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LEGALIZATION OF THE SHADOW ECONOMY WITH DIGITAL TOOLS INDUSTRY 6.0²

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Summary. Shadowing the economy in the context of digital transformation is possible with high-quality interaction between people, government institutions and effectively working innovations. Under the conditions of the functioning of Industries 5.0 and 6.0, shadowing the economy is possible through intellectual transformation. The purpose of the article is to identify the main aspects of the legalization of shadow business activities, to identify their characteristic features, to present the dynamics of digital changes that contribute to reducing the level of the shadow economy. To achieve the specified goal, the work used methods of analysis and synthesis, grouping, generalization, comparison, which allowed to comprehensively process the existing scientific achievements on the legalization of shadow activities, to solve the tasks set for scientists and to outline the prospects for future research on the development of digital tools of Industry 5.0 and 6.0. The article substantiates and indicates the place and role of the formation of Industry 5.0 and 6.0 for conducting transparent business activities. It's noted that the technical and technological breakthrough currently being observed in the official sector of the economy creates major obstacles in the face of strong competition for high-quality business in the shadow sector of the economy. The authors note that the size of the shadow economy is within 4–7% and isn't critical for the country's economy, provided that the institutions in the country are strong, the government professes democratic values, transparency in business is cultivated, taxes are thoughtfully and carefully implemented, and do not cause entrepreneurs to want to hide in the «shadow». It's argued that the rapid evolution of Industry 4.0 to 6.0 breaks shadow business schemes, influences the change in management decisions of business leaders. Each of these industries offers real opportunities for positive changes with the rejection of shadow activities. The authors express the opinion that the factors that restrain innovative and technical and technological development in a number of countries are a high level of shadow economy, slow digital transformation of the economy, unpreparedness for technological changes, reluctance to accept innovations, institutional failure, low level of interpersonal trust and trust in the institution of power. Scientists are of the opinion that it's the formation of ultra-personalization of smart production and smart industry that will allow us to quickly get rid of shadow relations in the business environment.

Key words: business de-shadowing, innovative tools, industry digital transformation, Industry 5.0, shadow economy, business reputation, e-commerce, e-business.

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ЛЕГАЛІЗАЦІЯ ТІНЬОВОЇ ЕКОНОМІКИ ЦИФРОВИМИ ІНСТРУМЕНТАМИ ІНДУСТРІЯ 6.0

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Резюме. Тінізація економіки в умовах цифрової трансформації можлива за якісної взаємодії людини, інститутів влади й ефективно працюючих інновацій. За умов функціонування Індустрії 5.0 та 6.0, детінізація економіки можлива шляхом інтелектуальної трансформації. Мета статті полягає в тому, щоб визначити основні аспекти легалізації тіньової бізнес-діяльності, визначити їх характерні особливості, представити в динаміці цифрові зміни, що сприяють зменшенню рівня тіньової економіки. Для досягнення визначеної мети використано методи аналізу та синтезу, групування, узагальнення, порівняння, що дозволили комплексно опрацювати наявні наукові здобутки з питань легалізації тіньової діяльності, розв'язати поставлені перед науковцями завдання й окреслити перспективи майбутніх досліджень розвитку цифрових інструментів Індустрії 5.0 та 6.0. Обґрунтовано й вказано місце та роль становлення Індустрії 5.0 та 6.0 для ведення прозорої бізнес-діяльності. Зазначено, що техніко-технологічний прорив, що простежується наразі в офіційному секторі економіки, створює великі переешкоди в частині потужної конкуренції для якісного ведення бізнесу в тіньовому секторі економіки. Автори зазначають, що розмір тіньової економіки є в межах 4–7% і не є критичним для економіки країни за умови, що інститути в країні сильні, уряд сповідує демократичні цінності, культивується прозорість ведення бізнесу, податки продумані й зважено введенні в дію, не викликають бажання у підприємців ховатися в «тінь». Аргументовано, що швидка еволюція Індустрії від 4.0 до 6.0 ламає тіньові бізнес-схеми, впливає на зміну управлінських рішень бізнес-лідерів. Кожна з цих індустрій пропонує реальні можливості до позитивних змін з відмовою від тіньової діяльності. Висловлено думку про те, що чинниками, які стримують інноваційний і техніко-технологічний розвиток в низці країн, є високий рівень тіньової економіки, повільна цифрова трансформація економіки, неготовність до технологічних змін, небажання сприймати інновації, інституційна неспроможність, низький рівень довіри міжособистісної та до інституту влади. Науковці стоять на позиції саме становлення ультраперсоналізації розумного виробництва й смарт-промисловості, що дозволить швидкими темпами позбутися тіньових відносин у бізнес-середовищі.

