Thematic Assessment on Research, Development, and Innovation (R&I) for Ukraine

Part of the Green Agenda for Armenia, Georgia, Moldova, and Ukraine Project

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DISCLAIMER:

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The findings, interpretations, and conclusions expressed in this report are those of the authors and do not necessarily reflect the official policy or position of Sida, SEI, or any other project partners or stakeholders.

The report is based on information available up to Summer 2024. For the latest data and analysis, please refer to the national green transition assessment report for Ukraine.

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1. Current state and trends

1.1. The profile of research, development, and innovation in Ukraine

The research, development, and innovation cross-cutting thematic area is referred to as research and innovation (R&I) in the Green Agenda for Georgia, Ukraine, Moldova, and Armenia project. **The R&I sector**[1] **in Ukraine has been suffering from declining investment over several decades,** with Gross domestic expenditure on research and development (GERD) reaching a historic low of 0.33% of GDP in 2022 and remaining at this level also in 2023, leaving science to perform only a limited function. This decline was accompanied by **a decrease in the number of R&I organizations, the number of researchers** (35.7 thousand in 2022), **and the aging of R&I staff due to a lack of R&I sector attractiveness to youth** (in 2022, 40% of researchers and scientists were under 44 years old).[2] The largest number of researchers is concentrated in public sector research organizations and falls in the fields of **engineering and natural sciences, the sectors receiving most of the R&I funding**. The state budget was the main source of funding for R&I activity, with the largest share dedicated to fundamental research in academic research institutions. **The European Green Deal (EGD) related areas are not emphasised in R&I policy, and cross-sectoral integration of R&I is needed to make sure R&I becomes a real driver of Ukraine's green transition.**

The private sector investment in innovation has been low and on a declining trend, dropping to 0.17% of GDP in 2021, demonstrating the low absorptive capacities of the enterprise sector for innovation.[3] Nonetheless, before 2022, Ukraine performed relatively well in international rankings on innovation based on its solid human capital, strong ICT sector, quality of education, and remaining R&I base, ranking 57th and fourth among the lower-middle-income economies in the Global Innovation Index (GII)[4] in 2022. However, due to the full-scale invasion by Russian Federation in 2022, Ukraine

[1] The Research, development, and innovation cross-cutting thematic area is referred to as research and innovation (R&I) in the GUMA project, as this is the current form used on the EU level in the context of the Green Deal. The key terms of R&I used in this report are aligned with those used in the OECD Frascati Manual and Eurostat-OECD Oslo Manual of "R&D" and "Innovation".

[2] Ukrainian Institute of Scientific and Technical Expertise and Information (2024). *Scientific and scientific and technical activity in Ukraine in 2023,* https://mon.gov.ua/static-objects/mon/sites/1/nauka/informatsiyno-analitychni/2024/05.08.2024/Naukovo-analitychna.dopovid-Naukova.naukovo-tekhnichna.ta.innovatsiyna.diyalnist.v.Ukrayini.u.2023.rotsi-05.08.2024.pdf (March 2024)

[3] Ministry of Education and Science of Ukraine (2023). *Roadmap on Science, Technology and innovation to Achieve the SDGs*, https://mon.gov.ua/storage/app/media/news/2024/01/03/Dorozhnya.karta.vykoryst.nauky.tekhnolohiy.ta.innovatsiy-03.01.2024-1.1.pdf (March 2024).

[4] UNECE (2023). *Interim Sub-Regional Innovation Policy Outlook 2022: Eastern Europe and the South Caucasus*. Geneva: United Nations, https://unece.org/sites/default/files/2023-06/UNECE_Interim_Sub-Regional_Innovation_Policy_Outlook_2022_web.pdf (March 2024).

dropped in GII to stand 60th in the ranking in 2024.[5] Against this background, Ukraine has been reforming its R&D sector through modernisation of legislation, aligning the performance of its R&D sector with EU standards, and increasing its attractiveness to young scientists since 2017.

The Russian aggression has had a significant negative impact on Ukraine's R&I system, with 35% of research infrastructure damaged or destroyed, and a quarter of researchers and scientists having left abroad as of 2023.[6] Furthermore, the mobilisation of state resources to sustain the war effort led to the sequestration of funding for R&I projects under the National Research Fund, further contracting the already limited R&I budget[7]. At the same time, **the war has spurred innovation in defence tech, govtech, and other fields in need of response to urgent needs**.

Donor funding has been crucial in supporting R&I, for example, the EU-financed "Climate package for a stable economy in Ukraine"[8], the EBRD/EU "Innovation Climate Vouchers" for innovative start-ups and SMEs, support for R&I grants disbursed by the Ukrainian Start Up Fund (USF) and the National Research Fund (NRF). Other than that, the funding focused on green R&I remains very limited and insufficient to effectively support Ukraine's green transition.[9]

The National Strategy for Innovation 2030[10] is the main policy document guiding R&I policy with a new strategy for "Global Innovation Vision Ukraine 2030" developed to better reflect the new priorities, including defence and security, innovation-driven economic growth, and EU integration. However, the new strategy has not been approved by the Government yet (as of June 2024). Around 200 legal acts regulate the R&I activity with several laws on priority directions for science and technology development and innovation activity development guiding state support for R&I. Full-scale invasion by Russian Federation resulted in **the integration of the national defence and security dimension into the list of priority areas for R&I which now include defencetech, energytech, mobilitytech, production of new materials and**

[5] WIPO (2024). *WIPO Global Innovation Index 2024 Ranking*, *GII Innovation Ecosystems & Data Explorer,* https://www.wipo.int/gii-ranking/en (March 2024).

[6] UNESCO (2023). *Analysis of war damage to the Ukrainian science sector and its consequences,* https://unesdoc.unesco.org/ark:/48223/pf0000388803 (March 2024).

[7] Ukrainian Institute of Scientific and Technical Expertise and Information (2023). *Scientific and scientific and technical activity in Ukraine in 2022,* https://mon.gov.ua/storage/app/media/nauka/2023/07/25/Nauk-analit.dopov.Naukova.ta.nauk-tekhn.diyaln.v.Ukr.2022-25.07.2023.pdf (March 2024).

[8] Cabinet of Ministers of Ukraine (2020). Agreement on financing between the Government of Ukraine and the European Commission acting on behalf of the European Union [Climate package for a stable economy: (CASE) in Ukraine ENI/2020/042-818]. Kyiv: Cabinet of Ministers of Ukraine, https://zakon.rada.gov.ua/laws/show/984_017-20#Text (March 2024).

[9] OCDE/EBRD (2023). *SME Policy Index: Eastern Partner Countries 2024: Building Resilience in Challenging Times*. Paris: Éditions OCDE, https://doi.org/10.1787/3197420e-en (March 2024).

[10] Cabinet of Ministers of Ukraine (2019). On the approval of the Strategy for the development of innovative activity for the period up to 2030' (10 July 2019, № 526-p). Kyiv, https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80#Text (March 2024).

nanotechnologies, agrotech, medtech; green tech, and modern ICT and robotics.[11] R&I in these areas is expected to enable Ukraine's transformation into a resilient and innovation-driven economy despite the ongoing war.

With regards to alignment with the EU Acquis in R&I, **Ukraine has a Roadmap in place to integrate into the European Research Area (ERA),** and it **participates in Horizon Europe and Euratom Research and Training Framework Programmes.**[12] However, evidence shows that Ukraine fails to fully leverage opportunities offered by the EU candidate status and the support the EU has provided following the full-scale invasion by Russian Federation, including enhancing its cooperation in R&I and closer alignment with ERA[13] Policy Agenda 2022-2024 priorities. This is mostly due to a lack of funding, human resources, and obstacles in national legislation.

The R&I policy design and implementation is fragmented across the Ministry of Education and Science (MoES), the Ministry of Economy (MinEconomy), the Ministry of Digital Transformation (MinDigital), and the Ministry of Strategic Industries (MoSI), each ministry playing a leading role in various aspects of R&I policy, which hinders effective policy implementation and its contribution to national development objectives. Such fragmentation is to be addressed in the framework of the new Digital Innovations Development Strategy, until 2030 planned to be adopted in January 2025. The strategy foresees that the MinDigital leads on innovation policy formulation, with the Vice-Minister for Innovation, education, science, and technology development responsible for cross-sectoral coordination on innovation policy. The **lack of effective policy coordination mechanisms and robust monitoring and evaluation** has been a major reason for R&I policy falling short of meeting the objectives it aimed to achieve. The **lack of capabilities within the public sector in R&I policy** implementation is complemented by **low performance of the R&I organisations, outdated R&I infrastructures, and a lack of incentives for technology commercialization and industry-science cooperation**, which the Government plans to address under current strategic policy documents.

While Ukraine has not formally joined the EGD, it was among the first countries to announce its intention to participate in it following EGD adoption in 2019. **A series of national strategic documents focuses on EGD areas**. For instance, the National Economic Strategy until 2030 places decarbonisation along with EGD alignment as a key objective and principle of Ukraine's economic development. The **Ukraine Facility Plan[14] (2024)** puts green transition among pillars for development and foresees the development of the following documents relevant for EGD and green R&I: i) the

[11] Ibid.
[12] Council of the European Union (2023). *ERAC Report on the role of Research and Innovation in Ukraine's Recovery,* https://data.consilium.europa.eu/doc/document/ST-10034-2023-INIT/en/pdf (March 2024).
[13] Ibid.
[14] The Government of Ukraine (2024). *Ukraine Facility Plan 2024-2027,* https://www.ukrainefacility.me.gov.ua/wp-content/uploads/2024/03/plan-ukraine-facility.pdf (March 2024).

Integrated National Energy and Climate Plan (NECP) adopted in June 2024, ii) the Law of Ukraine "On the Basic Principles of State Climate Policy", adopted in October 2024 iii) the Strategy for Implementing Circular Economy Principles and its Action Plan; iv) the National Waste Management Plan until 2033 (draft published for public consultations in May 2024). In addition, **several sectoral strategies**, such as the National Environment Protection Strategy 2030[15], the National Strategy for Waste Management 2030, the Long-term Strategy on Thermal Modernisation of Buildings 2050, the National Transport Strategy 2030, the State Regional Development Strategy 2021-2027 have integrated the provision on R&I for EGD to some extent. However, **R&I remains overall weakly integrated in sectoral policies, with innovation often expected to stem from the integration of ready-to-use technologies rather than the investment in and application of domestic R&I**.

The challenges in fostering R&I for green transition could be summarised as following: i) scarce funding of R&I and the need to better integrate green R&I in current R&I activities and other sectoral policy documents, ii) human resource shortages in R&I due to long-term declining trend exacerbated by the war and challenges of building green skills for transition (gaps in capabilities), iii) low innovativeness of the private sector (hence, low demand for domestic green R&I) and lack of understanding of the green transition as an opportunity rather than a constraint, iv) weak science-industry cooperation due to lack of incentives and no focus on green R&I solutions, v) obsolete or damaged R&I infrastructure requiring modernisation and better access for all R&I actors, vi) lack of capacities within public sector to implement R&I reform, including integration of green R&I, and finally vi) the need to anchor the R&I as an essential lever for Ukraine's recovery and EU integration with focus on green transition. **The EU integration and the associated financial and technical assistance, especially when it comes to capacity building, are an important opportunity for Ukraine to realise its potential in R&I for green transition while boosting the performance of its R&I system to ensure integration into the ERA.**

1.2. Key statistics and trends of the R&I thematic area

This section presents an overview of key statistics related to the R&I cross-cutting area to set the stage for assessing the position of R&I in supporting the green transition in line with EGD targets in Ukraine.

Table 1.2: Key statistics and trends

[15] Law of Ukraine on Basic Principles (Strategy) of the State Environmental Policy for the period up to 2030. Information of the Verkhovna Rada (VVR), 2019, No. 16, Article 70, https://zakon.rada.gov.ua/laws/show/2697-19#n14 (March 2024).

Relevant statistics/indicators	2010	2015	2020-22	Comments/trends
R&I governance and policy				
Global innovation score index	35.8 (in 2013)	36.5	36.3 (2022)	Ukraine ranked third among lower-middle-income economies, outperforming its level of development in 2020, and producing more innovation outputs. It was no longer an outperformer for its income group in 2022, ranking 57th with a score of 36.3.
Yearly investment into the R&I sector by the state (euro)	N/A	707 million UAH	1.5 bn UAH (of which 90 ml UAH for the NRF) (2022)	Budget allocations for R&I, incl. grants and operation of the National Research Fund. In 2021, R&I activity received 2.2 billion UAH of budget funding.
Yearly gross R&I expenditure (as % of GDP)	0.75	0.55	0.33 (2023)	Significant decrease observed over the years, with the 2022 sequestration of some of R&I funding due to martial law and state budget mobilisation.
Yearly final total government budget allocations for R&D (GBARD)	EUR 351.2 mln (3.6 bn UAH)	EUR 194.1 mln (6.2 bn UAH)	EUR 241.6 mln (7.4 bn UAH in 2020)	The equivalent in euros is calculated based on the average exchange rate in 2010, 2015, and 2020[16].
Governments' environmental and energy R&D appropriations and outlays as a proportion of GDP (%)	N/I	N/I	N/I	No such data is available at the moment.
R&I agenda is included in the main policy documents (Y/N)	N	N	Y	R&I is prominent in the *Ukraine Facility Plan (2024),* a framework document for development and reconstruction, and covers investments in R&D across energy and climate, sustainable food systems, sustainable mobility, building and renovation, industry, and circularity, zero pollution, biodiversity, digitalization, green transition finance, education and green skills. *National Environmental Protection Plan until 2025* (investments in R&I for low-

[16] Ukraine hryvnia to euro spot exchange rates for 2020 (no date), https://www.exchangerates.org.uk/UAH-EUR-spot-exchange-rates-history-2020.html (March 2024).

				carbon technologies, climate mitigation and adaptation, biodiversity. *National Strategy for Environmental Policy until 2030* (ensuring the implementation of the results of R&I and interaction between scientists and state bodies).
Green transition is considered in national R&I strategies (Y/N)	N	N	Y	The EU Association Agreement (2016) and the reconstruction agenda brought the EGD to the fore. The Law on Priority areas for R&I covers sustainable mobility, energy, agriculture, and digitalisation aspects of EGD. The R&D&I Roadmap for the SDGs (2024-2030) also covers R&I investments across digitalization of society, resource-efficient economy, and alternative energy; rational use of nature and circular economy; health of the nation; new substances, materials, industrial technologies; and safe food.
Is the green agenda included in smart specialization (S3) strategies? (Y/N)	N	Y	Y	The Action Plan of the Regional Development Strategy 2021-2027 includes measures in energy efficiency, nature preservation and sustainable use of natural resources, and sustainable agriculture.
Employment in R&I sector (% of total employment)	0,95	0.75	0.5 (2020)	A number of researchers are on a declining trend, exacerbated by the outflow of researchers due to the war in 2022.
Research capacity (including potential to develop green R&D capacity)				
Relevant statistics/indicators	**2010**	**2015**	**2020-22**	**Comments/trends**
Total research personnel as a proportion of total employment (%)	0.7	0.55	0.32 (2020)	The indicator accounts for researchers only (not technical and support personnel). In 2021, the share of researchers in total employment was 0,28%, and following the full-scale invasion by Russian Federation in 2022, an estimated quarter of the researchers left the country.

Yearly national research funding	EUR 78 mln (8.1 bn UAH)	EUR 46.1 mln (11 bn UAH in 2018)	EUR 55.5 mln (17 bn UAH in 2020)	Funding of R&I activities by the business sector, the government sector, and the higher education sector.
Number of research units/centres	1303	978	769 (2020)	Since the 2022 full-scale invasion by Russian Federation, around 35% of research infrastructure was damaged or destroyed, aggravating the declining trend.
Number of research units/ centres operating in areas related to the green agenda	N/I	N/I	N/I	In the context of Ukraine's EU candidate status obtention and the increased funding through EU and other instruments for EGD-related R&I, it is expected that the number of organizations operating in green agenda areas increases, and the data becomes available.
Number of master's/doctoral students[17]	491504/ 36214	322116/ 30308	392210/ 23974 (2019/20)	Since 2022, the number of students in Master's and Doctoral programs decreased due to population outflow, but an increase in male applicants to Bachelor's and Master`s program was observed in 2022-23 likely to avoid drafting into the Armed Forces of Ukraine.
Share of master's/doctoral students in EGD-related study fields (%)	N/I	N/I	N/I	
Yearly participation in Horizon (2020) Europe projects (number)[18]	N/I	N/I	203 (2015-2020)	Ukraine started taking part in Horizon Europe only in March 2015. The data available for the period 2015-2020 (not disaggregated) with 203 projects selected for a total funding of 37.7 mln EUR.
Share of participation in EGD-related Horizon projects (number/%)	N/A (not available)	N/A	160/78%	The funding for EGD-related components is included here. The most funding received under Maria Sklodowska Curie Component: EUR 10.55 mln, Energy Component: EUR 3.46

[17] Ukrstat (2020). Dataset Higher education in Ukraine in 2019, https://ukrstat.gov.ua/ (March 2024).
[18] МОН (2020). *Результати 'Горизонт 2020' за 2014-2020 роки в Україні,* https://mon.gov.ua/storage/app/media/nauka/horizont/2021/09/23/Rezult.progr.Gor.2020.23.09.21.pdf (March 2024).

				mln, Climate and Environment Component: EUR 2.53 mln, and Transport: EUR 4.12 mln.
Number of green R&D programmes/ projects (incl. donor-funded)[19]	1	7	11	1) Green Innovation Fund "Innovate Ukraine" (with the support of the UK Government) with EUR 60 mln pounds funding available[20] (launched in 2022); 2) "Climate Innovation vouchers" - EBRD and EU programme to support SMEs implementing green solutions (13 companies selected in 2022 with funding of up to EUR 50.000 each)[21]. In place since 2017. 3) EU4Environment (a programme on circular economy in Ukraine)[22] (in place since 2015). 4) The Global Green Chemistry Initiative (GreenChem) is financed by Global Environment Facility under UNIDO and the Resource Efficient and Cleaner Production Centre[23]. Launched officially in 2023 in Ukraine. 5) UpSHift Ukraine[24] (UNICEF) programme for youth (projects

[19] Estimates based on available information.
[20] *Кабінет Міністрів України - Фонд у сфері зелених інновацій InnovateUkraine: відібрано 16 проектів для швидкого відновлення енергосектору,* https://www.kmu.gov.ua/news/fond-u-sferi-zelenykh-innovatsii-innovateukraine-vidibrano-16-proektiv-dlia-shvydkoho-vidnovlennia-enerhosektoru (May 2024).
[21] *EBRD and EU support green innovators in Ukraine* (no date), https://www.ebrd.com/news/2022/ebrd-and-eu-support-green-innovators-in-ukraine.html (May 2024).
[22] *EU4ENVIRONMENT,* https://www.eu4environment.org/uk/about/ (May 2024).
[23] *Resource Efficient and Cleaner Production Centre,* http://www.recpc.org/mission-en/ (May 2024).
[24] *Інноваційна програма для молоді upshift* (no date) *Upshift – Україна,* http://upshiftukraine.org/pro-upshift / (May 2024).

				focused on eco-innovation in 2020)[25]. 6) Horizon Europe (2015-2020, and then 2021-2027); 7) Euratom (since 2015); 8) LIFE (L'Instrument Financier pour l'Environnement) programme – Ukraine joined in June 2022. 9) European Institute of Innovation and Technology (In 2022, Kyiv Taras Shevchenko University joined the consortium INTREPID-HEI (International Capacity Building in Innovation, Transfer and Entrepreneurship). 10) Associate Member of CERN (since 2016). 11) EUREKA (Ukraine member since 2008). 12) COST (Ukraine full member since 2022).
Number of academic publications with any of the English keywords in the title or abstract related to GUMA thematic areas or eco-innovation, social innovation, green transition, climate neutrality, carbon reduction, energy efficiency/productivity, material efficiency/productivity, resource efficiency/productivity.	N/I	N/I	N/I	The number of Ukrainian publications in Web of Science (% of total publications on the platform): 2013 – 6448 (5.6%) 2015 – 10914 (9.55%) 2020 – 15587 (12.83%) 2022- 13081 (10.76%) The highest share of publications is in Engineering and Technology, followed by Chemistry[26].
Skills forecasts per sector (Y/N)	N/I	N/I	N/I	ETF under EU4Skills was conducting a pilot in Ukraine on skills forecasting in 2018 – since, no systematic data on this is available. According to

[25] *Юнісеф підтримає екологічні проєкти молоді з усієї україни* (2020), https://www.unicef.org/ukraine/press-releases/upshift-green (May 2024).

[26] Писаренко, Т.В. and Куранда, Т.К. (2023). *Наукова та науково-технічна діяльність в Україні у 2022 році: науковоаналітична доповідь*. УкрІНТЕІ, https://mon.gov.ua/storage/app/media/nauka/2023/07/25/Nauk-analit.dopov.Naukova.ta.nauk-tekhn.diyaln.v.Ukr.2022-25.07.2023.pdf (May 2024).

				latest estimates based on the socio-economic situations and dynamics of the labour market, the following professions are prospective in Ukraine: IT specialists, medical workers, marketing and PR, healthcare, esp. psychologists, ecologists, engineers, public policy and construction[27].
Number of vocational programmes related to EGD topics	N/I	N/I	4 short-term programmes in 44 VET institutions with 1680 applicants (2022-2023)	During the first half of the 2023-2024 academic year, 411 people successfully completed courses in: • "Advanced thermal modernization systems of buildings and structures" (155) • "Installer of window and door structures" (99) • "Insulator from thermal insulation" (67); • "Membrane roof installer" (90)[28]
Higher-education programmes building capacity for green R&I (no of students/no of courses)	N/I	N/I	2022 data	Among key programmes provided by HEI are[29]: • 38 courses on programme 183 « Technologies in environmental protection»: 1593 students. • 112 courses on programme 101 « Ecology »: 9875 students. • 21 courses in 105 “Applied physics and nanomaterials” 1821 students;

[27] Девятка, О. (2024) ‘Найбільш затребувані професії в україні 2024’, https://www.grivnya.in.ua/karyera/top-profesiy-2024/ (May 2024).

[28] Міністерство захисту довкілля та природних ресурсів (2024) *Звіт про стан виконання у 2023 році Національного плану дій з охорони навколишнього природного середовища на період до 2025 року, затвердженого розпорядженням Кабінету Міністрів України від 21 квітня 2021 р. № 443,* https://mepr.gov.ua/wp-content/uploads/2024/03/Rozmishhennya-Zvit-po-vykonannyu-NPD-za-2023.pdf (May 2024).

[29] Національне агентство із забезпечення якості вищої освіти (2023). *Доповідь про якість вищої освіти в Україні, її відповідність завданням сталого інноваційного розвитку суспільства у 2022 році,* https://naqa.gov.ua/wp-content/uploads/2023/04.pdf (May 2024).

				• 129 courses in 123 “Computer Science”, 16508 students • 41 courses in 126 „Information systems and technologies“– 6798 students • 49 courses in 141 Power engineering, electrical engineering, and electromechanics: 18897 students; • 61 courses in 151 Automation and computer-integrated technologies – 11212 students • 24 courses in 161 Chemical technologies and engineering - 4539 • 28 courses in 162 Biotechnologies and bioengineering- 3482 students • 16 courses in 163 Biomedical Engineering – 1313 students • 37 courses in 181 Food technologies – 11526 • 10 courses in 207 Water resources and aquaculture - 1368 • 22 courses in 208 Agro-engineering– 9580 • 13 courses in 224 Technologies of medical diagnosis and treatment – 728 students • 30 courses in 275 Transport technologies - 11494 students
Number of study programmes for reskilling in EGD areas	N/I	N/I	N/I	
The share of public/private/foreign funding	N/I	N/I	N/I	Most students in HEI obtain their education at publicly-

for green skills and reskilling programmes				funded (state) Universities – 88,9% in 2021[30].
Participation of adults in lifelong learning (%)				In January 2023, the parliament adopted in the first reading the draft law "On Lifelong Learning", submitted by the Cabinet of Ministers (that the draft law was developed to implement the Association Agreement with the EU).
Investment in training for green jobs (euro)	N/I	N/I	N/I	
Companies committing to reskilling or upskilling workers (% or number)	N/I	N/I	N/I	
Innovation linked to the green agenda				
Relevant statistics/indicators	**2010**	**2015**	**2020-22**	**Comments/trends**
Number of companies supported by the state for green R&I	N/I	N/I	N/I	Only 14.5% of enterprises have implemented innovation in 2020 with a share of 14% of innovative enterprises on average over the last 10 years.
Investments from the private sector into green R&I measures (euro)	N/I	N/I	N/I	Only general information on private sector investments in R&I is available[31]: - 2010 – 996.4 mln UAH (12% of total private sector expenditure on innovation) - 2015 – 2039.5 mln UAH (15%) - 2020 – 3486.3 mln UAH (24%)
Number of incubators/accelerators supporting green start-ups/scale-ups	N/I	N/I	4-5?	There are over 75 industrial parks in Ukraine with only 10% operational; out of 40 science parks, 13 are active in technology commercialization and 6 are in active cooperation with the private sector; around 16 techno parks with only 3 operational as benefit from state support.[32]

[30] Національне агенство із забезпечення якості вищої освіти (2022) *Річний звіт Національного агентства із забезпечення якості вищої освіти за 2021 рік,* https://naqa.gov.ua/wp-content/uploads/2022/02/%D0%97%D0%B2%D1%96%D1%82-2021.pdf (May 2024).

[31] Innovation expenditure of industrial enterprises by Ukrstat.gov.ua.

[32] МОН, Мінцифра (2023) *Глобальна інноваційна візія України: Версія повна (громадські обговорення),* https://winwin.gov.ua/assets/files/%D0%93%D1%80%D0%BE%D0%BC%D0%B0%D0%B4%D1%81%D1%8C%

				From approx. 70 incubators, only 10 are operational. Those that support green tech are: Greencubator (under the EU4Energy and funds from Green for Growth Fund (GGF)); CfE Accelerator (Ukrainian Catholic University); AgrifoodLab (INSCIENCE)[33]; Ukrainian Start-up Fund (funding of around 94 start-ups in EGD-related areas over 2018-2023); Ukrainian Future Business Incubator[34]. In 2022, 13 Ukrainian companies received "climate vouchers" for a total of 500,000 euros.
Share of environment-related inventions – patents (%)	N/I	N/I	N/I	Number of applications for inventions in areas related to climate mitigation and adaptation proposed here instead. The figures are **366 in 2010, 220 in 2015 and 43 in 2020**.
Number of ISO 14001 certificates/ ~~population in millions~~	166[35] (in 2013)	155	334 (in 2022)	A proxy indicator is proposed: the number of ISO 14001 certificates, as per the ISO Survey results (Environmental Management System).
Investment in the development of green technology (euro/year)	179.9 thousand EUR 7.6 mln UAH	52.1 thousand EUR 2.2 mln UAH	232 thousand EUR 9.8 mln UAH	Environmental R&D investment[36] as shown in the Ukrstat publication. A newly established Fund for green innovations (with the support of the UK), InnovateUkraine (60 mln pounds to be used).
GHG emission productivity (GDP/GHGs)	N/I	N/I	N/I	Data available for carbon productivity, which includes only CO2 emissions from fuel

D0%BA%D1%96%20%D0%BE%D0%B1%D0%B3%D0%BE%D0%B2%D0%BE%D1%80%D0%B5%D0%BD%D0%BD%D1%8F.pdf (May 2024).

[33] *AGRIFOOD LAB,* https://agrifoodlab.com.ua/ua/ (May 2024).

[34] *UFincubator,* https://www.ufincubator.com/ (May 2024).

[35] *ISO/CASCO - Committee on conformity assessment* (no date), https://www.iso.org/committee/54998.html?t=dnBm2j_sAhhXB1XFYcHFdz9kmqJlQH9v-kmsAvQsa1mCgDLySpPIcp5ZMcOBvnI3&view=documents#section-isodocuments-top (May 2024).

[36] Ukrstat (2023). *Environment of Ukraine 2022: Statistical Publication,* https://ukrstat.gov.ua/druk/publicat/kat_u/2023/zb/10/zb_dov_22.pdf (May 2024).

				combustion (these account for over half of GHGs in Ukraine). Results are the following (GDP UAH th./CO2 t): **10.19 in 2010, 12.41 in 2015, and 13.90 in 2018**. The improvements in carbon productivity over 2010-2018 are explained by a 15% fall in GDP due to annexation of Crimea and Russian military aggression in the Donbas, reduction of gas consumption by households and central district heating through increases in energy efficiency, and a surge in natural gas prices leading to switch to biomass[37]. The GHG emissions stood at **37.5% of 1990 GHG emissions in 2019** (37.8% in 2015).
Material productivity (GDP/domestic material consumption)	N/I	100% (as a baseline)	100.5% (2019)	The index of material intensity of GDP is used. The national target for SDGs on this indicator was to reach 60% of the 2015 level in 2030. Ukraine was not on track as of 2019 data.
Water productivity (GDP/total freshwater abstraction);	49	49	63 (2019)	Expressed in UAH GDP (2016)/m3. The use of fresh water has decreased statistically over the last 10 years due to the temporary occupation of part of Ukraine, and the recycled water has significantly decreased.
Energy productivity (GDP/gross available energy for a given year)	4677	5335	6047 (2019)	Expressed in USD (PPP 2017) per ton of oil equivalent. Despite a 19% growth over 2010-2014 in energy productivity, Ukraine performs 2.5 times worse than the EU average. The energy intensity decreased by only 12% over the 2015-2019 period, and Ukraine remains the most energy-intensive economy among GUMA and EU states.

[37] OECD (2021). *Towards green transformation of Ukraine: State of Play in 2021,* https://www.eu4environment.org/app/uploads/2022/04/Towards-green-transformation-of-Ukraine-State-of-Play-in-2021-ENG.pdf (May 2024).

Human capital investment in eco-innovation activities (year/euro)	N/I	N/I	N/I	The 2022 Russian aggression has had a major impact on human capital, posing tough challenges for human capital development in general amid significant population displacement and "brain drain".
Are there any innovation-stimulating mechanisms, e.g., tax reduction/ exemption, state co-financing through environmental funds/loans/ budget allocations for green areas? (Y/N)	N/I	Y	Y	Dec 2023: Project "Innovators in energy efficiency" run by NGO "Impact Force" with the support of the project "Promotion of energy efficiency and implementation of the EU Directive on energy efficiency in Ukraine", implemented by GIZ on behalf of the Government of Germany and co-financed by the Government of Switzerland in cooperation with the Ministry of Community Development, Territories and Infrastructure of Ukraine, Office for Entrepreneurship and Export Development, the national project Diya.Business, as well as the State Agency for Energy Efficiency and Energy Saving of Ukraine[38]. Tax incentives in energy[39]: - Benefits of importing energy-efficient equipment. - Benefits for enterprises working in the field of renewable energy sources and alternative fuels. - Establishment of a "green" tariff for electric energy produced from alternative sources;

[38] Eeplatform (2023). *Запуск програми Інноватори енергоефективності,* https://eeplatform.org.ua/ (May 2024).
[39] *Пільги та стимулювання* (no date) *Держенергоефективності,* https://saee.gov.ua/uk/business/preferentsii/derzh-pidtrymka/podatkovi-ta-mytni-pilgy (May 2024).

				Broader, there is an eco-tax in place (since 2021),[40] which acts more like an additional source of budget revenues.
Value added in the environmental goods and services sector/GDP	N/I	N/I	N/I	
Export of goods and services in the field of environmental protection and resource management activities/total exports[41]	4.6%	3.6%	2.5%	Environmental goods exports as % of total exports.
Number of national campaign groups working to implement fair socio-environmental solutions in EGD areas (Y/N)	N/I	Y	Y	Several NGOs and analytical centres are working to raise awareness on the issues related to EGD and Ukraine`s adherence to it, as well as delivering solutions for economy greening: NGO EcoAction, Resource and Analytical Centre "Society and Environment", Analytical Centre "DixiGroup", Association of local self-governments "Energy-efficient cities of Ukraine". In addition, the Ministry of Environment together with Ministry of Education, local governments, and international partners (e.g., GIZ) are conducting actions to develop ecological behaviour and sustainable consumption among citizens[42].
Is the creation of collaborative R&I projects/networks/partnerships between private and public entities supported or funded? (Y/N)	N/I	Y	Y	Mostly through Horizon Europe and related EU-funded initiatives (EUREKA, COST, Euratom, EU4Energy and EU4Environment, etc.), there is a lack of incentives and

[40] *Верховна рада ухвалила законопроєкт про збільшення екоподатку | журнал ecobusiness* (2021), https://ecolog-ua.com/news/verhovna-rada-uhvalyla-zakonoproyekt-pro-zbilshennya-ekopodatku (May 2024).

[41] IMF (2023). *Climate Change Indicators Dashboard,* https://climatedata.imf.org/datasets/8636ce866c8a404b8d9baeaffa2c6cb3_0/explore?filters=eyJDb3VudHJ5IjpbIlVrcmFpbmUiXX0%3D (May 2024).

[42] Міністерство захисту довкілля та природних ресурсів (2024). *Звіт про стан виконання у 2023 році Національного плану дій з охорони навколишнього природного середовища на період до 2025 року, затвердженого розпорядженням Кабінету Міністрів України від 21 квітня 2021 р. № 443,* https://mepr.gov.ua/wp-content/uploads/2024/03/Rozmishhennya-Zvit-po-vykonannyu-NPD-za-2023.pdf (May 2024).

	funding by the Government in this regard.

2. Thematic area stakeholders mapping

This section outlines the main stakeholders in the R&I area, as well as their mandates regarding the R&I policy. It also provides a brief assessment of their potential role in promoting green R&I and current influence on green R&I (whether they are supporters or opposers of the green transition).

Due to GDPR considerations, we are unable to disclose the full mapping results publicly and include a summary table instead.

Table 2.1. Key stakeholders, their mandates, and their role in green R&I promotion

Stakeholders	Mandates in relation to R&I	Influence and scope for green R&I promotion
State and local authorities		
Ministry of Education and Science (MoES)	Formulation and ensuring the implementation of the policy on education, science, scientific research and inventions, innovation and technology transfer. Harmonisation of the legislation in R&I with the EU Acquis.	***EGD supporter*** There is scope for: - Ensuring that green R&I is among the priority areas for R&I with dedicated funding to support green R&I projects; - Putting in place higher educational programmes and courses to enhance green skills among graduates; conducting activities to promote awareness on skills for green transition; - Fostering industry-science linkages and enhancing the R&I infrastructures to support green R&I; - Developing and submitting for approval by the Cabinet of Ministers dedicated legislative acts to ensure the alignment of R&I legislation with EU Acquis and conducting reforms to enhance the readiness of the Ukrainian R&I system to integrate the European Research Area (ERA) effectively.

		- Facilitating and promoting the participation of Ukrainian scientists and researchers in collaborative EGD-focused R&I projects within the Horizon Europe, Euratom, and other framework programmes; - Ensuring R&I integration and promotion across all sectors of the economy through corresponding strategic documents and supporting prioritisation of R&I on the political agenda to ensure that R&I becomes a real driver of green and sustainable transformation of the Ukrainian economy.
Ministry of Economy (MinEconomy)	Formulation and ensuring the implementation of innovation in the real sector of the economy with focus on innovative entrepreneurship development, and corresponding infrastructure for innovative firms, including business incubators and accelerators, industrial parks and technoparks. Implementation of EU Acquis in trade, industrial policy, with integration of carbon and environmental considerations (e.g., preparing for the CBAM).	***EGD supporter*** There is scope for: - More support to innovative entrepreneurs in green transition through integration of green focus into strategic documents on support to entrepreneurship and allocation of dedicated resources for green innovative ventures and investments into green R&I by firms (e.g., through the Ukrainian Start-Up Fund, loans/guarantees mechanism). - Fostering investments in green skills by businesses through the introduction of relevant incentives (e.g., tax reductions, etc.). - Integrating a focus on green R&I within the available innovation support infrastructures (e.g., incubators, accelerators, technoparks) through fiscal and other incentives.
Ministry of Digital Transformation	Formulation and ensuring the implementation of policy in digital innovation and technologies across all sectors	***EGD supporter*** The new Digital Innovations Development Strategy integrates greentech, biotech, agritech, and

	of the economy and the public administration.	govtech clearly among its priority areas, thus facilitating the green transition of Ukraine. There is scope for: - prioritising the R&I policy areas related to EGD implementation to boost digital transformation of businesses and the public sector; - Enhancing digitalisation of science and research data (e.g., registries, depositories, etc.) in line with the Open Science principles.
Ministry of Strategic Industries	Formulation and implementation of innovation in strategic industries, such as aerospace, defence, and security.	***Neutral - neither supporter nor opposer to EGD*** Given the martial law and ongoing Russian military aggression, data on the Ministry's activities is not fully available; the Ministry is focused on supporting the defence and security of the country through support to relevant industries, including technological innovations and their quick integration into the battlefield or to address key issues related to defence and security. Currently, the national defence and security priorities overshadow the aspects related to EGD but the latter begin to take up in prominence as the country needs to find a means to respond to short-medium term needs in energy security, nature restoration, demining. There is scope for: - Investing in green R&I through dual-use technologies and promotion of "green" solutions where relevant (e.g., renewable energy integration, use of lightweight, durable, and recyclable materials for equipment, vehicles, and infrastructure); - Adaptation of successful industry-science cooperation

		frameworks and structures to other sectors to support EGD.
Ministry of Environmental Protection and Natural Resources Ministry of Energy Ministry for the Development of Communities and Territories *	Formulation of policies in the field of environment protection, energy, regional development, and infrastructure delivery and restoration; focus on ready-to-apply technologies to meet the innovation demands in corresponding sectors is noted in relevant sectoral strategies. **In December 2022, the Ministry of Infrastructure was merged with the Ministry of Development of Communities and Territories. In September 2024, the Ministry was renamed into the Ministry for the Development of Communities and Territories leaving in its mandate the infrastructure (no separate Ministry of Infrastructure was created).*	***EGD supporters*** Ministries support decarbonisation, improvements in energy efficiency, waste management, sustainable resource use, and green agenda with the over-arching objective of meeting requirements of the EU integration across respective sectors. Ministries face pressures from business sector and other stakeholders -potential "losers" of green transition (e.g., coal mining industry,). There is a need for: - Making place for green R&I in corresponding strategic documents to support achievement of the objectives (e.g., reduction of energy intensity of the housing sector, demining, etc.); - Conducting awareness-raising activities and building the capabilities of the civil servants to implement green transition policies (investments in green skills).
Deputy Prime Minister for European and Euro-Atlantic Integration of Ukraine	Political integration of Ukraine into the EU and fulfilment of the EU acquis.	**EGD supporter** The DM is responsible for the implementation of the "Green Deal", "Fit for 55" goals in Ukraine.
IP and Innovation Agency	Implementation of R&I policy through IP rights protection and provision of services such as mediation in IP litigation, IP rights registration, and support to researchers and innovators in tech-transfer, evaluation of IP rights, PRO management, and coordination of grant activities.	**Neutral - neither supporter nor opposer of EGD** There is scope for the provision of specific services, including for green R&I projects.

