

*Economic Theory*

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**HARMONIZING STATE INNOVATION
STATISTICS WITH THE REQUIREMENTS
OF EUROPEAN STANDARDS:
INSTITUTIONAL BASIS, CHALLENGES,
AND OPPORTUNITIES****Abstract**

The relevance of this work stems from the necessity to make informed government decisions aimed at strengthening the innovation ecosystem and its entrepreneurial component as the foundation for the recovery of the Ukrainian economy and overcoming its structural and technological backwardness. This requires the production of high quality and reliable statistical data that conform to the best practices of the European Union. The article delineates the institutional framework for adapting Ukraine's state statistics in the field of innovation to the requirements of European standards. The results show that the national statistical methodology for assessing innovation activities of enterprises generally complies with EU regulations and recommendations. However, the suspension of publication of current statistical information during the period of martial law prevents an assessment of all components of the quality of the respective state statistical observation for accuracy, consistency, comparability, and comprehensibility of statistical data. Furthermore, the article elucidates the specific aspects of the EU

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tools employed to assess national and regional innovation ecosystems and their entrepreneurial component, in particular, the European Innovation Scoreboard (EIS) and the Regional Innovation Scoreboard (RIS). It outlines the characteristics of individual EIS indicators that are outside the scope of state statistics in 2023 and assesses the capacity of the State Statistics Service to measure them. Among these indicators, those that were duplicated in another, more comprehensive EU toolkit for assessing the digital performance of Europe—the Digital Economy and Society Index (DESI)—were identified. Following a Ukrainian government decree, these indicators will be collected and published annually starting in 2025. Finally, the article outlines the conditions for the inclusion of Ukrainian regions in the RIS, which will be facilitated by the adopted statistical classification of territorial units of Ukraine (NUTS-UA).

Key Words:

innovations, innovation ecosystem, entrepreneurship, state statistics, indicators, institutional basis, EU regulations, digitalization, recovery.

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Problem Statement and Literature Review

The restoration of the Ukrainian economy and overcoming of its structural and technological backwardness (Kindzerskyi, 2023) largely depend on strengthening the national innovation ecosystem, creating favorable conditions for entrepreneurship, and fostering cooperation between enterprises, particularly small and medium-sized enterprises (SMEs), and scientists, investors, and international partners. After all, SMEs account for over 80% of employment and two-thirds of the country's value added (Ministry of Economy of Ukraine, 2024a). Consequently, government strategic documents recognize support for SMEs as the foundation of a new economic model for Ukraine (National Recovery Council, 2022, p. 3) and as a key instrument for its recovery and reconstruction (Ministry of Economy of Ukraine, 2024b, pp. 11, 24). This necessitates the implementation of government decisions aimed primarily at the accelerated development of technological sectors within the manufacturing industry and knowledge-intensive services. Additionally, it requires incorporating principles of sustainability, resilience, regeneration, and the circular economy into policies and management systems at all levels, from the state to territorial communities. The state's priority should be to safeguard domestic production and use of domestic raw materials and labor, support science and education, stimulate innovation and entrepreneurship, and develop modern infrastructure (Pidorycheva et al., 2023). Consequently, the national statistical system must produce the necessary data for government bodies to facilitate informed decisions.

As part of the European integration process, Ukraine has committed to aligning its public policies with EU legislation and gradually implementing the *acquis communautaire*, including in the field of statistics.

The issues of the reform of Ukraine's state statistics and its adaptation to the international and European norms and standards are being addressed by both the authorities and the scientific community.

Accordingly, the State Statistics Service of Ukraine (Derzhstat), which is responsible for formulating and implementing state policy in the field of statistics, reports annually on the results of its activities (State Statistics Service of Ukraine, 2024), in particular regarding the adaptation of Ukrainian legislation to EU legislation and the approximation of national statistical methodology to the requirements of international and European standards.

The progress of Ukraine's implementation of the Association Agreement is monitored by the Government Office for Coordination of European and Euro-Atlantic Integration of the Secretariat of the Cabinet of Ministers of Ukraine (hereinafter referred to as the Government Office). Every year, starting in 2015, it prepares reports that provide information on the results of the implementation of the

Association Agreement as a whole and in its individual areas, including the area of «Statistics and Information Exchange» (Government Portal, 2024a).