Ключові слова: детінізація бізнесу, інноваційні інструменти, галузева цифрова трансформація, Індустрія 5.0, тінізація економіки, бізнес-репутація, е-торгівля, е-бізнес.

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Problem statement. The shadow economy is gaining momentum in Ukraine. Currently, there's a low level of trust in the institution of power, as a result of martial law, interpersonal and institutional trust in the country has been «undermined». Under such conditions, conducting business transparently, opening venture and innovative enterprises becomes a significant challenge for business agents. The formation and development of Industry 6.0 is possible in the absence of corruption, bribery, nepotism, that's, a low level of the shadow economy.

Shadowing the economy in the context of digital transformation is possible with high-quality interaction between people, government institutions and effectively working innovations. Under the conditions of Industry 6.0, shadowing the economy is possible through intellectual transformation. The emergence of ultra-personalization of smart production and smart industry will allow us to quickly get rid of shadow relations in the business environment. The technical and technological breakthrough that's currently being observed in the official sector of the economy creates major obstacles in the face of strong competition for high-quality business in the shadow sector of the economy.

Analysis of recent research and publications. We consider the research of scientists R. Rame, P. Purwanto, S. Sudarno, who studied the consistency of Industry 5.0 technologies with environmental and social goals and sought to reveal the untapped potential of Industry 5.0 technologies in promoting sustainable development initiatives [11, p. 1]. An analysis of the industrial concepts of Industry 5.0 and Industry 6.0 in terms of their emergence, spread and potential institutionalization in management discourse was presented in their publication by scientists D. Madsen, K. Slatten, T. Berg [9, p. 1].

The focus of scientific attention of researchers S. Safuan, M. Habibullah, E. Sugandi is focused on clarifying the actual relationships between the progressive development of the financial sector and the shadow economy and proved that «the size of the shadow economy increases in the early stages of the development of the financial sector, up to a turning point and decreases as the development of the financial sector continues to grow» [13, p. 1]. D. Enste studied the shadow economy as an unregulated economic activity that leads to a decrease in tax revenues, reduces tax morale and leads to non-compliance with tax legislation, provokes higher costs of control and reduces the rate of economic growth. But on the other hand, as the scientist claims, «the shadow economy can be a powerful force for promoting institutional changes and can stimulate the overall production of goods and services in the economy» [5, p. 1].

Scientists O. Farooq, K. Aktaruzzaman, H. Satt, based on the results of the study, argue that formal firms use innovation as a tool to protect and maintain their competitive advantages compared to informal firms. They emphasize the fact that «the business environment at the firm level and the economic environment at the country level affect the sensitivity of innovations to informal competition» [6].

R. Remeikiene, L. Gaspareniene, F. Schneider, based on the conducted empirical research, formulate a definition of the digital shadow economy, which refers to illegal activities, such as the provision of digital services and the sale of goods/services online, when, acting exclusively in the digital space, subjects violate existing legal norms and rules in order to obtain illegal mutual benefit and material gain [12, p. 696]. Such an understanding lays the foundation for further research in terms of identifying the sources of origin of the shadow economy.

At one time, we conducted research to partially clarify the causes of the emergence of shadow economic relations in businesses [3], we analyzed the structure of the shadow economy [4], and made an attempt to present economic growth through the prism of technical and technological changes in Industry 5.0 [8] and to reveal the peculiarities of the functioning of digital platforms in the conditions of the emergence of the gig economy [7].

Purpose of the study. The purpose of the article is to analyze the level of the shadow economy and conduct a scientific search for ways to legalize shadow activities, determine the impact of digital transformation on the transparency of business activities, present the actualization of the digitization of enterprise activities in order to deshadow and implement transparent control over e-business activities.

Statement of the task. To indicate the chain of evolutionary interaction of Industry 5.0 and Industry 6.0; to analyze the dynamics of changes in indicators that characterize the digital development in Ukraine and industry digital transformation; to reveal the content of the work of digital tools of Industry 6.0 to accelerate the legalization of the shadow economy.

Statements of the main material of the study. In the era of digital transformation, growing global environmental problems, the importance of integrating sustainable development principles into the 4th industrial revolution, Industry 5.0 and 6.0, is becoming increasingly critical. This revolution marks a turning point from industrial, digital and «green» approaches focused on efficiency, automation and digitalization to a paradigm that prioritizes cooperation between people and machines, innovation and harmonization with the environment [11, p. 1]. But it's also about the dynamic intersection between Industries 5.0, 6.0 and the development of shadow relations in different sectors of the economy. The digital revolution has influenced

human creativity, defines new experiences with advanced technological capabilities, transformed forms of traditional entrepreneurship into new digitized ones, which has provoked some difficulties in the partial transparency of e-business and online trade.

