% of respondents had fully integrated cloud HR platforms. Most respondents used both cloud and on-premises software, and 29% did not use any systems at all. Cloud technologies provide companies with the ability to consolidate data, create a unified user interface, and improve data access. However, expectations regarding the positive impact on employee satisfaction and the perception of transitioning to a strategic HR role through cloud technologies were found to be greater than the actual results, according to Deloitte [18].

A Global HR System is software used by the HR department to manage personnel in enterprises with branches in multiple countries. The complexity of consolidated management with a large number of employees, whose data is stored in different countries, possibly on different technological platforms and differing standards, increases due to the need to comply with all data sources according to the local legislation of each country. The Global HR System, through the consolidation of decentralized systems, simplifies the execution of essential functions for HR professionals.

The integration of blockchain technology and HR is just beginning, and this technology is at the early stages of widespread application in the field of human resources. Unlike traditional information systems that rely on central authorities such as banks or governments, blockchain uses a decentralized network of computers to verify and store data. Each transaction is recorded as a block, permanently linked to the transaction, creating an immutable chain of information. This innovative technology is a system that eliminates the need for intermediaries, reduces costs, and enhances transparency and security [19].

Employee self-service is an HR technology that allows HR professionals to transfer part of their functional duties, minimizing the routine part of their work in processing personal data. Each employee, through a personal page, has access to their personal data and the ability to supplement or correct it. Most self-service systems allow employees to change personal information, such as address or contact information.

Virtual assistants can take on various roles in HR, including helping with adaptation, answering questions about personnel policies, providing instructions on software, conducting surveys, and more. For example, Interactive Voice Response (IVR) systems are widely used by organizations. IVR is a technology where a tone-dialing phone is used to interact with a database to obtain information or input data. IVR provides twice as many interactions as calls with live agents and five times

more than text chat. The increased productivity through IVR systems allows for a reduction in the number of staff performing corresponding functions. The demand for IVR technology continues to grow, and it is expected that the global IVR systems market will reach $9.26 billion by 2030, compared to $5.56 billion in 2023 [20].

The use of virtual reality/metaverse in the HR field can provide new perspectives in the hiring process. Candidates for vacant positions in virtual reality can view job openings, participate in virtual interviews, and have the opportunity to adapt to future working conditions through task modeling and execution in a virtual work environment. Virtual reality can enable employees to acquire new skills in realistically modeled environments and interactive training programs.

Mobile HR services refer to software designed for tablets and smartphones, tailored for small and medium-sized enterprises with a workforce not exceeding 250 employees. Mobile applications enable the management of key HR functions, including the collection and storage of employee data, document workflow within the enterprise, tracking of work and free time, vacation schedules, payroll, etc. These applications can integrate with all enterprise databases containing HR information, ensuring real-time access to data for effective personnel management.

Machine learning is a technology derived from artificial intelligence that allows computers to learn without explicit programming. In HR management, machine learning can be applied to the processes of selection, hiring, and personnel adaptation, collecting data in various areas. This learning enables algorithms to identify profiles and resumes of individuals ideally suited for vacant positions. Machine learning technology can verify the alignment of stated qualifications in resumes with actual qualification and educational levels, assess employees' attitudes toward work, satisfaction, and commitment, and predict the risk of turnover.

Gamification, as an HR technology, integrates game elements (tasks, levels, and rankings) and mechanisms traditionally not considered entertaining, aiming to increase employee motivation, foster higher engagement, and enhance employee loyalty. The goal of gamification in HR is to create a psychologically healthy work atmosphere, a positive and productive work environment, and to reduce stress levels in the workplace. An effective example of gamifying the work environment is creating associative connections between specific challenging goals, whether individual or collective, and material rewards or social recognition. This increases employees' internal motivation, forms a spirit of healthy competition and collaboration within the team. Gamification stimulates the creativity of employees, encouraging them to be more industrious.

Conclusions. HR technologies facilitate the optimization of personnel management processes, including documentation management, compliance with current legal requirements, analytical work, productivity management, and administration of benefits and rewards. The implementation of HR technologies allows human resource management professionals to minimize routine automated tasks, avoid repetitive assignments that may lead to burnout, increase productivity, and focus on transforming information into knowledge for managerial decision-making.

Modern HR technologies can assist department heads in identifying the strengths and weaknesses of human resource strategies and adjusting personnel management processes accordingly. Although there is no single effective technological solution in the HR technology market, enterprise leaders and HR professionals are increasingly actively integrating various technologies to make strategic managerial decisions and achieve set goals.

Companies that leverage powerful modern HR technologies for predictive analytics, enhancing workforce planning, and making data-driven decisions will gain a strategic advantage. While computer technologies are not the sole key to success in personnel management, they provide a powerful tool for handling information about human resources, facilitating its acquisition and dissemination, and ensuring a maximally positive outcome with a professional approach to personnel work.

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