
Systemic Transformations of the Labour Market Amidst Technological Economic Development

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Abstract. *The necessity of examining labour market transformations influenced by economic technological development from a systemic perspective is predicated on the requirement to comprehend these transformations theoretically and methodologically, and to adapt them practically by contemporary business entities and their present and prospective employees. Dynamic changes in the employment structure, qualification requirements and socio-economic relations, which are transformed and updated by innovative and digital technologies, must be understood. The objective of the present study is to identify, clarify and generalise systemic transformations of the domestic labour market in the conditions of technological development of the Ukrainian economy. The following general scientific research methods were employed in the study: system analysis, which involved the examination of the relationships between elements of the labour market; analysis and synthesis, which were utilised to elucidate the impact of digitalisation on labour market transformations; induction and deduction, which were employed to formulate general conclusions based on observations and arguments obtained to test hypotheses; historical and logical methods, which were employed to trace changes in the parameters of the domestic labour market. The study found that the functioning and development of the domestic labour market are characterised by the following trends: the disappearance of jobs and professions related to physical labour; increased flexibility in planning and performing work tasks; the requirement to possess advanced digital skills; gender equality in "classic" professions and jobs; an increase in unemployment among people who are unable to engage in lifelong learning and change professions; the need to develop high social skills among employees; the spread of digital platforms, digital recruiting, freelancing, online employment, crowdsourcing and other forms of digital employment; the gradual growth of the role of non-material forms of incentives in staff motivation processes to create a positive image of the employer in the labour market; the inability of top managers of companies and government agencies to effectively control digital employment. The study's practical value lies in its potential to inform the development of strategies and programmes for local, regional and national labour markets in an era of deepening digitalisation and economic process transformation, and in the context of wartime risks.*

Keywords: labour market, human capital, labour resources, personnel, technological development, economic development, enterprise employees, transformations.

JEL Classification: J21, J24, O33

1 Introduction

Technological progress and the widespread spread of Industry 4.0 trends have also been reflected in the changing parameters of the modern labour market. It is evident that the advent of automation has precipitated a paradigm shift in numerous processes that formerly necessitated manual labour. The advent of digital transformations in business processes has engendered remote employment opportunities, while the evolution of digital recruitment methodologies has facilitated the formation of business entities' human resource potential

without the direct involvement of prospective candidates. Furthermore, military operations and the mobilisation of personnel have served to neutralise gender disparities in traditionally male-dominated roles. The following observations are indicative of notable trends, which, in certain instances, appear to be balancing factors, while in others, they appear to be contributing to the perpetuation of imbalances between demand and supply in the domestic labour market. Ukraine's loss of human capital, which has significantly accelerated since the start of the full-scale invasion in 2022, leaves no chance for the

effective functioning of market mechanisms related to the labour resource provision of business, without taking into account the possibilities of the impact of technological development of the economy on this process. Therefore, a pressing issue requiring urgent attention in the theoretical, methodological and applied spheres is how to support Ukrainian businesses trying to survive in uncertain and risky conditions with limited human resources due to the war, while also helping them to develop their own strategic capabilities for post-war recovery and sustainable development.

A considerable body of contemporary research has been dedicated to the study of labour market transformations, with the objective of identifying their economic, demographic, and social characteristics. The study of scholars has focused on the examination of the causes and consequences of changes in the supply and demand for labour resources. Furthermore, the implications of such changes for the functioning of micro- and macro-level socio-economic systems have been a primary area of interest.

For instance, Skopenko N.S. and Yevsieieva-Severyna I. V. (2023) endeavour to track and analyse the course of modern transformational processes in Ukraine's labour market, while Kovach V.O. (2020) proposes a set of competent approaches to the socio-economic transformation of the labour market. A substantial body of academic literature examines the realities of labour relations transformation in Ukraine amidst wartime conditions: Azmuk N.A. (2022) delineates the challenges and strategies for labour force reproduction during periods of labour market transformation in times of war. Ushenko O.P. (2024) characterises the trends and challenges of transformational changes in Ukraine's labour market under martial law, and Krimkova O.S. (2023) conducts her research in the same context.