The Ukrainian Center for European Policy, supported by the Representative Office of the Konrad Adenauer Stiftung in Ukraine, provides alternative assessments of the implementation of the Association Agreement. According to its estimates, the overall progress in fulfilling Ukraine's obligations under the Association Agreement for 2022 is 55% (72% according to the Government Office), while in the area of statistics, it is estimated to be 44.4% (96% according to the Government Office) (Ukrainian Centre for European Policy, 2023; Government Portal, 2024b).

Osaulenko (2017) considered the experience of implementing the principles of the European Statistics Code of Practice in the state statistical activity, as well as the related problems. Chervona and Parfentseva (2022) systematized the results of the implementation of the *acquis* in the field of statistics within national legislation, outlining Ukraine's obligations to adapt its national statistical methodology to the EU methodology. Zaiets (2020) reported on the assessment of the dynamics of the statistical potential of state statistics, substantiated the need to improve the quality of official statistical data, and suggested ways to solve these tasks. Yegorov and Gryga (2019) analyzed the compliance of the statistical indicators of the Eastern Partnership countries with EU standards in the field of digitalization and addressed the challenges of implementing the corresponding information and statistical base of the EU (specifically, the Digital Economy and Society Index) for measuring the digitalization process in Ukraine. At the same time, the scale and complexity of ensuring greater consistency and comparability of Ukrainian statistics with EU statistics requires further research to identify inconsistencies and problems in using Eurostat tools in national practice, in particular in the assessment of innovation ecosystems and their entrepreneurial components.

The **aim of the article** is to analyze the compliance of state statistics in the field of innovations with regulations and recommendations of the EU, and to outline the problems and opportunities for using EU tools to assess innovation ecosystems and their entrepreneurial component in national statistical practice. The results of this study will provide a scientific and informational basis for the modernization of state statistics in accordance with EU standards and best practices, allowing the state to make informed decisions on its basis.

Methodology

The theoretical and methodological foundations of the study are grounded in the provisions of institutional theory, which allowed to determine the influence of EU institutions on the development of state statistics in terms of improvement

of legislation, statistical methodology, and raising the quality of statistical activity in Ukraine. The methods of analysis and synthesis, comparative studies, and the structural-functional method were used to prepare the article.

The information base of this study includes international documents, regulations of the European Parliament and the Council (EU), implementing regulations of the Commission (EU), and communiqués and working papers of the European Commission. It also incorporates laws of Ukraine and other normative acts of the Cabinet of Ministers of Ukraine, Ministry of Economy of Ukraine, Ministry of Digital Transformation of Ukraine, and the State Statistical Service of Ukraine. Additionally, the study utilizes multi-component EU ratings assessing national and regional innovation ecosystems, innovation activity, and digital performance of enterprises, as well as state statistical observations, statistical classifications of the State Statistical Service, internet resources, and periodicals.

Research Results

The compliance of state statistics in the field of innovation with regulations and recommendations of the European Union

Ukraine's obligations to adapt its national statistical system to the requirements of European statistics are laid down in the Association Agreement between Ukraine and the EU (hereinafter referred to as the Association Agreement) (Chapter 5 «Statistics», Section V «Economic and sectoral cooperation», Articles 355-359) (Verkhovna Rada of Ukraine, 2023 a). In accordance with Article 355 of the Association Agreement, Basic Regulation (EC) No. 223/2009, which establishes the legal framework for the development, production and dissemination of European statistics, the Law of Ukraine «On Official Statistics» was developed and adopted (Verkhovna Rada of Ukraine, 2022), which came into force on January 1, 2023.

The Program for the development of official statistics until 2028, approved by the Government of Ukraine in 2023, outlines measures to ensure the implementation of the *acquis* in the field of statistics. It defines the main directions for the development of the national statistical system, namely: harmonization of state statistics with international and European norms and standards; digital transformation; and openness and accessibility of statistical information (Verkhovna Rada of Ukraine, 2023b).

Moreover, in the «negotiating framework» drafted by the European Commission for Ukraine's accession negotiations with the EU (European Commission,

2023a), statistics are included in the key, fundamental, chapters on EU enlargement, along with democracy, public administration reform, judiciary and fundamental rights, justice, freedom and security, public procurement, and financial control. These chapters are usually the focus of discussions during intergovernmental conferences on the conditions and reforms that a candidate country must fulfill in order to become a full member of the EU, and Ukraine is no exception.

In Negotiating Chapter 18 «Statistics», Ukraine is expected to undertake the following measures in the current year 2024 (European Commission, 2023a, p. 83):

- Strengthen the institutional independence and administrative capacity of the State Statistics Service of Ukraine, and enhance coordination among relevant bodies to improve the quality of statistics;
- Adopt the national strategy for the development of Ukrainian statistics covering the period 2024-2029; and
- Increase the production and ensure the transfer of high-quality and timely data to Eurostat.