National Research Fund	Implementation of the R&I policy through the disbursement of competitive funding for R&I projects.	**Neutral** There is scope for the provision of specific green R&I grants.
Ukrainian Start-up Fund	Implementation of R&I and entrepreneurship support measures through the provision of grants to innovative tech start-ups, corporate innovation funding, etc.	**Neutral** There is scope for the provision of specific green R&I grants by the MoES and MinEconomy together with donors and partners (e.g., EU, EBRD, private sector, etc., building on the good track record of USF in attracting donor funding for its projects.
Technology and Innovation Support Centres	Provision of advice and consulting services on IP acquisition, use, protection, etc.; awareness raising activities on IPR, including through online training and seminars.	**Neutral** There is scope for the provision of specific services on green R&I IP.
National Academy of Sciences	The highest self-governing scientific organisation of Ukraine, conducting fundamental and applied research and financed from a dedicated line of the state budget; decide on the topics for R&I to receive funding under competitive funding scheme run by NASU.	**Supporter of EGD** There is scope for more integration of green R&I into its fundamental and applied research, with allocation of relevant funding.
Other stakeholder groups		
NGOs: • **EcoAction** • **Association of local self-government "Energy-efficient Cities of Ukraine"** • **Resource Centre "Society and Environment"** • **Technologies of progress** • **DixiGroup**	Analytical work, advocacy, and awareness-raising activities related to innovation for green transition across various sectors, incl. energy, environment, waste management, building and renovation, etc. Contribution to policy through participation in Public Integrity Councils, public consultations on draft strategies, laws, and other documentation; advocacy actions, including with partnerships and support of	**Supporters of EGD** There is scope for: - Strengthening advocacy for and promotion of green innovations as an important driver for Ukraine's resilience and reconstruction and EU integration; - Enhancing awareness-raising activities on the EGD and requirements associated with it within the Ukrainian public sector and private businesses; - Building capabilities of stakeholders to implement

• **Green Deal Ukraina**	international NGOs and international donor funding.	actions related to green transition through donor-sponsored seminars and trainings, analytical materials and recommendations (e.g., building on the EcoAction and the Resource Centre Society and Environment, DixiGroup work in this respect); - Strengthening capabilities and developing green skills of local NGOs to accompany the green transition through donor-funded projects.
Business associations: • **Association of Industrial Automation of Ukraine and Ukrainian Cluster Alliance** • **Ukrainian Chamber of Commerce and Industry** • **European Business Association Ukraine** • **Association of Startups of Ukraine** • **Association of Manufacturers of Ukraine** • **Cluster Association of Ukraine and Industry 4.0 Platform**	Conduct ad hoc discussions at the national and international level which include EGD-related topics, e.g., decarbonisation, energy efficiency, circular economy principles, etc. However, since the invasion and its significant negative effect on the economy, the main topics of discussions and capacity-building relate to building resilience in wartime, exporting under transport, tariff barriers and other constraints, exporting to EU markets with required alignment with production certification and quality requirements, etc.	**Mostly supportive of EGD with some opposition ("EGD as constraint" rather than an opportunity)** There is scope for: - Awareness raising on green agenda requirements as opportunities for Ukrainian industry/business to ensure competitiveness in the EU markets; - Promotion and explanation of benefits in investing in R&I to ensure compliance and cut costs (e.g., in the framework of the CBAM) and ensure lobbying for fiscal benefits for companies investing in green R&I; - Provision of training and seminars, advice on building green skills within the companies; fostering exchange of experience and practices with business organisations from the EU on leveraging green transition for higher productivity and competitiveness;
International partners • **EU Delegation** • **G7**	Provision of funding and financing for R&I through various projects in Ukraine; Support to Ukrainian researchers and scientists,	**Supporters of EGD** There is scope for: - More prominent role for green R&I in current and future programmes supporting green

• **OECD, UNECE, EBRD** • **US Embassy and USAID** • **Sweden and SIDA;** • **Germany and GIZ; etc.**	research infrastructures (e.g., concerted response by the EU); Ensuring capacity-building activities for R&I stakeholders in the context of insufficient resources (human capital, finances, knowledge and expertise, etc.).	transition and reconstruction of Ukraine (e.g., sectoral support programs on regional development, economic competitiveness, etc.); - More generally, conducting capacity building to foster green skills in public administration, the education system, and industry to facilitate the green transition.

3. R&I policy framework and capacity assessment

3.1. Policy and Legal Framework

This section assesses the existing legislative and regulatory framework in R&I policy and analyses the extent to which Ukraine has met the EU Acquis in R&I, while also considering Ukraine's environment and climate commitments under the EU Association Agreement.

3.1.1. Strategic and planning documents, goals, and targets

Legislative and regulatory framework for R&I

R&I in Ukraine is regulated by a set of laws, namely the **Law on "On Innovative activities", "On Scientific and Scientific and Technical Activity", "On State Regulation of Activities in the Field of Technology Transfer", "On Priority Directions of Science and Technology Development", "On Priority Areas for Innovation Activity in Ukraine",** as well as a set of laws on intellectual property protection and the law **"On investments"**.

Since 2015, Ukraine has been working to upgrade its regulatory framework and reform the R&I system to fulfil its obligations under the EU-Ukraine Association Agreement (2016) and to achieve economic transition towards an innovation-led growth and sustainable development. Significant improvements to legislative framework on innovation and R&D included, for instance, **introduction of the Law "On Scientific and Scientific and Technical Activity" (2015), establishment of the National Research Fund (2018) and introduction of support mechanisms for innovative enterprises** (e.g., establishment of the Ukrainian Start-Up Fund in 2018 and introduction of innovation vouchers in 2016).

The Law "On Scientific and Scientific and Technical Activity" sets the legal, organisational, and financial basis to foster technological development through better collaboration between education, science, business, and government sectors. It also **sets an ambitious minimum state funding of R&D at the level of 1.7 % of GDP** – a threshold that the Government has not been able to meet so far. The establishment of National Research Fund[43] - the first state institution providing competitive grants for R&D activities (operational since 2020) - and of the Ukrainian Start-Up Fund[44] focused on supporting innovative projects and tech startups at early stages of development[45], are both major developments reflecting the Government's ambition to foster innovation as a driver of economic growth.

The subsequent amendments to the Law "On Scientific and Scientific and Technical Activity" have been aimed at **enhancing the performance of the R&I system**, increasing its attractiveness to young scientists, and ensuring its alignment with international and EU practices. In fact, the changes introduced in 2020 clarified the terminology of R&I positions (PhD student, young scientist, etc.), allowed for more flexibility for researchers and scientists in teaching activity in other educational establishments (i.e., up to 240 hours per academic year), and determined the minimum salary of the young researcher. The Cabinet of Ministers also approved two sets of amendments to the law, but these have not been approved by the Verkhovna Rada so far. The first set of amendments of September 2023 intends to improve current legal norms related to research infrastructures and young scientists, approximating Ukrainian legislation with the EU's (e.g., expanding research infrastructure access rights, clarifying the term "research infrastructure" with differentiation of infrastructure types, and clarifying various procedures). The other amendments of April 2024 establish target performance indicators for heads of scientific institutions, introduce the obligation to develop strategies, and determine directions of activity for scientific institutions.

Furthermore, recent **amendments to the legislation on the priority areas in R&D and in innovation activity (introduced in January 2024) reflect the national security and defence priorities, adding defence technologies to the list of R&I areas**. Other priority areas for innovation and R&D are broadly aligned with the EGD areas and include:

1. energy tech, energy-efficiency, energy-saving, and alternative energy sources;
2. transportation tech, incl. space, aircraft, shipbuilding, weapons, and military equipment;

[43] Національний фонд досліджень україни – віримо в нашу перемогу! (no date), https://nrfu.org.ua/ (May 2024).
[44] Also known as Innovation Development Fund.
[45] About usf – Ukrainian startup fund (no date), https://usf.com.ua/en/about-usf/ (May 2024).

3. production of new materials, creation of the industry of nanomaterials and nanotechnologies;
4. Agro Tech;
5. med tech;
6. green tech (cleaner production and environmental protection);
7. modern ICT, robotics.

In addition, the **recent amendments to the Budget Code** allow state R&D institutions (excluding the defence sector), state universities, and academies, to credit 30% of dividends (income) from the commercialised intellectual property to the special fund of the budget, i.e., retaining 30% of the revenues. However, the current legislation on intellectual property (IP) rights and technology transfer regulation requires amendments as the technology transfer is over-regulated, leaving few incentives for the research organisation to commercialise their R&D and industry to engage in research projects with public research organisations[46].

However, despite the positive developments in the legislative and regulatory framework for R&I, it currently comprises more than 200 legal acts, **lacks coherence, and requires better alignment with national strategic priorities**. In addition, the regulatory framework faces challenges in implementation and lacks specific policy mechanisms to catalyse innovative activity in Ukraine and make innovation a true driver of economic growth and development, especially in the context of the ongoing war and post-war reconstruction.

Strategic policy documents on R&I

The State Strategy for Development of Innovative Activities in Ukraine until 2030[47] and **its Action Plan for 2021-2023**[48] are the main strategic documents guiding R&I policy development and implementation. The main goal of the Strategy is to "build a national innovation ecosystem to ensure the rapid and high-quality transformation of creative ideas into innovative products and services, and to increase the level of innovativeness of the national economy". This involves creating favourable conditions for the development of the innovation activities and increasing the number of implemented R&D projects, their value added to the economy, and attracting investments into innovative activities.

[46] European Commission (2021). *Technology Transfer in Ukraine 2019-2020,* https://publications.jrc.ec.europa.eu/repository/bitstream/JRC123282/technology_transfer_in_ukraine_2019%e2%80%932020_-_pdf.pdf (May 2024).
[47] Decree of the Cabinet of Ministers of Ukraine (2019). On Approval of the Strategy of Innovative Development until 2030, 10 October 2019, N526-p, Kyiv, https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80#Text (May 2024).
[48] No Action Plan for 2024-2027 was developed to date.

The strategy sets the following **targets** in this respect, namely:

1. Creation of a favourable regulatory and legal environment for innovation activity;
2. Development of innovation support infrastructure;
3. Development of innovative culture and entrepreneurship culture, fostering innovative activity and technology transfer;
4. Ensuring the provision of state support for the implementation of innovative activities;
5. Ensuring communication between all participants in the innovation process, facilitating provision of relevant advice and consulting services, and support at all stages of the innovation cycle;
6. Enhancing protection of intellectual property rights;
7. Fostering innovations and projects based on open data, digitalisation;
8. Ensuring monitoring in the field of innovative activity.

The Action Plan for 2021-2023 included 32 measures/activities, with MoES responsible for the implementation of 29 of them. The full-scale invasion by Russian Federation, which started on 24 February 2022, has had a negative impact on the realisation of these activities. Despite this, the MoES together with the Ukrainian Start-Up Fund managed to conduct the **Science&Business project** which resulted in the launch of the Online Mentor - a programme helping develop innovative ideas for acceleration[49], and funding of 25 knowledge-intensive start-ups at the level of $125,000[50] (projects in the areas of healthtech (5), agri- and biotech (5), infrastructure and industry (7), and energy and environment (8)). Furthermore, the MoES launched in 2022 the **Info Science Bot** (Telegram Bot) to inform scientists and innovators about current professional opportunities in Ukraine and abroad, and the **Science2Business platform** – a matchmaking platform connecting businesses looking for R&D results and researchers/research organisations looking to commercialise their R&D results[51]. However, the S2B platform has not been actively used so far. Finally, the MoES managed to develop and submit several proposals of legislation "On Innovation Parks", "On Support and Development of Innovation Activity", and finalise the “Roadmap for the use of science, technology, and innovation to achieve the Sustainable Development Goals”, which was approved in December 2023.

[49] USF (2022). The Ukrainian Startup Fund together with the Ministry of Education and Science of Ukraine are launching a new initiative to develop science-intensive projects – Online mentor Science2Business, https://usf.com.ua/en/usf-spilno-z-mon-zapochatkovujut-novu-iniciativu-dlya-rozvitku-naukoiemnih-proiektiv-online-mentor-science-amp-business/ (May 2024).
[50] USF (2023). Science & business – gist pitch days: results, https://usf.com.ua/en/science-business-gist-pitch-days-results/ (May 2024).
[51] Science 2 Business Platform access available at https://s2b.nauka.gov.ua/ (May 2024).

In addition, a new strategy guiding the innovation policy development was adopted on **14th January 2025** – the **Digital Innovations Development Strategy of Ukraine until 2030[52].** The Strategy[53] aims to support innovative activity across all sectors of the economy and strengthen Ukraine's innovation ecosystem with the ambitious goal of making Ukraine the most comfortable digital and innovative country in the world. The Action Plan for 2025-2027 for the implementation of the Strategy outlines 79 measures across 18 strategic objectives with specific integration of 14 priority areas for innovation and technology development. **Among the priority sectors, the EGD-related areas feature prominently, including medtech, biotech** (incl. tech for sustainable agriculture and quality of life), **govtech, agrotech** (incl. addressing the degradation of soils), **edtech, greentech** (incl. decarbonisation of energy sector, energy saving and energy efficiency, green energy transition, biomethane production, green metallurgy), **and fluid economy** (incl. fostering digital infrastructure and seamless connectivity, AI-ready education). The effective implementation of the newly adopted Strategy has strong transformative potential for the Ukrainian economy, placing innovation at the centre and facilitating Ukraine's green transition.

The "Roadmap for the use of science, technology, and innovation to achieve the Sustainable Development Goals (SDGs)" is another important strategic document with impact for R&I development, elaborated to fulfil Ukraine's commitments under the UN Sustainable Development Agenda 2030. The roadmap recognises the crucial role of innovation in countering the negative consequences of the war on Ukraine's progress in achieving SDGs, contributing to climate commitments under the Paris Agreement, and alignment with EGD.

The main objective of the roadmap is to increase the contribution of R&I to achieving of SDGs. Based on the analysis of R&D system potential in Ukraine, foresight studies, and assessment of the progress in SDGs implementation, the document sets out **six R&D and innovation missions**, or, in other words, problem-oriented areas of R&D and innovative activity. These are presented in the table below (Table 3.1). The roadmap outlines measures for the realisation of each of the six missions, including R&D, required legislative, organizational, and financial arrangements with corresponding indicators. The targets on GERD, share of innovative enterprises in the business sector, and other targets are aligned with the State Strategy for Development of Innovative Activities, the State Economic Strategy 2030, the National Strategy on Waste Management 2030, the draft programme for recovery "Energy security", and other relevant strategic documents. The newly adopted Digital Innovations Development

[52] Дія. Бізнес (2024). *Уряд затвердив Стратегію цифрового розвитку інновацій до 2030 року,* https://business.diia.gov.ua/.
[53] МОН and Мінцифра (2023). *Глобальна іноваційна візія України: Версія повна (громадські обговорення),* https://winwin.gov.ua/assets/files/.pdf (May 2024).

Strategy 2030 foresees operationalisation of the implementation of the roadmap under its strategic goal 5, as up to date, the Strategy's realisation was lagging.

Table 3.1. Missions for achieving SDGs through R&I[54]

	Missions (priority areas for R&D&I development)	*Relevant SDGs*	*Type of economic activity*
1	Digitalisation	9	ICT
2	Resource-efficient economy and alternative energy sources	7,12	Energy, waste management, and renewable materials
3	Rational nature resource use and circular economy	6,11,12,13,14,15	Waste management, sanitation, industry, construction, agriculture
4	Healthcare	3,12,14,15	Healthcare
5	New materials and industrial technologies	8,9,12	Processing industry, transport, production of chemical products
6	Safe food	2,15	Agriculture, food industry

In addition, the MoES developed **"The Concept of the State targeted programme for the development of research infrastructures in Ukraine for the period until 2026**". The purpose of the programme is to create the necessary organizational, legal, and financial conditions for the development of the system of research infrastructure in Ukraine, increase its competitiveness, and foster the development of the scientific, R&D and innovative activities in terms of access of Ukrainian researchers to advanced research infrastructures in the EU. Development and upgrading of Ukraine's research infrastructures is a critical element for Ukraine's integration into ERA and took on an additional dimension after the start of the war in 2022, as Ukraine suffered substantial R&D infrastructure losses.

The main task of the programme is the classification of research infrastructures, assessment of their compatibility with European research infrastructures, provision of priority funding for their development and ensuring consistency with the roadmap for the development of European research infrastructures, approved by the European Strategic Forum of Research Infrastructures (ESFRI).

The first (preparatory) stage (2021-2022) of the programme foresees the development of the document regulating the creation, modernisation and operation of research infrastructures followed by the second stage (2022-2026) with the actual creation and operationalisation of different research infrastructures (e.g., centres for the collective

[54] Adapted from the "Roadmap for the use of science, technology, and innovation to achieve the Sustainable Development Goals (SDGs)".

use of scientific equipment, national research centres, state laboratories, etc.). The indicators for the achievement of the programme by 2026 are as follows:

i) creation and operation of at least 50 centres of collective use of equipment, nine state key laboratories, three national scientific centres;
ii) creation and implementation of a system of interaction between existing and new Ukrainian e-infrastructures, considering the ERA guidelines;
iii) enabling the introduction of new research infrastructures at the European level in Ukraine;
iv) access of R&D actors to a competitive research infrastructure and motivation to engage R&D activities at a high level, to stop the brain drain in the R&I sector.

The draft programme went through public consultations in May 2021, but has not been approved by the Cabinet of Ministers since. In fact, according to recent amendments to the legislation, the state target programs are suspended due to fiscal constraints, including those associated with the martial law currently in place. The dedicated Horizon Europe Policy Support Facility (PSF) project launched by the European Commission in April 2024 is expected to provide analysis of the current state of R&D infrastructures in Ukraine and provide recommendations on the way to support their development and modernisation to facilitate ERA integration. The project results are expected to be published in Q1 2025. The PSF analysis could be instrumental in supporting Ukraine's R&I sector reform and strengthening the R&I system capabilities for EGD implementation.

Furthermore, the recent development includes the approval by the Government on 13 April 2024 of the **"Concept of the State targeted R&D programme on the use of artificial intelligence technologies in priority sectors of the economy until 2026**" with the Ministry of Strategic Industries taking the lead in development of the draft programme and its further implementation[55]. The concept foresees analysis of needs of priority economic sectors in terms of AI technologies and the capabilities of local R&D institutions in this regard; development of requirements for the IT infrastructure and safety; establishment of AI labs or centres within the educations establishments to provide services in development, testing, and teaching the use of AI technologies, creation of catalogue of AI technologies by Ukrainian R&D actors, etc. However, given the ongoing suspension of the implementation of state target programs in Ukraine, the target program was not operationalised.

[55] Кабінет міністрів україни (2024). *Кабінет міністрів україни - про схвалення концепції державної цільової науково-технічної програми з використання технологій штучного інтелекту в пріоритетних галузях економіки на період до 2026 року,* https://www.kmu.gov.ua/npas/pro-skhvalennia-kontseptsii-derzhavnoi-tsilovoi-naukovo-tekhnichnoi-prohramy-z-vykorystannia-s320130424 (May 2024).

In the absence of the Action Plan for the implementation of the Strategy for the Development of Innovative Activities in Ukraine until 2030, **the Strategic Plan of the Activity of the MoES for 2024** guides the R&I policy implementation. The MoES Strategic Plan of Activities for 2024 includes four main objectives, including:

1. R&D infrastructure development and integration into the European Research Area.
2. Ensuring R&D is closely aimed at solving world-level scientific problems and specific science-intensive priorities in the areas of defence, security, economy, and society of Ukraine.
3. Strengthening the capacity of researchers to carry out high-quality research and the creation of competitive scientific results and innovative products.
4. Enhancing R&D funding system to foster quality of R&D results (incl. through the Science City initiative and fostering non-state sources of R&D funding).

It also contains strategic priorities on European integration in the science and research sectors. Namely, it is foreseen to *align the legislative framework for education and science with the EU acquis,* including EU objectives in this area. In addition, the *development of effective cooperation in science and education with EU countries based on the best European practice and standards, and the participation of researchers in opportunities provided by the European educational and research sector*, including Horizon Europe, COST and other initiatives, are set forward as priorities for the MoES for 2024. Digitalisation of education and science is also foreseen under the Ministry's strategic priorities for action in 2024.

These measures are in line with **the Government Priority Activities Plan for 2024** which, in the area of science and innovation, foresees the development of the draft law "On support and development of innovative activity", provision of grants by the Ukrainian Start-Up Fund along the defined priority areas for R&I, and the development of the proposal for experimental network of business incubators and accelerators within universities and educational establishment. It can be noted **that ERA integration and fostering innovation in science and innovative entrepreneurship are priorities for the government for 2024 in R&I policy**.

As to the longer-term policy for R&I development, the **MoES has recently presented its Strategic Plan of Activities until 2027**[56], which mirrors the main objectives set out in the Strategic Plan of the Ministry for 2024 and expands on them with a 3-year projection. The Plan covers *Science and Innovation* under strategic priority 6, along with elements on EU integration and digitalisation of the R&I sector in priorities 7 and 8. The strategic objectives on science and innovation include:

[56] МОН (2024). Стратегічний план діяльності Міністерства освіти і науки України до 2027 року, https://mon.gov.ua/storage/app/media/Strateh.plan.diyalnosti.MON.do.2027.roku.pdf (May 2024).

1. *The research infrastructure of Ukraine is systematically developing, is effectively used and is integrated into the ERA* (in particular through the state audit and evaluation of activity of R&I organisations, and of R&I infrastructure in line with PSF 2017 recommendations, priority support to R&I in the areas of defence tech, cybersecurity, nuclear and green energy, nanomaterials, med and biotech, AI, etc.)
2. *R&D is aimed at solving as many world-level scientific problems and specific science-intensive tasks in the areas of defence and security, and economic and societal challenges in Ukraine* (incl. Institutional capacity building to support R&I in science-intensive sectors, creation of a new mechanism for state order on state-of-the-art R&I, supporting R&I development through private sector co-financing, Open Science initiative, increasing researchers' mobility and cooperation with diaspora on R&I, etc.)
3. *The R&I personnel are capable, undertake high-quality research and ensure the creation of competitive scientific results and innovative products* (incl. Increasing the financial and managerial autonomy of universities and state R&I organisations, deregulation of the R&I sector and simplification of procedures, change in the remuneration system of R&I workers, moving away from the tariff grid for salary allocations, removal of restrictions on remuneration within the scope of funding of an R&I project, etc.).
4. *The system of R&I funding is drawing on multiple sources and is effective, promoting the quality of research at various levels* (incl. Introducing performance-based research funding, updating the mechanism of basic funding of R&I organisations based on the results of state certification of higher education institutions, creating conditions for widespread use of extrabudgetary funds from the business sector and from abroad, and from Science. City initiative, creation of the National system of researchers for individual support of the best scientists, in particular young scientists, diversification of the portfolio of projects of the NRF, enhancing data availability through Ukrainian Electronic Research and Information System (URIS), etc.

The objectives related to EU integration include harmonisation of Ukrainian legislation with the EU Acquis and promotion of collaboration between Ukrainian researchers and scientists with the EU institutions/researchers and scientists, as well as the digitalisation of R&I administrative processes.

Finally, Ukraine has elaborated **a Roadmap for ERA integration** (presented below) and **legislative acts to enable Ukraine's participation in the Horizon Europe programme** (e.g., recent amendments to the legislation on state funding of competitive Ukrainian projects under Horizon Europe, see Annex 1).

International agreements on R&I

Ukraine signed **an Agreement on Science and Technology Cooperation with the EU** on 4 July 2002, which has been renewed several times. The latest renewal took place in 2022, making the Agreement effective as of 8 November 2019 for a period of five years. A Joint Committee established under the agreement provides a framework for dialogue on R&I policies, enables the sharing of best practices, and fosters R&I collaboration.

Ukraine has been fully associated with the EU's Horizon 2020 (and later, Horizon Europe) and Euratom Research and Training (2014-2020) programmes since 2016. Under Horizon 2020, Ukraine participated in 230 projects, involving 335 participants with a success rate of 9,23%57, for a total funding of €45.5m58. For comparison, Türkiye took part in around one thousand projects under Horizon 2020 with more than 1198 organisations involved for the total funding of €272,5 m and the success rate of 10,36%59. Energy, climate, and transport were particular strengths of Ukraine in H2020. In the Euratom programme, Ukrainian participants received funding for fusion and fission projects in the amount of EUR 4.9m. Ukraine is a full member of European Cooperation in Science and Technology Program (COST), financed under Horizon Europe in 2022. So far, Ukraine has been involved in 74 actions, and Ukrainian researchers are part of 116 working groups[60].

Ukraine has also been an associated member of **CERN** since 2016 and has been taking part in the **NATO Science for Peace and Security (SPS) Programme** since 2004[61]. In addition, Ukraine signed **over 50 bilateral agreements on cooperation in science and R&I** (e.g., with Germany, France, the US, Japan, Moldova, Latvia, Turkey, etc.)[62]. In 2008, Ukraine became a full-fledged member of the **EUREKA Programme**. The main goal of Ukraine's participation in the EUREKA is to foster the commercialisation of domestic innovation and R&D results and provide support to the most talented Ukrainian participants in the EUREKA projects to carry out competitive R&D. In 2020, Ukraine joined the initiative **EUREKA Globalstars** and the same year Ukraine's team won a USD 50 thousand for international R&D collaboration project. In total, as of 2020, Ukraine joined 5 EUREKA projects (4 networks and 1 cluster)[63].

[57] Success rate represents a ratio of the retained applications to the total number of eligible applications received.
[58] European Commission (no date) *Horizon 2020 country profile: Ukraine (2014-2020),* https://dashboard.tech.ec.europa.eu/qs_digit_dashboard_mt/public/extensions/RTD_BI_public_Country_Profile/RTD_BI_public_Country_Profile.html?Country=UA (May 2024).
[59] European Commission (no date). *Horizon 2020 country profile: Türkiye*, *Horizon country profiles (2014-2020),* https://dashboard.tech.ec.europa.eu/qs_digit_dashboard_mt/public/extensions/RTD_BI_public_Country_Profile/RTD_BI_public_Country_Profile.html?Country=TR (May 2024).
[60] MOH (no date). *ЄВРОПЕЙСЬКА ТА ЄВРОАТЛАНТИЧНА ІНТЕГРАЦІЯ,* https://mon.gov.ua/tag/evropeyska-ta-evroatlantichna-integratsiya (March 2024).
[61] Ibid.
[62] Ibid.
[63] Ibid.

Despite the wealth of international R&I agreements, Ukraine fails to capitalise on the opportunities they offer as the country often lacks funding and capacities for their effective implementation, but also due to obstacles in national legislation (e.g., restrictions on transfer of state funds to partners abroad by R&I organisations in Ukraine, hosting international scientists in Ukraine, etc).

Main gaps in the legislative framework implementation

Despite progress in the development of the policy and legal framework for R&I since 2014, important gaps remain that hinder the uptake of innovations and upgrading of the R&D system so it can drive the country's development and EU integration. First, the foreseen measures under the Strategy for Innovative Development of Ukraine until 2030 and the Roadmap on R&D to support SDG **lack financial resources and concrete policy tools for their implementation**. For instance, the source of funding is often not specified at all or is missing in the case of the Action Plan for the Implementation of the State Strategy for Innovative Development 2030, which makes the Action Plan look rather like a "wish-list" than a realistic plan of action for the implementation of the Strategy. In the context of already insufficient R&I funding, such an approach makes R&I even more vulnerable to failures. If the outlined weaknesses are not addressed when implementing the new Digital Innovations Development Strategy of Ukraine until 2030, there is a high probability that the Strategy will not deliver on its ambitious objectives and on tackling the existing R&I sector challenges. Thus, systematically integrating **robust key performance indicators (KPIs) for envisaged actions, assessing the potential cost of their implementation, and sources for mobilisation of such funds** would significantly strengthen R&I policy implementation and its intended impact on the real economy.

Other sectoral strategic documents with measures on R&I

A series of sectoral policy documents in environment, climate, energy, and regional development contain objectives or measures related to R&I promotion to support the sector transformation. Often, these strategic documents talk about **'technologies' and 'innovation' rather than R&D (e.g., creation of new and upgrading of existing applications, systems, services, processes, and products)**. A brief overview of these sectoral policy documents in relation to R&I and EGD is provided below.

The National Economic Strategy 2030 places EU integration, decarbonization of the economy (increasing energy efficiency, development of renewable energy, circular economy, and EGD alignment), fostering entrepreneurship and innovation among key principles and directions of Ukraine's economic development. It sets ambitious goals, such as a two-fold increase in real GDP, an increase in labour productivity by 1.7 times, and increasing the net inflow of FDI to at least 15 billion US dollars per year starting in 2025.

The National Environment Protection Strategy until 2030 sets such objectives as introducing ecologically safe, resource- and energy-saving technologies (in particular, in metallurgical, chemical, petrochemical and energy industries); introducing e-governance technologies in environmental sector; modelling of ecological risk through modern ICT technologies to preserve nature ecosystems and ensure population wellbeing; introduce modern energy-efficient and heat-preserving technologies in construction; improve technological processes and construction of high-tech complexes for solid waste disposal; ensuring the practical implementation of the results of modern fundamental environmental research and continuous interaction between scientists and state bodies in environment-related areas.

The **National Strategy for Waste Management until 2030** sets forward the following objectives when it comes to industrial waste: introducing cleaner production technologies and creation of a network of centres providing necessary technical, consulting and informational support; determining and putting to use the best available technologies for reuse, processing and disposal of industrial waste; providing financial assistance to business entities (loans, grants, etc.) for environmental modernization, introduction of cleaner production technologies, development of capabilities to process and dispose of industrial waste. It also includes objectives on the introduction of the latest technologies for the utilization and removal of solid household waste, reducing the volume of their disposal at landfills. The **Law on "Packaging and Packaging Waste" (2023)** in its article 4 stipulates the use of R&I to increase the efficiency of the recovery of packaging waste and the application of best available technologies for the processing of the packaging waste. The **Law "On Waste Management" (2023)** includes provisions on the reduction of the volume of waste generation using best available technologies and management methods and foresees tax and credit benefits to fund R&I in waste processing technologies, in particular recycling.

The Long-Term Strategy on Thermal Modernisation of Buildings until 2050 sets the development of innovations in this field as its strategic objective 7; however, it does not mention R&I in energy-efficiency or thermal modernisation technologies.

The **National Transport Strategy of Ukraine 2030** mentions support to the implementation of the R&I results, including through fostering international science and technological collaboration, as well as through integration of new transport technologies for safe, clean and energy-efficient transport in line with EU integration requirements.

The State Regional Development Strategy 2021-2027, under its operational **objective 4** on increasing regional competitiveness, promotes the introduction of innovations and the growth of the technological level of the regional economy, supports innovative

enterprises and startups. In particular, the measures include: fostering the technological upgrading of production sites and capabilities, including through energy-efficient, ecologically safe and resource preserving technologies, improvement of efficiency of use of raw materials of local origin; development and implementation of an effective support mechanism for start-up companies; facilitate the creation and support of existing business incubators supporting SMEs that develop and implement innovations, innovation clusters, technology transfer centres; promoting the development of regional innovative infrastructure systems (science and technology parks, etc.). The **smart specialisation (S3)**[64] features under operational objective 5 on sustainable industry development with measures including financial support to priority industrial sector development as defined by the regional S3 strategies, introducing instruments facilitation SMEs participation in S3, ensuring all regions of Ukraine join the S3 Platform with access to the dedicated instruments, and establishing a mechanism of priority support to industries that create new jobs based on the use of local resources, resource-saving technologies, use energy-efficient construction materials and equipment.

The main take-away from this brief overview of strategic documentation is that R&I remains poorly integrated into sectoral policies with the predominant focus on readily available technologies rather than R&D., the sectoral strategies recognise the importance of innovation for achievement of the set goals, but innovativeness often stems from integration of ready-to-use technologies rather than development and application of local R&D, and there are no R&D-related measures envisaged. This can be explained by the low-tech structure of the Ukrainian economy and the low innovative activity of the private sector, as well as the lack of R&D commercialisation and weak industry-science linkages. At the same time, integration of new readily available technologies carries important benefits for economic productivity and employment and is the most affordable form of innovation in the current context in Ukraine (e.g., fiscal constraints, ongoing war, destruction of R&I infrastructures, and outflow of researchers and scientists, but also innovators abroad). **The R&I policy, as formulated under the "Strategy for Development of Innovative Activities in Ukraine until 2030," seems to be operating in relative isolation from the rest of the policies.**

Finally, in the context of the full-scale invasion by Russian Federation and the overall objective in Europe to increase its competitiveness through innovation, **innovation has come to the forefront of the policy agenda in Ukraine.** It is believed that advanced technologies and increased investment in innovation are the means to ensure defence and security and to address socio-economic and environmental challenges exacerbated

[64] Smart specialisation strategy defines experimental R&D as a core element of its innovation policy approach, emphasizing the development and testing of new solutions tailored to the specific strengths and challenges of regions.

by the war. The R&I dimension was also mentioned in the **Ukraine Facility Plan** – a document outlining Ukraine's reform agenda up until 2027, developed by the Government of Ukraine and approved by the EU Council. The Plan emphasises the role of innovation and technology in ensuring Ukraine's reconstruction and contributing to achieving the EGD objectives, as well as facilitating Ukraine's progress on climate objectives, i.e., reduction of emissions by 65% below 1990 levels by 2030 and to zero by around 2060[65].

A more prominent role of the R&I in the **development and further transformation of Ukraine's economy** is an important step in the government's approach and strategic vision of the future of Ukraine. However, to put this vision into practice and make innovation truly a driver of sustainable economic development, **there is a need to substantially increase state R&D funding, promote investments in R&I, reform the R&I system to enhance its performance, increase talent retention and attraction, facilitate science-industry collaboration, and promote integration into ERA.**

R&I policy in the context of structural reforms in Ukraine

It is important to note that R&I reform in Ukraine has been taking place in a dynamic reform context. Thus, the **digitalisation reform**, accelerated in 2020, led to significant successes in simplification of business procedures, administrative services for citizens (e.g., Diia, Diia. Business, Diia.City), and progress in open data, making Ukraine the third country in Europe on open data transparency in 2020[66]. In addition, the **decentralisation reform** running since 2014 enabled local governments to assume a greater role in funding of R&D and innovation activities[67] through the possibility to allocate grants and establish investment funds for innovative projects, run support schemes for innovative enterprises through, for instance, establishment of business incubators and accelerators, foster science-industry collaboration through facilitation of contracts on R&D, etc. The national **Smart Specialisation Strategy (S3),** in place since 2019 and integrated into the State Regional Development Strategy 2021-2027, makes its contribution to R&I development. It seeks to **foster research and investment in competitive areas at the level of regions**, providing guidance to local authorities on the best areas for support of R&I activities to increase the competitiveness of their regions. Finally, **education sector reform is** another important pillar of the R&I landscape. The reforms in this sector have been guided by two strategic documents:

[65] Government of Ukraine (2023). Updated Nationally Determined Contribution of Ukraine to the Paris Agreement, https://unfccc.int/NDCREG (May 2024).
[66] Shevchenko, L. (2023). *Ukraine in top 3 in Europe for open data transparency*, *LIGA,* https://tech.liga.net/en/ukraine/novosti/ukraina-popala-v-top-3-v-evrope-v-reytinge-otkrytyh-dannyh (June 2024).
[67] UNECE (2021). *Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus*, https://unece.org/economic-cooperation-and-integration/publications/sub-regional-innovation-policy-outlook-2020 (May 2024).

the Concept of State Policy on Secondary Education Reforms "New Ukrainian School" and the Concept of State Policy "Modern Vocational Education". However, these policy documents do not sufficiently take into consideration the country's innovation policy needs[68] and the needs for skills development to support economic transformation, including green and digital transition. Secondary, vocational, and tertiary education could benefit from stronger business sector engagement in curriculum development, practice-based training, and the elements of dual education implementation.

The progress on digitalisation, decentralisation and education sector reforms has direct impact on the R&I sector readiness to integrate ERA and support EGD implementation, as they contribute to the implementation of the Open Science principles, better connectivity between researchers in Ukraine and the EU, supporting the regional dimension of innovation and capabilities of research organisations to engage in EU framework R&I programmes such as Horizon, as well as human capital equipped with necessary skills to perform research and innovation.

3.1.2. National legal framework compliance with international obligations and EU approximation

On 23 June 2023, Ukraine obtained the status of a **candidate country for EU membership** following the European Council decision. As of 2023, 2739 EU legal acts remain to be fully or partially implemented into Ukrainian legislation, and 1625 are already fully implemented. The European Commission in its latest Analytical Report on Ukraine's application for membership of the EU (2023) assesses Ukraine's **progress in science and research for the EU integration (Chapter 25) as *moderate***.

It is important to note that **the Acquis in the field of science and research does not require transposition of EU rules into national legislation.** Rather**, Chapter 25 is about ensuring that the national R&D system has necessary capacities to effectively integrate into European Research Area (ERA),** including alignment with ERA priorities, and participate in the EU's Framework Programmes in R&I (such as Horizon Europe, Euratom, etc.), while also aligning with EU standards in science and research.

In this regard, and since 2014, Ukraine has been working to put in place necessary policy mechanisms to enhance its R&I system capabilities to integrate ERA (such as described in sections 3.1.1 and 3.2). However, despite the notable progress, the European Commission's assessment in 2023 points to several important obstacles for Ukraine, such as limited national R&I technological absorption capacities, the declining number of researchers, and outdated research infrastructures because of insufficient

[68] Ibid.

funding, ineffective disbursement of funds, and fragmented governance[69]. The analysis also highlights the need for a strategy for retention and attraction of the R&I talent, including the work with diaspora, and the need for improved implementation of the existing R&I legislation (e.g., the "Law on Scientific and Technical Activities" sets the target of 1,7% of GERD which has never been reached in Ukraine).