The emergence of Industry 6.0 is a promising industrial paradigm characterized by intelligent, autonomous and sustainable systems based on the digital foundations of its predecessors [9, p. 1]. «Industry 6.0 stimulates organizational changes reflecting the change in social and managerial values... it has tangible consequences for managers and politicians, influencing their decision-making in the conditions of a changing industrial landscape» [9, p. 1]. New visions of Industry 6.0 go beyond automation and move towards dynamic cooperation between people and machines. It's about the symbiosis of cooperation of intelligent machines that assist and adapt to human behavior. For example, we are talking about wearable robotic exoskeletons used in production, or context-sensitive service robots [9, p. 4]. Traditional ideas about autonomy, accountability and personality are blurred in Industry 6.0 [9, p. 15].

Factors that hinder innovative and technical and technological development in a number of countries are a high level of the shadow economy, slow digital transformation of the economy, unpreparedness for technological changes, reluctance to accept innovations, institutional failure, low level of interpersonal trust and trust in the institution of power. Fig. 1 shows that the lower the level of technological development of the country, the higher the level of the shadow sector in the country. Thus, Qatar (2.2%), Singapore (3.4%) and Canada (4.5%) are innovative and institutionally strong countries, so the percentage of shadowing is the lowest. In turn, Ethiopia (50.2%), Burundi (49.1%), Tanzania (44.7%), Bolivia (32.1%), Uganda (31.1%) are underdeveloped countries with weak institutions, and as a result, the level of the shadow sector in these countries remains constantly high.

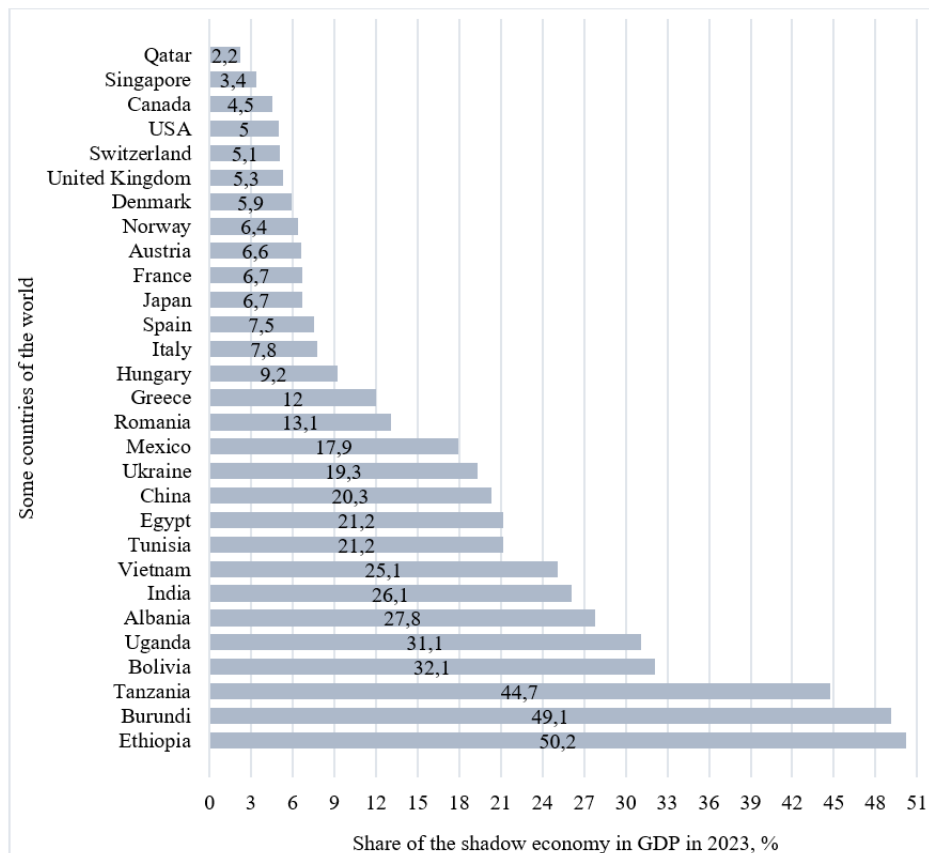


Figure 1. The size of the shadow economy in some countries of the world in 2023

Source: based on the source [10].