In the specialized statistical collection of the State Statistics Service for 2020 (State Statistics Service of Ukraine, 2021, c. 240), it is noted that when preparing statistical data on the scientific and innovative activities of organizations (enterprises), the State Statistics Service was guided by Regulation (EU) No. 995/2012 concerning the development of statistics on science and technology. It should be noted that this Regulation ceased to be in force on December 31, 2020, by virtue of Regulation (EU) No. 2020/1197 (EUR-Lex, 2020a). At the same time, looking at the methodology for the assessment of innovative activities of enterprises, approved by the State Statistics Service in December 2022 (State Statistics Service of Ukraine, 2022), there is no reason to claim that the national statistical methodology does not comply with the relevant EU regulations and recommendations. The State Statistical Observation (SSO) «Innovative activity of enterprises» is based on the requirements of Regulation (EU) No. 2019/2152 on European business statistics, Regulation (EU) No. 2022/1092, establishing technical specifications for data requirements on the topic of «Innovation», as well as the recommendations of the OECD and Eurostat on accounting for innovation (Oslo Manual, 4th edition) and the Community Innovation Survey (CIS) questionnaire (Eurostat, 2020).

However, due to the suspension of the publication of current statistical information during the period of martial law, it is not possible to assess all components of the quality of the SSO, in particular its accuracy, comprehensibility, consistency, and comparability. As noted by the Ministry of Digital Transformation of Ukraine (2023, p. 68), during this period, the State Statistics Service received information on the initiative of enterprises that were able to adapt to new operating conditions, including personnel shortages, disruptions in business processes and logistics, and changes in market conditions.

Along with that, upon analyzing the most recent statistical information available, it becomes evident that data is provided annually and for three-year periods (2016-2018; 2018-2020) for various indicators, mainly at the level of two-digit codes (21; 23; 24), or aggregated by divisions and sections of the Classification of Types of Economic Activities (KVED) (e.g., 19+20+21+22; 46+H+J+K+71+72+73). At the same time, the dissemination of data at the three-digit level (e.g., 25.4 «Manufacture of weapons and ammunition,» 30.1 «Construction of ships and boats,» 30.3 «Manufacture of aircraft, spacecraft, and related equipment») is problematic. In this case, the samples would contain a limited number of enterprises, making it impossible to ensure the confidentiality of the data provided to state statistical bodies. This, in turn, violates international and European standards, as well as the requirements of the Law of Ukraine «On Official Statistics».

Moreover, enterprises subject to observation include those with 10 or more employees classified under Sections B, C, D, E, H, J, K, Division 46 of Section G, and Divisions 71-73 of Section M according to KVED. The rationale for this coverage is most likely due to the much lower innovation intensity observed in microenterprises, as well as enterprises operating in sectors such as agriculture (Section F), temporary accommodation and catering services (Section I), or real estate transactions (Section L). These enterprises typically do not require the same level of monitoring and regulation as enterprises in the manufacturing sector (Section C) or in the high-technology knowledge-intensive services (Section J; Division 72 Section M); therefore, there is no need to include them in systematic statistical observations. It is important to note that these specific aspects of the national statistical methodology satisfy the requirements of Regulation (EU) No. 2022/1092 (EUR-Lex, 2022). Consequently, proposals in the Draft Strategy for the Development of the Innovation Ecosystem in Ukraine (Ministry of Digital Transformation of Ukraine, 2023, p. 68) to include agricultural enterprises and parts of the service sector in statistical observations cannot be taken into consideration, as they contradict European standards.

EU tools for assessing national and regional innovation ecosystems and their entrepreneurial component

Additional insight into the conformity of state innovation statistics with EU best practices can be gained from the European Innovation Scoreboard (EIS), a tool for assessing the state and providing comparative characteristics of national innovation ecosystems among EU member states and other countries, including those associated with the EU. The EIS helps countries to assess the relative advantages (strengths) of their innovation ecosystems and to identify their weaknesses, i.e., areas in which they are lagging behind and which should receive priority attention (European Commission, 2023b).

This tool was developed by the European Commission's Directorate-General for Research and Innovation and was first published in 2001 as part of the EU's Lisbon Strategy. The EIS system of metrics presented in the first edition has been revised several times: the first time when it was adapted to the key component «Innovation Union» of the Strategy «Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth»; and for the second time in 2021, when it was necessary to add metrics to track progress towards achieving the EU's new strategic goals, in particular the green and digital transition under the European Green Deal (EUR-Lex, 2019).