Another notable vector of publication activity by Ukrainian scholars is the impact of digital technologies on labour market transformation (Havryliuk, Bozhydarnik, 2023). For instance, Reznikova N.V., Bulatova O.V., Panchenko V.H., and Ivashchenko O.A. (2023) delineate aspects of the platform economy and identify novel threats of inequality in the context of techno globalism for the digital transformation of the labour market; Krylov D.V. (2024) describes the characteristic features of labour market transformation in the context of the digitalisation of Ukraine's national economy.

Scholars such as Chychkalo-Kondratska I.B. (2024), who tracks the professional and qualification aspects of modern global labour market transformations, and the aforementioned

researchers Panchenko V.H., Reznikova N.V., Ptashchenko O.V., Ivashchenko O.A. (2024), who elaborate on the digital transformations of the international labour market in the context of employment platformisation and study the gig economy as an environment for the transformation of the international labour market (Panchenko, Reznikova, Ivashchenko, Rusak, 2024), work on the scale of global labour market research and the international context of labour relations transformation.

In the context of Ukraine's economic convergence with EU countries, the research by scholars such as Pavlova O.M., Baryliuk S.A., Bardas V.P., Shyrshykov N.O., and Holubchuk I.M. (2024) dedicated to the transformation of the European labour market in the context of Russian military aggression against Ukraine deserves attention.

Concurrently, these significant scientific accomplishments do not evince endeavours to adopt a systemic approach to examining the challenges of labour resource provision for Ukraine's economic advancement through labour market mechanisms.

Building on existing theory and methodology, this study aimed to identify, clarify and generalise the systemic transformations of the domestic labour market in the context of the technological development of the Ukrainian economy.

2 Transformations of the Domestic Labour Market in Wartime Conditions

For the Ukrainian labour market, significant systemic transformation has been triggered by a number of factors over the last decade. These include the occupation of the Donetsk and Luhansk regions, the global pandemic of the COVID-19, and the full-scale invasion which has been ongoing since 2022. These three national-level factors are compounded by global processes, including digitalisation and the digital transformation of the economy, the shift in the world model from VUCA to BANI, convergence with EU countries and mutual penetration of labour markets at this level, and the rapid increase in opportunities for online employment, among others. It is evident that these circumstances and factors have shaped a unique architecture for the domestic labour market, and are constantly changing its fundamental parameters.

Kovach V.O. (2020) posits that in the pre-war period, the employment structure that developed in Ukraine's labour market was characterised by a high share of agriculture, industry, and construction. The level of employment in financial institutions and housing and communal services exhibited a gradual increase, while concurrently, negative trends such as underemployment and

forced unpaid leave persisted and intensified. In the contemporary context, economic instability has been identified as a significant impediment to the advancement of business enterprises. Concurrently, there is an escalating demand for personnel within critical infrastructure sectors, state institutions and organisations, and the medical and social sectors. The uninterrupted operation of these entities is of paramount importance for the survival of the state and its populace.

In the final pre-war year, 2021, the employment rate in Ukraine was 55.7%, representing a decrease of 0.5% compared to 2020, according to data provided by Ushenko O. P. (2024). Among women, this figure decreased to 51.5%, while remaining stable at 62% for men. This finding suggests that the labour market was characterised by a high unemployment rate, with labour supply exceeding demand. Concurrently, the segment of unofficial and informal employment underwent rapid and robust development (Ushenko, 2024). This trend has continued to gain momentum since mid-2025, largely driven by the significant fiscal pressures faced by enterprises in the context of official employment.

Since 2022, the country has been experiencing a decline in its existing and potential labour force, attributable to factors including migration, the deaths of military personnel and civilians, and the deportation of Ukrainians to the aggressor country. These processes hinder the complete replenishment of the labour force, resulting in a diminution of the supply of qualified and educated individuals within the national labour market, and a concomitant reduction in intellectual potential (Azmuk, 2022). Concurrently, from the onset of the military engagement, enterprises initiated cost optimisation measures to the greatest extent possible, resulting in workforce reductions, unpaid leaves, termination of employment, and wage reductions. However, new challenges and personnel problems also arise for employers, which generally indicates a crisis-induced imbalance in the labour market (Ushenko, 2024). In general, there is a shortage of skilled personnel in the market. Those with the necessary skills and talents have found work abroad, where they are paid higher salaries. However, the unemployment rate for low-skilled labour remains high, except for positions and professions involving heavy physical labour. These are traditionally performed by men, the majority of whom are currently in the armed forces of Ukraine.