It's also worth noting the fact that the size of the shadow economy, which's in the range from 4% to 7%, isn't critical for the country's economy, provided that the institutions in the country are strong, the government professes democratic values, transparency of business is cultivated, taxes are thoughtfully and carefully implemented and don't cause entrepreneurs to want to hide in the «shadows», and when domestic producers are supported. Among such countries, it's worth mentioning Canada (4.5%), the USA (5%), Sweden (5.1%), Great Britain (5.3%), Denmark (5.9%), Norway (6.4%), Austria (6.6%), France (6.7%), Japan (6.7%). As for Ukraine, the level of the shadow sector in 2023 was 19.3%, which's a high indicator, even for a country that's in a state of war and financially dependent on loans and donations from international partners. In order to quickly slow down the level of shadow economy in the country, the government should oblige even more enterprises and businesses to digitize business activities.

«Reducing the size of the shadow economy requires reducing its attractiveness and simultaneously improving formal institutions» [5, p. 1]. «Foreign direct investment limits the shadow economy... increasing incomes can expand the capabilities of the shadow economy, while the poverty index shows mixed results» [13, p. 1]. For shadow businesses, the challenge is infrastructural constraints (lack of physical space for expanding activities), institutional obstacles, lack of state support, financial and informational constraints, capital market imperfections, as banks are reluctant to provide loans to business entities with an unreliable business reputation, and the lack of technological knowledge, which prevents informal firms from implementing innovations [6] produced by Industry 5.0 and 6.0.

Fig. 2 presents the overall Digital Transformation Index of Ukraine by region in 2024. It should be noted that in general, across Ukraine, it's within 0.5 points out of 1 possible, that's, digital transformation occurred at 50% out of 100% possible. The most productive in 2024 were Lviv (0.85), Dnipropetrovsk (0.844), Odesa (0.804), Vinnytsia (0.755) and Volyn (0.711) regions. Chernivtsi (0.254) and Khmelnytskyi (0.23) regions slowed down in digital transformation compared to previous years. Frontline regions, such as Donetsk, Mykolaiv and Zaporizhzhia, showed disappointing indicators.

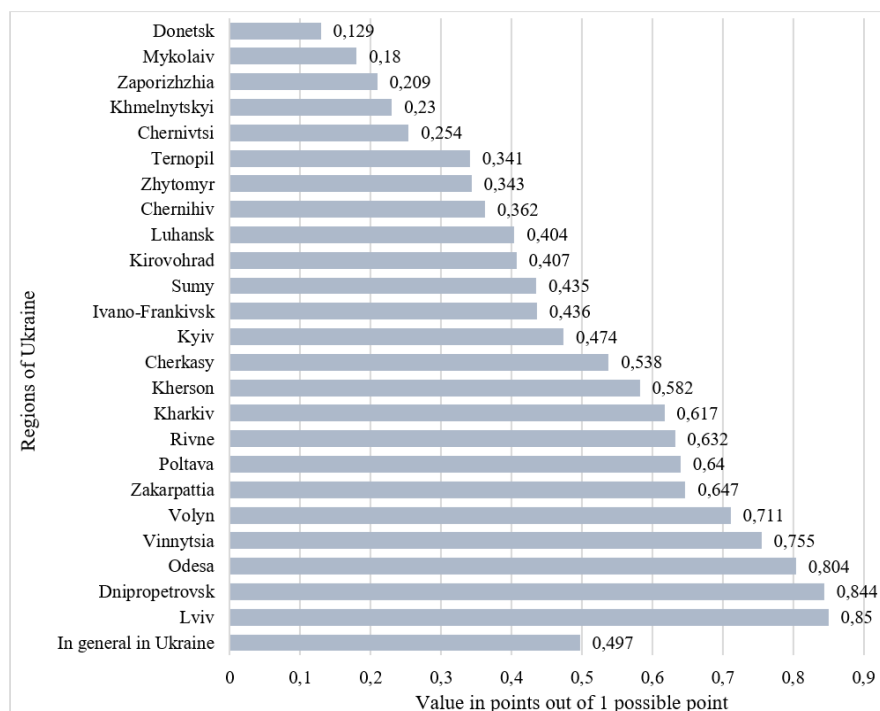


Figure 2. Ukraine's Digital Transformation Index by Region in 2024

Source: compiled based on the source [2, p. 8].

In order to further explore the topic of possible digitization of entrepreneurship in order to reduce shadowing in business, it's worth analyzing some more analytical data. Thus, Fig. 3 presents the share of enterprises that sent invoices in electronic format in the total number of enterprises in Ukraine in 2020 and 2023. From these data, we see that in the pre-war period there were 3.7% more such enterprises than in the second year of the war in Ukraine. However, it's also worth clarifying the fact that the total number of business entities in the first 2 years of the war decreased due to the closure of businesses due to the impossibility of logistics; loss of suppliers and customers; relocation of businesses abroad.