The current third edition of the European Innovation Scoreboard covers all EU Member States, 11 other European countries and, at a less detailed level, 11 global competitors: the United States, Canada, Australia, China, Japan, South Korea, Brazil, Chile, India, Mexico, and South Africa. It identifies four main types of activities—framework conditions, investments, innovation activities, and impacts—across 12 innovation dimensions (groups), containing a total of 32 indicators. Each type of activity includes an equal number of indicators, contributing equally to the Summary Innovation Index (SII). In comparison, the second edition of the EIS featured 10 innovation dimensions and 27 indicators.

Figure 1 shows the current system of metrics used in the European Innovation Scoreboard (Hollanders, 2023). Here, the symbol «✓» is used to mark new indicators that have not been assessed in previous editions of the EIS, and « » marks new groups (innovation dimensions) for assessment, as well as clarifies indicator «1.1.1 New doctorate graduates», which is currently measured solely based on STEM education.

Relative to the EU-average SII indicator, member countries are divided into four productivity groups:

I. «Innovation Leaders»: Productivity of national innovation ecosystems >125% of the EU average. In 2023, these countries were Denmark, Sweden, Finland, the Netherlands, and Belgium.

II. «Strong Innovators»: The productivity of innovation ecosystems is between [100%; 125%] of the EU average. These countries include Austria, Germany, Luxembourg, Ireland, Cyprus, and France.

III. «Moderate Innovators»: The productivity of innovation ecosystems is in the range [70%; 100%] of the EU average. Estonia, Slovenia, the Czech Republic, Italy, Spain, Malta, Portugal, Lithuania, Greece, and Hungary are characterized by this level of productivity.

IV. «Emerging Innovators»: The productivity of national innovation ecosystems is <70% of the EU average. This category includes Croatia, Slovakia, Poland, Latvia, Bulgaria, Romania, and Ukraine.

Figure 1

System of metrics used in the third, current edition of the European Innovation Scoreboard

<p>FRAMEWORKS</p> <p>Human Resources</p> <p>1.1.1 New doctorate graduates in STEM (per 1000 population aged 25-34)</p> <p>1.1.2 Population aged 25-34 with tertiary education (%)</p> <p>1.1.3 Life-long learning (all individuals aged 25-34 in private households)</p> <p>Attractive Research Systems</p> <p>1.2.1 International scientific co-publications (per 1 million population)</p> <p>1.2.2 Top 10% most cited publications worldwide (% of a country's total scientific publications)</p> <p>1.2.3 Foreign doctorate students (% of all doctorate students)</p> <p>Digitalization</p> <p>1.3.1 Broadband penetration (number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mbit/sec to total number of enterprises)</p> <p>✓ 1.3.2 Individuals who have above basic overall digital skills (% share of total population aged 16-74)</p> <p>INVESTMENTS</p> <p>Finance and Support</p> <p>2.1.1 R&D expenditure in the public sector and the higher education sector (in % of GDP)</p> <p>2.1.2 Venture capital investments (in % of GDP)</p> <p>✓ 2.1.3 Direct government funding and government tax support for business R&D (in % of GDP)</p> <p>Firm Investments</p> <p>2.2.1 R&D expenditure in the business sector (in % of GDP)</p> <p>2.2.2 Non-R&D innovation expenditure (in % of total turnover for all enterprises)</p> <p>✓ 2.2.3 Innovation expenditures per person employed</p> <p>Use of Information Technologies</p> <p>2.3.1 Enterprises providing training to develop or upgrade ICT skills of their personnel</p> <p>✓ 2.3.2 Employed ICT specialists (as a percentage of total employment)</p> <p>INNOVATION ACTIVITIES</p> <p>Innovators</p> <p>3.1.1 Small and medium enterprises (SMEs) introducing product innovations (in % of total number of SMEs)</p>	<p>✓ 3.1.2 SMEs with business process innovations (% of total number of SMEs)</p> <p>Linkages</p> <p>3.2.1 Innovative SMEs collaborating with others (% of total SMEs)</p> <p>3.2.2 Public-private research co-publications (per 1 million population)</p> <p>✓ 3.2.3 Job-to-job mobility of human resources in Science & Technology (in % of working age population aged 25-64)</p> <p>Intellectual Assets</p> <p>3.3.1 Patent applications filed under the Patent cooperation Treaty (PCT) per billion GDP in Purchasing Power Standard</p> <p>3.3.2 Trademark applications applied for at European Union Intellectual Property Office (EUIPO) (in % of GDP in Purchasing Power Standard)</p> <p>3.3.3 Design applications applied for at EUIPO (in % to GDP in Purchasing Power Standard)</p> <p>IMPACTS</p> <p>Employment Impacts</p> <p>4.1.1 Employment in knowledge-intensive activities (in % of total employment)</p> <p>✓ 4.1.2 Employment in innovative enterprises (in % of total employment for enterprises with 10 or more employees)</p> <p>Sales Impacts</p> <p>4.2.1 Exports of medium and high-technology products (as a percentage of total exports)</p> <p>4.2.2 Exports of knowledge-intensive services (as a percentage of total services exports)</p> <p>4.2.3 Sales of new-to-market and new-to-firm innovations (in % of total turnover for all enterprises)</p> <p>Environmental Sustainability</p> <p>✓ 4.3.1 Resource productivity (amount of GDP per unit of direct material consumed)</p> <p>✓ 4.3.2 Air emissions by fine particulates PM2.5 in the manufacturing sector per unit of value added in the processing industry</p> <p>✓ 4.3.3 Development of environment-related technologies (number of environment-related innovations to total number of patents)</p>
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Source: Compiled based on Hollanders (2023).