The monitoring tool of EU -Ukraine Accession Agreement implementation suggests that for the period of November 2014 - October 2024, Ukraine has implemented 68% of the Action Plan measures in "Science, Technologies and Innovation, Space", space-related legislation and digitalisation actions are responsible for most of the delay[70].

Ukraine seeks greater integration into the ERA, and, to this end, it elaborated and adopted a **Roadmap on integration into the European Research Area** (2021). The roadmap sets forward the following key objectives:

1. Harmonization of research and innovation policy with EU standards and norms;
2. Expanding access to the EU R&I programmes;
3. Development of research infrastructure in Ukraine and its integration into the EU research infrastructure;
4. Creation of favourable conditions for international and interdisciplinary mobility of scientists/researchers;
5. Application of a comprehensive gender approach in the field of science and innovation;
6. Application of open science principles and use of EU open access tools;
7. Development of innovative infrastructure considering the best European practices;
8. Internationalization of scientific research and innovation outside the EU.

Given the **New European Innovation Agenda (NEIA)** adopted in July 2022, Ukraine should **align its regulatory and policy framework with NEIA** and intends to do so under the Ukraine Facility Plan. Ukraine has also recently joined the European Research Area and Innovation Committee (ERAC), continued its participation in Horizon Europe and Euratom programmes (adoption of relevant legislation for continuous participation), and obtained membership in the COST programme (2023).

When it comes to the assessment of Ukraine's legislation alignment with **EU Acquis on Environment and Climate change (Chapter 27)**, Ukraine demonstrates ***early stages***

[69] European Commission (2023). *Analytical Report following the Communication from the Commission to the European Parliament, the European Council and the Council Commission Opinion on Ukraine's application for membership of the European Union,* https://neighbourhood-enlargement.ec.europa.eu/document/download/59c236e7-5cc3-421e-b254-50ee2a9454b4_en?filename=SWD_2023_30_Ukraine.pdf (May 2024).

[70] *Pulse – The tool to monitor EU-Ukraine Association Agreement Implementation*. Science, Technology and Innovations, Space, https://pulse.kmu.gov.ua/ua/streams/science-technology-and-innovations (June 2024).

of readiness to join the EU, as important gaps remain in the alignment with the EGD, waste management, national emissions reductions commitments, the Urban Wastewater Treatment and Bathing Water Directives, Drinking Water Directive, industrial and livestock rearing activities falling under the EU's industrial emissions legislation[71]. Under this chapter, Ukraine has fully implemented 13 acts and has 156 acts pending implementation (and for around 40% of those, implementation has not yet started).

Ukraine needs to fully align with the EU Regulations on Ozone Depleting Substances and on Fluorinated Greenhouse Gases, adopt provisions for a reduction in hydro chlorofluorocarbons (HCFCs) consumption, and a separate law on climate change. In addition, adoption of legislation for approximation of the Governance Regulation, an obligation under the Energy Community, is required, as well as development and adoption of a national energy and climate plan, and legislation for EMS. Action is needed to align with the Effort Sharing Regulation or the Regulation on Land Use, Land Use Change and Forestry, and legislation addressing the issues of fuel quality and reductions of GHGs from petrol, diesel, and gas oil fuel (see Annex 2).

Overall, when it comes to the EGD, Ukraine has not officially joined but was among the first countries to announce its intention to participate in EGD implementation. On 6 October 2020, at the Ukraine-EU summit, **the agreement on a "Climate package for a stable economy in Ukraine" (CASE)** was signed, providing EUR 10 million in funding, which was supposed to contribute to the financing of projects for the transition to a clean and climate-neutral economy. In 2021, the National Council on Security and Defence of Ukraine planned to develop the National Plan on Energy and Climate Change until 2030 – a document which is Ukraine's obligation under the Treaty on the Establishment of the Energy Community in accordance with the requirements of Regulation (EU) 2018/1999 and the EU membership path. However, this was not done until only recently, when in 2023, the Government of Ukraine developed a draft **National Plan on Energy and Climate (NPEC)[72]** under the Ukraine Facility Plan. The document includes five cross-cutting areas: energy security, internal energy market, energy efficiency, decarbonisation, as well as research, innovation, and

[71] European Commission (2023). *Analytical Report following the Communication from the Commission to the European Parliament, the European Council and the Council Commission Opinion on Ukraine's application for membership of the European Union,* https://neighbourhood-enlargement.ec.europa.eu/document/download/59c236e7-5cc3-421e-b254-50ee2a9454b4_en?filename=SWD_2023_30_Ukraine.pdf (May, 2024).

[72] Міністерство економіки (2024). *Проект Національного плану з енергетики та клімату України 2025-2030 | Міністерство економіки України,* https://www.me.gov.ua/Documents/Detail?lang=uk-UA&id=f7088035-142e-4912-9aa0-6fe2def80c1b&title=ProektNatsionalnogoPlanuZEnergetikiTaKlimatuUkraini2025-2030 (May 2024).

competitiveness. The NPEC was adopted by the Government on 25 June 2024[73]. The development and adoption of this plan is part of. It will also contribute to Ukraine's commitment to combating climate change under the Paris Agreement.

Furthermore, when it comes to Ukraine's climate goals, in July 2021, the Government revised **Ukraine's Nationally Determined Contribution (NDC)** raising it to 65% in GHG reduction by 2030, compared to the level of 1990 (the previous commitment was 40%).

Ukraine's EU integration in terms of the climate agenda means substantial decarbonisation of its economy and adjusting to the EU's **Carbon Border Adjustment Mechanism (CBAM**) to enter into force in 2025[74]. Following the adoption by the Ukrainian Parliament of the "Law on the Basic Principles of Climate Policy" on 8 October 2024, the Ministry of Environment developed and published for consultations the draft Action Plan on the creation of the national Emissions Trading System (ETS) on 11 November 2024. The draft plan envisages the launch of the ETS in 2026 as a pilot to run for two years before a full-scale up in 2029[75].

In addition, Ukraine will have to allocate at least 20% of the funds under **the Ukraine Facility**, an EU funding mechanism of 50 bn EUR to support the Ukrainian economy during 2024-2027, to climate mitigation and adaptation, environment protection, including the preservation of biodiversity, and the green transition. For example, at least 550 million euros are to be disbursed to increase the energy efficiency of centralized heating and public buildings, as a contribution to the Energy Efficiency Fund, as well as the development of renewable energy. The **Ukraine Facility Plan,** developed and presented by the Government of Ukraine in March 2024, emphasises the importance of EGD alignment for Ukraine and has a dedicated **chapter 15 on the green transition and environment protection**. It foresees the development and implementation of EGD-relevant legislative and policy documents, namely the Strategy for Implementing Circular Economy Principles and its Action Plan and the National Waste Management Plan until 2033, among other documents. **The funding available under the plan could be leveraged to support R&I in EGD areas and accompany**

[73] Decree of the Cabinet of Ministers as of 25 June 2024 n 587-p, On the Approval of the National Plan on Energy and Climate until 2030", https://zakon.rada.gov.ua/laws/show/587-2024-%D1%80#Text (May 2024).
[74] IMF (2023). Ukraine: selected issues paper. *IMF Staff Country Reports*, 2023(400), https://doi.org/10.5089/9798400261657.002.A001 (May 2024).
[75] Міністерство захисту довкілля та природних ресурсів України (2024). Повідомлення про оприлюднення проєкту розпорядження кабінету міністрів україни «про затвердження плану заходів щодо створення національної системи торгівлі квотами на викиди парникових газів» – міністерство захисту довкілля та природних ресурсів україни, https://mepr.gov.ua/povidomlennya-pro-oprylyudnennya-proyektu-rozporyadzhennya-kabinetu-ministriv-ukrayiny-pro-zatverdzhennya-planu-zahodiv-shhodo-stvorennya-natsionalnoyi-systemy-torgivli-kvotamy-na-vykydy-parnykovyh-ga/ (May 2024).

Ukraine in its green transition, even if the R&I aspects were not specifically mentioned in the Plan.

Finally, EDG-related actions feature prominently in the Government Priority Activities Plan for 2024. For instance, the Plan foresees to develop a draft document on principles of the state policy in the area of climate change (the Law was adopted by the Parliament in October 2024), development of the Action Plan on creation of a national system for GHGs trading quotas (the Action Plan developed and submitted for public consultations in November 2024), alignment with the EU chemical products packaging, other EU Acquis in the area of environment protection (i.e. Annex I to Council Directive 91/676/EEC of 12 December 1991 on the protection of waters against pollution caused by nitrate pollution from agricultural sources). It also contains measures on EU integration, digitalisation of public administration and services, and energy independence (including introduction of guarantees on origin of electric energy produced from renewable sources and promotion of renewable energy, introduction of smart grids for energy efficiency, ensuring operation of energy efficiency programmes providing household grants, development of requirements for near-zero emissions buildings (NZEB), creation of database on energy and exploitation of buildings). However, it does not specifically refer to innovation R&I, nor does it directly mention the innovation aspects of the sectoral policy actions.

To progress in alignment with the EU acquis in the areas relevant to EGD, the Government would need to address gaps in legislation and capacities in reform implementation (public sector) and reform compliance (private sector). The ongoing war and associated infrastructure destruction, continued relocation of businesses and population displacement, as well as imperatives for economic growth to ensure the economy's survival and gradual reconstruction process, overstretch already limited resources, requiring better policy prioritisation and coordination, and donor support in capacity building.

3.1.3. Summary of gaps/bottlenecks and needs

Area of assessment	Summary of gaps
Have the R&I-related international agreements been honoured? What are the main issues?	1. Existing strategic policy documents on R&I often lack concrete policy mechanisms for implementation, robust KPIs, and sufficient funding, with negative implications for R&I policy outcomes, including Ukraineś readiness for ERA integration. 2. Ukraine's alignment with the EU on science and research (chapter 25) is moderate as obstacles remain in technological absorption capacities, the declining number of researchers, outdated research infrastructures, insufficient funding, ineffective disbursement of funds, and fragmented governance.

	3. International bilateral and EU-Ukraine R&I cooperation face resource constraints in implementation (capabilities and funding) with some regulatory obstacles hindering smooth collaboration, while Ukraine's participation in existing EU R&I framework programmes has been increasing and leaves great room for scale-up. 4. Ukraine has streamlined objectives related to ERA integration in key policy documents in this area (e.g., Roadmap for ERA integration, Action Plans of MoES for 2024 and until 2027) but has not yet reflected on the New European Innovation Agenda in its R&I policy.
Are the current strategic objectives and targets in the R&I area in line with those of the EGD? How much do they differ?	1. The priority areas for R&I as outlined by the legislation and the policy documents are overall aligned with EGD areas, but the focus on green R&I across sectoral policies is currently lacking. 2. Sectoral strategies do not consistently integrate R&I and in case they do, the focus is on readily available technologies adoption and technology upgrading with no mention of R&D, reflecting the issue of systemic R&I underfunding and overall low absorption capacities of Ukrainian private sector. 3. The role of R&I in achieving EGD is reflected in the recently adopted National Energy and Climate Plan, but the R&I is largely missing from the Ukraine Facility Plan – a key document outlining priority government actions until 2027 to be supported by the EU funds.

3.2. Instruments for policy implementation

This section describes the implementation of R&I policy in Ukraine, including the existing policy instruments and how they contribute to reaching the R&I potential to support the green transition.

3.2.1. Regulatory and economic instruments

The policy instruments for R&I implementation are not well-adapted to assist the transformation in EGD areas, lacking concrete implementation mechanisms and funding, along with a further need to streamline and prioritise R&I across the sectors of the economy to ensure the transition to a more "demand-driven" innovation system in Ukraine. At the same time, the Government is planning a series of changes to enhance the R&I system performance and address these gaps.

The **MoES Strategic Plan of Activities until 2027** includes EU integration among its main objectives, which it intends to achieve through a set of measures aimed at enhancing the quality of the R&I system. To this end, the MoES envisages introducing

mechanisms and incentives for R&I funding by the business sector in the absence of sufficient state R&I funding. This is complemented by changes to the remuneration system of R&I workers (moving away from the tariff grid, removal of restrictions on remuneration within the scope of funding of an R&I project), the introduction of performance-based research funding, and establishment of additional financial incentives for young and prospective scientists and researchers, among other things. However, **it is important to note that the R&I system transformation towards high-quality EU- comparable performance cannot be achieved at the current level of state funding, i.e. 0.33% of GDP in 2023, and that state investments are needed to help catalyse and further direct the green R&I**. No increases in the state-allocated R&I budget are planned for the time being.

Currently, **R&I is not well-integrated into long-term sectoral policies, plans, programmes, and projects that have a direct impact on achieving EGD-related objectives**. Hence, it would be crucial to integrate measures on R&I across energy and climate, environmental protection, agriculture policies, and other policies with a focus on instruments to support R&I in these sectors to complement foreseen measures on integration of the ready-to-use technologies across sectors (*see section 3.1 for details*).

With regards to **the R&I regulatory tools**, these include legislation setting the priority direction for R&I activities and enabling R&I funding, such as the National Research Fund (NRF) and the Ukrainian Start-Up Fund. NRF is the main state instrument for competitive funding of R&I projects.

Economic instruments that are in place include the allocations of the state budget for Ukraine's participation in the "Horizon Europe" projects, grants for technology and innovative start-ups available through the USF, supported by the EU and international donors. Science and technology parks, as well as industrial parks, also offer additional incentives for innovative start-ups and R&I organisations to conduct their activities, including import tax exemption on R&I equipment, full or partial interest payment compensation, profit tax and property tax exemptions. However, many of these incentives are not operational in practice (due to issues with funding, lack of skilled personnel, etc.), with the Government currently considering options to reinvigorate the available R&I infrastructures, in particular industrial parks (under the new draft Innovation Strategy Innovation Vision 2030). Meanwhile, private initiatives cover the gap in this area (e.g., UNIT.City, UNIT.Kharkiv, Promprylad. Renovation, Lviv.Tech.City, etc.), showing good results in terms of residents, raised finance for innovative R&I, international cooperations, etc. The war has had a negative effect on the scale-up of these and similar private initiatives. A summary of the outlined instruments is provided below.

Loans, guarantees, credits, and co-financing mechanisms are provided through the State Innovative Financial and Credit Institution according to the current legislation, but

so far this support has not been provided in practice, as intended (the audit of the activities of this institution is foreseen under the new Digital Innovations Development Strategy 2030). Incentives to enhance R&I sector performance planned by the MoES include revision of the remuneration of researchers and R&I employees, introduction of performance-based funding for R&I organisations, establishing state funding allocation based on the results of state certification of higher education institutions (HEI) and creation of the national system of researchers supporting the best scientists and researchers with focus on funding young researchers' projects. Additional incentives to increase entrepreneurial activities by scientists, industry-science collaboration (e.g., Science City project), and technology transfer are also foreseen by the Digital Innovations Development Strategy 2030.

Table 3.2. Summary of main regulatory and economic instruments

Type of instrument	Name of the instrument and brief description	Statutory requirement	Responsible party/target group	Level of its application
Regulatory	*Legislation on priority areas for innovation and priority directions for science and technology development*. The legislation determines priority areas for R&I integrating defence tech, and the EGD-related areas, such as climate and energy, industry and circularity, biodiversity, sustainable mobility, digitalization.	Law "On Priority Directions of Science and Technology Development", Law "On Priority Areas for Innovation Activity Development in Ukraine" (as amended on 13/01/2024)	Ministry of Education and Science (MoES) and state-relevant R&I organisations	Applied with all the necessary bylaws in place to ensure its implementation
	Establishment and regulation of the activity of the National Research Fund (NRF) – NRF is the main instrument for state funding of R&D. It funds R&D projects in EGD areas such as energy and climate, sustainable food systems, industry and	Amendments to the law "On scientific and R&D activity", Resolution of the Cabinet of Ministers of 4 July 2018 No. 528 "On the National Research Fund of Ukraine", Resolution of the Cabinet of Ministers	MoES	Applied – the NRF has been providing state grants for R&D activities since 2020.

	circularity, biodiversity, and zero pollution.	of Ukraine dated 4 December 2019 No. 1007 "On approval of the Procedure for the use of funds of the National Research Fund of Ukraine"		
	Establishment and regulation of the activity of the Ukrainian Start-Up Fund (Fund for Innovation Development) – USF is the major government instrument to finance and support innovative start-ups. It provides competitive funding for projects across various areas, including EGD-related.	Resolution of the Cabinet of Ministers on "Creation of the Fund for Innovation Development" of 7/11/2018	Ministry of Digital Transformation (as of 2022, the Fund is under MinDigital; before that was under the Ministry of Finance).	The start-up Fund is established and operational and has played a crucial role in supporting the development of defencetech since the outbreak of war. Currently, financial support to companies provided by the USF is donor or private sector funding, state funding only covering its operational costs.
Economic	*Amendments to state funding of R&I projects under "Horizon Europe"* – it introduces changes to the maximum amounts of financial support from the state budget to selected projects (e.g., 35% instead of 42% to cover the costs of equipment and materials associated with the	Resolution "On Amendments to the Regulation on Competitive Selection of Scientific, Technological and Technical Works and Projects Financed by the European Union External Assistance Instrument to Fulfil	R&I organisations that have passed the competitive selection for "Horizon Europe"	In place since the amendment on Feb 9, 2024

	project, 40% instead of 55% for projects conducted by HEI, SMEs, and research organizations, and 20% instead of 2% for innovative projects run by HEI and R&D organizations, and 5% instead of 1% to cover the costs on technical and economic substantiation of R&D projects by businesses).	Ukraine's Obligations under the European Union Framework Programme for Research and Innovation 'Horizon 2020'"		
	Grants for tech and innovative enterprises and start-ups available through Ukrainian Start-Up Fund with the support of EU and donors.	Relevant cooperation frameworks.	Innovative start-ups and SMEs	In place and operational: since its operation, the USF disbursed 8.2 mln UAH in grants or 352 start-up teams. Recently, a new grant programme launched (total $2.5 mln) with Western NIS Enterprise Fund for technology start-ups.
	Amendment to the "Budget Code" concerning revenues from commercialisation of R&D - allowed the state-funded R&D institutions (except defence sector), state universities, academies, and institutes to credit 30% of dividends (income) from the commercialized intellectual property to	Law No. 3035-IX "On Amendments to the Budget Code of Ukraine", approved 06/05/2023	State R&D organisations, universities, and other public R&I institutions	In place since entry into force

	the special fund of the budget.			
	Access to funding available through "Horizon Europe" (renewed agreement).	"Agreement between the European Union and European Atomic Energy Community of the one part and Ukraine of the other part, on the participation of Ukraine in Horizon Europe – the Framework Programme for Research and Innovation and the Research and Training Programme of the Euratom (2021-2025) complementing Horizon Europe – the Framework Programme for Research and Innovation" approved 23/03/2022.	R&I organisations	Operational – R&D organisations can apply for funding available under "Horizon Europe"
	Economic benefits for technopark residents – the law allows for full or partial (up to 50%) interest-free crediting of projects; full or partial compensation of interest payments related to loans for tech projects.	Law "On special regime of innovation activity of technoparks " as amended on 05.12.2012[76]	R&I organisations and the business enterprise sector	Out of 16 officially registered technoparks in Ukraine, only three seem operational, with 98% of sales of innovative products made by technoparks

[76] *Law № 991-XIV On Special Regime of Innovative Activity of Technological Parks* (1999), https://zakon.rada.gov.ua/go/991-14 (May 2024).

				created at three institutes of the National Academy of Sciences (the Institute named after Eugene Paton, the Institute of Single Crystals, Institute of Semiconductor Physics). **The newly adopted Digital Innovations Development Strategy 2030 aims to abolish the technoparks and merge them with science parks, integrating the Industry 4.0 principles.*
	Economic benefits for science park residents: The law provides for an import tax exemption for R&I equipment used for the realisation of the project.	Law on "Science Parks" as of 12/04/2022[77]	R&I institutions and the business enterprise sector	Only 6 out of 40 science parks registered in Ukraine as of 2023 were operational. **The newly adopted Digital Innovations Development Strategy 2030 foresees increasing funding for science parks and implementing pilot projects to support the purchase of critical equipment within science parks for applied research*

[77] *Law № 1563-VI On Science Parks* (2010), https://zakon.rada.gov.ua/go/1563-17 (May 2024).

	Economic benefits for industrial park residents: the law allows for import tax exemption for new R&I equipment, profit tax exemption for firms in processing industry and waste management sector; full or partial compensation of the interest rate on loans for R&I projects; property tax exemptions/reductions.	Law on "Industrial Parks" as of 9/03/2022	R&I organisations and the business enterprise sector	Out of 52 registered industrial parks, only around ten are operational, but their activity is very small (e.g., over the years, the parks created only 400 jobs).
	Loans, guarantees, credits and co-financing mechanisms provided through the State Innovative Financial and Credit Institution – it provides support to innovative project but so far, the support has been limited due to the lack of funding.	Law "On Innovation Activity" (Art. 16 and 17); the relevant decree of the Cabinet of Ministers as amended on 25.11.2020	R&I organisations, innovative businesses	In 2021, the Institution has recorded total net losses of UAH 10.9 million and is generally highly indebted, failing to fulfil its mandate[78]. The audit of the activities of this institution is foreseen under the new Digital Innovations Development Strategy 2030 to revise the relevance of and adapt its activities.

[78] Кредитна установа Мінстратегпрому отримала 10,9 млн збитків за півріччя-2021 (2021). *Марлін*, 10 September, https://marlin.org.ua/news/kredytna-ustanova-minstratehpromu-otrymala-10-9-mln-zbytkiv-za-pivrichchia-2021/ (May 2024).

	Grants for innovative ideas provided under the Presidential Fund for Support to Education, Science and Sport – the Fund provides some financial support to innovative ideas/inventions but is mostly focused on supporting youth through the provision of grants for studying abroad, internships in HEI abroad, participation in international scientific conferences and seminars.	Decree of the President "On establishment of the Presidential Fund for Support to Education, Science and Sport" as amended on 16.12.2021	Young scientists, HEI students	Established in 2019, the Fund became operational in 2021. Several programmes of double degrees with foreign universities have been established[79]. No information on disbursed funding for innovations is available.
	Revision of the remuneration of researchers and R&I employees (moving away from the tariff grid, removal of restrictions on remuneration within the scope of funding of an R&I project)	Foreseen under the Strategic Plan of Activities until 2027 of the MoES	State R&I organisations and personnel	Planned action – requires elaboration of relevant legislative acts
	Revision of the state funding scheme of R&I organisations towards a performance-based research funding *And* *Updating the funding allocation mechanism* Based on the results of the state certification of higher education institutions (HEI)	Foreseen under the Strategic Plan of Activities until 2027 of the MoES	State R&I organisations and HEI	Planned action – progress in this area includes the introduction of harmonised certification of all HEIs and PROs for the distribution of state funding; further steps might require

[79] *Фонд президента україни з підтримки освіти, науки та спорту* (no date), https://presidentfund.gov.ua (May 2024).

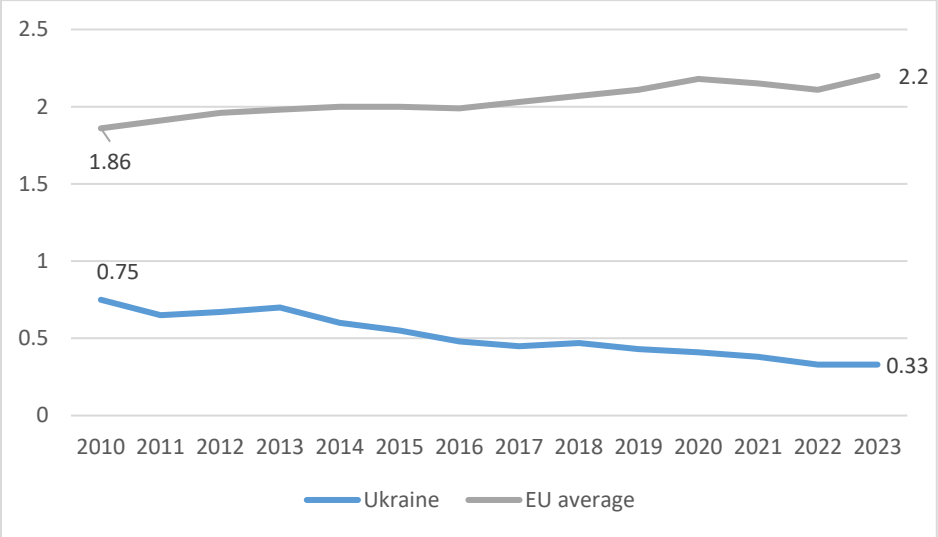
				elaboration of relevant legislative acts.
	Creating the National system of researchers supporting the best scientists and researchers, in particular young scientists, regardless of the results of the certification of their R&D organisation or HEI	Foreseen under the Strategic Plan of Activities until 2027 of the MoES	Best/high-potential young researchers and scientists	Planned action – requires elaboration of relevant legislative acts and funding provisions.
	Creation and development of Industry 4.0 implementation centers in the regions of Ukraine, in particular, factory-laboratories at HEIs	Foreseen under the Digital Innovations Development Strategy 2030	HEIs	Planned action – requires elaboration of relevant legislative acts and funding provisions.
	Creation of a legal regime for Science.City to stimulate the creation of knowledge-intensive companies and startups, science parks, and other joint ventures between public institutions and private companies	Foreseen under the Digital Innovations Development Strategy 2030	HEI, Public R&I organisations, business sector	Planned action – requires elaboration of relevant legislative acts and funding provisions.

3.2.2. Funding and financing

Overall funding of R&I

The R&I sector in Ukraine has been suffering from declining investment over several decades with GERD in 2022 reaching the historic low of 0.33% of GDP and remaining at this level in 2023, leaving science to perform only a socio-cultural function. The share of R&D expenditures as a share of GDP in Ukraine is currently almost seven times lower than the EU-average (Figure 1).

Figure 1. GERD in Ukraine and the EU-average, 2010-2023.



Source: Authors analysis based on Eurostat and Ukrstat data.

The state budget for R&I, otherwise called basic funding, is directed to funding of fundamental research, support to R&I in priority areas, and to cover the costs of material and technical stock for R&I activity, preservation of scientific objects that are national property, training of academic staff, etc. The state funding is complemented by funding from international sources, by the private sector, and the own funding of R&D organisations. **In 2023, the state budget made up almost 65% of the total amount of expenses on R&I.** After a significant decline in 2022, the share of the R&I projects funded from foreign sources increased nearly to 2021 levels to stand at 16,4% of all R&I expenditures in 2023 due to an increase of international support to Ukrainian science and innovative activities. In addition, enterprise sector organizations represented 11.5% of total R&I expenditures in 2023, with a recorded increase in expenditures on engineering and technologies development in the context of the increased demand for technologies and innovations from the Armed Forces of Ukraine[80]. The sources of funding of R&D of R&D organisations increased significantly in 2021-2022. For comparison, in 2020, the state budget funding represented 41%, followed by the foreign sources (25%) and business sector funding (15%)[81].

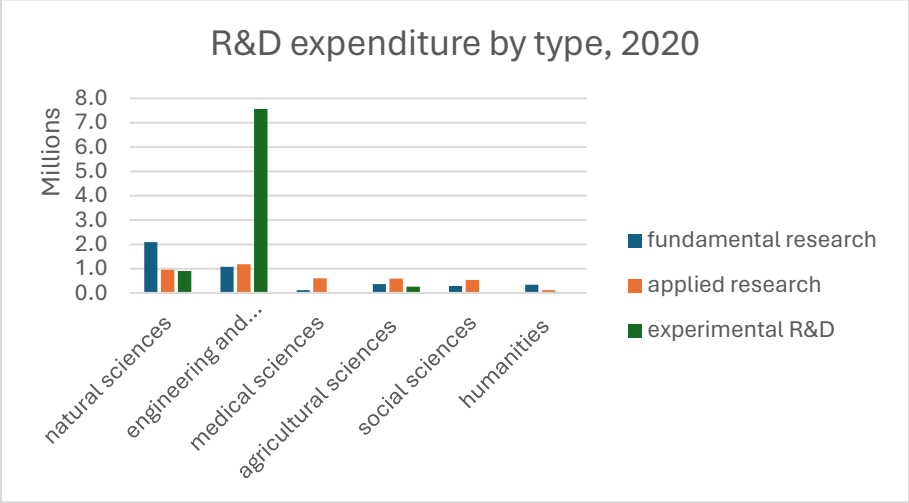
Overall, **there is a noticeable trend in the increase of the funding of applied R&D** as it represented 29,6% of all R&D expenditures in 2023 vs 19,6% in 2010. Scientific-

[80] Ukrainian Institute of Scientific and Technical Expertise and Information (2024). *Scientific and scientific and technical activity in Ukraine in 2023,* https://mon.gov.ua/static-objects/mon/sites/1/nauka/informatsiyno-analitychni/2024/05.08.2024/Naukovo-analitychna.dopovid-Naukova.naukovo-tekhnichna.ta.innovatsiyna.diyalnist.v.Ukrayini.u.2023.rotsi-05.08.2024.pdf (May 2024).
[81] Ibid.

technical or experimental R&D has decreased slightly but remains quite high – 49,5% in 2023 (vs 53,6% in 2010), while fundamental science funding stands at 20,7% in 2023 (vs 27% in 2010)[82]. When it comes to state funding of R&D[83], fundamental research received the most funding, i.e., 54,4%, followed by applied research almost 37,6%, grant funding disbursed by the National Research Fund (NRF) 6,7%, other program-specific funding (around 1%) and projects financed in the framework of the international scientific cooperation – 0,31% in 2023. It is important to note that NRF funding registered an increase compared to 0,84% in 2022 when the fund was sequestrated due to the full-scale invasion by Russian Federation, but it remains below the pre-war level of 9.19% (2021)[84].

When looking at R&D expenditures by type of R&D (Figure 2), in 2020, **engineering and technology has received most of state funding (58%) and boasts of the most experimental R&D** (i.e., systematic works based on existing knowledge obtained as a result of research and/or practical experience and aimed at creating new materials, products, processes, devices, services, systems or methods). Overall, in Ukraine, **engineering and natural sciences have shown a strong record of receiving state funding over the last decades** (Figure 3).

Figure 2. R&D expenditure by type, 2020.



Source: Author's analysis based on UK Statistics data.

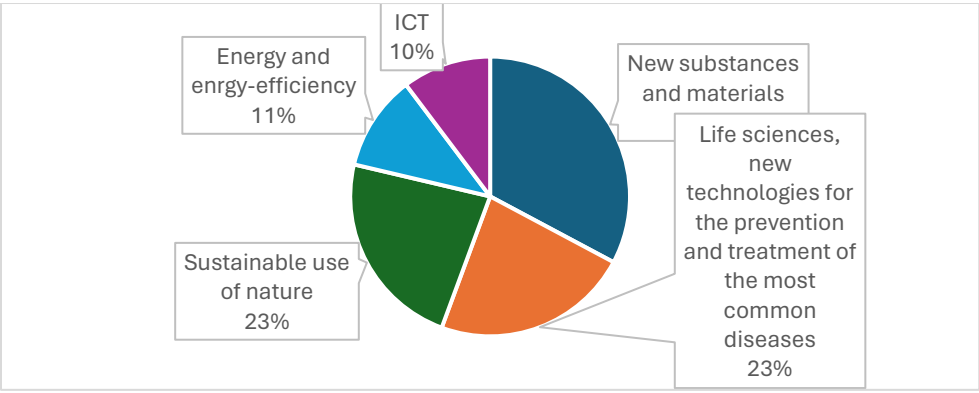
When looking at the state budget R&D expenditures, in 2023, as in previous years, the largest amount of funds (almost 80% of the general fund expenditures for

[82] R&D produced through practical testing, trials, and experiments.
[83] The data here concerns state basic funding of the R&D activities.
[84] Ukrainian Institute of Scientific and Technical Expertise and Information (2024). *Scientific and scientific and technical activity in Ukraine in 2023,* https://mon.gov.ua/static-objects/mon/sites/1/nauka/informatsiyno-analitychni/2024/05.08.2024/Naukovo-analitychna.dopovid-Naukova.naukovo-tekhnichna.ta.innovatsiyna.diyalnist.v.Ukrayini.u.2023.rotsi-05.08.2024.pdf (May 2024).

R&D) was allocated to the academic sector, most of it going to the National and Sectoral Academies of Sciences, while around 8% went to the industry sector (R&D organisations in various economic sectors), and 10.0% to the higher education sector (R&D organisations within HEIs). It is important to note that a significant amount of funding allocated to the academic sector and to the National Academies of Sciences specifically goes to ensure salaries of scientists, researchers, and the operation of the administration of these research organisations.

When it comes to funding of international projects on R&D cooperation from the state budget, in 2022, this amount stood at only 0,13% of the total expenditure from the general state fund on R&D (for comparison, in 2021, this amount stood at 0,23%) (Figure 3).

Figure 3. State general fund for R&D expenditures on international R&D cooperation along the priority areas, 2022.



Source: Author's analysis based on UK Statistics data.

The private sector investment in innovation has been low and on a declining trend, dropping to 0.17% of GDP in 2021, demonstrating low absorptive capacities of the enterprise sector[85]. While the share of innovative enterprises in business sector declined during 2016-2020, **the share of industrial enterprises undertaking innovation has been modestly growing since 2010, reaching almost 15% in 2020,** industrial enterprises investing the most among other enterprises in R&D. **The industrial enterprises represent important potential with regards to green transition in Ukraine as they are the ones investing and able to further invest in innovative green technologies and processes** (e.g. integration of circular economy principles, energy-efficiency and decarbonisation technologies, etc.).

EGD-related R&I programmes and their funding

[85]Ibid.

When it comes to EGD-specific R&I programmes and their funding, the R&I undertaken under the priority areas outlined in the dedicated laws are mostly in line with EGD, but the disaggregation by areas of EGD is not available.

However, the data on projects financed by NRF in 2020-2023 shows the amount of financing received across projects in R&I in priority areas funded through five main programmes and 5 additional programmes launched in 2022-2023 (Table 3.3). Donor funding has played a significant role in supporting the R&I sector following the full-scale invasion by Russian Federation and the associated reduction of availability of public funds for R&I (for instance, the German-Ukrainian joint call in the priority areas of "Physics" and "Mathematics" of 3.6 million UAH).

Table 3.3. Funding of R&I disbursed by the NRF, 2020-2023.

	Name of the programme	2023	2022	2021	2020
1	"Science for the safety of man and society"	5140.20	0	245645.6	53767.02
2	"Supporting the research of leading and young scientists"	251353.60	0	410477.6	175834.8
3	"Science for the security and sustainable development of Ukraine	114931.10	0	call held - total recommended funding 453171.162	
4	"Science for the reconstruction of Ukraine in the war and post-war periods"	80963.60			
5	“Advanced research in the field of mathematics, natural and technical sciences"		0	call held - funding TBD	
6	"Man, society, science before modern challenges: innovative research in the social and humanitarian sphere"		0	call held - funding TBD	
7	Joint call for research projects of the State Fund for Fundamental Research (DFFD, Ukraine) and the German Research Community (Deutsche Forschungsgemeinschaft, DFG), Germany, in the			3693,600 - funded through non-NRF budget	

	priority areas of "Physics" and "Mathematics"				
8	Implementation of the project "Horizon Europe Office in Ukraine as a key National Contact Point (NCP)" under grant No. 101132682 - HEOinUA	5.683.94			
9	Competition "Cambridge - NRF 2022. Individual research (development) grants for Ukrainian scientists (with the support of the University of Cambridge, Great Britain)"	693.900			
10	NRF-funded under the special fund of the state budget	6.377.840			
	TOTAL (UAH)	**458.766.340**	**37.983.100[86]**	**657.111.289**	**229.510.800**

Note: Amounts are indicated in thousand UAH.
Source: Author calculations based on the yearly reports provided by the NRF.

The programme “Science for security and sustainable development of Ukraine”, introduced and conducted in 2021, seems relevant to EGD due to the projects in areas of **sustainable use of nature, energy efficiency, new substances and materials** it funded[87]. However, the selected projects never received the funding expected in 2022-2023 due to the war-related NRF funding sequestration in 2022. In 2023, the funding was not disbursed either, with some projects probably no longer valid due to a change in research teams’ composition following the war, or lack of project relevance to the war context. Other projects in “Advanced research in the field of mathematics, natural and technical sciences" and in "Man, society, science before modern challenges: innovative research in the social and humanitarian sphere" programmes that won the funding in 2021 have not received the expected total amount of 36,732,600 UAH in 2023 either. Such a situation points to the **continued trend in underfunding of the R&I and underlines the lack of capabilities of the R&I sector to effectively support the green transition.**

The financing of innovative entrepreneurship presents, on the contrary, some positive dynamics, even if are mostly rely on donor support. A case in point is the

[86] Funds to ensure the operation of the NRF only, no funding for R&D grants available due to NRF sequestration due to war.
[87] The programmes selected 57 projects across the priority R&I areas, including fundamental research in key areas for economic and social development (12 projects), ICT (4), energy and energy-efficiency (2), sustainable use of nature (3), life sciences, new technologies and prevention and treatment of diseases (21), new substances and materials (15).

Climate Innovation Vouchers funded by EBRD and the EU and implemented by Greencubator in Ukraine. In place since 2017, the programme proposes vouchers of up to 50,000 euros for projects in climate and environmental technologies. In 2021, six companies received Climate Innovation Vouchers for a total amount of 240 thousand EUR.[88] In 2024, 10 Ukrainian companies were selected for vouchers of a total amount of 442 thousand EUR. [89]

Another initiative is the UNIDO project "**Low-carbon economy of Ukraine for climate change prevention: facilitating investment to scale-up innovative cleantech solutions for the low-carbon economy and climate action**[90]" with a total amount of 10 mln USD (2021- 2026). It is implemented by Greencubator, National Research Fund of Ukraine (NRFU), Network for Global Innovation (NGIN), and Cleantech Group (CTG). The project aimed to promote innovation and technology transfer for sustainable energy breakthroughs for clean-tech innovation through targeted support to innovative start-ups in clean tech and R&D commercialisation in this area[91]. It is unclear, however, at which stage of the implementation the project is at, but assuming its implementation is resumed and ongoing, it can be instrumental in supporting EGD-related R&I.

Other recently launched donor-funded projects include the **Green Innovation fund "Innovate Ukraine"** of total of £60 mln launched in 2022 with the support of the UK government (for now, no information available on its implementation)[92] and the **Global Green Chemistry Initiative (GreenChem)** financed by Global Environment Facility under UNIDO and the Resource Efficient and Cleaner Production Centre, launched officially in 2023. In addition, Ukraine **joined the LIFE (L'Instrument Financier pour l'Environnement)** programme in June 2022, and the **UpSHift Ukraine**[93], a UNICEF programme for youth with a focus on eco-innovation projects, was launched in 2020[94].

