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EVALUATION OF R&D AND INNOVATION POLICY IN UKRAINE: MISSING ELEMENTS

VITALII GRYGA, OLHA KRASOVSKA AND YULIIA RYZHKOVA
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ABSTRACT

The paper discusses a comprehensive approach suggested for the evaluation of the research, development and innovation (RDI) domain in Ukraine aiming to design evidence-based policy making. It is built around four main elements, namely the evaluation of research and development (R&D), the evaluation of innovation performance, performance the assessment of research institutions, and policy evaluations. The novelty of the approach lies in considering the complexity of the evaluation of the RDI domain through the prism of its elements. This paper analyses existing evaluation approaches for each element trying to identify the 'missing elements' needed for evidence-based RDI policy in Ukraine.

It is suggested to approach the evaluation of R&D performance using a model that examines the long-term correlation between the dynamics of scientific personnel and the science intensity of GDP. In turn, the authors consider composite indices as a proper way to analyse innovation performance, despite the controversial issues described in the paper.

The paper also highlights the absence of the unified approach to the assessment of research institutions' performance in Ukraine, despite the attempt to unify the assessment which recently has been undertaken. The paper argues that it's too early to assess the relevance of the approach.

The conducted analysis leads to the conclusion that Ukraine demonstrates good potential for ensuring only two of the four elements of the complex evaluation of the RDI domain, namely evaluation of R&D performance and

institutions, while evaluation of innovation performance and policy evaluations are lagging. Policy evaluations remain the weakest element of the complex evaluation system of RDI policy predominantly because of the absence of an independent evaluation culture.

Keywords: R&D and innovation policy, innovation performance, policy evaluations, assessment of research institutes, evaluation framework

INTRODUCTION

'Evidence-based' policymaking has become not only a common trend but rather a 'must have' for ensuring effective policy design (Newman et al, 2016). Meanwhile, «most academic research on public policy achieves little influence in government» (Mead, 2015), raising questions about the sources of evidence that fuel policy-making processes. Extensive research exists evaluating RDI policies and instruments. Many studies address financial instruments, particularly subsidies and taxes (Negassi and Sattin, 2019; Czarnitzki and Lopes Bento, 2010; Shim and Shin, 2022), using different econometric techniques. A more general approach to the evaluation of R&D policy was proposed by E. Arnold (2004), which focused on different levels of the system. Transitioning from the theory to practice, there is a comprehensive document outlining an evidence framework on monitoring and evaluation of the EU's research and innovation programme. It addresses nine key impact pathways, emphasizing more on impact rather than merely tracking inputs and outputs (EC, 2023), thus placing impact evaluations at the core of evidence-based policymaking.

Ukraine inherited a well-developed R&D system but has been unable to economically benefit from it. The country's R&D potential has been deteriorating for a prolonged period. However, recent reforms in RDI domain included updating the legislation, deeper EU integration, the establishment of a new R&D funding body based on international experience. An update of the legislation framework in 2015-2016 offered some hope for improving the situation in science and innovation. Nevertheless, these changes did not increase either the demand for regular RDI-policy evaluation or policymakers' awareness of its necessity.

At the same time, the active roles of civil society and international organisations – particularly the European Union (EU) and its member states – in supporting Ukrainian reforms have highlighted the need to ensure evidence-based policymaking across various domains, including RDI.

For example, the new law on official statistics, adopted in 2023, explicitly suggests that government authorities utilize the produced data for decision-making. In 2016-2017, upon request from the Ministry of Education and Science of Ukraine (MESU), the European Commission conducted a peer review of the Ukrainian research and innovation system. The review emphasized the necessity of setting up "...a system to continuously monitor the development of STI policies in Ukraine and introduce a full-fledged evaluation culture and system for research and innovation policy" (EC, 2017).