The European Innovation Scoreboard is complemented by the Regional Innovation Scoreboard (RIS), which assesses the performance of innovation ecosystems across 239 regions and 22 member states of the EU, the United Kingdom, Norway, Serbia, and Switzerland. The RIS follows a new EIS methodology and measures 21 out of 32 indicators due to lower data availability at the regional level (Table 1).

Table 1

Comparison of indicators included in the European Innovation Scoreboard (EIS) and the Regional Innovation Scoreboard (RIS)

	EIS 2023	RIS 2023
FRAMEWORKS		
Human Resources	<i>New doctorate graduates in STEM per 1000 population aged 25-34</i>	<i>No regional data available</i>
	Percentage of population aged 25-34 with full higher education	Identical
	Life-long learning	Identical
Attractive Research Systems	International scientific co-publications per 1 million population	Identical
	Top 10% most cited publications worldwide	Identical
	<i>Foreign doctorate students</i>	<i>No regional data available</i>
Digitalization	<i>Broadband penetration</i>	<i>No regional data available</i>
	Individuals who have above basic overall digital skills	Own estimates using Households with broadband access
INVESTMENTS		
Finance and Support	R&D expenditure in the public sector and the higher education sector	Identical
	<i>Venture capital investments</i>	<i>No regional data available</i>
	<i>Direct government funding and government tax support for business R&D</i>	<i>No regional data available</i>
Firm Investments	R&D expenditure in the business sector	Identical
	Non-R&D innovation expenditure	Data on SMEs
	Innovation expenditures per person employed	Data on SMEs
Use of Information Technologies	<i>Enterprises providing training to develop or upgrade ICT skills of their personnel</i>	<i>No regional data available</i>
	Employed ICT specialists	Estimates using ICT employment

	EIS 2023	RIS 2023
INNOVATION ACTIVITIES		
Innovators	Small and medium enterprises (SMEs) introducing product innovations	Identical
	SMEs introducing business process innovations	Identical
Linkages	Innovative SMEs collaborating with others	Identical
	Public-private research co-publications per 1 million population	Identical
	<i>Job-to-job mobility of human resources in Science & Technology</i>	<i>No regional data available</i>
Intellectual Assets	Patent applications filed under the Patent cooperation Treaty (PCT) per billion GDP in Purchasing Power Standard	Identical
	Trademark applications applied for at European Union Intellectual Property Office (EUIPO)	Identical
	Design applications applied for at EUIPO	Applications for patenting industrial designs
IMPACTS		
Employment Impacts	Employment in knowledge-intensive activities	Employment in low- and medium-high-technology manufacturing and knowledge-intensive services
	Employment in innovative enterprises	Data on SMEs
Sales Impacts	<i>Exports of medium and high-technology products as a percentage of total exports</i>	<i>No regional data available</i>
	<i>Exports of knowledge-intensive services as a percentage of total services exports</i>	<i>No regional data available</i>
	Sales of new-to-market and new-to-firm innovations	Data on SMEs
Environmental Sustainability	<i>Resource productivity</i>	<i>No regional data available</i>
	Air emissions by fine particulates PM2.5 in the manufacturing sector	Impact of fine particulates (PM2.5)
	<i>Development of environment-related technologies</i>	<i>No regional data available</i>

Source: compiled by the author based on Hollanders and Es-Sadki (2023).