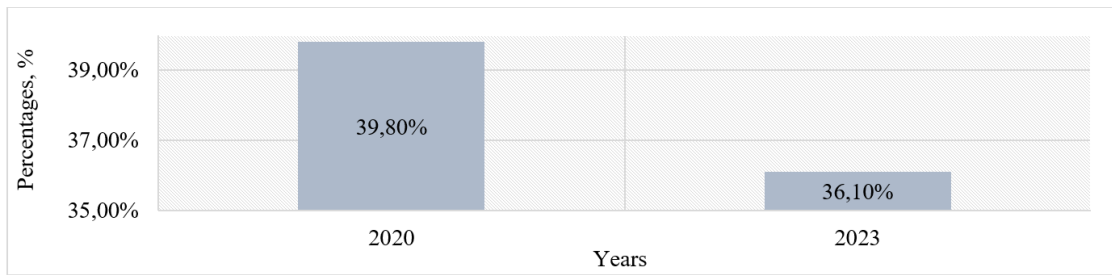


Figure 3. Share of enterprises sending invoices in electronic form in the total number of enterprises in Ukraine in 2020 and 2023

Source: compiled based on the source [1].

The indicators presented in Fig. 4 are somewhat paradoxical, because the general picture is that the larger the share of enterprises that carried out e-commerce from 2020 to 2023, the smaller the volume of products sold (goods, services) of enterprises received from e-commerce. Thus, in 2023 this ratio was 1:2.46, and in 2020 1:1.43.

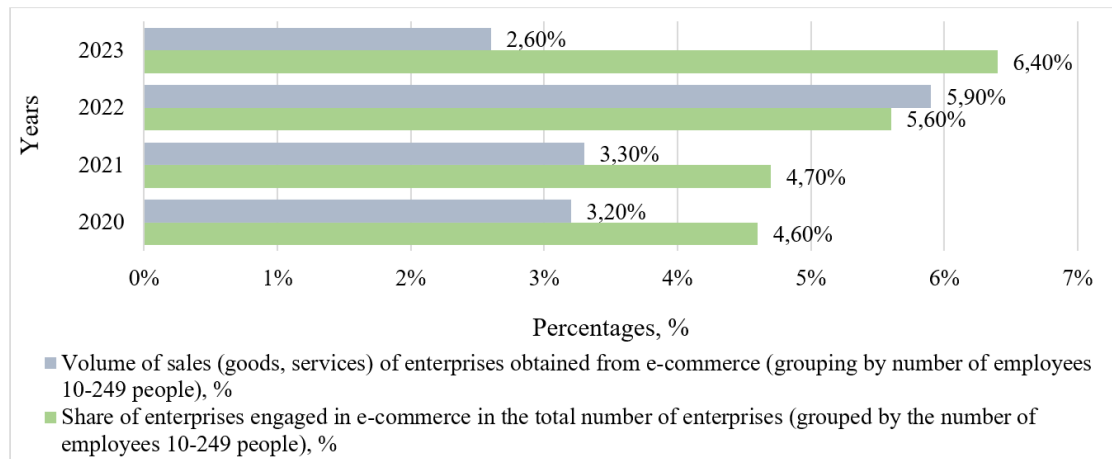


Figure 4. Some indicators characterizing the digital development of the Ukrainian economy and society in 2020–2023

Source: compiled based on the source [1].

The largest (5.9%) volume of sales (goods, services) of enterprises received from e-commerce in Ukraine was in 2022. The reason for this was the first year of the war in the country, which provoked the closure of a number of shops, enterprises, population displacement, and the inability of people to travel long distances to shops due to shelling. As a result of the unrest across the country, shops were closed for a long time for breaks. The lack of electricity also prevented shops from operating at full capacity offline. These reasons led to an increase in the share of online purchases. If we analyze this situation through the prism of

the shadow economy, it's worth noting that online sales are easier to control than offline sales under martial law. However, in order to transfer all trade to online mode, it's necessary to first digitize all activities and provision of services in the country. Fig. 5 presents the indicators of the subindex of industry digital transformation in 2024 by region of Ukraine.

The best was the sectoral digital transformation in Lviv region. Out of 1 possible score, this region scored 0.964 points. The average was the sectoral digital transformation in Ternopil (0.792), Poltava (0.694), Dnipropetrovsk (0.65), Volyn (0.664), Vinnytsia (0.652) regions. The worst sectoral digital transformation took place in 2024 in Zaporizhia (0.243), Mykolaiv (0.292), Cherkasy (0.311), Zhytomyr (0.327), Zakarpattia (0.379), Ivano-Frankivsk (0.357), Kirovohrad (0.359), Khmelnytskyi (0.393) regions.