Bringing evidence to the core of policymaking process becomes even more critical during economic crises, when public fundings are limited. Although the full-scale war in Ukraine is ongoing, discussions on the different modalities for the recovery process have already become quite active. A series of recovery conferences held after the invasion brought to the agenda the necessity to have a clear vision of multi-optional recovery strategies. The Ukraine Facility Plan, which serves as the basis for the implementation of the EU's financial support programme for Ukraine in 2024-2027, replaced the Ukraine Recovery Plan, previously characterized by loosely connected ideas and proposals rather than constituting a coherent strategic document. Therefore, the authors believe this is a crucial moment to raise awareness among policy makers and policy implementers as well as civil society regarding the importance of evidence-based policymaking and to conceptualize and RDI evaluation framework by revising previous experience through contemporary evaluation approaches.

METHOD /APPROACH

In this study, we rely on Arnold's approach to R&D policy evaluation which should have three levels (Arnold, 2004):

- traditional evaluation of individual interventions, such as programmes;
- assessment of the overall 'health' of RDI systems (including performance, connectivity, capabilities);
- subsystems evaluation or 'bottleneck analysis', which explores the systems role of institutions, classes of actors and clusters. It is based on the results from previous levels and proposes performance improvements of RDI system parts.

Based on the described approach, we explore the system of RDI evaluations in Ukraine, which is supposed to serve as the core of a comprehensive evidence-

based policymaking process in the mentioned domain. For this purpose, we consider four primary elements of a comprehensive evaluation system in RDI domain (see Figure 1):

1. Evaluation and assessment of research institutions and researchers.
2. Evaluation of R&D performance.
3. Evaluation of innovation performance.
4. Policy evaluations.

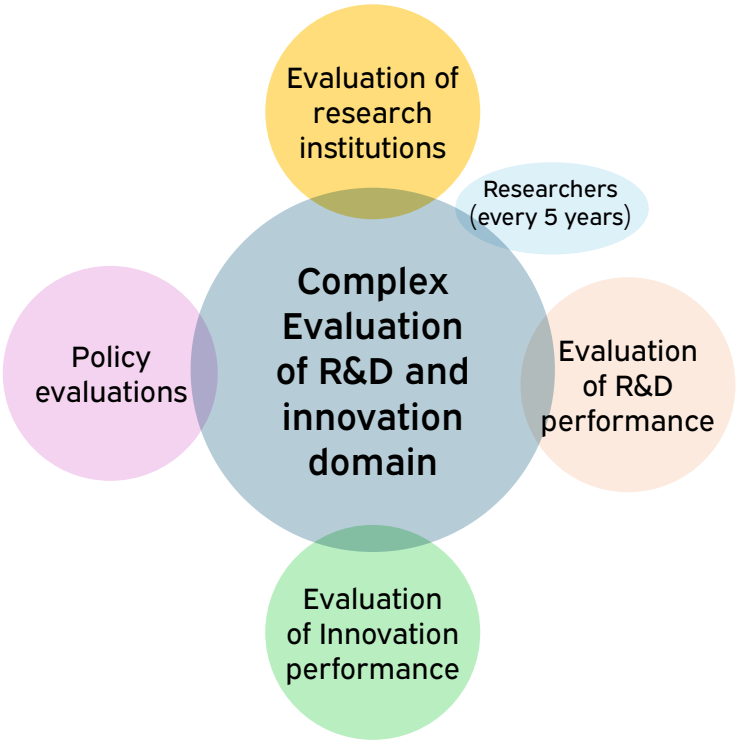

Figure 1. Building elements of the complex evaluation system in R&D and innovation domains
Source: developed by authors

Through a combination of various methods (desk research and secondary data analysis, including statistical analysis and econometric techniques), we investigated current evaluation practices in each component to identify the 'missing elements' necessary for evidence-based RDI policy in Ukraine. The data includes official statistics on RDI and economic development, official legislation, regarding the evaluation of research institutes and researchers as well as analytical reports, produced by international experts within the UNECE, the EU Policy Support Facility and other initiatives.

The study is based on the assumption that properly evaluation all aforementioned components which are essential for effectively assessing a complex domain such as RDI. Consequently, this contributes evidence-based policy, which in turn drives sustainable economic development.