Ukraine in multi-component EU ratings assessing innovation ecosystems, innovation activity, and digital performance of enterprises

Ukraine has been included in the European Innovation Scoreboard since 2016. However, the European Commission has repeatedly emphasized the limited availability of Ukraine's data. In the EIS 2023, for example, out of a total of 32 indicators, data from Ukraine is accessible for only 21. The European Commission notes that the country is still included in the EIS for historical reasons, but unless the situation changes, it will be excluded from future reports (Publications Office of the European Union, 2021, p. 76). There is already a precedent: Israel was excluded from the EIS in 2023 due to a lack of statistical information. The problem for Ukraine is that the EIS assesses not only the innovation activities of enterprises, but also other dimensions of the innovation ecosystem, for which the national statistical methodology has not yet been fully harmonized with European standards. Table 2 shows indicators for which data for Ukraine are not available in the third edition of the EIS for 2023. Let us comment on some of these indicators.

First, the absence of indicator 3.1.2 «SMEs introducing business process innovations, percentage of SMEs (% of the total number of SMEs)» for Ukraine in the EIS is most likely explained by the suspension of the collection and publication of current statistical data during the period of martial law. Judging by the indicators in the SSO «Innovative activity of enterprises», which are collected for two types of innovations (product and process) in accordance with the current 4th edition of the Oslo Manual, there are no problems with harmonizing the methodology for assessing this indicator with European standards.

The utility of measuring indicator 3.1.2 in the system of state statistics is conditioned by the need to track all areas of innovation activity of SMEs. Together with indicator 3.1.1 «Enterprises introducing product innovations (percentage of SMEs)», it would make it possible to determine the level of SMEs' involvement in various types of innovation activities.

It is worth adding that the focus of indicators 3.1.1 and 3.1.2 on small and medium-sized enterprises is explained by their importance in ensuring the economic and technological sovereignty of the European Union. SMEs make up 99% of all EU enterprises, employ around 100 million people, and contribute more than half of Europe's GDP (European Commission, 2019). Recognized as a key category of enterprises for the green transition and digital transformation, SMEs are essential for the development of the modern, resource-efficient, and competitive EU economy (EUR-Lex, 2019).

Table 2

Indicators for which data from Ukraine are not available in the third edition of the EIS for 2023

FRAMEWORKS	
Human Resources	1.1.2 Percentage of population aged 25-34 with higher education (%)
	1.1.3. Life-long learning (all individuals aged 25-34 in private households)
Digitalization	1.3.1 Broadband penetration (number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mbit/sec to total number of enterprises)
	1.3.2 Individuals who have above basic overall digital skills (% share of total population aged 16-74)
INVESTMENTS	
Firm Investments	2.2.3 Innovation expenditures per person employed
Use of Information Technologies	2.3.2 Employed ICT specialists (as a percentage of total employment)
INNOVATION ACTIVITIES	
Innovators	3.1.2 SMEs introducing business process innovations, percentage of SMEs
Linkages	3.2.3 Job-to-job mobility of human resources in Science & Technology (in % of working age population aged 25-64)
IMPACTS	
Employment Impacts	4.1.2 Employment in innovative enterprises (in % of total employment for enterprises with 10 or more employees)
Environmental Sustainability	4.3.1 Resource productivity (amount of GDP created per unit of direct material consumed)
	4.3.2 Air emissions by fine particulates PM2.5 in the manufacturing sector per unit of value added in the processing industry

Source: compiled by the author based on Hollanders (2023).

Through the *SME Strategy for a Sustainable and Digital Europe*, the European Commission seeks to support and strengthen SMEs of all sizes and activities, from innovative start-ups to traditional industries (EUR-Lex, 2020b). As mentioned above, the support of SMEs in Ukraine is also a priority, which makes it imperative to systematically monitor and publish the results of their activities in official sources of state statistical bodies. At present, the main task of the state is to create the most favorable conditions for enterprises so that they can effectively withstand the challenges of war, adapt to changes, and recover from crises and shocks. This will ensure that enterprises not only survive, but also actively develop and cultivate qualities of resilience, enabling the State Statistics Service to collect complete information from enterprises on their innovation activities.

