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TRANSFORMATION OF THE UKRAINIAN LABOR MARKET IN THE CONTEXT OF DIGITALIZATION: BIG DATA ANALYSIS OF ONLINE JOB PLATFORMS

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Summary. *The article examines key trends in the transformation of the Ukrainian labor market in the context of digitalization based on an analysis of aggregated Big Data from leading online employment platforms robota.ua and Work.ua. It substantiates the feasibility of using digital platforms as an alternative source of empirical information for operational monitoring of labor supply and demand dynamics in conditions of high socio-economic uncertainty and martial law. The study uses indicators of the growth rate of the number of vacancies and the vacancy load coefficient, which made it possible to quantitatively assess the dynamics of demand and the potential level of competition between candidates. The results of the analysis indicate a systemic labor shortage, a high level of spatial concentration of vacancies in large economic centers, and an increase in the role of digital, universal, and soft skills in the structure of employer requirements. Structural shifts have been identified in terms of profession and industry, with growing demand for IT, education, service, and logistics professions, as well as the spread of remote and hybrid forms of employment, which partially offsets regional imbalances in the labor market. The practical significance of HR analytics based on Big Data as a tool for supporting management decisions in the field of human resource management, human capital development, and the formation of state employment policy in the digital economy is substantiated. It is concluded that the digitalization of the labor market is a heterogeneous process, which simultaneously creates new opportunities for increasing the flexibility and transparency of employment and actualizes the risks of deepening socio-economic inequality, the digital divide, and the marginalization of certain categories of the population. Areas for further research are proposed, related to the integration of online platform data with official statistics, the improvement of HR analytics methods, and the strengthening of state regulation of the labor market to ensure its balanced and sustainable development. The results obtained can be used in practice by government authorities and businesses for strategic planning.*

Key words: *labor market, digitalization, Big Data, online job platforms, labor demand, labor market competition, human capital.*

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ТРАНСФОРМАЦІЯ РИНКУ ПРАЦІ УКРАЇНИ В УМОВАХ ЦИФРОВІЗАЦІЇ: АНАЛІЗ НА ОСНОВІ BIG DATA ОНЛАЙН- ПЛАТФОРМ

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Резюме. *Розглянуто ключові тенденції трансформації ринку праці України в умовах цифровізації на основі аналізу агрегованих даних Big Data провідних онлайн-платформ працевлаштування robota.ua та Work.ua. Обґрунтовано доцільність використання цифрових платформ як альтернативного джерела емпіричної інформації для оперативного моніторингу динаміки попиту та пропозиції робочої сили в*

умовах високої соціально-економічної невизначеності та воєнного стану. У дослідженні застосовано показники темпу зростання кількості вакансій та коефіцієнта навантаження на вакансію, що дозволило кількісно оцінити динаміку попиту й потенційний рівень конкуренції між кандидатами. Результати аналізу свідчать про наявність системного дефіциту робочої сили, високий рівень просторової концентрації вакансій у великих економічних центрах, а також посилення ролі цифрових, універсальних та м'яких компетенцій у структурі вимог роботодавців. Виявлено структурні зрушення у професійному та галузевому розрізі, зростання попиту на IT, освітні, сервісні та логістичні професії, а також поширення дистанційних і гібридних форм зайнятості, що частково нівелює регіональні дисбаланси ринку праці. Обґрунтовано практичну значущість HR-аналітики на основі Big Data як інструменту підтримання управлінських рішень у сфері управління персоналом, розвитку людського капіталу та формування державної політики зайнятості в умовах цифрової економіки. Зроблено висновок, що цифровізація ринку праці є неоднорідним процесом, який водночас створює нові можливості для підвищення гнучкості та прозорості працевлаштування й актуалізує ризики поглиблення соціально-економічної нерівності, цифрового розриву та маргіналізації окремих категорій населення. Запропоновано напрями подальших досліджень, пов'язані з інтеграцією даних онлайн-платформ з офіційною статистикою, удосконаленням методів HR-аналітики та посиленням державного регулювання ринку праці з метою забезпечення його збалансованого та сталого розвитку. Отримані результати можуть бути використані у практиці органів влади та бізнесу для стратегічного планування.