A BRIEF OVERVIEW OF THE UKRAINIAN RDI SYSTEM

Since its independence, Ukraine has inherited a Soviet-type RDI ecosystem characterised by a high R&D intensity of about 2% of GDP and approximately 450,000 research-oriented personnel. However, the prolonged economic transformation, the disruption of previous ties with Soviet partners and inefficient governance and policymaking have led to the deterioration of the R&D sector. Figure 2 presents the long-term dynamics of the research intensity of GDP and the share of the labour force involved in R&D (per 1000 of employees aged 15-70). It shows that even decades, after the shock following the collapse of the Soviet Union, the R&D sector is still struggling and shrinking. Currently, R&D funding is nearly seven times lower (0.33% of GDP) than the EU average and the number of R&D personnel is four times smaller.

The low level of RDI funding is attributed to persistent budget constraints and the prevailing attitude of the government, especially the Ministry of Finance of Ukraine, which has traditionally viewed the RDI sector as a fiscal burden. They have consistently demanded evidence of the value added generated by science, including its economic or social impact. Formal compliance of public R&D funding with fixed in budget plans indicators has not been sufficient for the government to consider increasing R&D funding. At the same time, no substantial evaluations at medium or large scale have been carried out for RDI programmes, strategies, or policy instruments.

However, a few nationwide evaluation-like exercises, supported by international institutions upon request from the MESU, are worth mentioning. The first is the UNECE Innovation performance, review of Ukraine (UNECE, 2013). It provides an examination of the RDI system, the institutional framework for innovation policy and the various mechanisms and instruments of public support for innovation in the country, along with valuable policy recommendations. However, the study did not evaluate the performance or impact of existing policies. The second exercise is the EU Horizon 2020 Policy Support Facility Peer Review of the Ukrainian Research and Innovation System (EC, 2017). EU experts developed 30 recommendations to raise the quality and relevance of the science base. Most of them were considered by MESU, gradually apart from those associated with an additional increase in public spending on RDI.

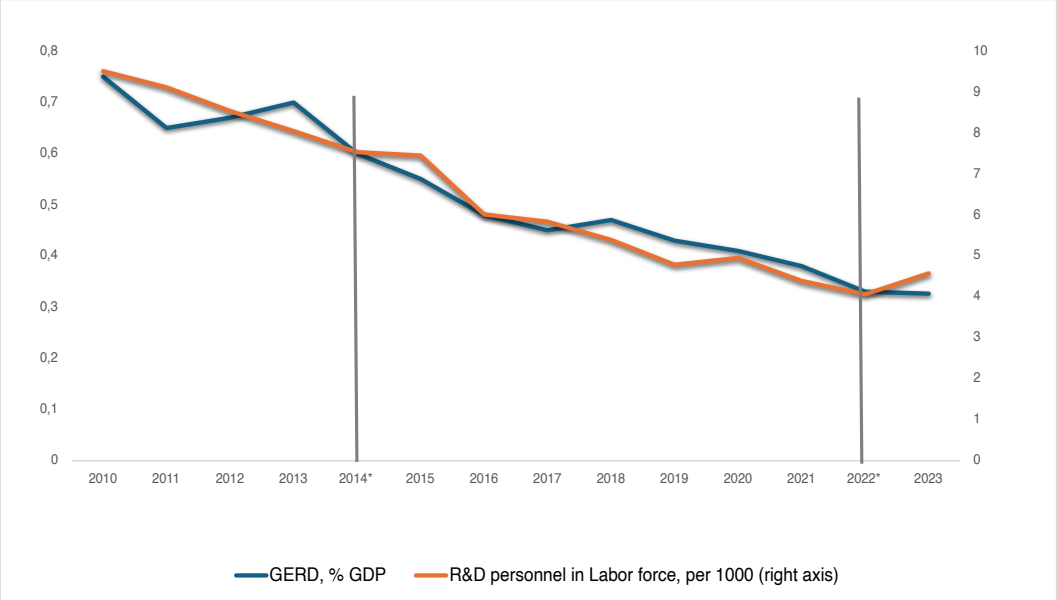

Figure 2. Main indicators of the R&D system dynamic of Ukraine
*) punctured lines reflects Russian invasions and military actions.
Source: compiled by authors, based on data from Ukrainian Statistic Service (Ukrstat).