The loss of human capital at the national level and human resources at the microeconomic scale has forced labour market actors to reassess their needs and expectations. Skopenko, N.S. and Yevsieieva-Severyna, I.V. (2024) observe that

the primary concern for contemporary business development continues to be the retention of personnel, in addition to the provision of material and psychological support for employees, along with the maintenance of staff integrity. In conditions of martial law, there is an observed decrease in business activity and an adaptation of business processes to new operating conditions. This results in a reduction in financial capabilities for wage payment (Ushenko, 2024). Nevertheless, non-material incentives are gaining popularity and being used more widely in various industries and for different purposes. A significant number of companies, starting from 2020 (considering the COVID-19 crisis) and taking into account the current state of war, continue to implement mental health support programs for their employees. The utilisation of motivational programmes and tools with the objective of ensuring employee well-being is becoming increasingly prevalent (Skopenko, Yevsieieva-Severyna, 2024).

In the context of the domestic labour market, the issue of a proportion of the youth demographic encountering challenges in securing their initial employment following the completion of their education has historically been a salient concern (Azmuk, 2022). Educational programmes that offer dual educational opportunities provide relevant professional competencies; however, they do not guarantee employment for young specialists, especially in light of the risk of Ukrainian enterprises losing their assets and material base due to enemy military attacks. Concurrently, the mobilisation process of the civilian population has emerged as a catalyst for the proliferation of informal employment within the labour market. This phenomenon can be attributed, in part, to the motivation of a segment of the male demographic to formally recognise and document their socio-labour relations, thereby circumventing the process of mobilisation (Ushenko, 2024). It is important to concur with Azmuk N.A. (2022) on the question of the destructive impact of the Russian-Ukrainian war on the labour market. The author posits that this impact is manifest in a number of ways, including job cuts, an increasing gap between supply and demand, the deepening of existing and formation of new qualification, educational, and gender imbalances, and the impossibility of full labour force reproduction.

In the context of wartime conditions, Krimkova (2023) identifies two key factors that influence the transformation of the labour market. Firstly, there is an increased demand for labour within the military industry, defence, and economically critical sectors. Secondly, there is a decreased demand for labour, resulting in job cuts due to infrastructure destruction

and economic degradation of the country. The aforementioned formed deficit in the number of jobs, in addition to the prevailing economic situation, is further complicated by the constant destruction of infrastructure and the economy, as well as a significant number of internally displaced persons concentrated in regions that do not have a large-capacity labour market. Concurrently, this negative trend is counterbalanced to a certain extent by the relocation of businesses to less populated regions, a process which facilitates the creation of employment opportunities and the employment of internally displaced persons.

Consequently, the pre-war Ukrainian labour market exhibited a disparity between labour supply and demand, resulting in a surplus that enabled employers to select the labour resource that met their specific requirements in terms of quality and quantity. Concurrently, a steady decline in the economically active, employed, and able-bodied population was observed, accompanied by a rise in the official unemployment rate. Conversely, there was a gradual increase in indicators of informal and unofficial employment, attributable to the high tax burden on the wages of officially employed persons. The proportion of registered unemployed individuals per vacancy has been observed to gradually decrease, a phenomenon attributable to stable external migration (Ushenko, 2024).

The military period in the domestic labour market is characterised by: a decline in employment due to the cessation of entrepreneurial activity in the occupied and frontline regions of Ukraine; an increase in the popularity and demand for remote work among employees; changes in the structure of the labour force due to trends in internal and external labour migration; dissatisfaction and demotivation among employees of enterprises, institutions and organisations due to the lack of a trend towards higher wages against the backdrop of a noticeable decline in real incomes; growth in informal employment among the male population and significant differences in wage levels between regions and between genders (Ushenko, 2024).