It's worth noting that the digital transformation and development of Industry 5.0 and the emergence of Industry 6.0 carry innovative potential, but their widespread implementation in all sectors is still the «task with an asterisk». This requires an understanding of the various dynamics, sector-specific requirements and operating conditions, and even cultural characteristics. Adapting them to the needs of a specific industry is a key element of the holistic implementation of these industries. At this technological stage, the goal remains clear: combining the capabilities of Industry 5.0 and 6.0 with sustainable development [11, p. 14], creating a high-tech future without corruption, bribery, and shadow business activities. It is Industry 6.0 that will define a promising industrial paradigm characterized by autonomous intelligent systems, extraordinary interconnection, cognitive integration of man and machine, and a strong focus on sustainable development. In fact, we are talking about a «leap» to fully self-regulated industrial ecosystems [9, p. 5], in which there is simply no place for the shadow economy and corruption.

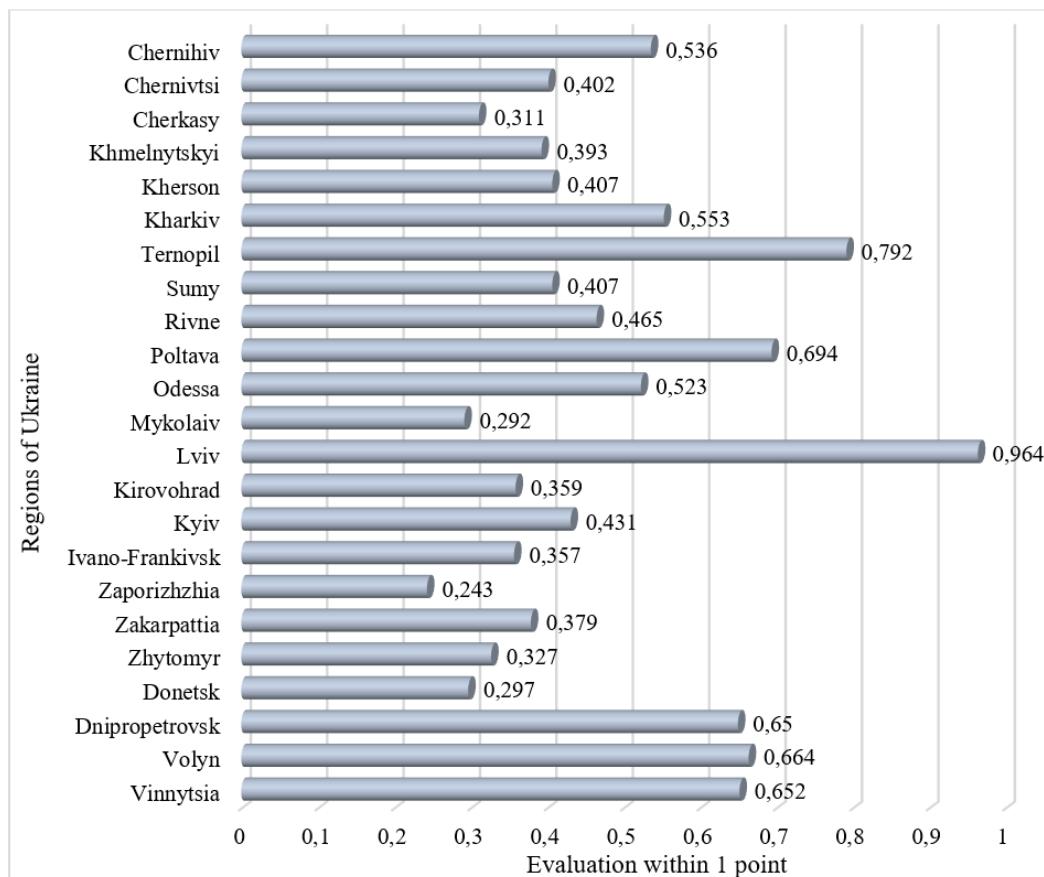


Figure 5. Digital Transformation Index of Ukraine by Regions by Sub-Index «Industry Digital Transformation» in 2024

Source: compiled based on the source [2, p. 20].

We share the scientific views of D. Enste in that the shadow economy shouldn't be viewed solely as an economic problem that needs to be solved by combating symptoms with higher fines and stricter control. In order to develop policy measures that correspond to the level of development of the country, an analysis of the causes and consequences that correspond to its specificities is necessary. The scientist emphasizes that politicians should consider «illegal work as a signal about the need to reduce the attractiveness of the shadow economy through better regulation, a fair and transparent tax system, as well as more effective institutions (good governance). However, organized crime and illegal employment should be combated through stricter control and law enforcement» [5, p. 1].