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[88] Greencubator (2017). Кліматичні інноваційні ваучери, 7 November, https://greencubator.info/climate-innovation-vouchers-an-ebrd-fintecc-project/ (May 2024).

[89] *10 українських компаній отримають близько пів мільйона євро від єбрр і єс на розвиток «зелених» інновацій - climatebiz* (2024), https://climate.biz/10-ukrayinskyh-kompanij-otrymayut-blyzko-piv-miljona-yevro-vid-yebrr-i-yes-na-rozvytok-zelenyh-innovaczij/ (May 2024).

[90] *Low-carbon economy of Ukraine for climate change prevention: Facilitating investment to scale-up innovative cleantech solutions for low-carbon economy and climate action* (2021) *Global Environment Facility,* https://www.thegef.org/projects-operations/projects/10454 (May 2024).

[91] GEF (2021). Low-carbon economy of Ukraine for climate change prevention: Facilitating investment to scale-up innovative cleantech solutions for low-carbon economy and climate action, https://downloads.unido.org/ot/24/59/24592697/GCIP%202%20Ukraine%20RCE_072621.pdf (May 2024).

[92] Кабінет Міністрів України (2024). *Фонд у сфері зелених інновацій InnovateUkraine: відібрано 16 проектів для швидкого відновлення енергосектору,* https://www.kmu.gov.ua/news/fond-u-sferi-zelenykh-innovatsii-innovateukraine-vidibrano-16-proektiv-dlia-shvydkoho-vidnovlennia-enerhosektoru (May 2024).

[93] Upshift - Україна (no date). *Інноваційна програма для молоді upshift,* http://upshiftukraine.org/pro-upshift/ (May 2024).

[94] UNICEF (2020). *ЮНІСЕФ підтримає екологічні проєкти молоді з усієї України,* https://www.unicef.org/ukraine/press-releases/upshift-green (May 2024).

Finally, in 2022, Kyiv Taras Shevchenko University joined the consortium INTREPID-HEI (International Capacity Building in Innovation, Transfer and Entrepreneurship) under the European Institute of Innovation and Technology.

As part of the Horizon programme, since 2015, Ukraine has participated in 203 projects selected for a total funding of 37,7 mln EUR. Out of 203, 160 projects or 78% received funding in EGD-related area, namely under the Maria Sklodowska Curie Component: EUR 10.55 mln, Energy Component, EUR 3.46 mln, Climate and Environment Component: EUR 2.53 mln, and Transport EUR 4.12 mln.

As part of the Euratom Programme, since 2016, Ukraine has successfully implemented 16 projects with a total budget of 3,659,189 euros (Ukraine covering 3,145,189 euros) in nuclear fission technologies. Ukraine was also involved in 10 work packages of the EUROfusion consortium in 2019, with positive dynamics in a gradual increase of Ukraine's contribution to the EUROfusion consortium.

Existing funding gaps and opportunities

Insufficient funding of R&I overall and the lack of dedicated funding for EGD-related areas a major obstacle to ensuring that the R&I sector in Ukraine can accompany the green transition effectively. Gaps in legislation on incentives for science-business collaboration on R&I, including on green R&I and for private sector investments into R&I, are also hindering the capabilities of Ukrainian R&I actors in the green transition. Donor funding plays a crucial role in supporting the R&I sector, in the context of the war-related budget optimisation, but it should be complemented by gradually increasing sources of state and private sector R&I funding.

The **MoES intends to deregulate the R&I sector to provide it with more financial and administrative autonomy** and hence enable more joint projects between science and the business sector based on co-financing mechanisms, collaboration with R&D and business organisations from abroad, etc. **The initiatives to introduce performance-based state budget allocation for R&I organisations** and associated changes in the remuneration scheme for researchers and scientists, if implemented, will also stimulate diversification of R&I funding sources and contribute to better quality of R&I results. For these measures to achieve a positive, tangible effect on the R&I sector, it is necessary to put in place a thorough implementation mechanism, including sufficient allocation of funding.

Increasing funding for priority R&I projects that are in line with EGD, such as energy, mobility, sustainable use of resources, agritech, medtech, and greentech, could be an important first step to address the gap in green R&I funding (e.g, in the framework of projects financed through NRF, leveraging the opportunities provided by international cooperation projects in this regard). Introducing dedicated instruments to

support EGD-specific R&I projects through additional funding or co-funding instruments would help further increase the R&I sector's readiness for EGD implementation. Moreover, the Government could **facilitate access of Ukrainian researchers to funding opportunities in the framework of Horizon Europe that specifically address EGD areas**, with the provision of tailored support to applicants and related awareness raising activities through the Office of Horizon Europe Ukraine and its National Focal Points network.

Introducing fiscal incentives for businesses to engage into green R&I (e.g. tax exemptions for investment in R&I in EGD areas), **and supporting participation of innovative firms from Ukraine** (e.g. covering consultancy/advisory fees for programme participation documentation, etc.) in projects such as EGD Data Space programme under the Digital Europe, grants for R&D in agrifood technology by Impact Funding Framework by EIT Food, the GRAINS project (European Cluster Collaboration Network) proposing grants on green transition, STAGE Grant Programme for Sustainable Development, and others would be an effective means to **leverage the available talent and build capabilities of Ukrainian firms for green transition**. Furthermore, additional funding for R&I could be leveraged through **better engagement with the private sector and establishment of dedicated incentives for science-industry cooperation** (e.g. with the uptake of investments in military tech in Ukraine, it could be worthwhile studying this experience with the view to replicate successful lessons learnt to other sectors, *also see section 3.4*).

The ongoing war and related budget constraints in Ukraine constitute an important obstacle to implementation of suggested policy instruments. At the same time**, the importance of the EU integration as Ukraine' strategic goal with related requirements on EGD alignment and the availability of funding under the Ukraine Facility provide solid grounds for boosting green R&I and making sure it becomes a driver of economic transformation of Ukraine**.

3.2.3 Summary of gaps/bottlenecks and needs

Area of assessment	Summary of gaps
Are R&I-related policy and legal areas covered with appropriate regulatory and economic instruments to ensure compliance with EGD?	1. The available R&I regulatory and economic instruments do not fully align with EGD even when EGD areas are covered to some extent by the legislation on R&I priority areas and associated funding. 2. The current array of instruments does not contain focus and dedicated incentives to foster green R&I, but foreseen policy and legislative changes may contribute to fostering green R&I.
Are the regulatory and economic instruments	1. Current reforms aimed at the provision of more financial and administrative autonomy to R&D organizations

sufficient to ensure that they lead to real and measurable R&I improvements?	(deregulation), enabling more science-industry collaboration on R&I can have tangible effect on green R&I, if implemented. 2. Existing instruments to incentivize business enterprise sector investments into R&I are insufficient and need strengthening (envisaged by current policy documents). 3. The R&I organizations do not leverage opportunities for cooperation on green R&I available under EU-funded projects due to a lack of financial support, awareness, and advice on participation.
Are the regulatory and economic instruments efficient, considering their ability to support green R&I in the country?	1. The R&I system reform as outlined by MoES in its Strategic Action Plan until 2027 and the Digital Innovation Development Strategy 2030 can be efficient in enhancing the R&I system performance, but additional measures are needed to support green R&I, specifically along with the necessary allocation of funding to operationalise envisaged actions. 2. Existing instruments for R&I support generally lack effectiveness (e.g., industrial and science parks are, for the most part, not operational in practice), with reasons for such inefficiencies having to be addressed first before introducing a focus on green R&I.
Are the cross-sectoral funding and financing instruments realistic to achieve the R&I goals related to the EGD?	1. There is limited funding available for R&I, and it remains insufficient to achieve the R&I goals related to the EGD, donor support playing an important role in the absence of sufficient state funding. 2. The business sector investments into green R&I constitute an important lever for achieving EGD goals, but current instruments are insufficient to further scale up these investments.
Is funding the green R&I goals important to the national government, or does most of the funding come from outside donors?	1. Despite the acknowledgement at the state level of the importance of R&I for economic transformation of Ukraine, including its green transition, there is no sufficient funding allocation, for the most part due to war-time budget constraints and lack of R&I prioritization on the policy agenda (might change under the new policy framework). 2. Donor funding is the main tool to finance green R&I in the context of R&I underfunding exacerbated by the full-scale invasion by Russian Federation but making R&I a driver of green transformation requires gradually increasing sources of state and private sector R&I funding.

3.3. Institutional/governance capacity

This section presents the analysis of R&I policy governance covering the institutional set-up for R&I policy implementation and assessing the capacities of existing state actors to carry out the R&I policy effectively.

3.3.1 Existing institutional set-up

Innovation policy governance

There is no single central executive body responsible for **innovation policy** in Ukraine, with responsibilities distributed across several ministries, the major ones including the Ministry of Education and Science (MoES), the Ministry of Economy (MinEconomy), the Ministry of Digital Transformation (MinDigital), and the Ministry of Strategic Industries. However, the Vice Prime Minister of Ukraine for Innovation, Education, Science, and Technology, currently Mykhailo Fedorov, is responsible for shaping the innovation policy and coordinating its implementation. Since January 2025, the Digital Innovation Development Strategy will be guiding the innovation policy development, with the Ministry of Digital Transformation responsible for innovation policy formulation.

Currently, the *Ministry of Education and Science* is responsible for the formulation and ensuring the implementation of the policy in education, science, scientific research and inventions, innovation, and technology transfer.

Ministry of Economy is responsible for policy formulation and ensuring the implementation of innovation in the real sector of the economy with a focus on innovative entrepreneurship development, and corresponding infrastructure for innovative firms, including business incubators and accelerators, industrial parks and technoparks.

The Ministry of Digital Transformation is responsible for formulating and ensuring the implementation of policy in digital innovation and technologies across all sectors of the economy and the public administration.

Ministry of Strategic Industries is responsible for the formulation and implementation of innovation in strategic industries, such as aerospace, defence, and security, etc.

This *fragmentation of policy formulation* and *implementation* reflects the lack of a systematic approach to innovation and coherence in innovation policy goals and objectives, as each ministry develops its own goals and measures for innovation separately. The Digital Innovations Development Strategy is poised to change that through streamlined policy formulation by MinDigital. The Strategy also aims to address the issue of lacking prioritisation and strategic vision for R&I's development and its role in achieving broader national strategic objectives (economic, social, environmental, digital). Finally, the R&I policy has been struggling with insufficient resource allocation, exacerbated by the budgetary constraints and lacking prioritisation in the time of war. This might change if the new digital innovation strategy is implemented, as intended.

A way to bridge innovation policy fragmentation would be an effective *coordination of innovation policy* through a dedicated inter-ministerial mechanism. Such a mechanism,

the Innovation Development Council, was established as a temporary advisory body by the Cabinet of Ministers in 2017[95], with the mandate to ensure coordination on innovation policy design. However, the Council has only met a few times since its establishment and has not been operational, leaving innovation policy alignment across central executive bodies an issue[96]. The Government is planning to re-invigorate the Council's work under the new digital innovation strategy, which, if done effectively, can bring significant improvement to the innovation policy governance.

The implementation of the innovation policy is distributed across organisations subordinated to the four main ministries responsible for innovation policy mentioned above. These organisations include the recently launched IP and Innovations Office, the Technology and Innovation Support Centre (TISC), R&I support infrastructures such as business incubators, accelerators, science parks and industrial parks, tech transfer offices within the HEIs, as well as the National and Sectorial Academies of Sciences and state R&D organisations carrying out R&I activity.

The IP and Innovations Office was established in October 2022 in line with the ongoing IP reform as exposed in Law 703-IX. The new IP Office provides a range of IP services but also established on its basis the **National IP& Innovations Hub** to support R&D development and commercialisation, technology transfer and investment promotion in R&D. The National IP& Innovations Hub provides services to scientists, researchers, and innovators in PRO-management, coordination of grant activities, advisory support in tech transfer and assessment of rights for IP objects. It is important to note that the IP Office has set ambitious objectives in cooperation with WIPO but also enhancing the cooperation with the Intellectual Property Office of the European Union (EUIPO), the European Patent Office (EPO) and the US Patent and Trademark Office (USPTO), as well as the national IP offices of other countries with subsequent development of methodological recommendations on IP assessment. The Hub also aims to develop instruments to support innovators and the business sector for the post-war recovery of Ukraine[97]. The Hub runs educational programmes to support capabilities of researchers, scientists and innovators in research commercialisation, such as, the Lab2Market UA, the Lab2Market MedTech (focused on solutions for military and civil persons injured due to the ongoing full-scale invasion by Russian Federation), Lab2Market Veterano (focused on supporting innovative ideas of war veterans and their families).

[95] Cabinet of Ministers of Ukraine (2017). *On establishment of Innovation Development Council,* https://zakon.rada.gov.ua/laws/show/895-2017-%D0%BF#Text (May 2024).
[96] UNECE (2021). *Sub-regional Innovation Policy Outlook 2020: Eastern Europe and the South Caucasus,* https://unece.org/economic-cooperation-and-integration/publications/sub-regional-innovation-policy-outlook-2020 (May 2024).
[97] *Головна - ip office* (no date), https://nipo.gov.ua/ (May 2024).

The Technology and Innovation Support Centre (TISC), a project financed by WIPO, is housed within the IP and Innovations Office and provides support on IP in Ukraine and abroad for applicants, conducts awareness-raising on the IP acquisition, use, and protection among SMEs, start-ups, inventors, and creative industries. For instance, it conducts an online educational programme "Talk about my idea" to address key elements of IP and innovation practice. Currently, there is only **one TISC** in Ukraine with plans to launch a regional TISC. The Centre reports successful cooperation with 9 institutions in Kyiv and 25 institutions across 13 regions (incl. business incubators and accelerators, R&D organisations, business sector, HEI, etc.).[98]

The National Academy of Sciences (NAS) is the highest self-governing scientific organisation of Ukraine, conducting fundamental and applied research and financed from a dedicated line of the state budget. It comprises 160 scientific institutions and 36 research and production organisations. As of January 2024, the NAS counted 24980 employees, including 13444 scientific personnel, among whom 2340 PhDs. The NAS membership comprises 163 members (academics), 345 corresponding members, and 83 foreign members. There are 5 sectoral academies, including the National Agrarian Academy of Sciences, National Legal Sciences Academy, National Arts Academy, National Medical Sciences Academy, and National Pedagogical Academy. The NAS is the main recipient of the state basic R&D funding, and recently, has been undergoing the harmonised certification process for HEIs and RPOs, which will affect its funding. The government's efforts to **harmonise policy implementation** resulted in the establishment of the National Council on Science and Technology Development[99] under the Cabinet of Ministers as an advisory body. It is chaired by the Prime Minister and is supposed to ensure coordination on R&I between the MoES, the National and branch Academies of Sciences, the National Research Fund, and other central executive bodies responsible for R&I[100]. The Council has two subordinate bodies: an administrative committee and a scientific committee with 24 members-representatives of the R&I organisation responsible for analytical support. However, the effectiveness of the Council's operation leaves much room for improvement, as the meetings are rare and not systematic[101]. In 2022, as the invasion started, the Council did not convene until February 2023. In 2021, the Council established nine working groups on various

[98] Ibid.

[99] *Засідання Національної ради України з питань розвитку науки і технологій* (no date). *Gov.ua*, https://www.kmu.gov.ua/diyalnist/konsultatyvno-doradchi-orhany/nacionalna-rada-ukrayini-z-pitan-rozvitku-nauki-i-tehnologij/zasidannya-nacionalnoyi-radi-ukrayini-z-pitan-rozvitku-nauki-i-tehnologij (May 2024).

[100] Chang, H. *et al.* (2017). *Peer Review of the Ukrainian Research and Innovation System*, https://projects.research-and-innovation.ec.europa.eu/sites/default/files/rio/report/KI%2520AX%252016%2520008%2520EN%2520N_UKR_0.pdf (May 2024).

[101] OECD (2022). *Building back a better innovation ecosystem in Ukraine*, https://www.oecd.org/ukraine-hub/policy-responses/building-back-a-better-innovation-ecosystem-in-ukraine-85a624f6/ (May 2024).

innovation policy issues, including infrastructure, EU integration, R&I priorities, on reform of the National Academy of Sciences, etc.

Among **main policy instruments** used by the Government to support innovation policy, as mentioned in the previous section, are the National Research Fund (competitive grant funding for innovative projects), the Presidential Fund for Support to Education, Science and Sport, mostly focused on building human capital through education, the Ukrainian Start-up Fund providing funding for innovative start-ups and of R&I projects, and the State Innovative Financial and Credit Institution also providing some support to innovative projects through loans, guarantees, credits and co-financing mechanisms *(see section 3.2 for details*).

Monitoring of the implementation of innovation policy is also fragmented, as it is carried out by responsible ministries based on their strategic plans. The monitoring of innovation policy generally lacks effective instruments and robust KPIs to track progress in policy implementation. As to **policy evaluation**, Ukraine does not have a track record in systematically assessing the impact and effectiveness of polies its deploys (incl. due to high costs of independent evaluation) and innovation policy is not an exception, making it difficult to assess the effectiveness of policy on the R&I system and real economy and make necessary adjustments.

Box 1. Reforming the R&I system through new approaches to the evaluation of performance and linked funding

When talking about monitoring of the quality of research outcomes, it is worth noting that in the framework of the reform of national science and research system, the MoES introduced a new methodology for evaluation of the R&I activity of the R&D institutions and HEIs [102], a development that has been long recommended by the international expert community (e.g., the2017 EU's Policy Support Facility Review recommendations[103]). The certification has been ongoing and is expected to finish in Q3 2025. It will have major implications for the allocation of state basic funding for the HEI and R&D organisations for R&D activities with a positive expected effect on the R&I institutions' performance and the quality of R&I output.
In addition, following the decree of the Cabinet of Ministers of 4 August 2021, the audit of the sectoral National Academies of Sciences**, i.e., National Academy of Agrarian Sciences, National Academy of Legal Sciences, National Academy of Pedagogical Sciences,** was conducted in 2021-2022**. It resulted in the audit of the state of land plots, property**

[102] *Наказ МОН України Про державну атестацію наукових установ та закладів вищої освіти в частині провадження такими закладами наукової (науково-технічної) діяльності від 21/10/2024,* https://nauka.gov.ua/docs/110/%D0%9D%D0%B0%D0%BA%D0%B0%D0%B7%D0%9C%D0%9E%D0%9D148521102024_compressed.pdf (May 2024).
[103] Chang, H. *et al.* (2017) *Peer Review of the Ukrainian Research and Innovation System,* https://projects.research-and-innovation.ec.europa.eu/sites/default/files/rio/report/KI%2520AX%252016%2520008%2520EN%2520N_UKR_0.pdf (May 2024).

complexes, and material and technical base of the Academies, as well as financial audit (i.e., use of state budget funds) and audit of the organizational structure to improve the efficiency and performance of these institutions. In addition, a reorganisation of the R&D institutions is ongoing, **with R&D institutions formally placed under the supervision of MoES (there are more than 100 R&D organisations of this status) being merged with relevant universities or, in some cases, with the National Academy of Sciences to enhance their competitiveness and performance.** Together, these actions are aimed at harmonising the approach to state funding of different actors within the R&I system to streamline governance and enhance performance in the context of high fiscal pressures.

Source: Authorś analysis based on desk research and MoES data.

Finally, innovation policy coordination remains weak in Ukraine, as noted by several international assessments (Chang *et al.*, 2017; UNECE, 2021), lacking an effective instrument to direct policy development and implementation. Existing instruments, i.e., the Innovation Development Council and the National Council on Science and Technology Development, have failed to fulfil their policy coordination role. The new Digital Innovations Development Strategy aims to address the issue of coordination of the innovation policy through 1) extension of the mandates of deputy heads of executive authorities on digital development to the field of innovation, and 2) reinvigorating the work of the Innovation Development Council. Furthermore, to ensure that **R&I is anchored in Ukraine's green transition, it is necessary for all ministries and agencies involved in the green transition agenda implementation to be part of innovation policy discussion** (e.g. Ministry of Energy, Ministry of Environment Protection, Ministry of Development of Regions, Territories and Infrastructure, etc.).

At the local level, **the implementation of innovation policy falls under the regional development strategies, particularly their "competitiveness" component, which also comprises smart specialisation strategies (S3).** The decentralisation reform has put local governments in a more active position in terms of innovation promotion, as they can dedicate funds to innovative projects and businesses, establish innovation support infrastructures such as business incubators, accelerators, industrial parks, etc., to enhance the innovation potential of their territories. Thus, the national innovation policy priorities are supposed to be reflected in regional development strategies with adaptation to local needs and opportunities, taking into consideration the S3 analysis.

The new Digital Innovations Development Strategy foresees an important role for S3 in fostering innovative activity across the country. It envisages the development of regional development strategies based on all regions of Ukraine (currently, this is the case for only a few regions) and connecting Ukrainian regions to the European S3 Platform to foster the exchange of practices and access to knowledge. Implementation of this activity would **strengthening the capabilities of institutions engaged in R&I policy implementation at local level** (e.g., regional administrations, SME support

offices, etc.) and provision of adequate support for R&I infrastructures development, partnerships building (between industry and local R&I organisations), and international cooperation (under S3 Platform). **The implementation of regional development strategies with an S3 focus would help to make R&I a driver of regional competitiveness and increase regional preparedness for the green transition.**

3.3.2 Capacity assessment of the existing institutional set-up

The capacity of existing institutions to ensure R&I policy implementation and support green R&I is assessed along the following categories, outlining the state of play, main gaps, and needs.

- **Long-Term Planning** – *requires strengthening*

The current policy framework does not properly anchor the R&I in Ukraine's economic development and recovery policies, as well as the green transition agenda. Long-term planning would require addressing the gaps in the current policy planning culture, including the lack of setting clear objectives and measurable targets to ensure monitoring of progress. Furthermore, effective long-term planning would benefit from better use of evidence from the foresight activities to anticipate future trends, while providing for sufficient flexibility to adapt to changing circumstances, which is particularly relevant for the green transition (anticipating and planning for green skills, technologies, R&I positions for EGD, etc.).

Despite the notable need for improvements, some progress in the consistency of vision of R&I development has been made. In fact, after several decades of R&I policy neglect, in 2015, Ukraine embarked on the path of EU integration, setting the alignment of the Ukrainian R&I system with the European practices and standards in R&I and integration into ERA as a long-term policy goal and a direction for R&I policy reform. This vision has been further confirmed and operationalised through several policy documents, including the National Innovation Strategy 2030, the Roadmap for Ukraine's integration into ERA, the Strategic Plan of Activities of the MoES until 2027, and the recently adopted Digital Innovations Development Strategy of Ukraine 2030. However, the Government is yet to **streamline R&I with a focus on EGD across the long-term planning documents**.

- **The extent of the mandates and authority** *requires strengthening/as foreseen by reforms*

The overlapping mandates between the four main ministries responsible for R&I policy, i.e., **MoES, MinDigital, MinEconomy, and the Ministry of Strategic Industries, have a negative impact on R&I policy effectiveness.** It results in inefficient resource use, duplication of efforts, and a lack of accountability for policy outcomes. Clarifying mandates among relevant ministries, including spelling out the

contribution of R&I to the green agenda and the responsibilities each ministry holds in this regard, would be essential to ensure R&I can support the green transition of Ukraine. The new digital development strategy suggests putting MinDigital as the main body responsible for R&I policy formulation, which could complicate the R&I policy implementation in practice if the mandates of other ministries, especially of the MoES, are not agreed upon. However, **ensuring that other ministries and agencies delivering on EGD are also considered in this architecture would be important for R&I to effectively accompany the green transition.**

- **Resource Allocation** – *requires strengthening*

The insufficient financial resources allocated for R&I policy implementation are a major constraint to R&I meaningfully supporting the economic and green transition of Ukraine. **The National Innovation Strategy 2030 and its Action Plan were underfunded, with some measures not having any funds allocated for their implementation, leading to weak policy outcomes**[104]. If the new Digital Innovations Development Strategy faces the same issue of lack of clarity on mobilizable resources for its implementation, it is likely not to deliver on the ambitious objectives set forward. In this regard, ensuring that strategies and action plans are properly costed at their design stage and that realistic sources of funding are identified is critical. The Ukraine Facility Plan that foresees direct support to the state budget of 38 bn EUR over 2024-2027 should be leveraged to ensure that R&I-related measures across various sectors are implemented (incl. energy, transport, agriculture, critical materials, entrepreneurship, digital transformation, and green transition).

Furthermore, **human resource allocation for the R&I policy implementation is of high relevance in the context of population outflow and human losses due to the war[105].** The ongoing public administration reform with changes in remuneration of civil servants and downsizing of the state administration apparatus has an additional effect on the human capital available to implement R&I policy. In fact, since 1 Jan 2024, civil servants have seen their salaries decrease (e.g., by 30-50% for local level administrations[106]) in line with the new remuneration scheme, and starting from 1 April 2024, the Government plans to cut 20 thousand jobs in the civil service over a few years. Combined with the planned downsizing of ministries and public agencies to meet wartime budget constraints[107], this may lead to an outflow of civil servants as they see

[104] OECD (2022). *Building back a better innovation ecosystem in Ukraine*, https://www.oecd.org/ukraine-hub/policy-responses/building-back-a-better-innovation-ecosystem-in-ukraine-85a624f6/ (May 2024).
[105] According to the National Agency on Civil Service, in 2022, more than 4000 civil servants moved abroad, around 3,500 were drafted into the army and another 4000 remained in the occupied territories.
[106] Економічна правда (2024). *Для одних – скорочення, для інших – підвищення. Як реформа держслужби змінила зарплати чиновників?,* https://www.epravda.com.ua/publications/2024/02/1/709389/ (May 2024).
[107] OECD (2022). *Building back a better innovation ecosystem in Ukraine*, https://www.oecd.org/ukraine-hub/policy-responses/building-back-a-better-innovation-ecosystem-in-ukraine-85a624f6/ (May 2024).

their workload and responsibilities increase (or not change) and remuneration decrease. Hence, it would be important to ensure **that R&I policy relies on sufficient human resources for its implementation, with actions aimed at building capacities and ensuring the attractiveness of the civil service** (e.g., donor support for capacity building, continued public administration reform). One option, for instance, would be adding the green R&I to the portfolios of civil servants familiar to some extent with the innovation/digitalisation/green agenda, with provision of subsequent training, secondment programs, and internships.

- **Interagency Coordination** – *requires strengthening/ foreseen by reforms*

The current interagency cooperation mechanism – the National Council on Science and Technology – meets rarely and on an ad hoc basis, and it has not been provided the level of support in R&I policy coordination, as expected[108]. In addition, the recent OECD review of the public administration reform in Ukraine emphasised the lack of progress on policy development and coordination since 2018[109]. In the context of fragmentation of R&I policy planning, implementation, and monitoring, effective coordination is crucial to achieve positive R&I policy outcomes, given the cross-cutting nature of R&I and the need to streamline green R&I across various sectors. The new digital innovation strategy foresees 1) adding innovation to the sphere of responsibility of the Chief Digital Transformation Officers (CDTOs) in each ministry and expanding the CDTOs network to the regional level, and 2) reinvigorating the activities of the Innovation Development Council to address the issue of innovation policy coordination. If reinvigorated, the Innovation Development Council could be structured as the National Innovation Councils elsewhere in Europe**.** This mechanism aims to coordinate, align, and ensure synergies across stakeholders engaged in R&I, facilitate action across levels of government, and provide the necessary agility to respond to new challenges[110]. Chaired by the Prime Minister, such a Council could give R&I policy the necessary prominence to ensure that innovation becomes the driver of green and sustainable transition, while also making effective implementation of R&I policy more likely. The Swedish Innovation Council, the Swiss Science and Innovation Council, or the Georgian Research and Innovation Council, offer good examples in this regard that Ukraine can study and consider for adoption and adaptation.

- **Compliance and Enforcement** – *requires strengthening/addressing by reforms*.

The capabilities of ministries and agencies to enforce policy measures are limited by available funding and human resources, as well as a lack of effective

[108] Ibid.
[109] OECD (2024). *Public administration in Ukraine: assessment against the principles of public administration*. https://doi.org/10.1787/078d08d4-en (May 2024).
[110] UNECE (2022) *Innovation for Sustainable Development Review of Moldova,* https://unece.org/info/publications/pub/364780 (May 2024).

monitoring of policy implementation. The R&I policy goals do not directly align with EGD goals, but R&I priority directions and measures envisaged by the Roadmap for ERA integration, the priority areas in the Digital Innovations Development Strategy 2030, somewhat reflect the EGD goals and priority areas. For instance, among the priority sectors of the Digital Innovations strategy, the EGD-related areas feature prominently, including medtech, biotech (incl. tech for sustainable agriculture and quality of life), govtech, agrotech (incl. addressing the degradation of soils), edtech, greentech (incl. decarbonisation of energy sector, energy saving and energy efficiency, green energy transition, biomethane production, green metallurgy), and fluid economy (incl. fostering digital infrastructure and seamless connectivity, AI-ready education). **It would be important to ensure the MoES aligns Ukraine's R&I policy with new policy priorities for the ERA, which address EGD areas to enable integration of green R&I into the portfolios of relevant central executive agencies and institutions**. The EGD-related goals are explicitly referred to in climate, energy, and environment protection legislation, and strategic documents guide relevant ministries and agencies in meeting these objectives.

- **Data collection, Monitoring, and Reporting** – *requires strengthening*

The use of evidence derived from thorough studies and analysis to inform policymaking is yet to become systematic, even if analytical studies on R&I topics are conducted on state demand by the Ukrainian Institute of Scientific and Technical Expertise and Information, and by local analytical centres sponsored by donors and international organisations**.** The need to strengthen evidence-based policymaking is highlighted by the current innovation strategy, as well as by the international reviews of the R&I system (e.g., UN, EU). When it comes to green R&I, there is a need to ensure the **production of relevant indicators for green R&I to enhance evidence-based R&I policy design and provide for international comparability** of Ukraine's data on relevant indicators. In addition, as reporting and monitoring progress towards R&I strategic objectives is fragmented, it is important to ensure there are clear, measurable indicators to track progress and harmonise and standardise data collection for reporting across ministries.

Ukraine's efforts on Open Science also contribute to better availability and transparency of data on academic and R&I activities. In fact, the MES launched dedicated platforms – the Ukrainian Research Information System (URIS) and the National Repository of Academic Texts and is currently introducing enhancements to URIS to facilitate research and access to relevant data. Furthermore, in 2020, Ukraine joined the European Open Science Cloud (EOSC) with some institutes of the NASU, and the Kyiv Academic University having started to transfer open data to the EOSC. Going forward, ensuring R&I projects' data storage and accessibility would be an important step towards transparency of R&I activities and quality of results.

- **Capacity Building** – *insufficient (esp. green R&I aspects) and requires strengthening*

Lack of capabilities of relevant institutions to implement R&I policy, and in particular green R&I, is a crucial obstacle to effective support to EGD. Multiple initiatives to build the capabilities of ministries and agencies in financial, economic, and regional development reforms have been in place, mostly financed by international partners, but these were insufficient to cover the gap in public administration capabilities. The war has aggravated the public sector capabilities, as many employees have fled the country. The technical assistance projects have been a strong tool to fill in the capabilities gap, but high reliance on such support without building in-house capabilities is not sustainable in the long term.

For instance, **the Ukraine Capacity Development Fund (UCDF),** a trust fund managed and administered by the IMF, was launched in February 2024 to provide resources for scaling the technical assistance and training in the areas of fiscal reforms, monetary policies, financial sector integrity, etc[111]. Other donor initiatives exist to ensure the capacity building of the Ministry of Finance, the Ministry of Energy, the Ministry of Economy, and anti-corruption bodies under the OECD Ukraine country programme[112]. However, limited capacity building is available for the Ministry of Education and Science (as of May 2024, 33 people covering all the R&I portfolio), and other ministries in areas related to R&I. **Targeted capacity building programmes on green R&I policy design, implementation and monitoring and evaluation** would be instrumental in facilitating Ukraine's R&I sector readiness for green transition.

Strengthening the capabilities of the R&I institutions to carry out R&I is another important vector of donor and state support. Several bilateral initiatives are in place, such as the US Science and Innovation Fund for Ukraine, to support the Ukrainian research community, providing opportunities to work and undertake collaborative projects[113]. Universities of the UK have put in place a UK-Ukraine twining initiative[114] to enable inter-university partnerships and build resilience in the time of war. The EU has made available significant support under dedicated initiatives, such as MSCA4Ukraine, EIC4Ukraine, ERC4Ukraine, the Human Frontier Science Programme, Horizon Europe,

[111] *Ukraine Capacity Development Fund Launches Operations* (no date) *IMF*, https://www.imf.org/en/News/Articles/2024/02/12/pr2444-ukraine-capacity-development-fund-launches-operations (April 2024).
[112] OECD (2023) *Ukraine Country Programme,* https://www.oecd.org/mcm/documents/Ukraine-Country-Programme.pdf (April 2024).
[113] National Academy of Sciences (2024). *Science and Innovation Fund for Ukraine,* https://www.nationalacademies.org/our-work/science-and-innovation-fund-for-ukraine (May 2024).
[114] *UK-Ukraine R&I twinning grants scheme* (2023). *Universities UK,* https://www.universitiesuk.ac.uk/topics/international/international-research-collaboration/uk-ukraine-ri-twinning-grants-scheme (May 2024).

etc.[115]. Support for the Ukrainian R&I organisation in applying for and taking part in EU programmes is further needed and is provided through the Horizon Office in Ukraine and the dedicated NFPs. However, the resources of these institutions are limited and require strengthening as well. Finally, joining the European Human Resources Strategy for Researchers (HRS4R) could also contribute to increasing the capabilities of R&I actors in Ukraine.

- **Stakeholder Engagement, Awareness, and Communication** – *requires strengthening*

The ministries responsible for R&I conduct public consultations on key strategic documents in accordance with relevant legislation (except for the Ministry of Strategic Industries due to limitations on information accessibility in the context of martial law). However, **the input from the civil society actors, business sector representatives and other stakeholders concerned with the R&I policies could be strengthened if the Innovation Development Council is re-activated or similar mechanism is put in place.** This would allow for a more systematic stakeholder engagement and contribute to better R&I policy design and implementation.

When it comes to stakeholder awareness on R&I policies and in particular green R&I, there is a lack of understanding among R&I stakeholders of the importance and benefits of the green R&I. **R&I stakeholders and the broader public often perceive EGD-related requirements as a constraint rather than an opportunity to solve current socio-economic challenges and achieve Ukraine's strategic objective of EU integration**. The fragmented initiatives to support green transition by various ministries do not seem to be making part of a broader narrative "explaining" the green transition. A strategic communication plan on green transition, highlighting the role of green R&I put in place by MoES, MinDigital, and MinEconomy, could help to raise awareness of R&I stakeholders on the rationale for and the benefits of the green transition for Ukraine's R&I system and the economy as a whole.

- **Transparency and Accountability** – *requires strengthening/ somewhat addressed by reforms*.

The digitalisation of public services and public administration has had a positive effect on the transparency and accountability of the policymaking process in Ukraine. According to the UN E-Government Development Index, Ukraine ranked 46 out of 193 countries in 2022, a few positions away from the regional leader, Poland. In the R&I sector**, the recent extension of URIS,** the Ukrainian Research and Innovation Information System, **to audit the performance of the R&I and HEI institutions** is one

[115] European Commission (2024). *International cooperation with Ukraine in research and innovation,* https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/europe-world/international-cooperation/association-horizon-europe/ukraine_en (May 2024).

example of using digital tools for more efficient and transparent policy implementation. Ukraine has shown progress **on the voice and accountability indicators** as assessed by the World Bank, reaching the score of 0,07 in 2021, a significant increase from to -0.08 in 2015 (on the scale of -2,5 to +2,5 with the latter showing best performance). However, Ukraine's performance on the government effectiveness indicators has remained weak over the last decade, varying from – 0.59 in 2012 to -0.50 in 2022, demonstrating significant room for improvement. **The establishment of the Public Integrity Councils within all the line ministries as a mechanism for civil society control** has been instrumental in holding public institutions accountable for implementation of policies, incl. the MoES on R&I. **Nevertheless, civil society control remains insufficient to ensure accountability and transparency in R&I policymaking with the need to further institutionalise and entrench civil society and citizen input into R&I policy**.

3.3.3 Summary of gaps/bottlenecks and needs

Areas of assessment	Summary of gaps
Are the roles and responsibilities regarding R&I set up in institutions clearly?	1. The overlapping mandates of the four main ministries responsible for R&I result in inefficient resource use and hinder effective policy implementation. 2. The current inter-ministerial R&I policy coordination mechanism lacks effectiveness and should be revised, as envisaged by the new innovation strategy. 3. At the sub-national level, R&I policy implementation falls under the S3 component of regional development strategies, with varying capacities of local institutions for its implementation and a need to address this capacity gap to increase regional competitiveness and preparedness for green transition.
Have the proper institutions been given a clear and sufficient mandate to reach the EGD-related goals set up for R&I?	1. The R&I goals do not directly reflect the EGD goals, and MoES is yet to align its R&I priorities with ERA policy priorities that address EGD with adequate allocation of funding for implementation required. 2. Other ministries responsible for R&I do not have a clear mandate to reach EGD-related goals.
Do the relevant institutions have enough (human) resources to handle the requirements for green R&I?	1. Current financial and human resources allocated to R&I policy are insufficient to meet the set goals and accompany the green transition, but some measures are foreseen to address this under the new innovation strategy. 2. Downsizing of ministries, recent revision of remuneration of civil servants, and decreasing staff in the public administration apparatus have a negative impact on human resource capacities for R&I policy implementation (esp. in the context of emigration due to the war).

Do the relevant institutions have transparent and sufficient data collection, monitoring, and reporting systems for green R&I?	1. Data for tracking progress on R&I policy implementation and outcomes are lacking with no robust mechanisms in place for reporting and monitoring despite progress on the digitalization of public administration; the "green" focus is also missing. 2. Implementing the Open Science initiative through the launch of the URIS platform and joining the EOSC contributes to better R&I data availability and transparency, but should be further deployed for green R&I.
Do the relevant institutions have sufficient and meaningful stakeholder engagement and communication activities in place for R&I issues, including green R&I?	1. The current stakeholder consultation mechanism allows for feedback on R&I policies, but policy development could be strengthened through more systematic and better institutionalised stakeholder engagement, for instance, if the Innovation Development Council is reinvigorated or a similar mechanism is put in place; EGD-related areas should be more prominently incorporated into R&I policy agenda. 2. There is a lack of understanding of the importance and benefits of the green R&I among the stakeholders as green transition is often perceived as a constraint rather than an opportunity to solve current socio-economic challenges and accelerate Ukraine's EU integration; there are few efforts at the state level to raise awareness on EGD and build a coherent policy narrative around green transition.