Currently, the RDI system of Ukraine consists of diverse players, including the National Academy of Sciences of Ukraine (NASU), sectoral academies of sciences, higher education institutions (both public and private universities), other R&D institutions and private research-oriented companies (see Annex I). To build stronger links between science and business, initiatives such as science parks, startup incubators, acceleration programmes and innovation-oriented educational programmes have also been established. The main channels of public R&D funding are the MESU, NASU and the National Research Foundation of Ukraine. An important source of RDI funding is foreign sector, particularly European programmes and initiatives, notably Horizon Europe and its predecessors. Innovations are supported through the Ukrainian Startup Fund, the State Finance Institution for Innovations, etc.

EVALUATION AND ASSESSMENT OF RESEARCH INSTITUTIONS

Currently, there is no unified approach for evaluating and assessing research institutions in Ukraine. The assessment of the effectiveness of research institutions conducted by the NASU uses its methodology updated in 2023 (NASU, 2023). The methodology draws on evaluation criteria and procedures used in the evaluation of scientific institutions in countries such as Germany, Austria, the United Kingdom, Poland and the Czech Republic. Based on

the evaluation results, research institutes are assigned to categories that correspond to recommended future actions—such as receiving a 'green light' to continue operations, enhancing international cooperation, undergoing reorganisation or being closed.

In parallel, the MESU has its own methodology for the state certification of scientific entities. In 2024, the Ministry developed a new approach to evaluate the R&D effectiveness of research institutions and universities. As a result, all public research-performing organisations are scheduled to be evaluated in 2025. MESU introduced new criteria that consider research contributions to global science, economic growth, national defence, and the overall benefit to Ukrainian society (impact assessment), alongside compliance with open science principles. It is planned that the evaluations will be conducted simultaneously in all research and higher education institutions within specific scientific fields. Based on the results of the assessment, research-performing organisations will be assigned to one of four categories: A) world-class and leading positions in their scientific area, B) high quality research, C) satisfactory research performance, lacking an active international profile, D) low research performance: the institution fails to meet state certification standards. MESU reserves the right to make R&D budgetary decisions, based on this categorisation.

To ensure transparency and efficiency, the National Electronic Scientific Information System (URIS) supports the evaluation process through its suite of digital tools. URIS is a multifunctional IT system that provides the collection, formation, processing, storage, and use of data and information in the field of scientific and science and technology (S&T) activity of Ukraine. The system was created to combine information on the results of scientific research, the activities of research institutions and higher education institutions (HEIs), as well as Ukrainian researchers1. In the future, it is expected that URIS will be used to provide evidence for decision-making, ensuring accessibility of data from the Ukrainian science system, including research data and information, equipment, services and resources for research, grant management (application and reporting), etc. URIS will serve as a Current Research Information System, a modern tool for managing scientific data and making strategic decisions in the field of science.

1 https://dntb.gov.ua/completed-projects/urisinfo

At this point, it is premature to evaluate the relevance of the new methodology or to determine the consistency of its application across research institutions. However, several drawbacks have already been identified. First, the approach requires institutions to manually insert information that could be automatically retrieved - for example, journal quartiles or publication titles via DOI2 - resulting in unnecessary additional effort and time for the staff. Second, the list of accepted evidence for impact is limited to only three items, whereas research organisations typically have a broader range of documents to demonstrate the impact of their R&D activities. Third, the methodology has not yet been tested on real-world cases, and not all indicators are sufficiently justified. For example, many indicators are based on formulas that disproportionately favour PhD students and university researchers, thereby giving HEIs an unjustified advantage over other public research organisations (PROs), which typically employ fewer staff:

$$\mathbf{(I)} = \frac{\text{scientific output}}{\textit{Researchers} + \mathbf{0.5} \times \text{Scientific and pedagogical personnel} + \mathbf{0.1} \times \mathbf{PhD\ students} + \textit{Doctoral sudents}}$$