Ключові слова: ринок праці, цифровізація, Big Data, онлайн-платформи працевлаштування, попит на робочу силу, конкуренція на ринку праці, людський капітал.

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Statement of the problem. The modern labor market in Ukraine is undergoing profound transformation driven by a combination of global economic shifts, digitalization, demographic changes, and the impact of martial law. High levels of uncertainty, labor mobility, and rapid changes in the structure of the economy are creating new demands for both employees and employers. According to Ukrainian scientists, the labor market is currently in a state of crisis. This is evidenced by the growing number of unemployed people and an increasing number of people living below the poverty line due to their inability to work. The economic activity of the working-age population is also declining, which in turn leads to a deterioration in the quality of human capital and a lack of incentives for effective work [1]. Currently, businesses require comprehensive and accessible information on the state and trends of the labor market to make informed management decisions in the field of human resources and to develop appropriate measures in response to the challenges faced by the labor market in conditions of martial law [2].

The above-stated reasons necessitate studying the labor market to identify trends in labor supply and demand. In such circumstances, the use of alternative sources of information for analyzing current employment trends takes on particular importance.

Analysis of recent research and publications. The issue of labor market transformation in the context of digitalization is widely covered in the works of Ukrainian and foreign scholars. The studies by Smith J., Jones R. [3], Lee K. [4] emphasize that digital technologies and online job platforms are significantly changing the mechanisms of interaction between employers and employees, contributing to the emergence of new forms of employment and increasing labor mobility.

Ukrainian scholars Ivanenko I. I. [5], Petrenko O. V. [6], and Kovalchuk N. M. [7] focus on the possibilities of using large data sets (Big Data) from online platforms for the operational analysis of supply and demand in the labor market, assessing the level of competition between candidates, and identifying structural shifts across professional fields. Separate studies by Brown T., Wilson A., Green P. [8], Zhang Y., Liu H. [9] are dedicated to the impact of external crisis factors on the proliferation of remote and hybrid employment.

At the same time, most scientific works are predominantly theoretical or generalized in nature. This creates a need for empirical research based on data from specific online employment platforms, which is the focus of this article.

Objective of the study. The objective of this scientific article is a comprehensive analysis of trends in the Ukrainian labor market based on analytical materials and aggregated data from the *robota.ua* and *work.ua* platforms. It further aims to identify key changes in the structure of labor demand, personnel requirements, and the role of digital tools in shaping modern employment.

Statement of the problem. To achieve this objective, the article sets out to accomplish the following tasks: analyze the dynamics of labor supply and demand in the Ukrainian labor market; to assess the level of competition among candidates using the vacancy load indicator; to identify structural shifts across professions and industries; to investigate the impact of digital platforms on the proliferation of remote and hybrid forms of employment; and to justify the practical feasibility of using Big Data analysis tools to support management decisions in the field of employment and human capital development.

Presentation of the main material. Traditional statistical tools based on periodic sample surveys are not always capable of promptly reflecting dynamic changes in the labor market. Instead, digital job search platforms accumulate vast data sets on the behavior of employers and candidates in near real time, justifying the use of such platforms as an empirical basis for analytical research.

In modern socio-economic research, such digital data sets are viewed through the lens of Big Data. Big Data refers to large volumes of structured and unstructured data generated in the process of digital user interaction, characterized by significant volume, diversity, and high update speed. Today, Big Data is one of the key drivers of information technology development, which is relatively new, it has already gained widespread adoption in Western countries [10].