3.4. Non-governmental R&I capacity

This section describes and analyses the non-governmental actors' capacity of supporting green knowledge creation and innovation, as well as broader R&I infrastructure able to support green R&I.

3.4.1. Technical and infrastructure capacity – current capacities and future needs

While Ukraine's R&I infrastructure is quite diverse, comprising such elements as science parks, technoparks, industrial parks, Industry 4.0 Centres, innovation hubs, and regional technology transfer centers, it currently falls short of meeting the demands of the green transition. In fact, only a small share of registered infrastructures is operational, and R&I infrastructure is often **not easily accessible to non-state actors**.

The legislative framework in place, i.e., Law on science parks, Law on Industrial parks[116], Law on technoparks, poses a foundation for the operation of innovation infrastructures but **lacks relevant fiscal and other incentives to stimulate R&I activity more**

[116] *Law № 5018-VI On Industrial Parks* (2012), https://zakon.rada.gov.ua/go/5018-17 (May 2024).

generally and R&I for green transition more specifically. Out of 16 technoparks, only three are operational, around 10 industrial parks out of 75 are demonstrating results, and out of 40 science parks, only 5 are reporting on their activities. There are two Industry 4.0 Centres functioning based on the National Polytechnical University in Kyiv and the Kharkiv Aviation University, while the ambition has been to have such centres in all regions of Ukraine to support the cluster development (as of 2023, 25 clusters in operation). The effect of the ongoing war should not be underestimated when assessing the performance of these infrastructures, **as at least 1,443 buildings belonging to 177 R&D institutions have been damaged or destroyed since February 2022,** with the total cost of restoring public research infrastructure estimated at US$ 1.2637 billion[117]. Integrating the EGD-related focus into existing infrastructures through, for example, specialisation of some science and technoparks on green R&I with relevant engagement of the private sector and/or international donor funding would help to build the capabilities for green transition.

The MoES is working to **enhance collaboration with the business enterprise sector on R&I** and **make available some of the infrastructures of the HEI, public R&D organisations to the private sector and other stakeholders for R&I activity** (e.g., through centres of collective use of equipment centres of excellence, the Science City initiative). However, limited access to quality research infrastructure for knowledge-intensive start-ups, scientists, and inventors remains a challenge that has also been noted by the new innovation strategy. Several initiatives of the MoES, as outlined in its Strategic Activities Plan until 2027, are aimed at enhancing the availability and access of R&I infrastructures to R&I stakeholders, fostering linkages between science and the business sector for R&I commercialisation. Together with MinDigital, MoES is working on launching "Science City" – an online platform with information and services for all R&I actors. While these are welcome developments, efforts introducing effective incentives for private sector cooperation and investments in R&I and in green R&I in particular are needed (e.g., fiscal incentives, deregulation of the R&D activity).

Through its efforts on the **Open Science initiative implementation**, as outlined in the National Plan on Open Science[118], Ukraine enhances access to data on R&I activities for all R&I stakeholders and promotes access to research infrastructures to innovators, industry representatives, and scientists. The National Repository of Academic Texts has been in place since 2019, with recent improvements made to ensure better access to information, and the Ukrainian Research Information System (URIS) was created to store, analyse, monitor, and manage data on the R&D activities of public R&D

[117] UNESCO (2024). *Analysis of war damage to the Ukrainian science sector and its consequences,* https://unesdoc.unesco.org/ark:/48223/pf0000388803 (May 2024).

institutions[119]. The MoES is working to simplify data search and procedures related to reporting, forms submission by R&I institutions and scientists to URIS. However, currently, there is no practice of saving scientific data and its reuse in Ukraine, and there are no data stewards in scientific institutions, which forces Ukrainian organizations carrying out international projects, under the EU Horizon Europe and Euratom, to save their scientific data in partner institutions in other countries. This situation is expected to be addressed by the Government through the National Plan on Open Government 2023-2025[120].

Regarding the private sector R&I support infrastructures, it has seen an important boost due to the burgeoning Ukrainian IT sector and its start-up ecosystem, with R&I infrastructure created to support IT sector growth. Over the last decade, Ukraine has seen a **proliferation of private innovation parks** such as UNIT. City, UNIT.Kharkiv, Promprylad.Renovation, Lviv.Tech.City, **which provides infrastructure and funding for innovative enterprises and R&I projects.** Venture capital initiatives, such as Angel One Fund, Flyer One Ventures, invest in Ukrainian innovative start-ups, and the funding under USF and WES NIS, Creative Europe, Horizon Europe, Visa, and Good programmes offer financing for innovative projects. While venture capital is still insufficient to meet the needs for the scale-up of Ukraine's prospective innovative technologies, it is sufficient for the early stages of innovative ventures and is playing an important role in supporting R&I in Ukraine, especially in the context of the lack of availability of foreign capital due to war-related risks.

When it comes to specific initiatives on **private sector "greening",** some services are provided by dedicated companies. For instance, the Resource Efficient and Cleaner Production Centre (RECP)[121] provides services to the private sector with over 170 companies as clients. It benefits from donor funding through projects focused on circular economy, industrial digitalization, and decarbonization, such as the "Circular Economy and New Growth Opportunities" component within EU4Environment Action for EaP countries and the Global Greenchem Innovation and Network Programme within the component focused on management of industrial chemicals and their waste. The companies can also join the UN Global Compact to enhance their ESG compliance, with 149 Ukrainian companies, mostly multinationals or large businesses, having joined so far and thus contributing to building a foundation for the green transition of Ukraine.

[121] *Resource Efficient and Cleaner Production Centre,* http://www.recpc.org/en/ (May 2024).

Since the full-scale invasion by Russian Federation, the **defence and security sector has attracted significant investments** from the state and private actors, with strengthened infrastructure to support innovations. For instance, the Ministry of Defence launched its own accelerator programme[122] for innovative military technologies, and the drone technology and production has grown significantly (e.g., from around 10 companies in 2021 to more than 200 companies in 2024 with more than certified 60 types of drones; Drone Hackathon[123] conducted in 2022 by MinDigital). The defence and security sector were included in the list of priority areas for R&I, with investments in R&I and dual-use technologies expected to further grow. As defencetech and related fields are attracting and absorbing state and non-state funding, capitalising on developments in this sector to **enhance technology transfer for dual-use technologies**, **R&I in dual use,** and replicating successful industry-science cooperation frameworks in non-military R&I fields could substantially boost the capabilities of Ukraineѐ R&I system. Moreover, **incentivising, to the extent possible, the militarytech to propose green solutions (e.g., through tax reductions/exemptions, matching funding mechanisms, provision of loans and guarantees, etc.) would make a solid contribution to the R&I system's capacities in EGD implementation.**

3.4.2. Green skills and awareness

Green transition awareness

The awareness of the green transition, its components, rationale and implications for various sectors is quite weak with **a few "pockets of excellence" across businesses and CSOs** that attach particular attention to green transition and realise its importance for competitiveness of Ukrainian economy and its EU integration.

Under the project "Integration of sustainable development in Ukraine in line with the European Green Deal", the EU has been funding **awareness raising** and analytical activities on EGD and Ukraineѐ green transition. For example, the online platform "***greentransform.org.ua***" gathers the latest information, practices, and updates regarding EGD legislation, and showcases initiatives in place in Ukraine (at the level of policy but also case studies from green measures implementation by local authorities). The platform is run by seven NGOs with DixiGroup playing the role of coordinator. Other EU-funded projects, such as the **Interreg Danube Region** projects on energy efficiency and greening of the Danube region, and broader projects of **EU4Energy and EU4Climate,** disseminate information on the green transition, contributing to the overall awareness of the public and stakeholder groups of the EGD. Several NGOs

[122] *Accelerator of the ministry of defence of Ukraine* (no date), https://mil-tech.gov.ua/en (May 2024).
[123] Мінцифра (2022). *Мінцифра запускає Drone Hackathon для пошуку нових рішень у галузі military-tech,* https://thedigital.gov.ua/news/mintsifra-zapuskae-drone-hackathon-dlya-poshuku-novikh-rishen-u-galuzi-military-tech (May 2024).

described below are undertaking awareness-raising campaigns, workshops, and seminars on topics related to environmental protection, energy efficiency, and decarbonisation.

The **media communications** and capacity-building activities conducted by **industrial associations (**e.g., Chamber of Commerce and Industry, Association of Industrial Automation of Ukraine and Ukrainian Cluster Alliance, Association of Manufacturers of Ukraine, Association of Start-ups, etc.) do not seem to prioritise green transition which is limited to ad hoc events on Industry 4.0, circular economy principles and energy efficiency. This mirrors the lack of prioritisation of green transition in sectoral policies and insufficient understanding of green transition and its role for competitiveness and growth of the Ukrainian economy.

Finally, **an effective and overlooked tool to support R&I sector development and its contribution to finding innovative solutions to pressing climate challenges is citizen science**. Citizen science is about the non-professional involvement of volunteers in the scientific process, commonly in data collection, but also in other phases of the scientific process, such as quality assurance, data analysis, interpretation, problem definition, or dissemination of results.[124] It can play a significant role in conflict zones where biodiversity and the natural heritage of communities are threatened by military action. In Ukraine, since the beginning of the full-scale invasion, several citizen science initiatives have emerged. For instance, the EcoCity network of air quality monitoring stations continued its work to gather information about the state of the air and the possible presence of hazardous substances or increased radiation due to the war.[125] Furthermore, the "Science at Risk" project envisages actions to promote and develop citizen science in Ukraine,[126] while the opportunities within Horizon Europe on citizen science initiatives under the IMPETUS call for Citizen Science project are promoted by the NRFU.[127]

Green skills

The Ukrainian government does not have a strategic vision for developing green skills in Ukraine to facilitate EGD compliance and EU integration. A recent report by the Resource Centre "Society and Environment" estimates that **the green post-war**

[124] European Commission (no date). *Citizen science – Importance and benefits,* https://maritime-forum.ec.europa.eu/contents/citizen-science-importance-and-benefits_en (May 2024).
[125] Zelinka, M. (2022) *Citizen science-based air monitoring in Ukraine is more important than ever. We have seen it for ourselves,* https://arnika.org/en/news/citizen-science-based-air-monitoring-in-ukraine-is-more-important-than-ever-we-have-seen-it-for-ourselves (April 2024).
[126] Citizen science in Ukraine: Olena Kozak's blog (2023), http://scienceatrisk.org/story/citizen-science-in-ukraine-olena-kozaks-blog (May 2024).
[127] Horizon Europe Office in Ukraine (2025). The 3rd Impetus Call for Citizen Science Projects is Open, https://horizon-europe.org.ua/en/news/calls/the-3rd-impetus-call-for-citizen-science-projects-is-open/ (May 2024).

reconstruction of Ukraine can create 4.2 million green jobs across transport, education, healthcare, energy and water supply, and irrigation sectors.[128] This shows a huge potential for green transition for the Ukrainian economy, but also the future demand for green skills. As the report notes, initial phases of reconstruction would be marked by the prevalence of low-skilled green jobs, facilitating employment and the reintegration of individuals into the workforce. However, as Ukraine pursues its green recovery, green jobs will increasingly require higher skills, with the need for policy measures to build these skills now to ensure workforce availability in the medium to long term.[129]

As of 2022, the Ukrainian **higher education system** counted at least **636 courses in EGD-related areas with a total of 110,734 students[130] out of one million students in higher education.[131]** For instance, the State Ecological Academy of Postgraduate Education and Management (DEA) provides retraining and advanced training of specialists in ecology and technologies for environmental protection. Given the demand for green jobs in the near future, i.e., 4.2 million, **current training efforts in green skills seem insufficient**. STEM education would be crucial for the green transition, and in the case of Ukraine, with its strong record in STEM graduates, could make an important contribution to higher-skilled green employment. For instance, in 2019, a quarter of graduates in tertiary education were STEM[132] (with women representing 28% of this share[133]). However, the full-scale invasion by Russian Federation caused migration of students and prospective students, including in STEM, reducing the potential pool of skilled labour available in Ukraine for green reconstruction. In this respect, the policy measures directed at **increasing the number of STEM graduates and graduates with skills required for green jobs are needed** (e.g., creating relevant educational programmes, incentivising students to apply for EGD-related programmes, etc.).

Reskilling programmes and on-the-job training for green jobs are not on the policy agenda of the Government and have not yet been integrated at scale by the business

[128] Razom We Stand and Resource and Analysis Centre Society and Environment (2023). *Green jobs and reconstruction of Ukraine,* https://rac.org.ua/wp-content/uploads/2024/01/greenjobsrecoveryeng.pdf (May 2024).
[129] Ibid.
[130] Calculations based on the Національне агентсво із забезпечення якості вищої освіти (2023). *Доповідь про якість вищої освіти в Україні, її відповідність завданням сталого інноваційного розвитку суспільства у 2022 році*, https://naqa.gov.ua/wp-content/uploads/2023/04/.pdf and *Вузи україни. Довідник внз україни - університети, інститути, академії – освіта. Ua* (no date), https://osvita.ua/vnz/guide/ (May 2024).
[131] Estimates based on the above sources.
[132] World Bank Education Statistics, Databank.
[133] *Share of graduates by field, female (%)* (no date). *World Bank Gender Data Portal,* https://genderdata.worldbank.org/en/indicator/se-ter-grad-fe-zs (May 2024).

sector. Whereas green skills have been on the EU agenda, the topic remains relatively new and not well-understood by most stakeholders in Ukraine. Cases of business integration of circular economy principles, energy and resource efficient practices in Ukraine exist and have been growing over the lats decade due to adoption of relevant legislation on energy-efficiency, but it has not become systematic across sectors of economy with ESG requirements integration representing for now a "low hanging fruit" on the path to businesses' sustainability.

In this context, it would be important for the Government to **develop a coherent strategic framework for green skills for Ukraine (e.g. a national strategy) and identify relevant sources of funding of potential measures** (e.g., a share of environment/carbon tax, donor-funded projects) **for investments in green skills programmes in HEI and business sector** (e.g., introducing incentives to provide trainings for employees in this area).

When it comes **to CSOs and sectoral NGOs in the area of green transition**, their skills to support green transition in Ukraine are strengthened through networks, knowledge, expertise, and practice sharing with European and other counterparts, the NGOs have access to as part of the donor-funded initiatives (the majority are donor-funded). Hence, **technical assistance and cooperation projects on green transition are instrumental in further building the capabilities of local civil society stakeholders to accompany the green transformation of the economy**.

3.4.3. Stakeholder capacity

CSOs and analytical centres

The green transition agenda in Ukraine is supported by several sectoral NGOs, including CSOs and analytical centres, that are fully donor-funded (with the majority coming from international donors, and some Ukrainian donor funding available through the "Renaissance Fund") to carry out their activities in policy support, advocacy, capacity building, and shaping policy discussions on green development and recovery of Ukraine. In fact, DixiGroup, EcoAction, and the Resource Centre Society and Environment are major actors in this respect, with the necessary weight to influence policy decisions and contribute to effective implementation of the donor projects on green transition in Ukraine. Below is a brief description of their activity.

- **DixiGroup** is a Ukrainian analytical centre specialised in the energy sector, providing policy support on Ukraine's energy sector reform, including its decarbonisation, sustainable development, and competitiveness in the view of Ukraine's EU integration. The centre also undertakes advocacy, public awareness campaigns, and capacity building (stakeholder education). In 2023, for instance, DixiGroup started the implementation of a project funded by the Netherlands and the EU on the development of green energy plans for local communities.

- **EcoAction** is a civil society organization focused on advocacy in the areas of energy efficiency, renewable energy, climate change, sustainable development of transport and agriculture, clean air, in line with EGD sectors. It has produced analytical material to support the reforms in the abovementioned sectors, and the CSO takes an active part in policy discussion on green transition and is recently leading, together with other organisations, on the assessment of the impact of war on Ukraine's environment and on climate.
- **Resource Centre "Society and Environment"** is an analytical centre focusing on environmental policy research, capacity building and implementation of innovative initiatives in Ukraine and in the Eastern Europe, Caucasus and Central Asia regions. Jointly with DixiGroup, it has been involved in several projects funded by the EU, including the annual monitoring of the green deal implementation in Ukraine, a survey of the Ukrainian population on EU accession, post-war reconstruction, and addressing environmental problems[134].

The work of the abovementioned organisations is amplified through their membership in international CSOs, such as, for example, the well-established environment-focused NGO CEE Bankwatch Network, where EcoAction is a member. **Integration into European networks of NGOs** that come with the international donor funding allows for the exchange of knowledge, expertise, and better collaboration on EGD-related topics between Ukrainian organisations and international organisations while increasing the capacities of Ukrainian NGOs to advance and support the green transition agenda in Ukraine. For instance, DixiGroup and Resource Centre Society and Environment, together with a few other NGOs, produce an annual "**Ukraine and European Green Deal Monitoring Report,**" which is invaluable in the context of a lack of systematisation and cross-sectoral approach to EGD in Ukraine[135]. The Government could leverage existing solid capabilities of CSOs to raise awareness of public, education and business sectors on the urgency, benefits, and actions required for green transition and the role of green R&I (e.g., public sector partnering with CSOs to run workshops, programmes, engage in the discussions on green R&I).

The capabilities of the non-governmental sector to support the green transition in Ukraine **rely a lot on donor funding**. A case in point is the **"Green Deal Ukraina"** project, funded by the German Federal Ministry of Education and Research (BMBF) and

[134] Resource and Analysis Centre Society and Environment (2024). *Ukraine of the future: EU accession, post-war reconstruction, environmental problems and energy independence through the eyes of average Ukrainians - Society and Environment,* https://rac.org.ua/en/war-and-post-war-reconstruction/ukraine-of-the-future-eu-accession-post-war-reconstruction-environmental-problems-and-energy-independence-through-the-eyes-of-average-ukrainians/ (May 2024).
[135] Resource and Analysis Centre Society and Environment (2024). *Ukraine and European green deal annual monitoring report 2023 - society and environment*, https://rac.org.ua/en/eu-accession/european-green-deal/uknaine-and-european-green-deal-annual-monitoring-report-2023/ (May 2024).

launched in 2023 to run until 2027. It is implemented by a consortium of partners in Germany, Poland, and Ukraine, including Helmholtz-Zentrum Berlin (HZB), Forum Energii (Poland), DixiGroup, and EcoAction (Ukraine). It aims to set up a Kyiv-based think tank to support Ukrainian government institutions, policymakers, experts, and society in making future-proof energy and climate policy decisions ahead of full EU integration. The main vectors of support include sustainable reconstruction of Ukraine's energy system and decarbonisation of the energy system and economy through support in data and modelling, policy analysis and advice, and capacity-building programmes. The project issued a set of proposals for the green recovery of Ukraine which focus on increasing Ukraine's industrial technological capacities to be competitive in the EU markets, decarbonisation of energy, transport and construction sectors, introduction of eco-standards in agriculture, as well as inter-government coordination on green transition policy with strategic engagement of civil society and relevant stakeholders for increased transparency and efficiency. This is the first "Green Deal" specific project looking to increase stakeholder capabilities that is implemented in Ukraine. **Finally, sectoral NGOs**, e.g., in energy, industry, agriculture, environment protection, waste management, conduct some activities on relevant EGD-related areas, contributing to advancing green transition (e.g., Association of Energy-efficient cities of Ukraine, Women Energy Club, Plato, etc.).

Business sector and business associations

When it comes to business sector organisations, the **UN Global Compact Initiative** is supporting the green transition in the business sector through its "Partnership through Sustainability Awards". For example, the Company group "Octava" (investment company) launched the environmental initiative "Post War Greening," which was awarded by the UN Global Compact in 2023[136]. The initiative allowed local communities to buy seeds for green zones rehabilitation following the war destruction at a reduced price (70% of the cost of seeds covered by the company).[137]

Large businesses, such as **DTEK**, a major energy company, and **Neo-Eco Ukraine**, a waste management company, have initiatives to support the greening of their relevant sectors of operation through investments into innovation, renewable energy projects, and the development of waste management solutions. Several prominent **business associations in Ukraine,** such as the Association of Industrial Automation of Ukraine and Ukrainian Cluster Alliance, Association of Manufacturers of Ukraine, and Association of Start-ups, **conducted ad hoc discussions at the national and**

[136] *Greentransform* (2023). *Ініціатива «post war greening» - фіналіст partnership for sustainability award 2023,* https://greentransform.org.ua/initsiatyva-post-war-greening-finalist-partnership-for-sustainability-award-2023/ (May 2024).
[137] Octava Capital (2023). Postwargreening – відновлюємо зелені території ушкоджені війною, https://postwargreening.octavacapital.ua/ (May 2024).

international level which include EGD-related topics, e.g., decarbonisation, energy efficiency, circular economy principles, etc. However, since the invasion and its significant negative effect on the economy, the main topics of discussions and capacity-building relate to building resilience in wartime, exporting under transport, tariff barriers and other constraints, exporting to EU markets with required alignment with production certification and quality requirements, etc. Integration of longer-term thinking and perspective would be necessary to prepare Ukraine's private sector for EU single market integration and related EDG-compliance, e.g., carbon border adjustment mechanism.

At the same time, the pursuit of EU integration opens an opportunity for Ukrainian businesses to integrate green practices and attract direct investments in green R&I, as green transition is a critical component to ensure Ukrainian businesses are competitive in the EU market. Building on the opportunities provided through the EU Association Agreement and Ukraine's candidate status with regards to knowledge and practice exchange with the EU professional networks on integration of green practices and procedures, the **business sector in Ukraine can enhance its capabilities in green transition, including R&I investments for EGD requirements compliance.**

3.4.4. Summary of gaps/bottlenecks and needs

Areas of assessment	Summary of gaps
Does the country have sufficient technical and infrastructure capabilities to reach national and EGD goals related to green R&I?	1. Current R&I infrastructure lacks effectiveness as many infrastructures are not operational in practice due to gaps in funding, personnel, and insufficient incentives laid out by legislation. 2. The war-related destruction and damage to infrastructure, as well as the associated lack of human resources, weaken Ukraine's capabilities for green R&I.
Are the discussions related to technical and infrastructure development focusing on making changes required for green R&I?	1. The planned improvements to ensure better accessibility of R&I infrastructure to all R&I stakeholders are likely to facilitate the development of green R&I. 2. The initiatives foreseen by MoES on fostering stronger linkages between science and business through Science. City and Science, and Business platforms contribute to building R&I sector capacities that can support the green transition but need sufficient resources for implementation and a long-term perspective. 3. The R&I sector has not yet benefited from spillovers of the surge of investments in military technologies, with potential to incentivize R&I for dual-use technologies and apply the lessons learned to strengthen industry-science cooperation on R&I.
Are there enough skilled workers who can support the green	1. The government does not have a clear vision and a laid-out plan for development of green skills to meet the projected demand of

R&I, and does the government have plans and measures in place to support the development of green skills?	4,2 million green jobs, if Ukraine is to ensure a green post-war recovery. 2. Current capacities of HEI are not sufficient to meet the demand for green jobs, especially when it comes to STEM, affected by the current and prospective students' war-related emigration, emptying the pool of skilled workers.
Are the relevant sectors aware of the changes they need to take to reach green transition-related goals and overcome the challenges?	1. Many CSOs and NGOs supporting green transition are aware of green transition challenges with advocacy, analytical and capacity-building efforts directed to address those and raise stakeholder awareness on the urgency, benefits, and actions required for green transition, but their activities require further scale-up. 2. The business sector generally lacks an understanding of urgency, benefits, and requirements for a green transition and the role green R&I investments can play in accelerating it.
Do the sector's key stakeholders have the capacity and resources needed to implement and support green R&I transition?	1. The government is missing out on leveraging the solid capacities of local CSOs and NGOs supporting green transition to increase public understanding and stakeholder "buy-in" for the green transition and promote green R&I. 2. The education sector does not have sufficient capabilities to prepare the workforce with the necessary green skills for Ukraine's green reconstruction. 3. The initial shock and continued negative impact of war on all sectors of the economy diverts the business sector's attention from building green skills of its employees, with potential negative effects (e.g., compliance with EU's carbon border adjustment mechanism).

4. R&I in other thematic areas

This section presents an overview of the most important developments in each EGD sector in Ukraine with a particular focus on R&I. It aims to explore to which extent the R&I policy and capacities can facilitate Ukraine's green transition across energy and climate, building and renovation, industry and circularity, farm to fork (F2F) strategy, biodiversity, zero pollution, just transition, transition finance and digitalisation sectors.

The analysis is structured across nine dimensions covering the extent to which the R&I is present in the sectoral strategic documents, green skills and skilled workforce available in the sector to implement the transition, the higher education and R&D programmes in the sector, the state of play in terms of innovation and potential for innovative development, the capabilities of the stakeholders, and finally, reflections around the place of R&I in the sector (Table 4.1). In addition, the analysis of social entrepreneurship initiatives to foster innovation for green transitions is briefly covered, followed by proposed priorities for R&I support on the EGD thematic areas.

Based on the analysis, several cross-cutting issues were observed:

- The significant negative impact of full-scale invasion by Russian Federation on the capabilities of the sectoral actors, human resources, and technical capacities of public and third-sector stakeholders, with considerable demand for building such capabilities despite the ongoing war.
- The weak linkages between enterprises in various sectors and relevant R&I organizations that can support the development of new solutions and facilitate the green transition.
- The insufficient readiness of the education system to develop necessary "green skills" (e.g., integration of relevant components to existing curriculum, availability of specialised courses) and gaps in systematic provision of relevant training by businesses across economic sectors.
- The gap in science-informed and evidence-based approach to policy through better engagement with relevant R&I stakeholders across sectors and policy cycle (e.g., policy design, implementation, monitoring, and evaluation), along with gaps in skills of civil servants in using data for policy elaboration and implementation.
- The R&I is often overlooked when considering solutions for policy issues across the EGD thematic areas, with instances of measures on integration and use of readily available technologies, and little attention paid to investments in R&D to build internal capabilities for long-term transformation of the economy.

4.1. Cross-sectoral social innovation to support green transition

Social entrepreneurship is not regulated in Ukraine, i.e., there is no legal definition of this phenomenon in SME legislation. However, **over the last decade, social entrepreneurship and innovative ideas have seen a rise in Ukraine**. Thus, several social innovation initiatives focused on facilitating the green transition are in place in Ukraine, with **donor support** being substantial to their activities. A case in point is the recently launched **"Green Innovation Challenge" for Ternopil**[138] by UNDP and BOOST, a regional acceleration programme for social impact innovators in Europe and Central Asia. The call is addressed to SMEs with innovative green solutions for the most pressing social challenges at the level of Ternopil municipality, with the award of up to USD 10,000 and the possibility to raise additional financing. Furthermore, the EU-launched **New European Bauhaus (NEB)[139] for Ukraine** provides an opportunity for exchange of expertise on affordable, sustainable, and aesthetic housing and urban architecture, with the launch of a capacity-building programme in March 2023 for 65

[138] Green innovation challenge - boost (no date), https://boostimpact.org/challenges/green-innovation-challenge/ (May 2024).
[139] European Commission (2023). *Greening the Ukrainian Recovery: Building a Sustainable Future Together,* https://ec.europa.eu/environment/stories/greening-ukrainian-recovery/index_en.html (May 2024).

Ukrainian municipalities on how to deliver socially sustainable and green housing for reconstruction.

The **SILab Ukraine** is a major organisation focused on building the ecosystem for social entrepreneurship and providing support to social entrepreneurs and innovators, including an acceleration programme, impact investment, and social partnership building[140]. The organisation supported several initiatives during wartime, including "Shelter Ukraine" to assist internally displaced persons, launched an express online incubator with the support of the Ukrainian Social Venture Fund, and the "Partnership for Impact" projects with support from Impact Europe (the European Venture Philanthropy Association, EVPA)[141].

Over 2018-2020, under the **EU-funded project "Social Business in Ukraine"**, a series of awareness-raising activities, advice, and training events for social entrepreneurs were conducted to support and foster the development of the social innovation ecosystem in Ukraine, including when it comes to advocacy and legislative change. These projects support just transition and equity and contribute to ensuring the social sustainability of business ideas. Furthermore, educational programmes, such as the "**Social Innovations for Municipalities"** launched in 2023 or the Ukrainian Social Academy, raise awareness on social entrepreneurship, build capabilities of local social innovators to support sustainable transformation of their municipalities and the country, contributing to green transition[142]. **Building on the existing capabilities in social entrepreneurship in Ukraine to promote green social initiatives by strengthening support to organisations such as SILab and introducing incentives for green social businesses (e.g., grants, loans, guarantees, partnerships matching, etc.) could help build capabilities for innovation and green transition.**

4.2. R&I in other thematic and cross-cutting areas

[140] *SILab Ukraine,* https://www.silabua.com/en/about (May 2024).
[141] Zagoriy foundation media (2022). Соціальне підприємництво у воєнний час: як працює ЯК ПРАЦЮЄ SILAB UKRAINE, https://media.zagoriy.foundation/velyka-istoriya/soczialne-pidpryyemnycztvo-u-voyennyj-chas-yak-praczyuye-silab-ukraine/ (May 2024).
[142] *UEP UkrEdPlatform*, *Соціальні інновації громад 2023*, https://www.ukredu.org/socialinnovations2023 (May 2024).

Thematic area and key developments	*R&I in strategic documents*	*Green skills/ skilled workforce availability*	*MA/PhD programmes, research centres, R&D projects*	*Innovation – state of play and opportunities*	*Stakeholder capabilities regarding R&I*	*Implications for R&I*
Energy Severe damages to the sector caused by the war, estimated at $36 billion, with $1.18 billion attributed to the generation of electricity from renewable energy sources. Around 50% of Ukraine's installed green energy capacities (wind and solar) are not operational or destroyed due to their location in the south of Ukraine (in the combat zone or under temporary occupation). Ensuring energy	R&I is considered through the **introduction of investments in innovative technologies** in the sector to help reach carbon neutrality by 2050, as noted by the Energy Strategy 2050. Energy Efficiency Action Plan sets a national energy efficiency goal of reducing primary energy consumption by 22.3% and final energy consumption by 17.1% by 2030 but does **not mention the role of R&I in achieving the set targets**.	Ukraine experiences a **shortage of qualified workers** across all energy sectors due to the ongoing war (incl. personnel outflow, relocation, or mobilisation into the Army). **Metallurgical and machine-building professions** are still the most common professional group among those employed in the energy sector but require training programmes in green skills to ensure sector transition in line with EGD. A particular issue is the lack of high-skilled labour, such as engineers and energy managers.	The quality of training of graduates in energy sector falls short of the employers' needs requiring better practice training esp. for the renewable energy sector (RES). In addition, there are **no approved state education standards for renewable energy specialities**, and many educational programmes on renewable energy are not yet accredited (in particular, master's level programmes, where 6/8 are unaccredited) posing an issue for the RES uptake.	Innovation in the sector is marked by the adaptation of legislation and regulation to the EU requirements on carbon reduction and renewable energy development (pre-war). **Hydrogen technologies and carbon capture and storage** regarded as areas of high potential for Ukraine, leaving much room for R&I. For instance, Metinvest and DTEK consider hydrogen technologies as key element of companies' green transition in the context of ETS and CBAM, while the Naftogaz sees CCS as a sector where the company can expand its operations considerably	Public bodies face constraints in assessing exact allocations needed for EGD initiatives due to their **focus on energy security during the war** (MinEnergy) or **lack of resources for EGD** (Min Restoration, MinEconomy) **or EGD-related technical expertise** (Min Environmental Protection). Public bodies demonstrate strong engagement with EU institutions and energy sector stakeholders and actively engage in comprehensive data collection despite **issues with data accessibility due to**	Ukraine's main commitments under the EU Association Agreement include **four flagship initiatives** directed at enhancing energy efficiency, promoting renewable energy, combating energy poverty, supporting the transition of coal regions, and representing the shared ambitions of Ukraine and the EU in the energy sector. **R&I could support Ukraine's progress in these areas through targeted R&D projects and the development of technologies to facilitate the**

security is the main objective of the Government of Ukraine currently.		Current capacities of educational programmes are insufficient to provide enough skilled workforce for Ukraine's "green" recovery (incl. biomethane, hydrogen, RES, CCS, etc). The **Ivano-Frankivsk National Technical University on Oil & Gas plays an important role in energy-related R&I** due to its strong research department and high-quality educational programmes. In addition, the **Institute of Renewable Energy of the National Academy of Sciences and the Institute of Nature**	with vast availability of abandoned gas mines suitable for carbon storage. The **renewable energy sources (RES), such as wind, solar, and bio**, represent important potential as well, given Ukraine's geography. Innovation in the energy sector can be instrumental in achieving a **greener and more competitive industrial sector**[143]**.**	**martial law and data formats.** However, further training and capacity-building programmes are needed to enhance the stakeholder skills to support the green transition in the energy sector, incl. when it understands of the **importance of the R&I to achieve progress**.	**implementation of these initiatives**. With the RES especially affected by the war as most capacities situated in the combat zone or temporarily occupied territories, the investments in R&I to compensate for these losses through other sources, such as biomethane, hydrogen, and carbon could make a substantial contribution to the energy security of Ukraine and greening of the energy sector. Promoting innovation in the energy sector could also contribute to achieving a greener and more competitive industrial sector.

[143] IKEM (2023). *Roadmap for a climate-neutral, sustainable Ukrainian energy sector and its role in an integrated EU energy market*. Available at: https://usercontent.one/wp/www.ikem.de/wp-content/uploads/2023/10/EUETh-Recommendations-WEB.pdf?media=1714412028 (May 2024).

			Management and Ecology Problems undertake research projects with potential for attracting investments in innovative CCS and hydrogen technologies.			There is potential for investments in direct reduction iron (DRI) technologies and technologies for transition from gas to "green" hydrogen produced using renewable electricity.
Climate Ukraine's Nationally Determined Contribution to the Paris Agreement is set at 65% of GHG emissions reduction by 2030 (compared to the 1990 level) and reaching climate neutrality by 2060.	National Environmental Strategy until 2030 sets as an objective **transition to resource- and energy-saving technologies** (in particular, in metallurgical, chemical, petrochemical and energy industries); introduction of **e-governance technologies in environmental sector.**	The NECP sets measures aimed at **addressing the skills gap for green transition and renewable energy** through upgrading of educational programmes, and modernization of material and technical support base of scientific and educational institutions to enhance the quality of education and training for the graduates in the field of energy	The information mentioned above on education in the energy sector applies to this area. In addition, the **waste management sector** represents a huge potential in terms of employment and hence requires specific skills and training, which is currently very scarce. The waste management sector is in its development with an urgent need for investments in	Innovation in energy efficiency/renewable energy generation is underway (see above), and **waste management remains an issue in terms of upgrading its practices and processes**. The opportunities for R&I contribution to climate adaptation and mitigation measures include project funding and support under the "Horizon Europe", under Pillar II focused on "climate, energy and mobility", participation	The establishment of the **Climate Office**[144] **in Ukraine** provides opportunities for financing green reconstruction and strengthening the capabilities of the private sector and other stakeholders in the green transition. In addition, the **Decarbonisation Fund**, operational since early 2024, which aims to support green initiatives of local communities, businesses, and civil	The R&I could make a significant contribution to addressing the climate challenges if **a share of funds from the carbon tax and other relevant climate taxation could be directed to finance R&I projects and capacities of the R&I actors** in this sector (e.g., trainings and programmes abroad, financing the participation in related Horizon

[144] *Climate policy in ukraine » ukrainian climate office* (no date) *Ukrainian Climate Office*. Available at: https://ukrainian-climate-office.org/en/climate-policy-in-ukraine/ (May 2024).

	National Strategy for Waste Management until 2030 sets the objective of **introduction of cleaner technologies, technologies for reuse, processing and disposal of waste**. The National Energy and Climate Plan (NECP) specifically addresses R&I, setting three objectives in this regard: **development and financing of R&I in cleantech, renewable energy, and low-carbon production; promotion of clean and low-carbon technologies; and enhancing competitiveness of Ukrainian clean and low-carbon tech**.	(also addressed by the draft Global Innovation Vision 2030). It also foresees incentives for on-the-job training in the energy sector by major public and private companies with the support of the IFC and donors. The **green recovery scenario for Ukraine is expected to generate around 4,2 million new jobs,** hence ensuring Ukraine has the labour force with necessary skills is critical for green transition.	infrastructure and skills.	in the EU LIFE programme, EUROATOM, etc. The recently established Office of Horizon Europe is a powerful mechanism to enhance the collaboration of Ukrainians researchers and scientists, and innovative enterprises with European peers (incl. European Innovation Council, European Institute of Technology, and Innovation). The R&I could benefit from **investments in the field of green chemistry, green hydrogen, AI for the energy sector, technologies for energy efficiency of industry, climate-friendly agro-innovations.**	society, could serve as an impetus for investment into R&I in the energy and waste management sector[145]. Current capabilities of stakeholders are limited, as a lot of the **legislation and regulation required is still subject to elaboration or approval by the Government**, with skills to be acquired and high level of investment capital to be attracted (around EUR 108 bn, according to the latest estimates). This poses a challenge for support of the R&I in the sector to accompany the green transition.	Europe programmes). Currently these funds are not used entirely for intended purposes at national and local levels (e.g., half of the revenues are absorbed by the general state fund and at local level, the funds are channelled to trust funds not focused on environmental issues).