In addition to the evaluation of research institutions, the government requires PROs and HEIs to perform examination (evaluation) of individual researchers every three to five years. The duration depends on the outcome of the previous assessment: researchers with strong performance are granted five years, while those with weaker results receive a three-year period. The data researchers provide during the evaluation process include a list of publications, information on participation in R&D projects, national and international cooperation, a description of scientific results, and other research-related activities. In fact, information for the evaluation of R&D institutions and researchers is similar, but the data formats differ significantly, which creates additional pressure on researchers. As research institutions typically gather data from researchers on an annual basis, conducting individual evaluations adds minimal value. Evaluation results can affect personal careers, but they may also help PROs/HEIs to improve their performance.

In order to consider the assessment of research institutes as a relevant element of evidence-based policymaking we suggest eliminating the outlined issues, continuing the alignment of methodologies for the assessment PROs and HEIs, and developing policy options with a funding mechanism for each R&D performing category.

EVALUATION OF R&D PERFORMANCE

The Ukrainian statistical office produces statistical data on S&T and innovation development, based on OECD manuals and Eurostat methodology. In contrast to the EU, many indicators in Ukraine have been subject to frequent changes over the past decades, hindering the development of consistent long-term datasets for in-depth analysis. Unfortunately, the government of Ukraine has not paid sufficient attention to the RDI, and as a result, no framework for RDI performance evaluation has been developed. Instead, the government predominantly depends on technical assistance from the EU, including the 2016 Peer Review of the Ukrainian Research and Innovation System (EC, 2017) and ongoing support for Ukraine in research infrastructure policies (2025), among other initiatives.

Analytical reports, produced by organisations affiliated with the MESU are limited due to their primarily descriptive nature and focus on budget expenditures. As a result, they do not reveal how RDI indicators are interconnected, whether policy instruments have affected the health of the RDI system and other critical insights.

Following the approach of Saltelli and Giampietro (2017), authors conclude that the practice of R&D evaluation in Ukraine lacks quantitative storytelling. Therefore, we suggest a mixed-method approach for the evaluation of R&D performance, using both quantitative and qualitative methods. The quantitative analysis should go beyond descriptive data and be enriched with econometric techniques to identify the strength of the links between the indicators. For example, we investigated the correlation of the dynamics of scientific personnel with the research intensity of GDP in the long-term perspective. The panel data, based on a heterogeneous sample of countries, confirmed the existence of a direct proportionate relationship between the indicators. Our research proves the validity of the proposed model with a high degree of statistical significance.

In addition, the panel data analysis reveals different patterns of S&T development across countries. Some demonstrate low elasticity of research personnel intensity, while in others the elasticity is considerably higher. Importantly, elasticity is not constant and varies according to the level of S&T development and each country's policy approach to science, technology and innovation development.

In the case of Ukraine, the relationship between R&D funding and research personnel intensity is relatively straightforward over the period 2010–2020 (see Figure 3). Moreover, between 2016-2020, the decline of R&D funding triggered an even stronger response in the reduction of research staff than in the previous period, emphasizing systemic failures of Ukrainian R&D policy.