Within the scope of this study, Big Data is defined as the set of aggregated, depersonalized data from online job search platforms, in particular *robota.ua* and *Work.ua*. These platforms are among the key recruitment tools in Ukraine, reflecting the quantity and structure of vacancies, competency requirements, salary levels, regional employment characteristics, and candidate activity. Utilizing this data allows for a comprehensive analysis of the Ukrainian labor market transformations amidst highly dynamic socio-economic processes, as well as identifying structural shifts in the labor market faster than traditional statistical tools, thereby enhancing the effectiveness of management decisions in the field of employment. The labor market is traditionally viewed as a system of socio-economic relations between employers and employees regarding the sale and purchase of labor. Classical economic theories focus on the balance of supply and demand, wage formation mechanisms, and labor productivity. Digitalisation requires a new paradigm for labour market analysis, in which online employment platforms, algorithmic recruitment, remote and hybrid employment, and big data analytics play a vital role. Digital platforms function as a new type of intermediary, integrating information, communication, and analytical tools.

Big Data in employment allows for a transition from selective statistical observations to the analysis of mass behavioral patterns. This provides a deeper understanding of structural changes, the demand dynamics for specific competencies, and regional employment characteristics. However, the data from these platforms requires careful interpretation, as it reflects user activity rather than the labor market as a whole.

Digital employment platforms are increasingly viewed not only as technical tools for job search, but as institutional elements of the labor market. They influence the speed of vacancy fulfilment, the formation of salary expectations, the standardization of candidate requirements, and the proliferation of certain employment models. Unlike official statistics, online recruitment data reflect current employer demand and candidate behavior in real time. This allows for the rapid identification of shifts in the structure of labor demand, including the

emergence of new professional roles, the growing importance of digital and soft skills, and the expansion of remote work. At the same time, one should take into account the limitations of such data: it may be biased towards urban and more digitized segments of the labor market, and may not fully cover informal employment. Therefore, it is reasonable to combine the use of such data with an analytical approach and clear methodological caveats.

In Ukraine, *robota.ua* and *Work.ua* are the two largest platforms by vacancy volume and number of active users. These platforms connect employers and job seekers across various sectors of the economy and play a leading role in shaping labor supply and demand. The data from these platforms accumulate vast amounts of information regarding the structure of vacancies, professional requirements, wage levels, regional employment patterns, candidate activity, and job competition. This allows *robota.ua* and *Work.ua* to be considered a comprehensive Big Data source for analyzing transformations in the Ukrainian labor market. The analytical materials of these platforms are based on anonymized data, ensuring the representativeness and relevance of information within the digital segment of the labor market. Such data serves as a valuable empirical foundation for analyzing employment transformations in highly turbulent conditions.

Analyzing the labor market in conditions of high socio-economic instability requires not only recording absolute labor demand indicators, but also evaluation of their dynamics. Specifically, changes in the number of vacancies reveal employers' adaptation processes, structural shifts across professions and industries, and the labor market's response to external economic and institutional factors. In this context, analyzing labor demand dynamics is essential for assessing the state and transformations of the Ukrainian modern labor market.

The empirical basis of the study comprises analytical materials and aggregated Big Data from Ukrainian two leading online employment platforms (*robota.ua* and *Work.ua*), covering the period up to October 2025. To evaluate the labour demand dynamics, the vacancy growth rate indicator was applied, while the vacancy load coefficient was used to evaluate the level of competition among candidates. Evaluating labour demand dynamics based on online platform data allows supplementing official statistics and provides a more real-time insight into the actual labour market processes.

$$T_v = \frac{V_t - V_{t-1}}{V_{t-1}} \times 100\%; \quad (1)$$

where T_v is the growth rate of the number of vacancies; V_t is the number of vacancies in the current period; V_{t-1} is the number of vacancies in the previous period.

To evaluate the level of competition, the vacancy load coefficient was utilized:

$$K_n = \frac{C}{V}; \quad (2)$$

where K_n is vacancy load coefficient; C is the number of active applicants (responses); V is the number of open vacancies.

The calculated indicators of demand and competition dynamics in the Ukrainian labor market for the period September–October 2025 are presented in Table 1.

Table 1. The calculated indicators of demand and competition dynamics in the Ukrainian labor market (September–October 2025)

| <i>Indicator</i> | <i>Value</i> |
|---|--------------|
| Growth rate of the number of vacancies, % (T_v) | +6,1 |
| Vacancy load coefficient (K_n) | ≈2,1 |
| Labor shortage index, % | ≈0,40 |

*Calculations are based on aggregated analytical data from the online platforms *robota.ua* and *Work.ua* for September–October 2025.