[145] Oleksandr Kubrakov: from January 2024, the State Fund for Decarbonisation and Energy-Efficient Transformation will be operational, https://mtu.gov.ua/news/34252.html (May 2024)

Industry and circularity Losses in production capacities due to the war and labour shortage affect the developments in the sector, together with the considerable gaps in waste management (industrial waste recycling stood at only 3% in 2020 and 0.3% for household waste). The Circular Economy Strategy is under elaboration, and Ukraine does not possess an Industrial Strategy. Steel and cement manufacturing are key GHG emitters	The National Strategy for Waste Management until 2030 plans the **introduction of cleaner production technologies for industrial waste reduction, as well as use of technologies for reuse, processing and disposal of industrial and solid household waste**. The Strategy does not mention R&I and seems to refer to the technologies in the spirit of the "readily available" technological solutions that can be quickly integrated into the process. The Ukraine Facility Plan stipulates the development of a Strategy and Action Plan on Circular Economy and alignment with EU	**Large industrial companies mainly have qualified staff with sufficient green skills**, develop and implement decarbonisation policies, and enhance their production based on circular principles introduction. Medium and small-sized companies do not have necessary skills and require capacity-building in this area. There is a **lack of qualified personnel in sustainable waste management.** As the waste management sector employed only 0.3-0.4% of workforce in 2021, representing significant potential if Ukraine pursues green transition (considering he trajectory in the EU where waste management sector was a major driver of	Educational programmes still need to integrate the knowledge and build the skills of graduates in the areas of decarbonisation, sustainable resource use, and waste management. Some assistance to businesses is available through international donor projects. For instance, in the framework of the "Circular Economy and New Growth Opportunities" within EU4Environment Action for EaP countries and the Global Greenchem Innovation and Network Programme, **the Resource Efficient and Cleaner Production Centre[1] provides**	Apart from several large companies, the integration of circular economy technologies and industrial technologies for decarbonisation is rare. There is an ample room for innovation, for **R&I in technologies for extraction of scrap metals from concrete for the reuse of construction waste** (esp. relevant for the reconstruction); **greening of industrial technologies, new technologies in waste management and circular economy.** The uptake of the technologies is hampered by the lack of financing and lack of incentives for investments in waste management infrastructure, reduction of waste generation, its reuse and recycling by	The overall capacity of the public sector in industry greening and circular economy remains modest, with gaps in skills and technical knowledge for policy implementation, monitoring, and evaluation. At the local level, the need to build capacities for green and circular economy transformation is facing the priority of meeting the urgent needs of the population in the context of the war. **Strengthening institutional capacities** would allow for more effective operation of policy instruments fostering industry greening and circular economy transition (e.g, fiscal incentives for companies, promoting	The low-tech nature (low innovativeness) of Ukrainian industry is symptomatic of the **low R&I investments** despite the pressing need for technological upgrading and the ambition of the Government to transition to a higher value-added economy. Hence, the importance of ensuring **the demand and funding for the R&I for industry transformation and the circular economy.** Smart specialisation (S3) could help to guide efforts in industry upgrading and circular economy at regional level, incl. when it comes to financing or supporting R&I in

in the industrial sector and play an important role for the economy, their decarbonisation presenting a priority.	Acquis in this area. Furthermore, it foresees the development and implementation of regulatory environmental standards for goods, services, and construction projects.	green jobs growth over the last decade).	**RECP services to the private sector, supporting transition to circular economy, industrial digitalization, and decarbonisation.**	the industrial sector. Some financing is available for R&I projects in this area through the "Horizon Europe" and LIFE programmes, as well as initiatives financed under the EU4Environment.	research-industry collaboration in the field through financing mechanisms, effectively using the Decarbonisation Fund financing of industry decarbonisation and energy-efficiency).	specific areas at locally.
Building and renovation The impact of war on the housing stock is estimated at $58 billion of damage[146]. High energy intensity of the residential buildings with 80% of the housing stock worn out and technologically outdated, the	The Long-Term Thermal Modernization Strategy sets development of human potential, **digitalization, and innovations in the field of thermal modernization of buildings** as its strategic objective 7. The measurable indicators it sets for reaching this goal are the number of skilled	The construction sector has seen the number of jobs almost halve (i.e., to 8.2 thousand) after the invasion in 2022. It experiences a **shortage of professionals able to implement green and circular solutions in the construction sector**, especially given the reconstruction demands due to war.	To ensure green transition in B&R, **comprehensive approach to professional training and qualification**, **combining knowledge and skills in construction, energy, and environment sectors** is required. The educational programmes should be upgraded to focus	The unsuccessful implementation of the energy efficiency projects in buildings (in the framework of "warm loans", other initiatives by the State Agency on Energy Efficiency with the support from donors) pre-war has seen the **application of technological solutions in the sector, digitalisation, and automation of processes**. Before the war, there was a	Ukraine has built robust capacities in energy efficiency policy pre-war, including policy design, implementation, and coordination. When it comes to the capabilities of non-government stakeholders to implement energy efficiency projects in buildings, they have acquired important skills and knowledge for green B&R but	The focus of strategic documents on building necessary green skills in the B&R sector can contribute to fostering R&I in the field, but **additional incentives are required to foster local technological solutions to accompany the green transformation of the construction sector**. Putting in

[146] World Bank (2023). *Ukraine - Third Rapid Damage and Needs Assessment (RDNA3): February 2022 - December 2023*, https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099021324115085807/P1801741bea12c012189ca16d95d8c2556a (May 2024).

capital investments required for thermal modernisation of buildings stand at EUR 160-214 billion. The deployment of net-zero emissions buildings (NZEB) is foreseen for public buildings as of 1 January 2026 and for all buildings starting from 1 January 2028.	professionals in the area of energy efficiency – 164,6 thousand professionals per year by 2050. However, there is **no mention of R&I in energy efficiency and construction, nor associated targets.**	In addition, to meet the objectives set out by the state strategic documents on energy-efficiency and modernisation of building stock, NZEB, there is a **need in highly skilled professionals** (e.g., engineers, architects, designers, etc). Some companies in the sector provide **training and professional certification for design engineers,** which contributes to skills upgrading. Building the absorption capacities of the construction sector engineers in terms of use of relevant technologies should also be a priority for the Government. Establishment of the **NZEB Hub of the Kyiv**	on the application of modern construction technologies and environmentally sustainable building materials, as well as the integration of renewable energy sources and digital solutions into engineering systems. Some initiatives are already in place and can be scaled up or serve as an example for further action. For instance, In 2020, as part of the project "Training of Energy Auditors to Work with the Energy Efficiency Fund", the **training programmes for audit specialists in buildings** were provided with the assistance of GIZ (currently, there are 3,000 energy auditors	sufficient supply of both domestic and international companies producing heat boilers/heating systems, energy-efficient windows, heat-insulating materials, and renewable energy systems for buildings, making the way for the NZEB. However, a comprehensive approach to building modernisation in line with the EGD was lacking, with **gaps in incentives for construction companies** to invest in innovation and technologies. The **key areas for innovation in B&R include** thermal modernisation of buildings; digitalisation of the construction and renovation industry through integration of new technologies (e.g.,	**further upgrading of these skills is needed to ensure the NZEB deployment**. This requires better alignment of education and training programmes with the needs of the thermal modernisation of buildings.	place targeted support to R&I in B&R through public grant programmes or ensuring business sector investments in the R&I would substantially boost innovation in the sector and facilitate its green transition.

		National University of Construction and Architecture contributes to green skills as the centre trained 350 construction specialists over 2016-2020. In VET education, 4 short-term programmes were implemented in 44 institutions with 1680 applicants in 2022/23 (incl. “Advanced thermal modernization systems of buildings and structures”, “Insulator from thermal insulation”).	in the building market in Ukraine). Under the Erasmus+ programme launched in 2023, new **Master's Courses on “Energy Efficiency, Building Retrofitting and Energy Planning” were launched in eight Ukrainian Universities** with the promotion of EU best practices and knowledge in energy efficiency and sustainability of buildings.	Building Information Modelling (BIM) technologies); decarbonization of heating and cooling systems; innovation and technologies for combating energy poverty; development of new construction materials with reduced environment footprint.		
Zero pollution 2/3 of the population lives in areas with air quality not meeting hygienic standards, with effects on morbidity. The war	The National Environmental Strategy until 2030 contains provisions on ensuring the practical **implementation of the results of modern fundamental environmental research in**	Fragmented initiatives in the education and business sectors are taking place to build the necessary green skills. For instance, the **STEM curriculum in HEI increasingly includes “green” components, while**	In 2023, the National Research Fund launched a call on the use of R&I to strengthen the defence and security of the country. The call includes such areas as safe demining and	Initiatives in the business sector on ESG compliance, circular economy principles integration, energy efficiency and decarbonisation are in place but are not systematic often due to the lack of the right	Institutional capacity for policy implementation is insufficient, as there are **gaps in technical skills for adaptation of the legislation to the EU norms**, the need for personnel training and expertise	The strategic documents related to zero pollution could more clearly and explicitly refer to the role of R&I in achieving strategic goals in this area. **Operationalising the provisions of**

increased the PM2.5 emissions by 75%, contributed to water and soil pollution (i.e., dangerous toxins and chemicals) Around 57 % of the territory is affected by water and wind erosion, and 12% by floods.	**environmental protection and fostering linkages between the scientific community and policymakers** for better policy design and implementation. Law "On waste management" includes provisions on reducing the volume of waste generation using best available technologies and management methods in the process of industrial production (Article 5-5) **and foresees the provision of tax and credit benefits for financial support of R&I in waste processing technologies, in particular recycling** (Article 56-8).	**the private sector, especially exporting enterprises, provides training for their staff on green practices.** However, better alignment of educational programmes with the employers' needs in decarbonisation, energy-efficiency, resource-efficiency use, sustainable manufacturing, etc. is needed. Businesses should be incentivised to invest more in human capital development and R&I in green transition (e.g., fiscal incentives, compensation mechanisms, loans, grants).	identification of dangerous environmental pollutants and expects the winning R&I projects implementation in 2024-2025 with maximum financing per project of 4,5 mln UAH and the total budget of 300 mln UAH allocated[147]. Another call by the NRF "On Science for the reconstruction of Ukraine in wartime" launched in December 2023, included addressing environmental consequences of war among its priority topics. The maximum amount of financing per project is UAH 4,5 mln with the total	incentives for green transition and sufficient funding opportunities. **R&I could support developing the solutions** for removing nitrates from water due to high nitrate pollution of groundwater; technologies for clean transport, waste management, and energy efficiency, other pollution-related areas.	on translating relevant legislation into policy and concrete support mechanisms; there is **an over-reliance on external expertise** (donor-provided) in this regard which hinders public sector internal capabilities growth. Reporting and monitoring tools, as well as data in line with the EU statistics (to ensure comparability), are lacking. Most of the funding for projects implemented by state and third sector actors on zero pollution comes from international donors which points to the lack of internal capacities (technical, financial).	**the Law "On Waste Management", which foresees financing of R&I in the field of waste processing** with a focus on recycling, would be important to ensure R&I contributes to the zero pollution solutions. Ensuring effective linkages, facilitating the cooperation between R&I organisations and industry (esp. metallurgy, steel, cement, chemical, and mining industries as largest polluters) through provision of funding, fiscal incentives, etc. would be instrumental in advancing the zero-pollution agenda.

[147] NRF (2023). УМОВИ проведення Національним фондом досліджень України конкурсу проєктів з виконання наукових досліджень і розробок, спрямованих на зміцнення стійкості та обороноздатності країни, https://nrfu.org.ua/wp-content/uploads/2024/01/umovy-konkursu-oboronozdatnis-2023.docx-1.pdf (May 2024).

			budget of the call of UAH 450 mln[148].			
Smart Mobility The transport system of Ukraine faces challenges of interoperability and technological development to be fully connected to the TransEuropean Transport Network (TEN-T). The share of electric vehicles has seen a robust growth over the last couple of years. Public transportation requires modernisation and faces difficulties in providing quality service and effectively	The recent amendments to the law on priority areas for innovation activity mention transportation technology, including space, aircraft, shipbuilding, weapons, and military equipment, as a priority area. Given the needs of national and security defence, the **transport tech appears to be skewed towards the military sector.** The amendments to the law on the priority areas of science and technology do not include transportation as a priority. However, **other priority areas, such as modern ICT and robotics, can be**	The current education and training system is unable to ensure the innovative development of the transport industry, as noted by the National Transport Strategy of Ukraine 2030. In addition, the **ambiguity of national standards for professional competence of transport industry experts, flaws in transport training** and **retraining programmes**, and a lack of recognition of educational documents (individual licenses and certificates) of Ukrainian educational institutions by the EU represents an issue for	There are roughly **275 bachelors and master programmes in transport field** in Ukraine, and several research institutes conducting R&I in the field. The **National Institute for the Development of Infrastructure (DerzhdorNDI)** is the main research institute focused on construction, repair and maintenance of highways and transport facilities. "Horizon Europe" programme also offers opportunities for Ukrainian R&I organisations and innovative businesses to access	Some cities have been systematic in developing the public transport, e.g., Ivano-Frankivsk, Lviv, and Ternopil, but have faced challenges in operating due to war-caused recurrent electricity black-outs undermining the electric transport reliability in the context of war. **Digitalisation of the transport system is ongoing** with introduction of e-passenger ticket, implementation of e-cargo system, digital payment solutions, etc. In the context of growing sustainable practices and attitudes of population to mobility (e.g., in 2022, 40% choose a more ecological way of	Under the EU-funded "Supporting Ukrainian Authorities in the Development of the National Transport Model and Master Plan" project, the **Ministry of Infrastructure benefited from training courses aimed at building capacities in solving mobility problems** by using **innovative practices and new technologies**. However, more generally, the capacities of the public sector stakeholders in supporting smart mobility are lacking due to **gaps in knowledge and skills for the implementation of**	Building the smart mobility system in Ukraine requires high levels of capital investments, which could be mobilised if the right incentives are in place for the private sector involvement, e.g., through PPPs, concessions, joint ventures, performance-based contracts, and commercial loans. These incentives should be coupled with **specifications on the innovativeness of the assets and services delivered, boosting the demand for R&I in smart mobility**. The Government could

[148] NRF (2022). УМОВИ проведення Національним фондом досліджень України конкурсу проєктів з виконання наукових досліджень і розробок «Наука для відбудови України у воєнний та повоєнний періоди», https://nrfu.org.ua/wp-content/uploads/2023/01/umovy-konkursu-2022.01-2.pdf (May 2024).

ensuring inter-city and rural-urban mobility (e.g., 72% of the market in interregional mobility operates in "shadow", failing to meet safety and comfort requirements).	**relevant for smart mobility**, together with the energy technologies (e.g., development and use of new types of fuel, energy-efficient transportation systems). The National Transport Strategy 2030 notes as one of its objectives the **support for implementation of R&I results in the field of transport**, including through building international scientific and technological cooperation in this area, and implementation of joint programmes by educational institutions, public administration and businesses.	upgrading of skills of transport graduates and experts[149]. The estimates of jobs created in the context of Ukraine's "green" recovery[150] place the transport sector first among sectors expected to generate green jobs (**more than 2 million new jobs**), which makes upgrading of existing educational programmes, training, and retraining programmes for green skills development an important task for the government.	funding for smart mobility projects.	transportation, including cycling, electric car, walking compared to 25% in 2018) and the need to enhance mobility infrastructures (in particular, rural-urban mobility, public transportation, networks having suffered war-related destructions), innovation could be instrumental in driving smart mobility. **The areas for the most potential for R&I** include: sustainable and resilient transportation networks (development of electric public transport, means to ensure resilience of transportation network to war-related risks), digitalisation of public transport (improving	**the EGD-related requirements**, as well as outflow of personnel related to the war posing a severe challenge for support of the R&I in the for smart mobility.	ensure that smart mobility is made a priority for regions that have seen population growth due to relocation, with incentives for local governments to invest in SM solutions and R&I (e.g., Ivano-Frankivsk, Ternopil, Khust, Lviv, etc.). More generally, to advance sustainable mobility technologies, alternative fuels, and mobility services, R&I could be fostered through **funding by the NRF and co-financing mechanisms for innovative solutions developed by businesses**.

[149] Ministry of Transport (2018). National Transport Strategy of Ukraine 2030, https://mtu.gov.ua/files/NTSU%202030.pdf (May 2024).
[150] Razom We Stand and Resource and Analysis Centre Society and Environment (2023). *Green jobs and reconstruction of Ukraine,* https://rac.org.ua/wp-content/uploads/2024/01/greenjobsrecoveryeng.pdf (May 2024).

				accessibility, interoperability of electronic tickets, etc.); ensuring mobility in remote rural areas (as low connectivity between cities and rural areas), inclusive transportation (e.g., adapted to people with disabilities).		
Farm to Fork (F2F) The updated version of the NDC presented in 2021 did not include any specific targets for the agriculture sector. As of April 2023, the estimates of the war-related losses of the sector stand at USD 31.5 billion. The main provisions of the EU F2F strategy have not been implemented in	According to the latest amendments to the law on priority areas for innovation activity, **99CivTech99 was introduced as one of the R&I priority areas**. According to the law on priority areas in science and technologies, R&I in agriculture falls under the broad category of areas with high relevance for the sustainable economic and social development. The Strategy on Environmental Security	Agriculture represented 13,9% of employment in the economy in 2021. Among those employed in the agrisector, 64% are qualified specialists. However, a **large share of informal workers** in the sector makes the evaluation of employment in the agrisector difficult. **International partners have deployed several programmes** supporting the development of green	At least 34 higher education institutions provide programmes in food technologies and food processing, while the curriculum of students in agri specialisations must address climate change and environmental topics. However, **only in agronomy and agricultural engineering is it required for the graduates to have hard skills related to green transition**. Hence, the	Several businesses in the agrisector have introduced **sustainability-related practices** to reduce their climate footprint (Kerel, MHP) and are **investing in green energy,** particularly biofuels. In addition, private companies have been integrating new technologies to enhance their operations (e.g., drones). Ukraine has historically been **strong in R&I in biodiversity,** with the efforts of various	The public sector stakeholders **lack financial and human resources** to effectively implement the F2F Strategy with **required improvements in strategic planning, capacity building, monitoring, and reporting**. A large proportion of the existing **green infrastructure has been damaged or lost** since 2022 due to the ongoing war, with significant investments required to increase	**The promotion of organic farming by the Government** can be a **catalyser of demand in R&I in the field**, while strong research capabilities in biodiversity could be used by the government to promote commercialisation of R&I results to ensure food security and reduction of climate footprint of agriculture, while contributing to sustainable diets.

the Ukrainian strategic policy. Only 1% of agricultural land in Ukraine is occupied by organic farming (around 10 % in the EU).	and Climate Adaptation until 2030 notes the **lack of contribution of the R&D and education sector to solving environmental protection challenges** with regards to climate mitigation and adaptation measures, but **does not mention support to R&I**. The draft law "On Packaging and Packaging Waste" (under consideration by the Parliament) stipulates in Article 4 the **use of the results of R&I to increase the efficiency of the recovery of packaging waste** and the application of the best available technologies and management methods for the processing of packaging waste.	skills. For instance, in 2020, the international research organisation Corteva Agriscience launched an **educational programme for women farmers in rural areas** aimed at enhancing skills in ensuring food security, combating climate change, and preserving ecosystems. The USAID has been providing a **mini-MBA programme on sustainable agriculture for women farmers and underrepresented groups** of the population. Large agricompanies (such as Kernerl MHP) provide **training opportunities for their employees**, but these are often focused on enhancing	educational programmes should be updated to ensure that they develop the necessary green skills of graduates in the field. **The National Academy of Agrarian Sciences** with 52 respective institutes in different fields. In 2018, Ukraine was 49th in the world in registered agriculture patents, with the **National University of Bioresources and Nature Management** of Ukraine and the **Dnipro State University of Agrarian Economics** holding the largest share of patents (398 and 123, respectively).	institutes to develop varieties of plants. The **R&I can greatly contribute to the following areas of F2F strategy**: *sustainable farming practices* (incl. crop rotation, agroecology, regenerative agriculture); *agroecology and biodiversity* by better understanding the impact of different agricultural practices on biodiversity and developing innovative solutions to enhance ecological sustainability; *reduction of pesticide use* through development of alternatives to traditional pesticides, evaluating the effectiveness of precision agriculture technologies in reducing the need for chemical inputs; *digital agriculture and precision farming* by developing tools to	current capacities for green agriculture, including when it comes to private companies (e.g., establishing the right incentives).	Furthermore, the scaling up of precision farming technologies and remote sensing technologies would contribute to higher productivity and better land management. Technologies, such as satellite spectral analysis of fields, can enhance farm sustainability, and drone technologies for spraying services in agriculture, and generally, the integration of digital technologies into agri-sector competitiveness. Ukraine's obligation to reduce the usage of pesticides by 50% by 2030 could drive the R&I in this area. In addition, technologies for the demining of

		managerial skills, with not enough emphasis on the green transition-related skills.	Re-training and training of agriculture sector workers is also required to ensure they have necessary skills to accompany sector's green transition. Under the German-funded project on organic agriculture (COA Phase II), an **Organic Knowledge Platform was created.**	optimize resource use and improve crop yields; *circular economy in agriculture* by minimization of waste, recycling nutrients, and promoting sustainable resource management; *alternative protein sources* to investigate alternative protein sources, such as plant-based proteins or lab-grown meat, as innovative solutions to reduce the environmental impact of livestock farming; and *digital traceability and blockchain* via the applications of blockchain technology and other innovations to ensure transparency in the food supply chain.		agricultural land are of high relevance and priority.
Biodiversity and preserving ecosystems	Law of Ukraine "On the Key Principles (Strategy) of the State Environmental Policy of Ukraine for the	The sector **lacks skilled staff in habitat restoration**, and the personnel in the areas of protected areas and water	As of 2022, Ukrainian higher education offered **112 courses** across its universities on « Ecology », 38 courses on	**R&I could be used to develop technologies for genetic analyses, remote biodiversity and landscape monitoring**, new uses	The Ministry of Environmental Protection lacks the capacities (human and financial) to effectively implement the	There is a notable **gap across sectors with the largest impact on biodiversity. i.e., energy, industry**

	Period until 2030"[151] is guiding the environmental protection and biodiversity conservation policies. The Strategy stipulates **the implementation of the R&I results in environmental research and dialogue between the academic and R&I stakeholders and public bodies to advance the environmental protection policy.** The strategic document also promotes the **Technologies for e-governance** of the environment sector; introduction of an environmental risk management system with integration of the	management could benefit from strengthening their technical skills. Systematic staff training and capacity development programmes in conservation and natural resources management should be put in place to improve green skills in the sector. A **gap is noted in the knowledge about biodiversity and nature preservation among the employees of local community authorities**. There is a potential for knowledge exchange and awareness-raising activities between regional organisations	« Technologies in environmental protection», and 10 courses in "Water resources and aquaculture". The **Ukrainian Scientific Research Institute of Ecological Problems**[152] is the main R&D organisation (under the management of the Environment) conducting research and technical and scientific works in environmental protection and rational/sustainable resource use.	of GIS technologies, and space-based earth sensing for solving biodiversity and nature preservation challenges. **There is room for R&I contribution to technologies for the forest management and planning** (with integration of the GIS tools for monitoring fires, deforested areas, or recovery after fires, timber accounting, providing access to forest management materials, logging tickets, creating a transparent timber market, etc.). The sector could benefit from the **development of innovations that use drones and GIS technology** to ensure the operation of the	biodiversity and nature preservation policy. There is a need to **strengthen skills and knowledge** across sectors ensuring awareness of biodiversity in agriculture, energy, and transport sectors that often disregard biodiversity in their activities, with negative effects for nature preservation. **Investments in technical capabilities and infrastructure** are required to increase the capabilities of the biodiversity stakeholders to effectively ensure the sector alignment with the EU Acquis (complicated by the	**and transport, in knowledge and understanding of the main challenges in biodiversity and nature protection** in the context of the EGD. Promoting R&I in the sector could help addressing this gap, facilitate the diffusion of knowledge on the issue and provide solutions for addressing main challenges of biodiversity. Dedicated resource allocation and **creation of incentives for energy, industry and transport stakeholders to invest in the R&I** with positive effects

[151] *Про Основні засади (стратегію) державної екологічної політики України на період до 2030 року* (no date), https://zakon.rada.gov.ua/go/2697-19 (May 2024).
[152] *Науково-дослідні роботи (2023). Український науково-дослідний інститут екологічних проблем,* http://www.niiep.kharkov.ua/naukovo-doslidni-roboti-2023.html (May 2024).

	latest IT; use of energy-efficiency and waste management technologies for decarbonisation of the energy sector, and better resource management.	and organisations at the level of local communities on the issues of biodiversity and nature preservation to facilitate green transition at the local level.		public actors in the sector in the context of limited human and technical capacities during the war, with the subsequent use and adaptation for reconstruction purposes.	war damages and wartime budget constraints). Better resource management capacities should be developed among stakeholders who use biodiversity and nature reserves to generate income.	for biodiversity and nature conservation would be important.
Just transition	The "**Roadmap on using R&I for achieving SDGs" outlines healthcare, safe food as priorities for R&I** with direct contribution to a more equitable and inclusive green transition. Measures on supporting technologies and innovation across energy, climate, housing (building and renovation), F2F, and biodiversity outlined in relevant strategic documents contribute to just transition.	The **legislative framework provides for the retraining and reskilling of employees of the coal industry, but these were not effectively implemented** due to inadequate and inconsistent funding. The few examples of successful retraining programmes are **donor-funded**, such as the retraining of miners of Chervohohrad financed by GIZ. At the local level, the **Platform for**	**Higher educational institutions lack programmes related to green sectors** or involving the development of green skills, while **limited funding of scientific research** is hindering technologies development and application for a just transition. R&I organisations in the field have had little impact on technology development for just transition so far, also due to a lack of	Private sector, such as DTEK, OKKO Group, have invested in green technologies, such as renewable energy, biofuels, hydrogen but still rely considerably on fossil fuels. Innovations by Ukrainian start-ups across different sectors provided solutions in energy-efficiency and carbon emissions reduction, even despite the ongoing war.	Ukraine has committed to the just transformation of the fossil fuel extraction industry and corresponding regions as a long-term policy goal, coherent with the EGD. However, given ongoing war and economic imperative related to it, the progress on this commitment has been stalled. In addition, **lack of funding has hindered implementation of measures under the Powering Past Coal**	R&I can accompany just transition through dedicated R&I projects financed by the state and donors, through **promotion of cooperation between Ukrainian R&I organisations with peers abroad under EU Horizon Europe** and other projects to ensure knowledge and skills transfer. Ensuring adaptation of public services to different population groups, including

		Sustainable Development of Coal Towns was established in 2021 to facilitate the shift to a low-carbon economy, gradually phase out coal, and promote the retraining and employment of laid-off miners. At the beginning of 2022, the Platform published a joint Strategy for Transformation and an Action Plan.	industry-science cooperation on R&I that can have direct practical application.		**Alliance**. Non-state actors, such as CSOs and private sector have strong capabilities in advancing the just transition through investments, pilot programmes, education and awareness raising activities.	marginalised or vulnerable groups (e.g., IDPs, war veterans, disabled, single-parent families, elderly, etc.), would ensure better inclusiveness of public services for a just transition.
Transition Finance (TF)	There is **no strategy for TF, no legal obligation for companies to disclose information on the ESG** impact of their operations and no obligation or incentives for financial institutions to introduce sustainable financing frameworks. The National Bank's Sustainable Finance Development Policy 2025 envisions the	Green finance is a relatively new concept in Ukraine, with limited use so far and ongoing efforts to ensure its integration into relevant sectors (e.g., banking, business sector, public sector). Ukraine would require **enhancing basic professional qualifications, training for middle management and civil servants, as well**	There is a notable **gap in the understanding of connections between environmental and social sustainability, economic cost-benefit analyses, and their implications for the real economy and the financial sector,** with efforts required to expand educational	The available transition finance for Ukrainian firms and innovative R&I projects is **limited and relies mostly on donor support**, given budget constraints due to the prioritisation of war-related expenses. For instance, the EBRD/EU financed "Innovation Climate Vouchers" grant programme and the "Horizon Europe" are	Available expertise in sustainable finance is not sufficient to ensure the green transition. **Capacity-building activities on the integration of sustainability considerations into decision-making processes** in ministries, agencies, and supervisory authorities are needed, coupled with robust evidence produced by	The R&I policy could better integrate the green transition finance elements to explicitly **promote and allow the R&I projects financing** through these means. The progress on requirements for sustainable financing and climate risk management could have a **positive effect on the**

	elaboration of these provisions, including climate risk management. **Some instruments to enable green transition are in place but lack effectiveness**: the **green bonds** introduced in 2021 but not been operational since February 2022. Ukraine is yet to develop its regulatory framework to make green bonds effective in financing environmentally friendly projects (criteria for project funding, monitoring, and evaluation mechanisms).	**as training initiatives for employees** in critically important state-owned companies on effective integration of sustainability considerations.	opportunities in schools, research institutions, and training programmes. Ukraine has little research on sustainable finance and **could benefit from knowledge transfer**. There is a benefit in the development of scientific measurement methods to assess the impact and outcome effects of various ESG approaches (currently absent).	the main sources of financing of green R&I. In private sector, the **UN Global Compact Network Ukraine seems to be the only initiative promoting ESG-compliance** in the business sector. The ongoing international support in promoting green finance is directed towards **assistance to the Government in preparation for carbon pricing reform** and introduction of **green public procurement** (through the EU4Environment project).	the research institutions to enhance understanding of the environmental, social, and economic components of sustainable financing.	**demand for green innovations and drive industry-science cooperation** in EGD areas. R&I could contribute to closing the gaps in understanding of interactions between various aspects of sustainable finance and interdependencies between reporting, performance indicators, eco-labels, and risk-return indicators.
Digitalisation	**IT is one of the priority areas for R&I according to the current legislation**. Overall, application of IT in other EGD areas to address pressing	As of 2022, the IT sector accounted for 4.9% of Ukraine's GDP, and the IT services exports valued at almost $7 billion on average over the last	Over 2016-2021, the number of **BA graduates in IT specialties** stood at **16,2 students per year on average**. There is a trend in	The digitalisation has been a flagship reform of the Government since 2014, allowing for significant improvement in **public services through their**	The capacities of public sector stakeholders in effectively implementing digitalisation reforms have been **strengthened**	R&I in ICT could become a powerful driver of the green transition, drawing on the successes of Ukraine's IT industry and robust STEM

	challenges is stipulated across various sectoral strategic documents. **Introduction of digital tools** to simplify interactions between the actors of the R&I system is ongoing and in the plans of the MoES (e.g., launch of Science City) to increase the effectiveness of R&I policy implementation.	three years. In **2023**, the sector saw a **7% increase in the number of tech specialists**, with the **IT sector playing a leading role in Ukraine's economic resilience and war efforts**. STEM education in Ukraine has been strong but requires further adaptation to the rapidly changing and growing needs of the IT industry**. The IT sector is critical for reforms in public administration, but also in addressing EGD-related challenges** through the development of dedicated technologies. Due to the population outflow because of the war, the	the **decreasing number of MA graduates** in IT over the last decade. **On-the-job training and non-university training seem to have been playing a key role** in the robust growth of skilled IT specialists in Ukraine[153] and the rapid development of the IT sector. However, taking into consideration the continued growth of IT industry in the war-time, growing demand for IT specialists given sector's importance for resilience and war effort, **Ukraine risks having a lack of IT specialists in the coming years** (e.g., pre-war, the	**digitalisation** with such innovations as Diia.UA, an application for administrative services for the population and businesses. The **digitalisation of the research and science sector is ongoing** as new mechanisms to connect researchers, academia, and businesses, provide information to innovators, etc., are being elaborated. Under the Concept of Development of the Digital Economy and Society of Ukraine for 2018-2020 development of digital infrastructure, e-governance, cybersecurity, and digital skills training were outlined as priorities. Digital skills development and digital	**through the establishment of the dedicated Ministry of Digital Transformation and the appointment of the Chief Digital Transformation Officers (CDTOs) across ministries and local administrations.** Digitalisation is high on Ukraine's Government agenda with the **ambition to make Ukraine the most comfortable "state in a smartphone" country**. IT industry associations play an important role in promoting R&I in the IT industry, and the IT sector is marked by innovations, knowledge transfer, and spillovers, as	talent. R&I in areas such as AI, blockchain, digital twin technologies, cloud computing, etc., could contribute to a more equitable and just transition, facilitate green transition across sectors, and contribute to meeting the climate commitments of Ukraine

[153] BRDO (2021) *АНАЛІЗ ІТ-ОСВІТИ У ВИШАХ УКРАЇНИ*. Available at: https://brdo.com.ua/wp-content/uploads/2021/02/Analiz_IT_osvity_u_vyshah_Ukrainy_Print.pdf.

		mobilisation into the Army, the sector might experience a lack of skilled labour to effectively accompany current and future efforts on the green transition.	expected demand is 30-50 000 per year of IT graduates vs 16-17 000 currently[154]).	literacy programmes are underway targeting youth and underserved communities (incl. Coding bootcamps, online courses, and vocational training programmes_.	companies are actively engaged in the development of emerging technologies such as artificial intelligence (AI), blockchain, and Internet of Things (IoT).

[154] ain.ua (no date). ЧОГО НЕ ВИСТАЧАЄ УКРАЇНСЬКІЙ ІТ-ОСВІТІ ТА ЯК ЦЕ ВИПРАВИТИ ЩЕ ЗІ ШКОЛИ. ПИТАЄМО У ФАХІВЦІВ ВІДОМИХ ІТ-КОМПАНІЙ, https://ain.ua/special/problems-of-modern-it-education/ (April 2024).

4.3. Priority areas where R&I support is most needed

A particular focus on EGD-related areas such as energy, industry, and circularity, building and renovation, and zero pollution, in particular waste management, would help to accelerate the green transition while simultaneously responding to the most pressing challenges Ukraine is facing in the context of war and reconstruction.

First, the **energy sector** has been the most associated with the "green transition" in Ukraine, and important progress was achieved in enhancing energy efficiency and fostering renewable energy sources over the last decade. The R&I in the energy sector contributes to meeting the objectives in several EGD areas, including climate, building and renovation, industry and circularity, smart mobility, while also helping to achieve objectives set out in relevant national sectoral strategies, national development goals and hence could accelerate Ukraine's progress across at least five sectors. Furthermore, the sector's strong capabilities and revealed interest in investments in new technologies, such as hydrogen, biofuels, RES, create a demand for R&I in energy with favourable conditions for fostering local R&I and strong potential contribution to energy sector transformation in line with EGD.

Second, the R&I could support the **greening of industry and promotion of circular economy** to facilitate EU integration, in particular when it comes to compliance with CBAM. Furthermore, green technologies and circular economy principles can help to decarbonize the Ukrainian steel and cement industries, enhance industrial waste recycling, and reduce waste generation. The pressing need to ensure the transformation of Ukrainian industry for it to remain competitive in the view of EU Single market integration and the availability of financing from the local private sector and donors can facilitate the uptake of R&I in the sector.

Next, **reducing pollution through waste management** is one of the major challenges for Ukraine, given the country's long-standing culture of landfilling (over 90% of household waste is landfilled and the industrial waste recycling was 3% in 2020) and significant amount of demolition waste due to war-related destructions and the scale of reconstruction ahead. R&I in waste recycling technologies should be accompanied by robust waste management policy implementation and can have a significant positive impact on Ukraine's GHG emissions reduction, contributing to progress on Ukraine's commitment under the Paris Agreement.

Finally, given the level of destruction caused by the war and infrastructure reconstruction plans, as well as outdated housing stock, **innovation in the building and renovation sector** is crucial to set Ukraine's reconstruction process and construction industry on a more sustainable path and contribute to achieving climate neutrality objectives. The R&I in

this sector could also help contribute to the social sustainability of infrastructure and just transition, as housing and social infrastructure construction and renovation are in focus of the Ukrainian government and donors' efforts in the context of the ongoing war. In addition, green infrastructure reconstruction has positive spillovers for preservation of the ecosystem and reducing pollution, one of the areas of EGD of high importance for Ukraine.

5. Executive summary: research, development, and innovation in Ukraine

The project Green Agenda for Georgia, Ukraine, Moldova, and Armenia aims to assist Georgia, Ukraine, Moldova, and Armenia in reaching climate neutrality goals through the green transition. This report presents an assessment of the cross-cutting European Green Deal area, Research, Development and Innovation (R&I) in supporting Ukraine's green transition. It includes an analysis of current trends in the R&I sector, institutional and regulatory setup, capabilities for R&I policy implementation, and capacities of the R&I stakeholders to support the green transition. It also draws on the main findings of other thematic areas to provide insights into R&I potential in achieving green transition across other nine EGD areas, including energy, climate, industry and circularity, building and renovation, smart mobility, zero pollution, farm to fork, biodiversity and nature preservation, just transition, transition finance, and digitalisation.

5.1. Current state of the green transition in R&I

Green R&I is constrained due to systemic issues that the R&I sector faces in Ukraine, including underfunding, gaps in human capital, obsolete infrastructure, and low demand for R&I. Thus, in 2023, the Gross Domestic Expenditure of R&I (GERD) in Ukraine remained at its historic low of 0.33% of GDP. This decline was accompanied by a decrease in the number of researchers (R&I representing 0,95% of total employment in 2010 and 0,5% in 2020), the degradation of R&I infrastructures and R&I staff aging as research, innovation and development sector has failed to attract youth (in 2022, 40% of researchers and scientists were under 44 years old). With private sector investment in R&I standing as low as 0.17% of GDP in 2021, Ukraine's economy demonstrates low absorptive capacities for innovation, even if there are some pockets of excellence in the IT sector, defence tech, and govtech, where demand for R&I has resulted in new products and services.

In addition, to **ensure the alignment with the EU acquis in science and research, Ukraine adopted the Roadmap on ERA Integration**, **obtained the status of full member in EU framework programmes such as Horizon Europe,**

Euratom, and COST. Ukraine has also expanded its international R&I cooperation with more than 60 bilateral agreements in place and taking part in international programmes such as CERN, NATO Science for Peace and Security, EUREKA, LIFE, etc. However, Ukraine has faced obstacles in the effective implementation of these agreements and fully leveraging the existing opportunities for international R&I cooperation due to insufficient funding and regulatory barriers. Furthermore, Ukraine's participation in international R&I projects has not contained a strategic focus on green R&I – an element that could be improved going forward with the support of, for instance, the EU Horizon Europe Office in Ukraine and bilateral initiatives in place.

Donor funding has been crucial in supporting green R&I, such as, for example, the EU-financed "Climate package for a stable economy in Ukraine"[155], the EBRD/EU "Innovation Climate Vouchers" for innovative start-ups and SMEs, and support for R&I grants disbursed by the USF and the NRF. The state and private sector funding for green R&I remains very limited and insufficient to effectively accompany Ukraine's green transition.[156] The Government plans to boost private sector investments in R&I and cooperation between science and industry on innovative technologies across 14 priority sectors, as outlined by the new Digital Innovation Development Strategy, but would require sufficient resource allocation and capabilities in implementation.

When Ukraine obtained EU candidate country status in June 2022, the European Commission assessed **Ukraine's progress on alignment with EU legislation in science and research (Chapter 25) as *moderate*.** It pointed to the limited national R&I technological absorption capacities, the declining number of researchers, and outdated research infrastructures as the result of insufficient funding, ineffective disbursement of funds, and fragmented governance. Addressing these issues is the way to enhance the R&I system capabilities to effectively participate in the EU's framework programmes, which is the core requirement of the EU acquis in science and research.