At present, in 2025, the vast majority of Ukrainian companies are not planning or actively hiring new employees. However, if required, they seek personnel only in regions where business can function and develop, namely in the western regions of Ukraine. In order to address the ongoing challenges posed by the military conflict, the domestic market must not only arrest the ongoing decline in available employment opportunities, but also proactively generate additional employment prospects for individuals compelled to seek new employment due to the conflict (Krimkova, 2023).

The termination of martial law is expected to facilitate the repatriation of a segment of the Ukrainian male working age population, thereby augmenting the labour force in foreign countries and consequently exacerbating the deficit in this particular segment of the domestic labour market (Pavlova, Baryliuk, Bardas, Shyrshykov, Holubchuk, 2024). Thus, to facilitate Ukraine's post-war economic recovery, it is necessary to initiate changes in state policy that will encourage the return of the labour force from abroad once the active phase of hostilities has ended. These changes should aim to update the knowledge, skills and competencies of personnel in accordance with the requirements of the new "economic era", provide highly intellectual and innovative businesses with talented young specialists by supporting their professional education, create new opportunities for remote and flexible employment and consider the needs of potential employees, both material and mental.

3 Labour Market Transformations Under the Influence of Industry 4.0

In the preceding decade, the world has witnessed a substantial technological advancement, with the rate of innovation and digital progress being particularly noteworthy. In such conditions, economic development is contingent on the capacity of company personnel to adapt to new realities and utilise innovations and digital tools effectively to enhance their professionalism and utility to the enterprise. Consequently, labour productivity across all forms of ownership is significantly influenced by the growth of technical and energy equipment, and so forth (Kovach, 2020). In 2022, a significant number of international and financially powerful companies regarded automation as a solution to personnel problems and a means to avoid large-scale losses in the labour market due to the inability to find "cheap" personnel (Havryliuk, Bozhydarnik, 2023). This trend is set to continue, given that the rates of decline in real incomes due to inflation and the economic capabilities of businesses to expand the scope of material motivation for their employees are growing at significantly different paces.

In the future, in the digital world, the majority of individuals who are unemployed will be unable to maintain the same social status and income level without undergoing a process of reskilling. However, it is important to acknowledge that professional retraining is a phenomenon that is not exclusively relevant in wartime conditions. The contemporary workplace is characterised by rapid changes in all spheres of economic life, as well as social and technological phenomena affecting the labour market. This necessitates that

employees possess the capacity for flexibility and the ability to engage in continuous learning and retraining (Skopenko, Yevsieieva-Severyna, 2024). In the contemporary context of the labour market, a pivotal aspect of achieving equilibrium entails the adaptation and evolution of the workforce in alignment with emergent digital imperatives (Krylov, 2024). This underscores the paramountcy of digital literacy competencies within the financial sector, encompassing the domains of information retrieval and processing, document management, and digital communication.

In the context of business process digitalisation, a discrepancy is becoming increasingly apparent between the competencies required by employers of prospective employees and the competencies and knowledge acquired by students in higher and vocational education institutions. As Azmuk (2022) demonstrate, discrepancies in the supply and demand of labour are evident in certain areas, characterised by an excess of supply relative to demand, while concomitantly experiencing a paucity of labour in other areas. Concomitant with the process of business digitalisation, novel requisites for workers are emerging, encompassing an optimal combination of business, technical, interpersonal, and creative competencies (Krylov, 2024). As Reznikova, Bulatova, Panchenko and Ivashchenko (2023) have demonstrated, those occupying middle-skilled roles and typically engaged in intermediate routine tasks are most vulnerable to robotisation. Digitalization exerts a substantial influence on the labour market, giving rise to the emergence of novel professions and establishing new criteria for prospective employees (Krylov, 2024). The field of generative artificial intelligence is exerting an increasingly significant influence on the composition of the labour force, prompting employers to place greater emphasis on "soft skills". The possession of these competencies by employees enables companies to respond expeditiously to changes and adapt to digitalisation (Chychkalo-Kondratska, 2024). For instance, the importance of creative thinking is rising in comparison to that of analytical thinking, as workplace tasks become more automated. It is anticipated by companies that by 2027, there will be a 9% increase in the automation of thinking and decision-making processes. The importance of cognitive skills is increasing at the fastest rate, driven by the need to solve complex problems in the workplace (Chychkalo-Kondratska, 2024).