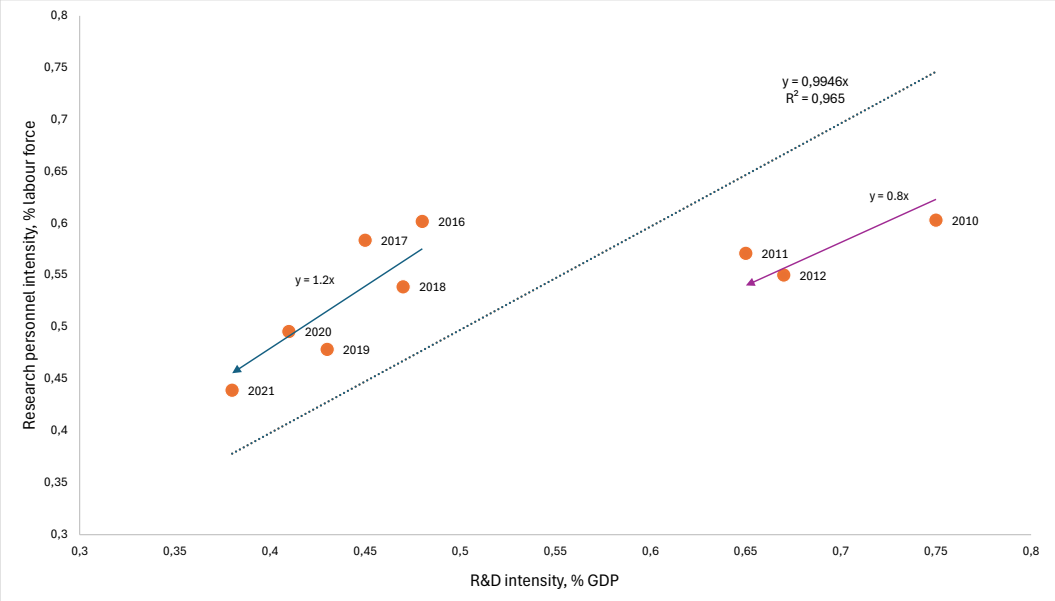

Figure 3. Comparison of indicators of GDP science intensity and the workforce in Ukraine.
Source: Authors calculations based on data from the State Statistics Service.
URL: https://ukrstat.gov.ua/

The practical value of the conducted analysis lies in the justification of target indicators to be considered for the development of strategic documents and key targets. The model allowed us to calculate the necessary level of R&D funding in Ukraine by 2030 to achieve at least 40% of the EU-27 level of 2021. According to our calculations, to reach this goal, Ukraine needs to increase R&D funding by at least EUR 200 million by 2030.

EVALUATION OF INNOVATION PERFORMANCE

The evaluation of innovation performance was not a priority for the government of Ukraine, although some data were produced by the national statistical office. The lack of interest in assessing innovation performance was evident in the fact that no dedicated public funding for innovation was provided for nearly two decades. The State Innovation Fund, established in 1992 to distribute innovation grants and soft loans, lost credibility, due to opaque and allegedly politicised award decisions. After most of its core functions were suspended in 2000, the fund was nominally replaced by the State Innovation

Financial-Credit Institution. However, for years, the new institution received only symbolic budget allocations and did not launch any competitive funding programmes.

As a result, for almost two decades, Ukraine lacked effective national innovation policy instruments - grants, tax credits or co-investment schemes - to support innovative firms. This further undermined the incentive to track innovation outcomes systematically. The situation is set to change with the creation of the Innovation Development Fund, also known as the Ukrainian Startup Fund, which provides grants for innovative start-ups.

Ukraine applies the EU's Community Innovation Survey (CIS) methodology to gather data on innovation activity that are comparable to EU standards. In parallel, a national methodology is used to assess innovation performance in the industrial sector exclusively. The data are shared with international statistical institutions, which use them to calculate various innovation indices, e.g. the Global Innovation Index, the European Innovation Scoreboard, as well as in reports like the UNECE Innovation Performance Review of Ukraine (UNECE, 2013). Meanwhile, domestic demand for innovation statistics comes primarily from the researchers themselves (e.g. Zhernovyi, 2024) and partially from regional authorities who need to deal with smart specialisation, namely, to identify regional strengths in innovation activity. Smart specialisation was introduced into regional policymaking in 2019. Currently, Ukrainian regions are updating their strategic and operational objectives. However, the update is expected to reflect the economic impact of the war, rather than assessing the effectiveness of smart specialisation implementation and its role in driving innovative transformation.