Table 5.1**.** below summarises the progress on achieving the EGD objectives in R&I area based on the requirements of the EU integration in science and research and capacities of the R&I system to support green transition in line with the 8th EAP priority objectives.

Table 5.1. Ukraine's R&I system assessment regarding the EGD objectives.

EGD objectives and targets	Relevant actions for integration	Assessment

[155] Cabinet of Ministers of Ukraine (2020). Agreement on financing between the Government of Ukraine and the European Commission acting on behalf of the European Union [Climate package for a stable economy: CASE in Ukraine ENI/2020/042-818], Kyiv, https://zakon.rada.gov.ua/laws/show/984_017-20#Text (March 2024).
[156] OCDE/EBRD (2023). *SME Policy Index: Eastern Partner Countries 2024: Building Resilience in Challenging Times*. Paris: Éditions OCDE, https://doi.org/10.1787/3197420e-en (March 2024).

Alignment with values and principles underpinning the European Research Area (ERA);	Integrating the New European Innovation Agenda (NEIA) 2022. Enhancing R&I policy framework. Enhancing R&I policy governance.	ERA integration and fostering innovation in science and innovative entrepreneurship are a priority for the MoES as per its Action Plan until 2027 and the newly adopted Digital Innovation Strategy of MinDigital. The Roadmap for Integration into ERA is in place with updates to be made to reflect the new ERA Policy Priorities. Current R&I policy priorities are to some extent aligned with EGD areas and include energy tech, energy-efficiency, energy-saving and alternative energy sources; production of new materials, creation of the industry of nanomaterials and nanotechnologies; agrotech; medtech; greentech (cleaner production and environmental protection); modern ICT, robotics. With the full-scale invasion by Russian Federation, the new priority area of defence and security was added. The Digital Innovation Strategy of MinDigital outlines another 14 priority technologies, which correspond in part to the EGD areas. Upgrading of legislative framework on innovation and R&D took place with introduction of the Law "On Scientific and Scientific and Technical Activity" (2015), establishment of the National Research Fund (2018) and introduction of support mechanisms for innovative enterprises (e.g., establishment of the Ukrainian Start-Up Fund in 2018 and introduction of innovation vouchers in 2016). The State Strategy for Development of Innovative Activities in Ukraine until 2030 guides policy development along with the newly adopted Digital Innovation Development Strategy of Ukraine 2030. and the latter addresses existing gaps in policy governance and contains measures to enhance the R&I system as a driver of Ukraine's economic development and recovery. The R&I policy governance is fragmented across four main ministries, and the effective mechanism for policy coordination is yet to be put in place, as the National Council on Science and Technology Development under the Cabinet of Ministers is not fulfilling its coordination functions effectively. The monitoring of R&I policy lacks effective instruments and robust KPIs to track progress, and policy evaluation has not been performed in Ukraine in the context of the need for more evidence-based policymaking.
Investments in R&I (funding)	Increasing state R&I funding and enhancing the disbursement mechanisms (e.g., competitive calls). Increasing private sector investments in R&I. Funding for green R&I.	The Law "On Scientific and Scientific and Technical Activity" (2015) sets minimum state funding of R&D at the level of 1.7 % of GDP – a threshold that the Government has not been able to meet so far. The expenditure on R&D stood at 0,33% of GDP in 2023. The Government established the National Research Fund - the first state institution providing competitive grants for R&D activities (operational since 2020). The NRF was sequestrated in 2022 due to the Russian invasion and was back in operation in 2023, but without the disbursement of funds for winners of competitive calls in 2021/22. Two new calls were launched by NRF in 2023, focused on solving the defence and security challenges of Ukraine, and a special fund of the state budget was used to co-fund two international programmes (i.e., Cambridge NRF and Horizon Office in Ukraine). Green transition is the objective somewhat reflected in several calls, but there is no focus on green R&I with the grant funding of the NRFU representing only 6% of the total state funding of R&I in 2023.

		The economic instruments to promote R&I in place include the allocations of state budget for Ukraine's participation in the "Horizon Europe" projects, grants for technology and innovative start-ups available through the USF, supported by EU and international donors. Technology and science parks, as well as industrial parks, offer additional incentives for innovative start-ups and R&I organisations to conduct their activities, including import tax exemption on R&I equipment, full or partial interest payment compensation, profit tax, and property tax exemptions. However, many of these infrastructures are not operational in practice (due to issues with funding, lack of skilled personnel, etc.). Meanwhile, private initiatives cover the gap, showing good results in terms of residents, raised finance for innovative R&I, international cooperation, etc. The State Innovative Financial and Credit Institution is charged with the provision of loans, guarantees, credits, and co-financing mechanisms to stimulate innovation, but so far, this support has not been working as intended. The Strategic Plan of MoES until 2027 and the new Digital Innovation Strategy foresee measures to enhance the R&D funding system (i.e., performance-based funding) and improve the quality of R&D results (incl. through better incentives and tools for private sector investment in R&I within Science City initiative, other means). The planned revision of the remuneration of researchers and R&I employees, introduction of performance-based funding for R&I organisations, establishment of state funding allocation based on the results of state certification of HEI and R&I institutions, creation of the National system of researchers supporting the best scientists and researchers could be instrumental in promoting R&I and supporting green transition.
Strengthening human capital	Enhancing the attractiveness of the R&I field to young researchers and scientists. Supporting researchers' careers.	The amendments to the Law "On Scientific and Scientific and Technical Activity" (2020) were aimed at increasing R&I attractiveness to young scientists. In fact, the changes introduced in 2020 clarified the terminology of R&I positions (PhD student, young scientist, etc.), allowed for more flexibility for researchers and scientists in teaching activity in other educational establishments (i.e., up to 240 hours per academic year), and determined the minimum salary of the young researcher. The MoES in its Strategic Activities Plan until 2027 foresees the creation of the National system of researchers supporting the best scientists and researchers with focus on funding young researchers' projects. The ongoing war and continued underfunding of R&I sector in Ukraine hinder significantly human capital development to support green R&I.
Modernising the R&I system for research excellence	Upgrading of R&I infrastructures. Strengthening the R&I system performance. Reforming the research assessment system.	The MoES developed "The Concept of the State targeted programme for the development of research infrastructures in Ukraine for the period until 2026" but it cannot be adopted due to suspension of state programs in the context of the war. The MoES has prepared a draft law amending the "Law on Scientific and Scientific-Technical Activities" to integrate the research infrastructures. The draft law was adopted by the Parliament in first reading in June 2024. The Strategic Plan of MoES for 2024 puts forward the R&D infrastructure development to facilitate the integration into ERA, while the Digital

	Implementation of the Open Science Initiative.	Development Strategy outlines actions to enhance access to and quality of R&I infrastructures. The MoES and MinDigital intend to deregulate the R&I sector to provide it with more financial and administrative autonomy and hence strengthen the collaboration between science and business sector based on co-financing mechanisms, as well as joint projects with R&D and business organizations from abroad. The planned MoES initiatives to introduce performance-based state budget allocation for R&I organizations and associated changes in the remuneration scheme for researchers and scientists can stimulate diversification of R&I funding sources and contribute to better quality of R&I results. The National IP& Innovations Hub was established within the new IP and Innovations Office to support R&D development and commercialisation, technology transfer and investment promotion in R&D. In addition, the Technology and Innovation Support Centre (TISC), a project financed by WIPO, is housed within the IP and Innovations Office and provides support on IP in Ukraine and abroad for applicants, conducts awareness-raising on the IP acquisition, use and protection among SMEs, start-ups, inventors and creative industries. In the framework of the reform of the national science and research system, a series of evaluations (called "state certifications") of R&I institutions and HEIs have been taking place based on the harmonised methodology to enhance their performance in R&I activities and optimise the state funding allocation. In addition, the process of the re-organisation of the R&I institutions is ongoing to enhance their competitiveness and performance with four sectoral National Academies of Sciences undergoing audit in 2021-2022 and the R&D institutions under the National Academies of Sciences being re-organised. MoES launched dedicated platforms – the Ukrainian Research Information System (URIS) and the National Repository of Academic Texts and is currently introducing enhancements to URIS to facilitate research and access to relevant data. In 2020, Ukraine joined the European Open Science Cloud (EOSC) with some institutes of the NASU, and the Kyiv Academic University having started to transfer open data to the EOSC. The Government adopted the National Plan on Open Science in Ukraine on 8 October 2022, which is an important step on Ukraine's path to ERA integration and enhancing the excellence of its research system.
Enabling innovation for greening in the business enterprise sector (*building innovation absorption capacities*)	Enhancing the availability of grants, loans, and guarantees for innovative businesses for green R&I. Incentives for businesses to invest in green R&I.	The Government established the Ukrainian Start-Up Fund with the aim to support innovative projects and tech startups at early stages of development. Despite the war, the MoES together with the Ukrainian Start-Up Fund managed to conduct the Science&Business project which resulted in the launch of the Online Mentor - a programme helping to develop innovative ideas for acceleration, and funding of 25 knowledge-intensive start-ups at the level of $125,000 (projects in the areas of healthtech (5), agri and biotech (5), infrastructure and industry (7), and energy and environment (8)). The MoES launched in 2022 «Info Science Bot» (Telegram Bot) to inform scientists and innovators about current professional opportunities in Ukraine

		and abroad, and Science&Business – a matchmaking platform connecting businesses looking for R&D results and researchers/research organisations looking to commercialise their R&D results. Together with MinDigital, MoES is working on Science.City initiative which aims to bring together all the players of the R&I ecosystem to promote technology commercialisation, collaboration on R&I, and enhance human capital in R&I sector. Donor support has been key in the promotion of green innovation in the business sector, with examples including the Climate Innovation Vouchers funded by EBRD and the EU and implemented by Greencubator in Ukraine. In 2024, 10 Ukrainian companies were selected for vouchers of a total amount of 442 thousand EUR. Other initiatives, the Green Innovation fund "Innovate Ukraine" of a total of £60 mln, launched in 2022 with the support of the UK, the Global Green Chemistry Initiative (GreenChem), financed by the Global Environment Facility under UNIDO and the Resource Efficient and Cleaner Production Centre, launched officially in 2023.
Association and participation in the EU R&I framework programmes	Participation in Horizon Europe, Euratom, and other programmes.	Ukraine has been fully associated with the EU's Horizon 2020 and EURATOM Research and Training (2014-2020) programmes since 2016. Under Horizon 2020, Ukraine participated in 230 projects, involving 335 participants, for a total funding of €45.5m. Energy, climate, and transport were the strengths of Ukraine. In the Euratom programme, Ukrainian participants received funding for fusion and fission projects for EUR 4.9m. Ukraine is a full member of COST and has been involved in 74 actions so far, with Ukrainian researchers being part of 116 working groups. Ukraine has also been an associated member of CERN since 2016 and has been taking part in the NATO Science for Peace and Security (SPS) Programme since 2004. In addition, Ukraine signed over 50 bilateral agreements on cooperation in science, R&I (e.g., Germany, France, the US, Japan, Moldova, Latvia, Turkey, etc.). In 2008, Ukraine became a full-fledged member of the EUREKA Programme. In 2020, Ukraine joined the initiative EUREKA Globalstars, and the same year, Ukraine's team won a USD 50 thousand grant for an international R&D collaboration project. In total, as of 2020, Ukraine joined 5 EUREKA projects (4 networks and 1 cluster). In 2023, the Horizon Office was opened in Kyiv to facilitate and foster the participation of Ukrainian researchers and scientists in "Horizon Europe". The Strategic Plan of the Activity of the MoES for 2024 foresees the development of effective cooperation in science and education with EU countries based on the best European practice and standards, and participation of researchers in opportunities provided by the European educational and research sector, including Horizon Europe, COST, and other initiatives. The same vision for enhanced linkages with the European R&I sector is outlined in the Digital Innovation Strategy. However, the funding of international projects on R&D cooperation from the state budget, in 2022, this amount stood at only 0,13% of the total expenditure from the general state fund on R&D and needs to be increased considering Ukraine's ambitions to enhance international cooperation in R&I.

Capacities to support progress towards the priority objectives of the 8th EAP	Policy alignment with the nine EGD sectoral areas. Mechanisms are in place to foster R&I in EGD areas.	Several sectoral strategies recognize the importance of innovation in achieving their goals, e.g., the National Economic Strategy 2030, The National Environment Protection Strategy 2030, National Strategy for Waste Management 2030, the Law on "Packaging and Packaging Waste" (2023), the Law "On Waste Management" (2023), the Long-Term Strategy on Thermal Modernisation of Buildings until 2050, the State Regional Development Strategy 2021-2027, the National Transport Strategy 2030. However, they tend to focus on readily available technologies rather than R&I more broadly, containing almost no measures specific to R&I development. The Ukraine Facility Plan set to support policy reforms in Ukraine in the coming three years emphasises the role of innovation and technology in ensuring Ukraine's reconstruction and contribution to achieving the EGD objectives, with 20% to be allocated to climate mitigation and adaptation, environment protection measures, and green transition. However, it does not foresee any measures specific to expressly anchoring R&I in Ukraine's development and recovery agenda. The National Plan on Energy and Climate (NPEC), adopted in 2024, includes five cross-cutting areas among which is research, innovation and competitiveness which is a welcome development with potential to leverage the R&I for Ukraine's green transition. A particular focus on EGD-related areas such as energy, industry and circularity, building and renovation, and zero pollution, particularly the waste management, would help to accelerate the green transition while simultaneously responding to the most pressing challenges Ukraine is facing in the context of the war and reconstruction.

5.2. Impact of War on Research & Innovation

The full-scale invasion by Russian Federation on 24 February 2022 has had a significant negative impact on Ukraine's R&I system, with **35% of research infrastructure damaged or destroyed, and a quarter of researchers and scientists having left abroad, as of March 2023.**[157] According to the latest assessment by UNESCO, as of January 2024, 12% of Ukrainian scientists and university teachers were forced to emigrate or relocate internally, while 30% of all Ukrainian scientists were working remotely due to the war.[158] The R&I infrastructure is bearing a heavy toll, as **at least 1,443 buildings belonging to 177 R&D institutions were damaged or destroyed since February 2022, with a total cost of restoring public research infrastructure estimated at USD 1.26 billion.**[159] Furthermore, mobilisation of state resources to sustain the war shock led to sequestration of the

[157] Ukrainian Institute of Scientific and Technical Expertise and Information (2023). Scientific and scientific and technical activity in Ukraine in 2022, https://mon.gov.ua/storage/app/media/nauka/2023/07/25/Nauk-analit.dopov.Naukova.ta.nauk-tekhn.diyaln.v.Ukr.2022-25.07.2023.pdf (May 2024).
[158] UNESCO (2024). *Analysis of war damage to the Ukrainian science sector and its consequences,* https://unesdoc.unesco.org/ark:/48223/pf0000388803 (May 2024).
[159] Ibid.

funding for R&I projects under the National Research Fund in 2022, contracting the already limited R&I budget. For instance, the budget allocated to the National Academy of Sciences has dropped by 48% since 2021, with scientists receiving 39% less in salaries (UNESCO, 2024). At the same time, the Ukrainian tech start-up ecosystem and IT sector showed a remarkable resilience in the face of war, as start-ups from the Ukrainian Start-up Fund attracted more than USD 10 million in investments in 2022,[160] and the Ukrainian IT exports reached a record $7 billion by the end of 2022.

The **EU has offered major support to Ukraine's researchers,** providing opportunities to undertake collaboration with EU institutions, hosting of Ukrainian scientists under Marie Skłodowska-Curie Actions (MSCA4Ukraine) and European Research Council Actions for Ukraine (ERC4Ukraine), etc.[161] In December 2023, a New Horizon Europe Office in Kyiv was established to facilitate Ukraine's participation in "Horizon Europe" projects, and initiatives to support local tech start-ups, e.g., through EUR 20 million under European Innovation Council for Ukraine (EIC4UKraine) initiative, and the launch of the European Institute of Innovation and Technology (EIT) Community Hub in Kyiv to provide the Ukrainian innovators remaining in Ukraine with access to partners, markets, testbeds, trainings and investment.[162] In November 2023, in response to the Russian invasion of Ukraine, the European Strategy Forum on Research Infrastructures (ESFRI) called upon Research Infrastructures (RIs) to establish support measures for the Ukrainian research community (e.g., facilitating access, providing training, and donating scientific equipment) with at least 32 European RIs reporting having provided some kind of support.[163]

Innovation has come to the forefront of the policy agenda due to the need in advanced technologies to ensure defence and security and to address socio-economic and environmental challenges exacerbated by the war (i.e., high number of amputations and need in advance prostheses technology, AUV technology for testing of military equipment, etc integration of internally displaced persons, providing admin services in emergency, etc.). For instance, in 2023, the enterprise sector in Ukraine recorded a recorded increase in expenditures on engineering and technologies development in the context of the increased demand for technologies and innovations from the Armed Forces of Ukraine. The defence and security challenges are also the reason behind the introduction of defence tech among the priority sectors for R&I at the

[160] USF (2023). 4 years of the USF activity: key results – Ukrainian Startup Fund, https://usf.com.ua/en/4-years-of-the-usf-activity/ (April 2024).
[161] European Commission (no date) *Greening the Ukrainian Recovery: Building a Sustainable Future Together,* https://ec.europa.eu/environment/stories/greening-ukrainian-recovery/index_en.html (March 2024).
[162] European Commission (2023). *Commission launches three new initiatives to support Ukrainian researchers and innovators,* https://ec.europa.eu/commission/presscorner/home/en (March 2024).
[163] Plaskan, J., Brečko, B. and Kolar, J. (2023). *ESFRI Report on the Support of Research Infrastructures to the Ukrainian Research Community*. Zenodo, https://doi.org/10.5281/zenodo.10201620 (March 2024).

legislative level and putting the objective of fostering innovative technologies as a policy priority (also outlined by the Digital Innovations Strategy). In the context of fiscal constraints, the Government is looking to attract private investments in innovative technologies, foster tech transfer and science and industry collaborations on R&D that could be tested and used quickly. **The Ukraine Facility Plan**, a document outlining the envisaged reform implementation under the EU-financed Ukraine Facility over 2024-2027, **emphasises the role of innovation and technology in ensuring Ukraine's reconstruction and foresees achieving the EGD objectives and facilitate meeting of Ukraine's obligations on climate under Paris Agreement**, i.e., reduction of emissions by 65 % below 1990 levels by 2030 and to zero by around 2060. However, the Plan does not provide for any R&I-specific measures or funding that are needed if Ukraine is to truly leverage R&I for its economic transformation, recovery, and green transition.

5.3. Key gaps and needs

Building on its solid human capital, strong ICT sector, quality education, and R&I base inherited from the Soviet times, Ukraine qualified as an Emerging innovator under the European Innovation Scoreboard 2024[164] and has ranked fourth among the lower-middle-income economies in 2024 on GII, outperforming the expectations for its level of development.[165] Despite this, Ukraine`s R&I policy suffers from policy fragmentation, weak policy coordination, and insufficient monitoring and evaluation, as well as a lack of capacities of the public sector to implement the R&I reform, which impede the development of a strong R&I system able to effectively accompany the green transition.

To address these gaps, the Government adopted a new Digital Development Strategy which aims to streamline innovation policy formulation (MinDigital to be leading on this effort), implementation (through introduction extension of the mandates of deputy heads of executive authorities on digital development to the field of innovation) and coordination (via re-invigorating the Innovation Development Council and ensuring the cross-sectoral coordination on the innovation policy by the Vice Prime Minister of Ukraine for Innovation, Education, Science, and Technology, currently Mykhailo Fedorov. For the strategy to realise its ambitions, it would be necessary to ensure it has sufficient funding and capabilities of the public sector and R&I stakeholders for its implementation. In addition, the anchor the R&I firmly in the Government's priorities for economic development and recovery, as well as green transition, is required. Furthermore, outdated and damaged research infrastructures, limited collaboration between science and

[164] European Innovation Scoreboard 2024, https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en (May 2024).
[165] WIPO (2024). *Ukraine ranking in the Global Innovation Index 2024,* https://www.wipo.int/gii-ranking/en/ukraine (May 2024).

business sectors, as well as insufficient capabilities in technology transfer, hinder green R&I uptake in Ukraine, and if addressed as planned by the Government, would boost Ukraine's green transition.

Ukraine has not formally joined the EGD, but it has set decarbonization along with EGD alignment as a key objective and principle of Ukraine's economic development in its National Economic Strategy until 2030. In the field of R&I policy, the amended R&I priority areas reflect to some extent the EGD areas, while sectoral strategies in EGD areas (e.g., energy efficiency, climate, waste management, zero pollution, sustainable food systems, etc.) recognise the importance of innovation for achieving the set objectives. At the same time, the R&I is not well-integrated into sectoral strategic documents, and sectoral policy tends to regard innovation predominantly as readily available technologies with lacking measures on R&I development. Government efforts to streamline R&I across EGD areas, building necessary capabilities and skills for green transition, supported by effective policy governance, would enable Ukraine to meet the ambitious objectives of climate neutrality and accelerate progress on EU integration.

A focus on promotion of the R&I in the EGD sectors, such as energy, industry and circularity, building and renovation, and waste management would help to accelerate the green transition while simultaneously responding to the most pressing challenges Ukraine is facing in the context of the war, reconstruction and EU integration.

In addition, Ukraine can better leverage bilateral agreements and opportunities offered under the EU Association Agreement (as a member of EU R&I framework programmes such as Horizon Europe, Euratom, COST, etc.) to collaborate on green R&I addressing gaps in capabilities of R&I stakeholders to engage with partners abroad, insufficient funding and legislative obstacles for cooperation.

Finally, if Ukraine is to embark on the reconstruction based on green principles, this process is expected to generate 4.2 million green jobs across transport, education, healthcare, energy and water supply, and irrigation sectors. Currently, the Government does not have a clear vision and plan of action for the development of green skills to meet this demand, nor are the capacities of HEIs sufficient to ensure a pool of skilled labour for post-war recovery in this scenario. The R&I sector has limited funding and capabilities to accompany this transition with some "pockets of excellence" in energy, biodiversity, and agrisector and green innovation in the business sector relying on donor funding and limited R&D investments of large companies (e.g., DTEK, MetInvest, Kerel, MHP).

Green skills across EGD thematic areas are limited, with existing educational programmes absent or yet to integrate green components or to pass the required accreditation mechanisms (e.g., renewable energy-related programmes). The agriculture sector has

requirements for hard skills related to green transition in agronomy and agricultural engineering, and STEM curriculum increasingly includes “green” components. However, the shortage of skilled labour across all EGD sectors due to the war in Ukraine poses an additional challenge for the Ukrainian Government. This is complemented by a lack of understanding of the importance of green transition and the role R&I can play in driving it among the R&I stakeholders. Several prominent CSOs carry out awareness-raising, advocacy, and educational campaigns on green transition, but their efforts remain insufficient to bring about the required changes, with a need for a strategic Government vision and prioritization of green transition at the national level. Hence, building green skills and raising awareness on the green transition is crucial to catalyse necessary dynamics in the private sector, create the demand for green R&I, and ensure skills for the green transition.

Based on the assessment above, Table 5.2 sums up the main enabling conditions, gaps, and needs related to Ukraine’s R&I system that need to be addressed to effectively support the green transition.

Table 5.2. Summary of main enabling conditions, gaps, and needs

Main elements	Enabling conditions	Key gaps	Needs
EU Strategic Framework and Acquis (policy and legal readiness) (section 3.1)	Since 2014, Ukraine has been working to align its regulatory framework with the EU framework on R&I to fulfil its obligations under the EU-Ukraine Association Agreement (2016). These efforts included significant upgrading of legislation (e.g., adoption of Law "On Scientific and Scientific and Technical Activity" (2015), amending priority direction for R&D and innovation activity), introduction of new policy tools to support R&I (e.g., NRF, USF, innovation vouchers, setting the state minimum funding of R&D at 1.7% of GDP), and adoption of strategic policy documents to guide R&I policy development (i.e., the State Strategy for Development of Innovative Activities 2030), including in areas related to sustainable development (i.e., Roadmap for the use of science, technology, and innovation to achieve the SDGs) and integration into ERA (i.e., a dedicated roadmap (2021)). In addition, Ukraine has	1. Existing strategic policy documents on R&I often lack concrete policy mechanisms for implementation, robust KPIs, and sufficient funding, with negative implications for R&I policy outcomes, including Ukraine`s readiness for ERA integration. 2. Ukraine's alignment with the EU on science and research (chapter 25) is moderate as obstacles remain in technological absorption capacities, the declining number of researchers, outdated research infrastructures, insufficient funding, ineffective disbursement of funds, and fragmented governance. 3. International bilateral and EU-Ukraine R&I cooperation face resource constraints in implementation (capabilities and funding) with some regulatory obstacles hindering smooth collaboration, while Ukraine's participation in existing EU	1. Ensure that strategic documents contain clear KPIs, actionable targets, and clear mechanism for their implementation with adequate allocation of funding to meet the set objectives. 2. Provide sufficient funding for Ukraine's international cooperation on R&I, diversifying sources of this funding in the context of a limited state budget; addressing obstacles in legislation inhibiting international cooperation, including when it comes to transfer of funds abroad, hosting international scientists in Ukraine, etc. 3. Align R&I policy objectives and actions with the New European Innovation Agenda and undertake the foreseen actions on R&I sector reform under the Strategic Plan of Action of the MoES until 2027 and the Digital Innovation Strategy 2030. 4. Introduce focus on green R&I in priority areas for R&I and ensure that sectoral strategies in EGD areas leverage R&I for achieving the set goals. 5. Explore the possibility to allocate funding for EGD-related R&I under

	become fully associated with the EU's Horizon 2020/Horizon Europe and Euratom Research and Training (2014-2020) programmes since 2016, along with becoming a member of CERN (2016), COST (2023), and expanding its participation in EUREKA. The assistance provided by the EU at the outbreak of the Russian invasion allowed to support Ukrainian scientists home (e.g., launch the European Institute of Innovation and Technology (EIT) Community Hub in Kyiv to provide the Ukrainian innovators in Ukraine with access to partners, markets, testbeds, trainings and investments), ensure access and foster their participation in Horizon Europe programmes (e.g., establishment of Horizon Europe Office in Kyiv) and host Ukrainian scientists abroad (MSCA4Ukraine, ERC4Ukraine initiatives). R&I is featured under the NECP as one of the key pillars, and the Ukraine Facility Plan emphasises the role of innovation and	R&I framework programmes has been increasing and leaves great room for scale-up. 4. Ukraine has streamlined objectives related to ERA integration in key policy documents in this area (e.g., Roadmap for ERA integration, Action Plans of MoES for 2024 and until 2027) but has not yet reflected on the New European Innovation Agenda in its R&I policy. 5. The priority areas for R&I as outlined by the legislation and the policy documents are overall aligned with EGD areas, but the focus on green R&I across sectoral policies is currently lacking. 6. Sectoral strategies do not consistently integrate R&I and in case they do, the focus is on readily available technologies adoption and technology upgrading with no mention of R&D, reflecting the issue of systemic R&I underfunding and overall low absorption capacities of Ukrainian private sector.	Ukraine Facility (e, g., under energy and climate objectives). 6. Consider integrating R&I in the upcoming strategic documents related to the EU support to Ukraine's economic transformation, including specific mentioning of green R&I.

	technology in ensuring Ukraine's reconstruction, but does not contain dedicated actions to support R&I. In the context of the war, innovation has come to the forefront of the national policy agenda due to the need for advanced technologies to ensure defence and security and to address socio-economic and environmental challenges exacerbated by the war.	7. The role of R&I in achieving EGD is reflected in the recently adopted National Energy and Climate Plan, but the R&I is largely missing from the Ukraine Facility Plan – a key document outlining priority government actions until 2027 to be supported by the EU funds.	
Instruments for policy implementation (implementation readiness) (section 3.2)	Regulatory instruments include legislation setting the priority direction for R&I activities and enabling R&I funding. Economic instruments include the allocation of the state budget for "Horizon Europe" projects, grants for technology and innovative start-ups available through the USF, supported by EU and international donors. Recent amendments to the Budget Code allowed the state-funded R&D institutions to credit 30% of dividends from the commercialized IP to the special fund of the budget. Technology and science parks, as well as industrial parks, also	1. The available R&I regulatory and economic instruments do not fully align with EGD, even if EGD areas are covered to some extent by the legislation on R&I priority areas and policy documents in this area. 2. The current array of instruments does not contain focus and dedicated incentives for green R&I, but foreseen policy and legislative changes may contribute to green R&I (namely under the Digital Innovation Strategy). 3. Current reforms aimed at provision of more financial and administrative autonomy to R&D organizations,	1. Introduce the focus on green R&I in existing regulatory and economic instruments. 2. Ensure the reform of R&I sector has necessary funding and resources for its implementation, including through mobilisation of support of international partners and donors, to provide for tangible improvements in R&I sector capabilities. 3. Revise and improve existing incentives for business sector investments in R&I, such as those available under science parks and the State Innovative Financial and Credit Institution, to mobilise private sector on green R&I.

	offer incentives for innovative start-ups and R&I organisations in the form of import tax exemption on R&I equipment, full or partial interest payment compensation, profit tax, and property tax exemptions. However, many of these infrastructures are not operating way below their potential. Loans, guarantees, credits, and co-financing mechanisms are provided through the State Innovative Financial and Credit Institution, but so far, this support has not been operational in practice. Incentives to enhance R&I sector performance planned by the MoES include revision of the remuneration of researchers and R&I employees, introduction of performance-based funding for R&I organisations, establishing state funding allocation based on the results of state certification of HEI and creation of the National system of researchers to support best scientists and researchers with focus on	enabling more science-industry collaboration on green R&I can have tangible effect on R&I sector, if implemented. 4. Existing instruments to incentivize business enterprise sector investments into R&I are insufficient and need strengthening (envisaged by current policy documents). 5. The R&I organizations do not leverage opportunities for cooperation on green R&I available under EU-funded projects due to a lack of financial support, awareness, and advice on participation. 6. Existing instruments for R&I support generally lack effectiveness (e.g., industrial and science parks are for the most part not operational in practice) with reasons for such inefficiencies having to be addressed first before introducing focus on green R&I.

	funding young researchers' projects.		
Financial capacity (implementation/financial readiness) (section 3.2.2)	The declining funding of R&D reached 0,33% of GDP in 2022, which is almost seven times lower than the EU average. In 2022, the state budget made up 64.5% of the total amount of expenses on R&I, with foreign sources representing 10.8% and business sector organizations 11.5% of funding for R&I activity. In 2022, as in previous years, fundamental research has received more state funding than applied research: 59% to 37% of state funds, and experimental/innovative R&D only 2%. Engineering and natural sciences have shown a strong record of receiving state funding over the last decades and represent areas with a strong academic record. The programme-specific funding fell from 9.19% in 2021 to 0.84% in 2022 due to the budget sequestration in the context of war. The funding was further re-established, amounting to UAH 4,6 million in 2023 for NRF.	1. The business sector investments into green R&I constitute an important lever for achieving EGD goals, but current instruments are insufficient to incentivise these investments. 2. The R&I organisations do not leverage opportunities for cooperation on green R&I available under EU-funded projects due to a lack of financial support, awareness, and advice on participation. 3. There is limited funding available for R&I and it remains insufficient to achieve the R&I goals related to the EGD, donor support playing an important role in the absence of sufficient state funding. 4. Despite the acknowledgement at the state level of the importance of R&I for economic transformation of Ukraine, including its green transition, there is no sufficient funding allocation,	1. Consider increasing funding for priority R&I projects that are in line with EGD, such as energy, mobility, sustainable use of resources, agritech, medtech, and greentech. 2. Introduce fiscal incentives for businesses to engage in green R&I (e.g., tax exemptions for investment in R&I in EGD areas) and support participation of innovative firms from Ukraine (e.g., covering consultancy/advisory fees for programme participation documentation, etc.) in international EGD-related projects (such as EGD Data Space programme, Impact Funding Framework, GRAINS project, STAGE Grant Programme for Sustainable Development, etc.). 3. Facilitate access of Ukrainian researchers to funding opportunities under "Horizon Europe" by leveraging the Office of Horizon Europe Ukraine in Kyiv and its National Focal Points network for provision of advice and raising of awareness on opportunities for green R&I projects participation.

	Several donor-funded initiatives are instrumental in supporting green innovative entrepreneurship, such as Climate Innovation Vouchers funded by EBRD and the EU and implemented by Greencubator in Ukraine, and the Global Green Chemistry Initiative (GreenChem) financed by the Global Environment Facility with implementation by UNIDO and the Resource Efficient and Cleaner Production Centre.	mostly due to wartime budget constraints and lack of R&I prioritisation on the policy agenda. 5. Donor funding is the main tool to finance green R&I in the context of R&I underfunding exacerbated by the war but making R&I a driver of green transformation requires gradually increasing sources of state and private sector R&I funding.	4. Providing for a steady increase of state and private sector funding of green R&I to build and retain in-house capabilities and to prevent over-reliance on donor funding for green R&I. 5. Leveraging the Ukraine Facility to ensure that R&I-related measures across various sectors are implemented (incl., energy, transport, agriculture, critical materials, entrepreneurship, digital transformation, and green transition).
Public capacity (institutional capacity - effectiveness and efficiency - implementation readiness) (section 3.3)	Innovation policy formulation and implementation are fragmented across key focus ministries, namely MoES, MinEconomy, MinDigital, and MoSI. There is no effective coordination mechanism in place since the Innovation Development Council and the National Council on Science and Technology Development have not been effective in fulfilling the coordination role. The reform of the IP Agency resulted into IP and Innovations Office saw the establishment on its basis of the National IP& Innovations Hub to support	1. The overlapping mandates of four main ministries responsible for R&I result in inefficient use of resources and hinder effective policy implementation. 2. Current inter-ministerial R&I policy coordination mechanism lacks effectiveness and should be revised (envisaged by current policy documents). 3. At the sub-national level, R&I policy implementation falls under the S3 component of regional development strategies, with varying capacities of local institutions	1. Clarifying mandates among relevant ministries, including spelling out the contribution of R&I to the green agenda and the responsibilities each ministry holds in this regard. 2. Enhancing R&I policy coordination through revision of the current mechanism, drawing on international experience, for example, the National Innovation Council mechanism (Sweden, Switzerland, Georgia) and/or implementation of measures envisaged by the Digital Innovation strategy in this regard. 3. Address weaknesses in R&I policy implementation at the sub-national level by strengthening the capabilities of relevant institutions (e.g., regional

	R&D development and commercialisation, technology transfer and investment promotion in R&D. Monitoring of implementation of innovation policy is fragmented across the four ministries and generally lacks effective instruments and robust KPIs to track progress. Policy evaluation has not yet become part of the policy culture in Ukraine (incl. due to high costs of independent evaluation), making it difficult to assess the impact of policy on the R&I system and real economy. However, evaluation of the performance of R&I organisations (certification) is ongoing, and the National Agency got Quality Assurance in Higher Education aims to ensure compliance of Ukrainian HE with European norms and standards. Noted weaknesses in R&I policy governance reflect the lack of an overarching strategic vision for R&I development and its contribution to achieving national strategic objectives. The new draft innovation	for its implementation and a need to address this capacity gap to increase regional competitiveness and preparedness for green transition. 4. Current financial and human resources allocated to R&I policy are insufficient to meet the set goals and accompany the green transition. 5. Downsizing of ministries, recent revision of remuneration of civil servants and decreasing staff in public administration apparatus have a negative impact on human resource capacities for R&I policy implementation. 6. Data for tracking progress on R&I policy implementation and outcomes are lacking with no robust mechanisms in place for reporting and monitoring. 7. Implementation of Open Science initiative through the launch of URIS platform and joining the EOSC contributes to better R&I data availability and transparency but should be further deployed.	administrations, SME support offices, etc.) and provision of adequate support for R&I infrastructures development, fostering partnerships between industry and local R&I organisations, and drawing on S3 principles. 4. Ensure the alignment of R&I policy with new policy priorities for ERA to provide for the integration of green R&I into the portfolios of relevant ministries and agencies. 5. Addressing human resource constraints through dedicated capacity-building programmes for civil servants, sufficient remuneration and “attractiveness” (e.g., donor support for capacity building activities, continued public administration reform) to build internal capabilities for R&I and green R&I implementation (e.g., adding the green R&I to the portfolios of civil servants familiar to some extent with the innovation/digitalisation/green agenda topics to foster synergies. With the provision of subsequent training. 6. Strengthening public institutional capacities for R&I policy implementation by addressing the underfunding of R&I strategies

	strategy "Global Innovation Vision 2030" aims to address this issue and the identified gaps by streamlining policy implementation, enhancing coordination on R&I, and introducing mechanisms for better monitoring and evaluation. The R&I policy implementation at the sub-national level falls under the regional development strategies, together with S3, with expanded local governments' mandate on innovation promotion because of the decentralisation reform. However, due to a lack of a national strategic vision of the role of R&I for economic development and varying degrees of implementation of S3 principles given differences in capabilities across regions, it is challenging for the sub-national governments to systematically invest in R&I promotion.	8. Current stakeholder consultation mechanism allows for feedback on R&I policies, but policy development could be strengthened through more systematic and better institutionalised stakeholder engagement, for instance if the Innovation Development Council is reinvigorated or a similar mechanism is put in place; EGD-related areas should be more prominently incorporated into R&I policy agenda. 9. There is a lack of understanding of the importance and benefits of green R&I among the stakeholders, as they often perceive green transition as a constraint rather than an opportunity to solve current socio-economic challenges in Ukraine and accelerate Ukraine's EU integration, with few efforts at the state level to raise awareness on EGD.	through the introduction of strategy costing practice and identification of sources of funding at the stage of strategy design. 7. Ensuring the production of relevant indicators for green R&I to enhance evidence-based R&I policy design and provide for international comparability of Ukraine's performance on relevant indicators. 8. Ensuring there are clear, measurable indicators to track progress on R&I implementation and harmonising and standardising the process of data collection for reporting across responsible ministries. 9. Enhance transparency and accessibility of data on science and R&D activities results by providing for the storage of data of R&I projects on the dedicated science cloud in Ukraine. 10. Consider membership in the European Human Resources Strategy for Researchers (HRS4R) to enhance the capabilities of R&I actors in Ukraine. 11. Provide targeted capacity-building programmes for public stakeholders on green R&I policy (e.g., civil servants, public R&D organisations managers, etc.), leveraging donor

			assistance, including through the Ukraine Facility and directing it towards green transition.
R&I capacity of other sectors (implementation readiness) (Section 3.4)	Ukraine's R&I infrastructure is quite diverse, comprising such elements as science parks, techno parks, industrial parks, Industry 4.0 Centres, innovation hubs, and regional technology transfer centres. It currently falls short of meeting the demands of the green transition. Only a small share of registered infrastructures is operational, and R&I infrastructure is often not easily accessible to non-state actors. The legislative framework in place poses a foundation for the operation of innovation infrastructures but lacks relevant fiscal and other incentives to stimulate R&I activity more generally and R&I for green transition more specifically. The MoES is working to enhance collaboration with the business enterprise sector on R&I and make available some of the infrastructures of the HEI, public R&D organisations to the	1. Current R&I infrastructure lacks effectiveness, as many infrastructures are not operational in practice due to gaps in funding, personnel, and insufficient incentives laid out by legislation. 2. The war-related destructions and damages to infrastructure, as well as associated lack of human resources weakens Ukraine's capabilities for green R&I. 3. The planned improvements to ensure better accessibility of R&I infrastructure to all R&I stakeholders are likely to facilitate the development of green R&I. 4. The initiatives foreseen by MoES on fostering stronger linkages between science and business through Science. City and "Science and Business" platform can contribute to building R&I sector capacities to accompany the green transition, but they need sufficient resources for their	1. Revise current R&I infrastructures, identify and allocate necessary resources (financial, human, knowledge) to make these infrastructures operational (incl. revising legislation to add fiscal and non-fiscal incentives), as envisaged to an extent by the Digital Innovation Strategy 2030. 2. Integrating the EGD-related focus into existing infrastructures through, for example, specialisation of some science parks on green R&I with relevant engagement of the private sector and/or international donor funding. 3. Ensure that the planned measures to improve R&I infrastructure quality and accessibility to non-state R&I actors are implemented, along with the initiatives to strengthen industry-science collaboration on R&I projects. 4. Provide for mechanisms that would leverage the uptake of military tech to enhance frameworks for science-industry cooperation in other fields and incentivise R&I for dual use technologies (e.g., introducing

	private sector and other stakeholders for R&I activity, e.g., through centres of shared equipment use that can be established. For instance, the matchmaking platform «Science and Business» has already been launched, and another one, "Science. City" – an online platform with information and services for all R&I actors, is under development. Through its efforts on the Open Science initiative implementation, as outlined in the National Plan on Open Science, Ukraine enhances access to data on R&I activities for all R&I stakeholders and promotes access to research infrastructures to innovators, industry representatives, and scientists. Private sector R&I support infrastructures have achieved good success over the recent decade, fuelled by the vibrant IT sector growth, effectively supporting innovative entrepreneurship ideas. Private sector greening has mostly been taking place in the	implementation, including in the long-term perspective. 5. The R&I sector has not yet benefited from spill overs of the surge of investments in military technologies with potential to incentivise R&I for dual use technologies and apply the lessons learnt to strengthen industry-science cooperation on R&I. 6. The government does not have a clear vision for the development of green skills to meet the projected number of 4,2 million green jobs if Ukraine is to ensure a green post-war recovery. 7. Current capacities of HEI are not sufficient to meet the demand for green jobs, especially when it comes to STEM affected by the current and prospective students' emigration due to the war and thus emptying the pool of skilled (future) workers. 8. CSOs and NGOs supporting green transition are aware of green transition challenges with advocacy, analytical, and capacity-building efforts	legislative provisions, putting in place a policy mechanism). 5. Develop a strategic vision for green skills for Ukraine (e.g., a national strategy) with allocation and identification of relevant sources of funding (e.g., a share of environment/carbon tax, donor-funded projects) for investments in green skills programmes in HEI and business sector (e.g., introducing incentives to provide trainings for employees in this area). 6. Leverage the capabilities of CSOs focused on green transition to raise awareness of public, education and business sector actors on the urgency, benefits, and actions required for green transition and the role of green R&I (e.g., public sector partnering with CSOs to run workshops, programmes, engage in the discussions on green R&I). 7. Leveraging the opportunities for the business sector provided due to Ukraine's EU candidate status to promote knowledge and practice exchange with the EU professional networks (e.g., European Enterprise Network) on integration of green practices to enhance business sector capabilities for green transition,

	framework of donor-funded initiatives such as EU4Environment Action for EaP countries and the Global Greenchem Innovation and Network Programme. The voluntary ESG compliance certification under the UN Global Compact Ukraine has attracted almost 150 companies in Ukraine, building the preparedness for green transition. The awareness of the green transition, its components, rationale, and implications for various sectors is quite weak, with a few “pockets of excellence” across businesses and CSOs that attach great attention to the green transition and realise its importance for the competitiveness of the Ukrainian economy and its EU integration. Green skills building across all sectors is needed as the green recovery of Ukraine is estimated to create 4.2 million green jobs. Higher education programmes and training for employees to acquire new skills in line with	directed to address those and efforts to raise awareness on the urgency, benefits, and actions required for green transition, but their activities should be scaled up. 9. Business sector generally lacks the understanding of the benefits and requirements for green transition and the role the green R&I investments can play in accelerating it. 10. Government is missing out on leveraging the solid capabilities of local CSOs and NGOs supporting green transition to increase public understanding and stakeholder “buy-in” of the green transition and promotion of green R&I in this respect. 11. Education sector does not have sufficient capabilities to prepare the workforce with necessary green skills for the development and green reconstruction of Ukraine. 12. The initial shock and continued negative impact of war on all sectors of economy diverts business sector	including R&I investments for EGD requirements compliance.

	the green transition are taking place on an ad hoc basis, requiring a more strategic approach from the government. The capabilities of the non-governmental sector to support green transition rely a lot on donor funding, which is the main source of funding for many CSOs, and analytical centres focused on the promotion of the green transition agenda (e.g., DixiGroup, EcoAction). The donor funding also allows these organisations to build their capacities in supporting green transition as they benefit from knowledge transfer from European peers in this area and take part in relevant networks.	attention from building green skills of its employees as it manages the urgent problems with potential immediate negative effects (e.g., exports under constraints).