The application of calculated indicators allows for a quantitative assessment of labor demand dynamics and the level of competition in the Ukrainian labor market. According to the Work.ua platform, the growth rate of the number of vacancies in October 2025 compared to September 2025 was approximately 6.1%, indicating a moderate recovery in employer demand. The calculated vacancy load coefficient of approximately 2.1 indicates the persistence of relatively high competition among candidates in certain labor market segments. At the same time, a comparative analysis of data from robota.ua and Work.ua confirms the overall consistency of trends, but records a slightly higher competition level according to Work.ua, possibly due to differences in the audience demographics of the platforms. It should be noted that the calculations are based on aggregated open data, thus limiting the possibility of a detailed analysis of specific occupational groups, but not diminishing the representativeness of the results obtained regarding general labor market trends.

Furthermore, the results of the analysis confirm the systematic labor shortage, which, according to analytical data from the Work.ua, is estimated at approximately 40% and is driven by a number of interrelated factors: migration: approximately 8 million people have left the country due to the war; mobilization: 2 million people are engaged in the security and defense sector, including approximately 700,000 in the Armed Forces of Ukraine; internal displacement: 7.7 million internally displaced persons (IDPs), approximately 3 million being of working age. This indicates the formation of a labor market oriented toward employer competition for qualified workers, particularly in socially significant and service-oriented professions. An analysis of aggregated data from the robota.ua platform indicates significant structural changes in labor demand. The general distribution of vacancies by main professional fields is presented in Table 2.

Table 2. Distribution of vacancies by main professional fields

| <i>Field of Activity</i> | <i>Share of vacancies (robota.ua), %</i> | <i>Share of vacancies(Work.ua), %</i> | <i>General trend</i> |
|------------------------------|--|---------------------------------------|----------------------|
| Information technology | 22 | 21 | Growth |
| Sales and customer service | 19 | 20 | Moderate growth |
| Education and training | 14 | 15 | Growth |
| Logistics and transport | 13 | 12 | Stable demand |
| Medicine and social services | 10 | 11 | Growth |

To more clearly illustrate the structural differences in the distribution of vacancies by field of activity on the robota.ua and Work.ua platforms, it is helpful to present the results in the form of a comparative diagram. Figure 1 shows a comparative structure of vacancies by professional fields.

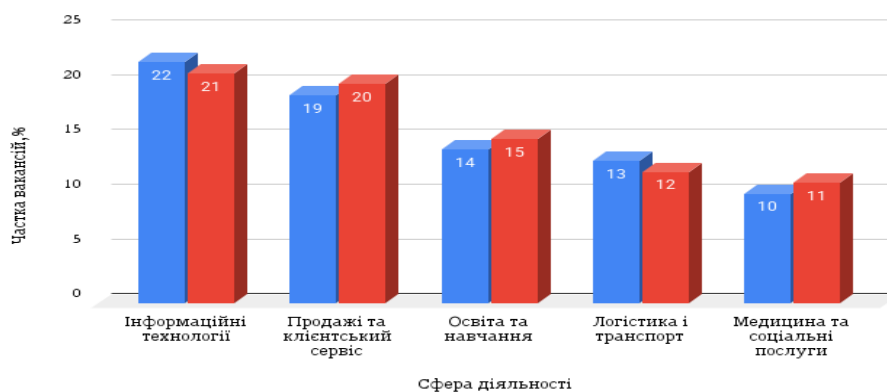


Figure 1. Vacancy Structure by Main Professional Fields on robota.ua and Work.ua, %

*Calculated based on data from robota.ua and Work.ua.

The data indicate significant structural changes. The dominance of the IT sector in the demand structure confirms the trend toward digitalization of the economy and an increasing need for highly qualified specialists. At the same time, a substantial share of vacancies in education, medicine, and services points to the growing importance of social and customer-oriented professions. The most significant demand growth (+3%) can be observed in the following sectors: media, publishing, printing, IT, computers, the internet, and law. This reflects a shift in demand towards information, digital, and legal sustainability in business.