Relying on composite indices for the evaluation of innovation performance does not appear sufficient to gain a comprehensive understanding. The relevance of this approach has sparked debate among scholars, given that innovations are inherently unpredictable and often depend on the interactions and relationships between stakeholders (Granger, 2020). In addition, composite indices are rather 'static', meaning they do not consider the innovation process per se, which changes over time. This limitation is particularly problematic in rapidly changing environments, where policy must respond promptly. For countries at an early stage of developing RDI evaluation systems, it is crucial to take into account the general limitations of composite indices, as outlined in Nardo et al. (2005).

The comparability of indicators remains a significant challenge. Although the indicators themselves are designed for comparison, the data and procedures

used for their collection and interpretation differ across countries and are not standardised across all fields of science, technology, and research. One example of this is Cyprus. According to Eurostat, innovation activity in Cyprus was reported over 65% in the CIS 2018 and 2020, but it suddenly dropped to 40% in the CIS 2022. Similar statistical inconsistencies are observed in Ukraine: after a modest rise to 28% in the CIS 2018, innovation activity dropped to less than 9% in the CIS 2020. These drastic changes appear to have been driven by several factors that warrant thorough investigation. Without proper interpretation, innovation data can be easily misread by policymakers, potentially leading to flawed policy decisions.

Furthermore, these indices rarely capture the relative importance of individual factors, the relevance of input data, the causal relationship between input and output or the frameworks and conditions under which innovation emerges. The link between investments and results is particularly unclear and underresearched: investments in innovation cannot easily traced to specific outcomes and their attributability diminishes over time. Such as indicators fail to reflect the time lag between investments in innovative activities input and their eventual output. This time lag is not only undefined but also likely to vary across different types of innovative activity.

Despite the limitations and even though indicators can, at best, only identify strengths and weaknesses rather than explain them, composite indices offer a broad overview of a country's innovation system and may therefore be considered a useful tool for evaluating innovation performance over time. However, from a short-term perspective, countries with underdeveloped innovation ecosystems often require alternative evaluation methods, such as targeted surveys, to track progress and enable timely interventions at early stages.

POLICY EVALUATIONS

Today, there is no explicit strategy for the development of science in Ukraine. The attempt by MESU to develop a National Strategy for Education and Science was unsuccessful in 2023, partly due to a lack of institutional capacity to reconcile and align the hundreds of ideas and measures proposed by more than 1,700 experts. Meanwhile, the Ukrainian government has shown greater willingness to approve documents, associated with the European integration process, such as the National Plan for Open Science, which was adopted in 2022.

There were also other documents related to science and innovation. In 2023, MESU updated the Roadmap for EU Integration in Education and Science, with a focus on aligning Ukrainian legislation with the EU acquis and expanding Ukraine's participation in EU programmes. However, the fragmented approach to policymaking continues to undermine the coherence and effectiveness of RDI policy evaluations in Ukraine. An analysis of this domain highlights that Ukraine yet develops a common framework or set of guidelines for conducting policy evaluations. Some policy areas such as culture and regional development do include explicit legal provisions for evaluation, including basic modalities and provisions for external evaluations. Although these are not enforced, the existence of such legislative framework at least provides a potential foundation for the future introduction of policy evaluations. In contrast, in RDI domain, the legislative framework for evaluation is rather limited. Several strategic documents (e.g. Strategy of Innovation Development till 2030[3], Strategy for Digital Development of Innovation Activity till 2030[4]) contain target indicators alongside policy measures. However, these documents do not include provisions for independent evaluation and instead envisage a simplified form of accountability rather than rigorous policy evaluation process.

The analysis of key legislation revealed the following shortcomings in the governance of research and innovation:

- a misalignment between outcomes and indicators, the strategies' tasks and measures, thereby undermining the intervention logic;
- poor coordination of policy documents in the RDI domain;
- low enforcement and implementation of the policy documents, and
- permanent underfinancing of the policy measures' implementation.