The main difficulties currently faced by the Ukrainian population when seeking employment include a lack of job vacancies in their speciality, insufficient wages for available positions, and insufficient qualifications compared to employer

requirements. Furthermore, the path to successful employment is now fraught with problems such as the need for additional education, a lack of active job search skills, despair in the job search process itself, and active hostilities in one's place of residence (Ushenko, 2024).

In contemporary business environments, non-material factors are gaining salience in determining employee satisfaction and fostering organisational loyalty. As Havryliuk O. and Bozhydarnik T. (2023) observe, the creation of a favourable moral and psychological climate across all parameters serves as an ideal guarantee for the retention of the most suitable candidates in the modern labour market and the enhancement of business efficiency. Consequently, the development of human resources policies and the establishment of a favourable employer brand by Ukrainian companies in the labour market should become significant strategic guidelines for their activities in the forthcoming years.

Reznikova N.V., Bulatova O.V., Panchenko V.H., Ivashchenko O.A. (2023) summarize economic development trends affecting labour market transformations, such as the spread of the platform economy, access economy, sharing economy, crowd economy, gig-economy, and freelance economy. Researchers have noted that technological changes can increase labour demand by creating new jobs and stimulating increased labour productivity. This frees up production resources, which can then be used to increase labour demand for other tasks within the industry. Technologies can also increase labour demand by boosting consumer demand (Reznikova, Bulatova, Panchenko, Ivashchenko, 2023).

In the future, Krylov D. V. (2024) hypothesises that the development of artificial intelligence will have a radical effect on the labour market. This assumption can be explained by the fact that the use of AI will become more efficient compared to human labour in currently popular professions in the labour market, such as translator, copywriter, travel agent, tour guide, salesperson, and driver. However, it can be predicted that there will be an increase in demand for new professions caused by the needs of the time. These include artificial intelligence specialists, data analysts, information security specialists, digital marketers, e-commerce and social media specialists, personal development coaches, communications managers and business coaches (Krylov, 2024).

According to Krylov (2024), the modern development of the labour market is driven by the modernisation of labour relations, involving the active use of ICT and innovative technologies, as well as new forms of behaviour in the interaction between employers and employees. The digital

transformation of the labour market is characterised by the emergence of a platform economy, within which local and global labour platforms are established, thereby performing the infrastructure function of the market (Reznikova, Bulatova, Panchenko, Ivashchenko, 2023). New forms of employment are emerging in the context of the transformation of international labour markets, including worker sharing, job sharing, voucher work, interim management, casual work, ICT-based mobile work, platform work, portfolio work, and collaborative or shared employment (Panchenko, Reznikova, Ivashchenko, Rusak, 2024).

Another notable trend in labour market transformation is the active development of freelance exchanges, which are sometimes also called online outsourcing, outsourcing marketplaces, or the online staffing industry. The company in question has amassed a substantial number of independent contractors, who collectively generate significant revenues (Reznikova, Bulatova, Panchenko, Ivashchenko, 2023).

Panchenko V.H., Reznikova N.V., Ptashchenko O.V., Ivashchenko O.A. (2024) emphasise that digital employment platforms occupy a unique place in the modern labour market. In the context of online platforms, work tasks are performed remotely by workers, while tasks on location-based platforms are performed by workers in person at specific physical locations (taxi hailing, delivery, housework, and care). Such characteristic features of digital labour platforms have been named by scholars: the commodification of labour (the opposite of human-centrism), the fragmentation of labour relations, the economisation of social life, the calculation of human labour and partial reciprocity (Panchenko, Reznikova, Ivashchenko & Rusak, 2024).

Another notable trend in the evolution of the domestic labour market, which is also reflected on a global scale in economic processes, is crowdsourcing. This is defined as a type of collaborative online activity in which an individual, institution, non-profit organisation, or company offers a group of people with heterogeneous specialisations, competencies, and knowledge, through a flexible open competition, the opportunity for voluntary task execution (Panchenko, Reznikova, Ivashchenko, Rusak, 2024). The concept under discussion offers the advantages of flexible time management, teamwork, and opportunities for professional and personal development.