Governments should expand access to credit markets for micro, small and medium-sized enterprises and improve existing programs to reduce poverty [13, p. 1] and reduce the income gap among Ukrainians. It makes sense to focus on financial inclusion programs and launch effective financial sector reforms, encourage fiscal policy and implement tax incentives that could attract more foreign direct investment into the country [13, p. 12]. These actions will lay the foundation for reducing the size of the shadow economy in the near future.

Conclusions. Summing up the analysis of the indicators of the shadow economy through the prism of innovation, digital transformation, sustainable development goals, which are one way or another professed by Industry 4.0, Industry 5.0 and Industry 6.0, it becomes obvious that the rapid evolution of the industry breaks shadow business schemes, affects the change in management decisions of business leaders, and forces us to constantly reconsider political decisions made by politicians in the country, as part of its nearest innovative future. Each of these industries offers real opportunities for positive changes with the rejection of shadow activity. Business leaders have to change their approaches to conducting digital entrepreneurship both strategically and critically.

Industry 5.0 offers transparent cooperation between man and machine, which enhances the involvement of innovations in production with a harmonious combination of high-quality workforce competencies, without giving up the value of human labor. Industry 4.0, using Big Data, IoT, digital twins and automating business processes, allows state institutions to easily detect shady business schemes, tax evasion, and shadow employment. Industry 6.0 allows you to reduce the number of devices, but at the same time work no less efficiently than in the previous two industries and build exclusively transparent business cooperation without giving up on a smart person who cooperates with artificial intelligence and robots.

References

1. Indeks tsyfrovoy ekonomiky ta suspilstva (DESI) (2025) [Digital Economy and Society Index (DESI)]. *State Statistics Service of Ukraine*: website. Available at: <https://ukrstat.gov.ua/> (accessed: 11 December 2025).
2. Indeks tsyfrovoy transformatsii rehioniv Ukrainy. Pidsumky 2024 roku (2025) [Digital Transformation Index of Ukrainian Regions. Results for 2024]. *Ministry of Digital Transformation of Ukraine*: website. Available at: <https://thedigital.gov.ua/storage/uploads/files/page/community/reports/%D0%86%D0%9D%D0%94%D0%95%D0%9A%D0%A1%202024%202%201.pdf> (accessed: 12 December 2025).
3. Kraus N. M. (2005) Prychyny vynyknennia ta rozvytku tinovoho sektora ekonomiky v umovakh transformatsiinykh peretvoren [Reasons for the emergence and development of the shadow economy in the context of transformational changes]. *Ekonomika: problemy teorii ta praktyky*, vol. 20, tom IV, pp. 862–866.
4. Kraus N. M. (2007) Pro strukturu tinovoho sektora ekonomiky v umovakh transformatsiinykh peretvoren [On the structure of the shadow economy sector in the context of transformational changes]. *Naukovyi visnyk Poltavskoho universytetu spozhyvchoi kooperatsii Ukrainy. Seriya: Ekonomichni nauky*, no. 1 (21), pp. 31–34.
5. Enste D. H. (2015) The shadow economy in industrial countries. *IZA World of Labor*, Art. 127. DOI: <https://doi.org/10.15185/izawol.127>
6. Farooq O., Aktaruzzaman K., Satt H., Bendriouch F. Z. (2022) Innovations as a response to shadow economy: Evidence from privately held firms. *Journal of Industry, Competition and Trade*, vol. 22, pp. 349–370. DOI: <https://doi.org/10.1007/s10842-022-00388-6>

7. Kraus K., Kraus N., Manzhura O., Ishchenko I., Radzikhovska Y. (2023) Digital transformation of business processes of enterprises on the way to becoming Industry 5.0 in the gig economy. *WSEAS Transactions on Business and Economics*, vol. 20, Art. 93, pp. 1008–1029. DOI: <https://doi.org/10.37394/23207.2023.20.93>
8. Kraus K., Kraus N., Radzikhovska Yu. (2025) Economic growth under the influence of technical and technological changes of Industry 5.0. *Baltic Journal of Economic Studies*, vol. 11(1), pp. 121–134. DOI: <https://doi.org/10.30525/2256-0742/2024-10-3-180-192>
9. Madsen D. O., Slatten K., Berg T. (2025) From Industry 4.0 to Industry 6.0: Tracing the evolution of industrial paradigms through the lens of management fashion theory. *Systems*, vol. 13 (5), Art. 387. DOI: <https://doi.org/10.3390/systems13050387>
10. Neufeld D. (2025) Mapped: The size of each country's shadow economy. *Visual Capitalist*, May 13, 2025. Available at: <https://www.visualcapitalist.com/size-of-the-shadow-economy-by-country/> (accessed: 11 December 2025).
11. Rame R., Purwanto P., Sudarno S. (2024) Industry 5.0 and sustainability: An overview of emerging trends and challenges for a green future. *Innovation and Green Development*, vol. 3 (4), Art. 100173. DOI: <https://doi.org/10.1016/j.igd.2024.100173>
12. Remeikiene R., Gasparyniene L., Schneider F. G. (2018) The definition of digital shadow economy. *Technological and Economic Development of Economy*, vol. 24 (2), pp. 696–717. DOI: <https://doi.org/10.3846/20294913.2016.1266530>
13. Safuan S., Habibullah M. Sh., Sugandi E. A. (2021) Mitigating the shadow economy through financial sector development in Indonesia: some empirical results. *Heliyon*, vol. 7 (12), Art. e08633. DOI: <https://doi.org/10.1016/j.heliyon.2021.e08633>