According to the data, the structure of labor demand by major professional spheres is generally similar across both platforms, confirming the representativeness of the empirical base. At the same time, minor differences in the share of vacancies may be attributed to the specifics of the audience and the functional features of the respective platforms.

Compared to the pre-war labour market configuration, which was characterised by greater stability and predictability, current demand shows clear signs of flexibility and adaptability. The regional distribution of vacancies is marked by a concentration of demand in large cities and regional centres, which traditionally serve as centres of economic activity. The generalised data is presented in Table 3.

Table 3. Concentration of Labor Demand by Regions of Ukraine

| <i>Region</i> | <i>Share of vacancies, %</i> |
|-----------------------|------------------------------|
| Kyiv region | 43,3 |
| Lviv region | 8,6 |
| Dnipropetrovsk region | 8,5 |
| Odesa region | 8,4 |
| Kharkiv region | 2,9 |

Compiled based on robota.ua data, September 2025.

Table 3 shows a high level of spatial concentration of labor demand. Kyiv is the absolute leader, accounting for over 43% of all vacancies, which indicates excessive labor market centralization. A significant share is also formed by large economic centers such as Lviv, Dnipropetrovsk, and Odesa regions, each accumulating over 8% of vacancies. Meanwhile, most regions are characterized by fragmented and significantly lower levels of demand, confirming the presence of regional imbalances in the Ukrainian labor market.

Similar territorial trends are recorded in the analytical materials of the Work.ua platform, which also indicate the dominance of large cities and regional centers in the structure of vacancies, confirming the systemic nature of regional concentration of labor demand. However, the spread of remote and hybrid forms of employment is gradually reducing regional disproportion, allowing employers to recruit staff regardless of their residence. For job seekers, remote (45%) or hybrid (30%) employment formats are a major advantage, fostering a new spatial logic in the labor market. This creates a new spatial logic in the labor market, in which the geographical factor loses its decisive importance.

On the labor supply side, there is an imbalance between the number of candidates and the quality of their skills. In some market segments, there is a surplus of applicants, while high-tech and service sectors continue to face a shortage of qualified personnel. The labor market is dominated by women, who account for 63% of the workforce, compared to 37% for men. Additionally, 47% of candidates have no prior experience.

One of the key trends is a shift in emphasis from formal education to practical skills and results, as employers increasingly require digital literacy and proficiency with online tools, client-oriented approach, independence and responsibility, and the ability to learn quickly. A competency-based employment model is emerging, where digital and soft skills

are becoming just as important as hard skills. In addition to salary, key factors for job seekers include benefits and official employment (27%), as well as opportunities for training and career growth (25%). This has significant implications for the education system and corporate training.

Martial law has intensified structural labour market imbalances, particularly between supply and demand within certain occupational groups. This has led to a situation where the quantity of labour available is not matched by the corresponding quality of skills. Migration processes, internal displacement and shifts in the economic structure make it difficult to forecast personnel needs. In such conditions, the role of operational analytics based on data from the platforms studied is significantly increasing. The use of HR analytics based on Big Data allows employers to optimize recruitment processes, reduce recruitment costs, and improve the quality of hiring. For state institutions, such data can serve as an additional tool for monitoring the state of the labor market and justifying employment policies.

Conclusions. According to the results of the conducted research, the use of Big Data online platforms, in particular *roboata.ua* and *Work.ua*, is proven to be an effective tool for analytical analysis of the modern labor market in Ukraine. The data from these platforms reveal a shift in demand towards flexible, digitally oriented, and customer-centric professions, as well as the increasing importance of universal and soft skills, the existence of a systemic labor shortage (up to 40%) caused by migration and mobilization, which has led to increased employer competition for personnel and a change in the priorities of job seekers, where not only salary but also social benefits, official employment, and training opportunities are becoming important. The results confirm the feasibility of further developing HR analytics as a component of economic research and employment management practices in conditions of high uncertainty.

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