Should a trend towards the liberation of Ukrainian territory emerge, vacancies related to construction and transportation will become relevant in the labor market. Moreover, in light of the challenges posed by inadequate air and sea

connections, there will be an increased reliance on ground logistics, railway transportation, and truck freight (Krimkova, 2023). On a global economic scale, Havryliuk O. and Bozhydarnik T. (2023) posit that professions such as IT specialists, virtual reality architects, big data model developers, intellectual property appraisers, virtual lawyers, smart home designers, HR specialists, blockchain developers, digital marketers, cloud computing specialists, artificial intelligence and machine learning experts, software developers, cybersecurity experts, and financial managers will be in demand.

Figure 1 summarises the directions of systemic transformations in the labour market in the context of technological economic development.

It is evident that systemic transformations of the domestic labour market, influenced by technological economic development, result in profound and interconnected changes in its structure, functional processes and socio-economic relations between employers and potential employees. These changes are initiated by a number of phenomena, including automation, digitalisation, robotisation and the spread of artificial intelligence. Transformations in the structure of employment in the labour market are especially noticeable, since digitalisation provokes a reduction in the number of jobs in traditional sectors of the economy, the production and business processes of which are easy to automate. At the same time, digitalisation creates the prerequisites for increasing demand for new high-tech specialties. These specialties are associated with the development, implementation and maintenance of new technologies or the use of intellectual capital. In addition, there are substantial changes occurring in the list of requirements for the level of qualifications and skills of personnel that employers are seeking. The necessity for digital literacy, digital competencies, the ability to learn throughout life and effective mastery of social skills is increasing at a constant rate. In particular, the following skills are in high demand: creative thinking, analytical thinking, critical thinking, adaptability, the ability to work in a team and communicate effectively, the ability to solve problems, and so forth. Alongside the evolution of traditional employment models, new formats are emerging and developing, such as freelancing, digital platforms and online work. As these formats are difficult to control and regulate, it is necessary to introduce levers of influence and a regulatory framework to streamline processes in the labour market.

In the contemporary context of 2005, there is a marked increase in the polarisation of the Ukrainian labour market, which is evident in the rise in inequality between highly qualified personnel and talents, capable of rapidly and adaptively embracing new