Список використаних джерел

1. Індекс цифрової економіки та суспільства (DESI). *Державна служба статистики України* : вебсайт, 2025. URL: <https://ukrstat.gov.ua/> (дата звернення: 11.12.2025).
2. Індекс цифрової трансформації регіонів України. Підсумки 2024 року. *Міністерство цифрової трансформації України* : вебсайт. URL: <https://thedigital.gov.ua/storage/uploads/files/page/community/reports/%D0%86%D0%9D%D0%94%D0%95%D0%9A%D0%A1%202024%202%201.pdf> (дата звернення: 12.12.2025).
3. Краус Н. М. Причини виникнення та розвитку тіньового сектора економіки в умовах трансформаційних перетворень. *Економіка: проблеми теорії та практики*. 2005. Вип. 204. Том IV. С. 862–866.
4. Краус Н. М. Про структуру тіньового сектора економіки в умовах трансформаційних перетворень. *Науковий вісник Полтавського університету споживчої кооперації України. Серія : Економічні науки*. 2007. № 1 (21). С. 31–34.
5. Enste D.H. The shadow economy in industrial countries. *IZA World of Labor*. 2015. Art. 127. DOI: <https://doi.org/10.15185/izawol.127>
6. Farooq O., Aktaruzzaman K., Satt H., Bendiouch F. Z. Innovations as a response to shadow economy: Evidence from privately held firms. *Journal of Industry, Competition and Trade*. 2022. Vol. 22. P. 349–370. DOI: <https://doi.org/10.1007/s10842-022-00388-6>
7. Kraus K., Kraus N., Manzhura O., Ishchenko I., Radzikhovska Y. Digital transformation of business processes of enterprises on the way to becoming Industry 5.0 in the gig economy. *WSEAS Transactions on Business and Economics*. 2023. Vol. 20. Art. 93. pp. 1008–1029. DOI: <https://doi.org/10.37394/23207.2023.20.93>
8. Kraus K., Kraus N., Radzikhovska Yu. Economic growth under the influence of technical and technological changes of Industry 5.0. *Baltic Journal of Economic Studies*. 2025. Vol. 11 (1). P. 121–134. DOI: <https://doi.org/10.30525/2256-0742/2024-10-3-180-192>
9. Madsen D. O., Slatten K., Berg T. From Industry 4.0 to Industry 6.0: Tracing the evolution of industrial paradigms through the lens of management fashion theory. *Systems*. 2025. Vol. 13 (5). Art. 387. DOI: <https://doi.org/10.3390/systems13050387>
10. Neufeld D. Mapped: The size of each country's shadow economy. *Visual Capitalist*, May 13, 2025. URL: <https://www.visualcapitalist.com/size-of-the-shadow-economy-by-country/> (Last accessed: 11.12.2025).
11. Rame R., Purwanto P., Sudarno S. Industry 5.0 and sustainability: An overview of emerging trends and challenges for a green future. *Innovation and Green Development*. 2024. Vol. 3 (4). Art. 100173. DOI: <https://doi.org/10.1016/j.igd.2024.100173>
12. Remeikiene R., Gasparyniene L., Schneider F. G. The definition of digital shadow economy. *Technological and Economic Development of Economy*. 2018. Vol. 24 (2). P. 696–717. DOI: <https://doi.org/10.3846/20294913.2016.1266530>
13. Safuan S., Habibullah M. Sh., Sugandi E. A. Mitigating the shadow economy through financial sector development in Indonesia: some empirical results. *Heliyon*. 2021. Vol. 7 (12). Art. e08633. DOI: <https://doi.org/10.1016/j.heliyon.2021.e08633>