Second, the absence of indicators 2.2.3 «*Innovation expenditures per person employed*», 3.2.3 «*Job-to-job mobility of human resources in Science & Technology*» (as a percentage of the working age population aged 25-64 years), and 4.1.2 «*Employment in innovative enterprises*» (as a percentage of total employment in enterprises with 10 or more employees) can be attributed to several concurrent reasons. On the one hand, these indicators are new and have only recently (since 2022) been included in the list of EIS indicators (see Figure 1), so state statistics may not yet be ready to provide such data to Eurostat. On the other hand, the challenges of wartime conditions have affected the collection and publication of state statistics.

Judging by the SSO form No. 2-Innovation «Survey of the innovative activity of the enterprise for the period 2020-2022» and the corresponding indicators distributed by state statistics bodies, indicator 2.2.3 can be measured. It is calculated for enterprises of all sizes in the EIS, while the RIS calculates this indicator for SMEs. This allows for assessing the effectiveness of innovation expenditures relative to the total number of workers employed in innovative enterprises. The same conclusion can be drawn from indicator 4.1.2. The source of data for its measurement in the EU is the *Community Innovation Survey* (CIS) – a questionnaire guiding state statistical authorities in collecting and disseminating information on the innovation activities of enterprises (State Statistics Service of Ukraine, 2022). Measuring this indicator will make it possible to determine the place of innovatively active enterprises (IAEs) in the employment structure and, consequently, the level of influence of innovation on the country's economy. An increase in the share of employment in the IAEs indicates a rise in innovation activity in the economy and may signal an improvement in the innovation and business environment and the effectiveness of government innovation policy instruments.

Indicator 3.2.3 measures the percentage of the population aged 25-64 who have changed jobs in the course of their career over a 12-month period. The value of this indicator is that it can indicate the interest of professionals in acquiring new skills and experience or, conversely, their tendency to be conservative. The utility of its measurement lies in the fact that professional mobility stimulates the generation of new knowledge. This happens through the exchange of ideas,

experiences and best practices, the expansion of networks of contacts, and the creation of a more creative environment conducive to the production of innovation. Workforce mobility benefits companies by attracting scientists from other sectors (public, private, non-profit or higher education) to work in their laboratories and research departments. This allows companies to build teams with diverse skills and experiences and to use their ideas to advance their innovative developments. In order to calculate this indicator and provide timely and reliable statistics to Eurostat, Ukraine should, inter alia, implement Regulation (EC) No. 452/2008, which establishes a uniform framework for the systematic production of statistical data in the field of education and lifelong learning (EUR-Lex, 2021).

Third, indicators 1.3.1 «Broadband penetration», 1.3.2 «Individuals who have above basic overall digital skills» (% of the total population aged 16-74 years), and 2.3.2 «Employed ICT specialists» (as a percentage of total employment) reflect the level of digitalization of national innovation ecosystems and partially duplicate the indicators found in another, more comprehensive EU toolkit for assessing Europe's digital performance—the *Digital Economy and Society Index* (DESI). Starting from 2023, according to the Digital Decade 2023 Policy Framework, the DESI has been integrated into the «State of the Digital Decade» report (European Commission, 2023c).

The *DESI 2023 Dashboard for the Digital Decade* (hereafter referred to as DESI 2023) contains 34 indicators grouped into four dimensions: digital skills, digital infrastructure, digital transformation of enterprises, and digitalization of public services. Among them, the indicator «Above basic overall digital skills» (desi_1a3) is identical to EIS indicator 1.3.2, while the indicator «ICT specialists» (desi_1b1) is identical to EIS indicator 2.3.2. However, EIS indicator 1.3.1 is not measured in the DESI 2023, which instead reports the share of households with fixed broadband connections of at least 100 Mbps. It is clear that focusing on enterprises rather than households is more informative for assessing the digital potential of national innovation ecosystems, so the choice of this particular object for EIS observation is logical.

The approval of the list of indicators for the Digital Economy and Society Index (DESI) by Order No. 774-r of the Cabinet of Ministers of Ukraine dated 5 September, 2023 (Verkhovna Rada of Ukraine, 2023c) allows the State Statistics Service to conduct relevant observations (SSO «Survey of living conditions of households», «Use of information and communication technologies in enterprises») and measure indicators 1.3.2 and 2.3.2. According to this Order (Verkhovna Rada of Ukraine, 2023c), the collection and publication for indicators «Number of persons with above basic digital skills» and «Number of specialists employed in the field of information and communication technologies» will be carried out annually from 2025 onwards. At the same time, attention should be paid to a discrepancy in the age group targeted for the second indicator compared to European standards: Derzhstat surveys professionals aged 15-74, while Eurostat uses the age range of 16-74. Regarding indicator 1.3.1, Ukraine's values ap-

peared in the EIS reports for 2018-2021. However, presumably due to the ongoing war, these data were not included in the EIS reports for 2022-2023.