UNECE experts studied Ukrainian innovation policy during the COVID time and reached similar conclusions. According to them, poor coordination and complementarities with small and medium enterprises development and industrial policies, inadequate institutional and legal frameworks, and a miscoordination at the central government level are the weakest point of innovation policy of Ukraine (UNECE, 2020).

A key requirement for ensuring evidence-based policymaking is, to initiate a new policy cycle only after a thorough assessment of the effectiveness and lessons learned from the previous one. It is worth noting that this represents a common challenge in the Ukrainian policymaking context. While most policy documents include indicators to monitor implementation, they often

3 https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80#Text (in Ukrainian)

4 https://zakon.rada.gov.ua/laws/show/1351-2024-%D1%80#Text (in Ukrainian)

lack a clear intervention logic or a well-defined theory of change. This issue is commonly attributed to the absence of a well-established evaluation culture, which remains in the early stages of development in Ukraine.

Accordingly, the absence of independent evaluations of the policy measures and their implementation renders policy evaluations virtually absent within the evaluation system for the RDI domain. To improve the situation, greater efforts are needed to develop a national RDI evaluation framework that incorporates both, a solid theoretical foundation and international best practices, for example, the Horizon Europe evaluation framework for RDI programmes and large-scale policy instruments.

CONCLUSIONS

In this study, we attempted to examine the RDI evaluation framework of Ukraine in order to support the development of a unified approach to evaluation and avoid the duplication of efforts by linking different elements (or layers) of the RDI system. The findings revealed significant asymmetries across the four pillars of evaluation: R&D performance, innovation performance, research institution assessment and policy evaluations.

While Ukraine demonstrates promising potential in R&D performance and institutions' evaluation, supported by methodologies that are harmonised with international and EU standards, both innovation performance evaluation and policy evaluation remain underdeveloped. Most critically, the absence of a culture of independent and regular policy evaluations hinders the integration of evidence-based decision-making into strategic planning processes.

Despite ongoing reforms of the RDI system, the full potential of evaluation efforts has yet to be realised. Ukraine must address structural challenges – including data consistency, methodological biases, and the lack of integration across evaluation components – to build a robust, evidence-driven innovation ecosystem. The introduction of new policy measures and instruments should be inseparably linked with proper *ex ante*, interim, and *ex post* evaluations.

Ukraine's experience offers valuable lessons that can be transferred to other transition countries. The key priority is to establish a balanced and comprehensive RDI evaluation framework encompassing institutional assessment, R&D performance, innovation performance, and policy evaluation, in order to mitigate evidence asymmetries and reduce the reporting burden.

Secondly, the long-term value of statistics hinges on their quality, reliability, the compatibility of indicators, and the documentation of any data discontinuities. Thirdly, composite indices should be complemented by mixed method 'quantitative storytelling' to capture local dynamics that static benchmarks often obscure. Additionally, embedding independent, cyclical policy evaluations and implementing an automated national research information system — rather than relying on manual data entry are crucial safeguards against an 'evidence-poor' policy cycle.

LIMITATIONS

The study has several limitations that readers should bear in mind. First, some findings rely on official statistics, whose definitions and collection procedures have changed repeatedly. Such breaks may distort long-term trends, most notably in the CIS-based innovation and science indicators. Second, the econometric test addresses only the bivariate link between R&D-personnel intensity and GERD to GDP, without controlling other factors, so the reported elasticities are descriptive rather than causal. Third, the conclusion, regarding the forthcoming URIS-supported institutional review and the new MESU evaluation approach remain provisional, as they have not been completed yet.

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AUTHORS

VITALII GRYGA
Institute for Economics and Forecasting NAS of Ukraine
Email: v.gryga@gmail.com
ORCID: 0000-0003-0026-3591

OLHA KRASOVSKA
Ukrainian Evaluation Association
Email: olha.krasovska@gmail.com
ORCID: 0009-0006-3230-684X

YULIIA RYZHKOVA
Institute for Economics and Forecasting NAS of Ukraine
Email: yu.ruzhkova@gmail.com
ORCID: 0000-0001-7944-2247

Annex I. The conceptual model of Ukraine's RDI system