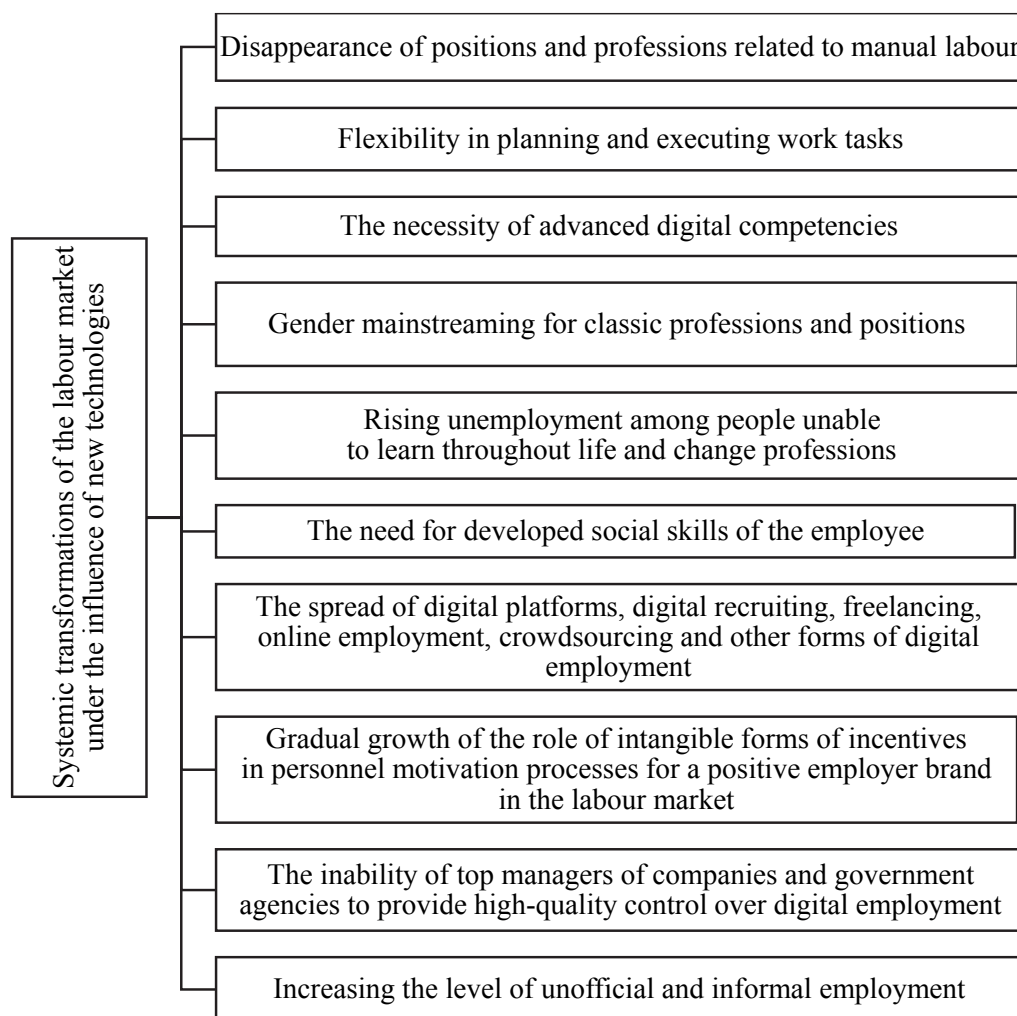


Figure 1 Directions of the spread of systemic transformations of the labour market in the context of technological development of the economy

Source: author's scientific vision

technologies and comprehending the significance and advantages of the implemented changes, and low-skilled workers, whose roles are likely to be automated in the coming years, thereby precipitating a new wave of unemployment. The most significant transformation of the domestic labour market is its globalisation, since technological development provides an opportunity for international competition among the most accomplished specialists and for international co-operation in the field of employment. This transformation occurs without the need for physical border crossings, the adjustment of time zones, and the assurance of the possibility of working from any location in the world in a convenient and comfortable environment while respecting biorhythms.

The systematic nature of the listed transformations of the domestic labour market is explained by interdependence and cause-and-effect relationships. Collectively, these form a complex

challenge for modern economic and social policies, the education sector, and the demographic sector. A proactive response from state authorities and public administration is required in the form of developing strategic guidelines to ensure the achievement of sustainable development goals and compliance with social justice norms.

4 Conclusions

Research into systemic transformations in the Ukrainian labour market in the context of technological development of the economy has led to the conclusion that the functioning and development of the domestic labour market is characterised by the following trends: the disappearance of jobs and professions associated with physical labour; increased flexibility in planning and performing work tasks; the need to possess advanced digital skills; the levelling of the gender factor for 'classic' professions and jobs; rising unemployment among

people who are unable to engage in lifelong learning and change professions; the need to develop high social skills among employees; the spread of digital platforms, digital recruiting, freelancing, online employment, crowdsourcing and other forms of digital employment; the gradual growth of the role of non-material forms of incentives in staff motivation processes to create a positive image of the employer in the labour market; the inability of top managers of companies and government agencies to effectively control digital employment.

The phenomenon of increased unofficial and informal employment has been observed. The systematicity and interpenetration of these factors are attributed to the constant redistribution of

human capital between sectors of the economy, the emergence and disappearance of positions and professions. These phenomena are also intensified by the growth of requirements for the qualifications of potential employees from employers and the increase in interest in the brand of a potential employer from talented and qualified personnel. These individuals can form the basis of the intellectual capital of a business entity and provide it with competitive advantages in a strategic perspective. The potential for further research in this area lies in the prediction of additional changes in the demand and supply of labour within the labour market, particularly in relation to the propagation of Industry 4.0 and Society 5.0 trends.

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