When assessing the degree of harmonization of the Ukrainian statistical system with that of the EU, it should be noted that Ukrainian regions are not included in the Regional Innovation Scoreboard (RIS). This is mainly due to the long-standing discrepancy between the Ukrainian statistical classification of territorial units and the EU standard established by Regulation (EU) No. 1059/2003, which defines the common Nomenclature of Territorial Units for Statistical Purposes (NUTS) (EUR-Lex, 2024). The State Statistics Service of Ukraine developed the corresponding statistical classification of territorial units (NUTS-UA) in 2021, which was approved by the Decree of the Ministry of Economy of Ukraine in 2022 (Ministry of Economy of Ukraine, 2022). Currently, this classification enables the production of national statistical information that is spatially comparable with that of the EU member countries and the inclusion of Ukraine's territorial units in the RIS observations. However, this also requires the adaptation of regional statistics to the statistical methodology of the EU.

Conclusions

Strengthening the national innovation ecosystem and its entrepreneurial component is the cornerstone of Ukraine's economic recovery. To a large extent, this goal can be achieved if the government significantly improves the conditions for the development of the innovation ecosystem, entrepreneurship and cooperation between enterprises, especially SMEs, which generate the lion's share of the country's value added, and scientists, investors, and international partners. Accordingly, the possibility of making informed government decisions arises in the presence of high-quality and reliable statistical information produced by the national statistical system, harmonized with European standards.

Ukraine's commitment under the Association Agreement to align its state statistics with EU norms and standards are prioritized by the «negotiating framework», which identifies statistics as one of the fundamental areas, on the state of which the country's prospects for EU membership depend. To this end, the State Statistics Service has undertaken measures in recent years to enhance legislation and improve the quality of statistical activity. Specifically, the national statistical methodology for assessing enterprise innovation activities has been brought into line with Regulation (EU) No. 2019/2152 on European business statistics, Regulation (EU) No. 2022/1092 establishing technical specifications for data requirements on the topic of «Innovations», as well as current recommendations of the Oslo Manual and the CIS Innovation Survey questionnaire. However, problems still remain with the timely provision of relevant statistical information, the publication of which was effectively suspended during the period of martial law. This also

makes it impossible to evaluate all components of the quality of the current SSO «Innovation activity of enterprises» in terms of accuracy, consistency, comparability, and comprehensibility of statistical data.

The European Innovation Scoreboard (EIS) is another source of information that can be used to draw conclusions about the conformity of national statistical methodology with European standards in the field of assessment of national innovation ecosystems and their entrepreneurial component. Ukraine has been included in this ranking since 2016. Data from Ukraine are available for 21 out of 32 indicators included in the third, current edition of the EIS. Not included are indicators of the level of human potential, digitalization, environmental sustainability, innovation expenditure, and the linkages of enterprises within the national innovation ecosystem. Looking at the SSO «Innovation activity of enterprises», SSO Form No. 2 «Innovation», as well as at the list of indicators included in the Digital Economy and Society Index (DESI), which was approved by the government decree of September 2023, several of these 11 indicators can already be measured by the State Statistics Service. In particular, these are indicators 3.1.2 «SMEs introducing business process innovations», 2.2.3 «Innovation expenditure per person employed», 4.1.2 «Employment in innovative enterprises», 1.3.2 «Individuals who have above basic overall digital skills», and 2.3.2 «Employed ICT specialists». The last two, which are identical to the DESI 2023 indicators «Above basic digital skills» (desi_1a3) and «ICT specialists» (desi_1b1), respectively, will be collected and published annually by the State Statistics Service from 2025 onwards. The measurement of other EIS indicators requires the implementation of the respective EU regulations, in particular Regulation (EC) No. 452/2008, which establishes a common basis for the systematic production of statistics in the field of education and lifelong learning, the improvement of legislation and statistical methodology in accordance with the acquis, European norms and standards.

The assessment of innovation ecosystems at the regional level in the EU is carried out using the Regional Innovation Scoreboard (RIS), which follows the EIS methodology. Ukrainian regions are not included in the RIS. The statistical classification of territorial units of Ukraine (NUTS-UA), which will enable the generation of national statistical information that is spatially comparable with that of the EU member countries, will help to address this issue. However, this will also require the gradual harmonization of regional statistics with European standards and practices, which is an area for further research.

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