5.4. R&I in other EGD areas

Enabling conditions

In terms of enabling conditions for R&I in other thematic and cross-cutting areas, it can be said that **R&I is considered through the introduction of and investments in innovative technologies in energy, waste management, transport, thermal modernisation of buildings and environment protection** to help reach carbon neutrality by 2060, as noted by relevant strategies (i.e., Energy Strategy 2050, National Environmental Strategy 2030, National Strategy for Waste Management 2030, National Transport Strategy 2030, the National Energy and Climate Plan (NECP)). Moreover, the draft Law "On Packaging and Packaging Waste" (under consideration by the Parliament) stipulates in Article 4 the use of the results of R&I to increase the efficiency of the recovery of packaging waste and the application of the best available technologies and management methods for the processing of packaging waste. Finally, the Law "On waste management" includes provisions on tax and credit benefits for financial support of R&I in waste processing technologies, in particular recycling (Article 56-8).

Several sectoral R&D organisations play an important role in promotion of R&I in thematic areas, such as, for instance, the R&D departments of the Ivano-Frankivsk National Technical University on Oil & Gas, the National University of Bioresources and Nature Management of Ukraine and the Dnipro State University of Agrarian Economics; the Ukrainian Scientific Research Institute of Nature Management and Ecological Problems, the National Agrarian Academy, National Institute for the Development of Infrastructure, the Institute of Renewable Energy of the National Academy of Sciences. A certain number of R&I projects are carried out under Horizon Europe, GreenChem Innovation, and the Network Programme etc. Ukraine has historically been strong in R&I in biodiversity, with the efforts of various institutes to develop varieties of plants.

Capacities across thematic areas for green R&I implementation vary (e.g., energy and agriculture having stronger capabilities) but remain limited to effectively support the green transition. Donor-funded projects are aimed at building local actors' capabilities. For instance, training for audit specialists in buildings was organised with support from GIZ contributing to forming 3,000 energy auditors in the building market in Ukraine. However, these efforts are not systematic and do not cover the existing gaps.

Green skills across thematic areas are limited, with existing educational programmes yet to integrate green components or to pass the needed accreditation mechanisms (e.g., renewable energy-related programmes). The green skills among employees across sectors vary, with energy and agrisector being the most advanced (e.g., in agronomy and agricultural engineering, it is required for the graduates to have hard skills related to

green transition), but both sectors are experiencing labour shortage due to the war. There are no incentives for businesses to invest in the green skills building of their employees, and there is a general lack of understanding of the urgency and importance of the green transition and the role R&I can play in it. However, the CSOs and the third sector manifest a high level of knowledge and understanding of the requirements of green transition, carrying out important awareness raising, advisory, lobbying, and often capacity-building roles for other stakeholders.

Ad hoc initiatives are taking place in the private sector to ensure green transition, but these efforts lack direction and incentives from the government to ensure their systematic and systemic nature. For instance, several businesses in the agrisector have introduced sustainability-related practices to reduce their climate footprint (Kerel, MHP) and are investing in green energy, particularly biofuels; some are integrating new technologies to enhance their operations (e.g., drones).

The funding available under the Ukraine Facility foresees the use of at least 20% on the measures related to acceleration of green transition across all sectors with possibility to leverage it for advancing R&I in all EGD areas.

Key gaps

In terms of key gaps, a particular focus on EGD-related areas such **as energy, industry and circularity, building and renovation, and zero pollution, in particular the waste management, would help to accelerate the green transition** while simultaneously responding to the most pressing challenges Ukraine is facing in the context of the war and reconstruction.

- Ukraine experiences a **shortage of qualified workers** across all energy sectors due to the ongoing war.
- **Lack of a coherent approach to education programmes to promote green skills development among graduates**, and almost non-existent incentives for businesses' investment in green skills of their employees (e.g., building skills for delivering the NZEB).
- **Gaps in capabilities of public sector actors across all thematic areas**, esp. when it comes to the technical knowledge required for policy design and implementation of EGD-supportive sectoral policies. Connected to this is the **over-reliance on external expertise** (donor-provided) of the public administration when it comes to green transition, which also hinders public sector internal capabilities growth (need for ensuring the spill-over effects of the donor projects).
- **Data accessibility and availability** due to martial law and ongoing military action is an obstacle for effective policy monitoring (e.g., energy, some environment data).

- **Implementation of policy documents and enforcement of relevant laws is weak** due to inadequate allocation of resources and the absence of effective monitoring and coordination mechanisms.

Main development needs

R&I has the potential to **support the green transition across all thematic areas**, in particular through the development of technologies and innovative solutions for:

- removing nitrates from water due to high nitrate pollution of groundwater, and other technologies to address water, soil, and air pollution;
- greening of industrial technologies, new technologies in waste management and circular economy, e.g., extraction of scrap metals from concrete for the reuse of construction waste (esp. relevant for the reconstruction);
- genetic analyses, remote biodiversity and landscape monitoring, new uses of GIS technologies, and space-based earth sensing for solving the biodiversity and nature preservation challenge;
- forest management and planning (with integration of the GIS tools for monitoring fires, deforested areas, or recovery after fires, timber accounting, providing access to forest management materials, logging tickets, creating a transparent timber market, etc.);
- thermal modernisation of buildings; digitalisation of the construction and renovation industry (e.g., Building Information Modelling (BIM) technologies); decarbonisation of heating and cooling systems; innovation and technologies for combating energy poverty; development of new construction materials with reduced environmental footprint;
- crop rotation, agroecology, regenerative agriculture; agroecology and biodiversity; reduction of pesticide use, evaluating the effectiveness of precision agriculture technologies in reducing the need for chemical inputs; digital agriculture and precision farming; circular economy in agriculture by minimization of waste, recycling nutrients; alternative protein sources; reducing environmental impact of livestock farming; and digital traceability and blockchain;
- sustainable and resilient transportation networks (development of electric public transport, means to ensure resilience of transportation network to war-related risks), digitalisation of public transport (improving accessibility, interoperability of electronic tickets, etc.); ensuring mobility in remote rural areas (as low connectivity between cities and rural areas), inclusive transportation (e.g., adapted to people with disabilities);

- green chemistry, green hydrogen, AI for the energy sector, technologies for energy efficiency of industry, climate-friendly agro-innovations; hydrogen technologies and carbon capture and storage, renewable energy sources (RES).

5.5. Summary

Since 2014, Ukraine has been actively aligning its regulatory framework with the EU framework on research and innovation (R&I) to meet the obligations under the EU-Ukraine Association Agreement (2016). This alignment has involved upgrading legislation, introducing new policy tools, and adopting strategic policy documents. Ukraine's integration into the European Research Area (ERA) is marked by its association with Horizon 2020/Horizon Europe and Euratom programmes, membership in CERN and COST, and expanded participation in EUREKA. The full-scale invasion by Russian Federation of February 2022 brought the importance of innovation to the forefront of the national policy agenda, both in civilian and military realms.

Despite the ongoing R&I sector reform, significant gaps remain in Ukraine's R&I framework. Strategic documents often lack concrete policy mechanisms, robust key performance indicators (KPIs), and sufficient funding. The country also struggles to capitalize on EU integration opportunities due to inadequate funding and legislative obstacles. There is a need for Ukraine to reflect the New European Innovation Agenda in its policies and further reform its R&I sector to better prepare it for ERA integration. Additionally, there is much room for strengthening green R&I and tapping into the potential of R&I for achieving Ukraine's energy and climate objectives.

Ukraine's financial capacity for R&I implementation remains a challenge, especially when it comes to supporting the EGD agenda. In 2023, the R&D funding was only 0.33% of GDP, far below the EU average, and the donor funding played a critical role in green R&I initiatives. The lack of business sector investments into R&I, weak demand for R&I, and insufficient state funding of the sector hinder further progress. Despite recognizing the importance of R&I for economic transformation, wartime budget constraints and limited prioritization of R&I on the policy agenda exacerbate funding issues.

Institutional capacity for R&I policy implementation in Ukraine is fragmented, with overlapping mandates across key ministries and ineffective coordination mechanisms. Despite the adoption of a new Digital Innovation Development Strategy with a vision for R&I development and its role in achieving national development objectives, R&I and, in particular, green R&I, are not properly anchored into Ukraine’s long-term economic development and recovery agenda. The ongoing and proposed reforms of the R&I sector aim to address the issues in innovation policy coordination, increase private sector

funding for R&I, and enhance human resource capacities for a more effective R&I ecosystem that can become a driver of the green transformation of Ukraine. However, public and private sector awareness of the green transition is weak, requiring a more strategic approach to building green skills and leveraging local non-governmental organizations and the expert community for better stakeholder engagement and support for green R&I.

To enhance Ukraine's R&I sector, it is essential to ensure strategic documents have clear KPIs, actionable targets, and adequate funding. The R&I system reform, as outlined by MoES in its Strategic Action Plan until 2027 and the Digital Innovation Development Strategy 2030, can be efficient in enhancing the R&I system performance, but additional measures are needed to support green R&I specifically, along with the necessary allocation of funding to operationalise envisaged actions. Furthermore, efforts should be made to align R&I policies with the New European Innovation Agenda, increase funding for green R&I projects, provide fiscal incentives for business investments, and facilitate access to EU funding opportunities in the EGD-related R&I projects and programmes. Improving public sector capacity involves clarifying ministry mandates, strengthening policy coordination, and building human resource capabilities, while raising awareness on the essence, importance, and benefits of green transition and investing in green skills to prepare for the next steps in Ukraine’s green agenda. Additionally, upgrading R&I infrastructures affected by the war, integrating EGD-related focus into R&I activities of NRFU and USF, and leveraging military technology for dual-use innovations can help Ukraine build a robust R&I sector that supports its just green transition and overall economic recovery.

Annex 1. Mapping of strategic national documents, as well as relevant thematic objectives and targets

R&I relevant international or EGD policy area/ strategic document	Existing national strategic document	Time of adoption and date of last revision	Legally binding or not	Relevant objectives and targets	Comments:
R&I policy					
Founding legislation	Law "On Innovative Activities"[166]	O4/07/2002, latest amendments 31/03/2023	Yes	The Law defines the legal, economic and organizational principles of state regulation of innovative activity in Ukraine, establishes forms of state stimulation of innovative processes and is aimed at supporting the development of the Ukrainian economy through innovation.	In its first version, the law stipulated benefits in land tax and payment of import duty payments for enterprises engaged in innovation activity, but in 2005, these provisions were deleted. The law is often critiqued for the lack of practical arrangements for the innovation-led economic transformation of Ukraine.
Founding legislation	Law "On State Regulation of Activities in the Field of Technology Transfer"	14/09/2006, latest amendment 16/10/2020	Yes	The Law stipulates that funds received as a result of the transfer of technologies dine with budget funds are to be used by the development organization to pay the remuneration to the authors of technologies and/or objects of intellectual property rights, for the development of innovative activities and technology transfer of the organization, in particular, payment for foreign patenting.	
R&I in EGD areas: climate and energy, industry and circularity, biodiversity, digitalisation.	Law "On Priority Directions of Science and Technology Development"[167]	11/07/2001 Latest amendment	Yes	The latest amendment added the development of science and technology around national security and defence to the list of priority areas for science and technology.	

[166] *Про інноваційну діяльність* (2002). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/40-15 (May 2024).
[167] *Про внесення змін до деяких законів України щодо пріоритетних напрямів розвитку науки і техніки та інноваційної діяльності* (2024) *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/3534-20 (May 2024).

		13/01/2024 [168]		Other areas include; fundamental research on the most important problems of scientific-technical, socio-economic, socio-political, and human potential-related development to ensure Ukraine's competitiveness in the world and sustainable development of society and the state; ICT, energy and energy efficiency; rational nature management; life sciences and tech for disease treatment; new materials.	
R&I in EGD areas: climate and energy, industry and circularity, biodiversity, sustainable mobility, digitalization.	Law "On Priority Areas for Innovation Activity Development in Ukraine"[169]	08/09/2011 Latest amendment 13/01/2024	Yes	The latest amendment aligned the R&I sectors with the national security and defence priorities adding to the list of R&I priority areas defence tech. The law also defined the term of validity of these priority areas until the end of the martial law in Ukraine. Other priority areas in R&I include: energy tech, energy-efficiency, energy-saving and alternative energy sources; transportation tech, incl. space, aircraft, shipbuilding, weapons and military equipment; production of new materials, creation of the industry of nanomaterials and nanotechnologies; agrotech; medtech; greentech (cleaner production and environmental protection); modern ICT, robotics.	
Funding of R&I activities, including in priority areas	Law "On Scientific and Scientific and Technical Activity"[170]	26/11/2015, latest amendment 04/01/2024	Yes	This Law defines the legal, organizational and financial principles of functioning and development of scientific and R&D activities, creates conditions for carrying out scientific and R&D activities, meeting the needs of society and the state in technological development through the interaction of education, science, business and government.	This law also sets the minimum state funding of R&D activities at the level of 1.7 % of GDP. This threshold has consistently not been met by the Government.

[168] *Про пріоритетні напрями розвитку науки і техніки* (no date). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/2623-14 (May 2024).
[169] *Про пріоритетні напрями інноваційної діяльності в Україні* (2012). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/3715-17 (May 2024).
[170] *Про наукову і науково-технічну діяльність* (2016). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/848-19 (May 2024).

				The latest amendment of 13/12/2022 concerned adding provisions on the functioning of the National Research Fund (a state budget institutions providing state grants for R&D activities; NRF was established in 2018[171] but did not start its operation until 2020; it funds R&D projects in areas related to current societal challenges, incl. health care, biological, ecological, food security issues).	
Funding of R&I activities – IP dividends	Law "On Amendments to the Budget Code of Ukraine"[172]	Approved by the Parliament 06/05/2023	Yes	The amendment allows the state-funded R&D institutions (except defence sector), state universities, academies, and institutes to credit 30% of dividends (income) from the commercialized intellectual property to the special fund of the budget.	
Participation in EU R&I activities and programmes (Horizon Europe)	Resolution "On Amendments to the Regulation on Competitive Selection of Scientific, Technological and Technical Works and Projects Financed by the European Union External Assistance Instrument to Fulfill Ukraine's Obligations under the European Union Framework Programme for Research and	Approved by the Cabinet of Ministers Feb 9, 2024	Yes	The resolution amends the procedure of conducting competitive selection by the MoES of R&D projects financed under Horizon Europe (e.g., composition of research team taking part in the competition), and introduces changes to the maximum amounts of financial support from the state budget to selected projects (e.g., 35% instead of 42% to cover the costs of equipment and materials associated with the project, 40% instead of 55% for projects conducted by HEI, SMEs, and research organizations, and 20% instead of 2% for innovative projects run by HEI and R&D organizations, and 5% instead of 1% to cover the costs on technical and economic substantiation of R&D projects by businesses).	The amendments are done in the spirit of the overall increase of state co-financing of R&D and innovation projects by Ukrainian participants, in particular, allocation of more resources to HEIs and research organizations.

[171] *Про Національний фонд досліджень України* (2018). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/528-2018-%D0%BF (May 2024).
[172] *Про внесення змін до Бюджетного кодексу України* (2023). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/3035-20 (May 2024).

	Innovation 'Horizon 2020'"[173]				
Policy documents					
R&I in EGD areas: digitalization	"The State Strategy for Development of Innovative Activities in Ukraine until 2030"[174] and its Action Plan for 2021-2023[175]	Approved by the Cabinet of Ministers 10/07/2019	No	A cross-sectoral strategy which aims to build a national innovation ecosystem to ensure the rapid and high-quality transformation of creative ideas into innovative products and services, increase the level of innovativeness of the national economy, increasing the number of implemented R&D, increasing the economic return from them, and attract investments in innovative activities. Sets the targets to be achieved by 2030 (2017 as a baseline): • GERD – 3% of GDP (in 2017 - 0.45 percent); • % of innovative enterprises in the total number of enterprises - at least 30% (in 2017 - 16.2 percent); • % exports of high and medium-tech goods in the total volume of exports of goods – 30% (in 2017 - 15.4 percent); • % workers employed in high and medium-tech enterprises in the total number of employed workers in industry - 29 % (21.3 percent in 2017); • % innovative products sales in the total volume of industrial sales – 10% (in 2017 - 0.7 percent).	The Action Plan for 2021-2023 includes actions to promote innovation based on open data and digitalisation.

[173] *Про внесення змін до Положення про конкурсний відбір наукових, науково-технічних робіт та проектів, які фінансуються за рахунок зовнішнього інструменту допомоги Європейського Союзу для виконання зобов'язань України у Рамковій програмі Європейського Союзу з наукових досліджень та інновацій "Горизонт 2020"* (2024). *Офіційний вебпортал парламенту України*, https://zakon.rada.gov.ua/go/183-2024-%D0%BF (May 2024).

[174] *Про схвалення Стратегії розвитку сфери інноваційної діяльності на період до 2030 року* (2019) *Офіційний вебпортал парламенту України*, https://zakon.rada.gov.ua/go/526-2019-%D1%80 (May 2024).

[175] *Про затвердження плану заходів на 2021-2023 роки з реалізації Стратегії розвитку сфери інноваційної діяльності на період до 2030 року* (2021) *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/1687-2021-%D1%80 (May 2024).

R&I for EGD areas: Climate and energy, digitalisation, industry and circularity, sustainable food systems.	"Roadmap for the use of science, technology, and innovation to achieve the Sustainable Development Goals"	Approved by the MoES 22/12/2023	No	The roadmap proposes 6 missions/ problem-oriented areas of scientific research and innovative activity to support SDG implementation. These include: digitalization of society; resource-efficient economy and alternative energy; rational use of nature and circular economy; health of the nation; new substances, materials, industrial technologies; safe food.	The document was created following the methodology of the United Nations, considering recommendations for preparing roadmaps for the use of science, technology, and innovation to achieve the Sustainable Development Goals.
Alignment with the European R&I system	"Roadmap for Ukraine's integration into ERA"	Approved by the Cabinet of Ministers 10/02/2021	No	The key objectives include: - harmonization of research and innovation policy with EU standards and norms; - expanding access to the EU R&I programmes; - development of research infrastructure in Ukraine and its integration into the EU research infrastructure; - creation of favourable conditions for international and interdisciplinary mobility of scientists/researchers; - application of a comprehensive gender approach in the field of science and innovation; - application of open science principles and use of EU open access tools; - development of innovative infrastructure considering the best European practices; - Internationalization of scientific research and innovation outside the EU	Ukrainian R&I priorities should be better aligned with the ERA's priorities.
Alignment with European R&I infrastructures	"The Concept of the State target programme for the development of research infrastructures in Ukraine for the period until 2026"[176]	Approved by the Cabinet of Ministers 14/04/2021	No	The purpose of the Programme is to create the necessary organizational, legal and financial conditions for the development of the system of research infrastructures in Ukraine, increase their competitiveness, and foster the development of the scientific, research, technology and innovative	Research infrastructures include centres for the collective use of scientific equipment, national research centres, state laboratories, etc. Modernisation of the material and technical stock of research organisations is also

[176] *Про схвалення Концепції Державної цільової програми розвитку дослідницьких інфраструктур в Україні на період до 2026 року* (2021). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/322-2021-%D1%80 (May 2024).

				activities in terms of access to advanced research infrastructures in the European Union. The main task of the Programme is the systematization of research infrastructures, assessment of their compatibility with European research infrastructures, provision of priority funding for their further development, and ensuring consistency with the Roadmap for the development of European research infrastructures, approved by the European Strategic Forum of Research Infrastructures (ESFRI).	among the priorities due to outdated stock and destructions caused by the war.
Priority areas for technology development	"The Concept of the State Target Programme for the development of	Approved by the Cabinet of Ministers 13/04/2024	No	The concept foresees analysis of needs of priority economic sectors in terms of AI technologies and the capabilities of local R&D institutions in this regard; development of requirements for the IT infrastructure and safety; establishment of AI labs or centres within the educations establishments to provide services in development, testing, and teaching the use of AI technologies, creation of catalogue of AI technologies by Ukrainian R&D actors, etc.	The Ministry of Strategic Industries is the responsible body. The concept is to be operationalised through the development and approval of the dedicated programme within the 6-month period.
Alignment with the EU Acquis, integration in ERA, digitalization	Strategic Plan of the Activity of MoES for 2024[177]	Approved by MoES 29/03/2024	No	The Plan of MoES for 2024 puts forward several strategic objectives around R&I, including: 1. R&D infrastructure development and integration into the European Research Area. 2. Ensuring R&D is closely aimed at solving world-level scientific problems and specific science-intensive priorities in defence, security, economy and society of Ukraine. 3. Strengthening the capacity of researchers to carry out high-quality research and create competitive scientific results and innovative products.	

[177] МОН (2024). ОПЕРАТИВНИЙ ПЛАН МІНІСТЕРСТВА ОСВІТИ, НАУКИ УКРАЇНИ НА 2024 РІК, https://mon.gov.ua/storage/app/media/rizne/Plany.roboty/2024/29.03.2024/Operativn.plan.MON.2024.1.pdf (April 2024).

				4. Enhancing R&D funding system to foster quality of R&D results. It also contains strategic priorities for Ukraine's EU integration in the science and research sectors and the digitalisation of education and science.	
International agreements					
Participation in the EU's R&I mechanisms	"Agreement between Ukraine and the European Community on scientific and technological cooperation"[178]	Ratified by Verkhovna Rada 25/12/2002. The agreement was prolonged for 5 years on 23/12/2020	Yes	The Agreement establishes grounds for joint activities in science, research, and development in the areas of mutual interest. The following areas for science and R&D cooperation are noted: climate, biomedical research in healthcare, agriculture, industry, materials, energy (except for nuclear), transport, IT, social sciences, R&D policy, and training and exchange of scientific and research personnel.	
Participation in the EU's R&I mechanisms	Agreement between the Government of Ukraine and the European Atomic Energy Community on scientific and technological cooperation and the associated participation of Ukraine in the Euratom Research and Training Programme (2014-2018).	Ratified by the Verkhovna Rada 22.09.2016	Yes	The agreement allowed Ukraine's participation in the Euratom Programme, with Ukraine becoming an Associate Member in 2016.	Between 2015-2020, Ukrainian entities received approximately €4.9m for both fusion and fission activities.
Participation in the EU's R&I mechanisms	"Agreement between Ukraine and the European Union on Ukraine's participation	Ratified by the Verkhovna	Yes	The Agreement allowed Ukraine's participation in Horizon 2020 as an Associated member from 2015 to 2020.	Under Horizon 2020, Ukraine participated in 230 projects, involving 323 participants, for a total funding request of €45.5m.

[178] *Угода між Україною та Європейським Співтовариством про наукове і технологічне співробітництво* (2019) *Офіційний вебпортал парламенту України*. Available at: https://zakon.rada.gov.ua/go/994_194 (May 2024).

	in the European Union Framework Programme for Scientific Research and Innovation "Horizon 2020"	Rada 15/07/2015			Ukraine has been particularly strong in researchers' mobility (MSCA), energy, climate, and transport.
Participation in the EU's R&I mechanisms	Agreement between the European Union and European Atomic Energy Community of the one part and Ukraine of the other part, on the participation of Ukraine in Horizon Europe – the Framework Programme for Research and Innovation and the Research and Training Programme of the European Atomic Energy Community (2021-2025) complementing Horizon Europe – the Framework Programme for Research and Innovation.	Ratified by Verkhovna Rada 23/03/2022	Yes	Allows Ukraine's participants in the Horizon Europe and Euratom Programmes without having to contribute financially for 2021 and 2022; cooperation with Ukrainian research and innovation actors affected by war is encouraged.	
	"Associate Member Agreement between Ukraine and the European Organization for Nuclear Research (CERN)"[179]	Ratified by Verkhovna Rada 2/09 / 2014	Yes	Establishes formal grounds for cooperation in the area of nuclear research between Ukraine and the EU. Ukraine became an Associate Member of CERN in 2014.	

[179] *On Ratification of the Associate Member Agreement between Ukraine and the European Organization for Nuclear Research (CERN)* (2014) *Official website of the Parliament of Ukraine*. Available at: https://zakon.rada.gov.ua/go/1666-18 (May 2024).

Sectoral laws and strategic documents with provisions on/mentioning R&I					
Energy and climate, zero pollution, industry, and circularity.	National Economic Strategy until 2030[180]	Decree of the Cabinet of Ministers 3/03/2021	No	Places EU integration, decarbonisation of economy (increasing energy efficiency, development of renewable energy, circular economy, and EGD alignment), fostering entrepreneurship and innovation among key principles and directions of Ukraine's economic development. The targets are: - Two-fold increase in real GDP; - growth of nominal GDP per capita to at least 10,000 US dollars; - increase in labour productivity by no less than 1.7 times; - increasing the net inflow of FDI to at least 15 billion US dollars per year starting in 2025; - growth of export volumes up to 150 billion US dollars; - reduction of the unemployment rate (according to the ILO methodology) to 6 percent; - Reducing the gender pay gap to 10 percent.	No explicit mention of R&I-related targets but states the important role of innovation in achieving the set objectives for economic development.
Energy and climate, zero pollution, industry, and circularity	National Environmental Strategy until 2030[181]	Decree of the Cabinet of Ministers 28/02/2019	Yes	One of the objectives is to introduce ecologically safe, resource- and energy-saving technologies (in particular, in metallurgical, chemical, petrochemical, and energy industries); the introduction of e-governance technologies in the environmental sector. Other objectives include modelling of ecological risk through modern ICT technologies to preserve nature ecosystems, ensure population wellbeing; introduction of modern energy-efficient and heat-preserving technologies in construction;	

[180] *Про затвердження Національної економічної стратегії на період до 2030 року* (2021) *Офіційний вебпортал парламенту України*. Available at: https://zakon.rada.gov.ua/go/179-2021-%D0%BF (May 2024).
[181] *Про Основні засади (стратегію) державної екологічної політики України на період до 2030 року* (2019) *Офіційний вебпортал парламенту України*. Available at: https://zakon.rada.gov.ua/go/2697-19 (May 2024).

				improvement of technological processes and construction of high-tech complexes for solid waste disposal; ensuring the implementation of the results of modern fundamental environmental research and dialogue between R&I community and state bodies.	
Energy and climate, zero pollution.	Strategy on Environmental Security and Climate Adaptation until 2030[182]	Decree of the Cabinet of Ministers 20/10/2021	Yes	The Strategy recognises the lack of contribution of the R&D and education sector to solving environmental protection challenges with regard to climate mitigation and adaptation measures. It also points to the lack of coordination of R&D projects on climate, no mechanism for systematization, analysis, and verification of the R&D results.	Despite recognition of the lack of R&I contribution to solving climate challenges, the Strategy does not mention support to R&D in this area among its objectives, nor does it mention the importance of doing so through other available sectoral planning documents.
Climate and energy, zero pollution.	Action Plan for the implementation of Ukraine's climate policy within the framework of participation in the global initiative to reduce methane emissions "Global Methane Pledge[183]	Decree of the Cabinet of Ministers 7/07/ 2023	Yes	Two out of eight measures are related to the introduction of specific technologies, such as technologies on methane capture and utilization under the programme of fair transformation of coal regions, and technologies for biomethane production from agricultural waste.	The action plan under relevant measures does not foresee allocation of funding for R&I in the area to find solutions, however, and only limits itself to legislative and regulatory changes as activities to tackle the issue with no additional financing required.
Energy and climate, industry and circularity	National Strategy for Waste Management until 2030[184]	Decree of the Cabinet of Ministers 8/11/2017	No	In the area of industrial waste, it is planned to: introduce cleaner production technologies and create a network of centres providing necessary technical, consulting and informational support; determine and put to use the best available technologies for reuse, processing and disposal of industrial waste; providing financial assistance to	The Strategy does not mention R&I and seems to refer to the technologies in the spirit of the "readily available" technological solutions that can be quickly integrated into the process.

[182] *Про схвалення Стратегії екологічної безпеки та адаптації до зміни клімату на період до 2030 року* (2021). *Офіційний вебпортал парламенту України;* https://zakon.rada.gov.ua/go/1363-2021-%D1%80 (May 2024).
[183] *Про затвердження плану заходів з реалізації кліматичної політики України в рамках участі в глобальній ініціативі із скорочення викидів метану "Global Methane Pledge* (2023). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/laws/show/607-2023-%D1%80#Text (May 2024).
[184] *Про схвалення Національної стратегії управління відходами в Україні до 2030 року* (2017) *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/820-2017-%D1%80 (May 2024).

				business entities (loans, grants, etc.) for environmental modernization, introduction of cleaner production technologies, development of capabilities to process and dispose of industrial waste. The document also includes the objectives on introduction of the latest technologies for the utilization and removal of solid household waste, reducing the volume of their disposal at landfills; promote the use of waste-free and environmentally safe technologies by business entities. Among the goals set, there is a reduction of the volume of primary raw materials by 70% and an increase in the share of waste sent for recycling to 50%.
Zero pollution, industry, and circularity	Law "On Waste Management" [185]	Approved by the Verkhovna Rada as per the latest amendment 31/03/2023	Yes	The Law establishes the hierarchy of waste management, waste management system planning at the national, regional, and local levels. Introduces a system of extended producer responsibility, foresees the gradual creation of modern infrastructure and waste collection and processing facilities, and stipulates the improvement of waste management processes, including a license and permit system. In terms of R&I, the law includes provisions on reducing the volume of waste generation through the use of best available technologies and management methods in the process of industrial production (Article 5-5) and foresees the provision of tax and credit benefits for financial support of R&I in waste processing technologies, in particular recycling (Article 56-8).

[185] *Про управління відходами* (2023). *Офіційний вебпортал парламенту України*. Available at: https://zakon.rada.gov.ua/go/2320-20 (May 2024).

Energy and climate, industry and circularity, zero pollution, F2F	Draft Law "On Packaging and Packaging Waste"[186]	Under consideration by the Parliament Committee since October 2023	No	The Law in Article 4 stipulates the use of the results of R&I to increase the efficiency of the recovery of packaging waste and the application of the best available technologies and management methods for the processing of packaging waste.	
Energy, Building, and Renovation	Long-term Strategy on Thermal Modernisation of Buildings until 2050[187] and the accompanying Concept on State Policy to Support Thermal Modernisation of Buildings until 2030	Approved by the Cabinet of Ministers 29/12/2023	Yes	The Strategy is built on principles such as energy efficiency, decarbonisation, comfort and safety, financial accessibility and economic relevance, considering the life cycle of the building, digitalisation and attention to architectural value and aesthetics. It sets the development of human potential, digitalization, and innovations in the field of thermal modernization of buildings as its strategic objective 7. The measurable indicators it sets for reaching this goal is the number of skilled professionals in energy efficiency – 164,6 thousand professionals per year by 2050; the intermediate indicator for 2030 is set to no less than 100 thousand professionals per year. However, there is no mention of R&I in energy efficiency and construction, nor associated targets.	The Strategy contains the focus on the development of necessary skills among the sector professionals to enable the green transition, in particular the deployment of the near zero energy buildings (NZEB). These are set to become a new norm for all public buildings as of 1 January 2026, and then all buildings in 2028. The integration of new technologies in this field is understood as a mandatory element to achieve the set goals.
Energy and climate, industry and circularity	State Regional Development Strategy 2021-2027[188]	Approved by the Cabinet of Ministers 5/07/2020	No	Under its operational objective 4 on increasing regional competitiveness, the Strategy promotes the introduction of innovations and the growth of the technological level of the regional economy, support innovative enterprises and startups. The S3 figures under operational objective 5 on sustainable industry development with measures	

[186] Government of Ukraine, https://mepr.gov.ua/povidomlennya-pro-oprylyudnennya-proyektu-zakonu-ukrayiny-pro-upakovku-ta-vidhody-upakovky/ (May 2024).
[187] Government of Ukraine, https://mtu.gov.ua/files/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D1%96%D1%8F_0901.pdf (May 2024).
[188] *Про затвердження Державної стратегії регіонального розвитку на 2021-2027 роки* (2020). *Офіційний вебпортал парламенту України*, https://zakon.rada.gov.ua/go/695-2020-%D0%BF (May 2024).

				including financial support to priority industrial sector development as defined by the regional S3 strategies, establishing a mechanism of priority support to industries that create new jobs based on the use of local resources, resource-saving technologies, use energy-efficient construction materials and equipment.	
Smart mobility	National Transport Strategy of Ukraine 2030[189]	Approved by the Cabinet of Ministers 30/05/208	Yes	The Strategy notes as one of its objectives the support for implementation of R&I results in the field of transport, including through building international scientific and technological cooperation in this area, and implementation of joint programmes by educational institutions, public administration, and businesses. It also stresses the importance of integration of new transport technologies and innovation to ensure safe, clean, and energy-efficient transport in line with the global trends in mobility and the provisions of the EU Association Agreement (e.g., digitalisation of transport, decarbonisation, development of seamless mobility and multimodal transportation, etc.).	The R&I is mentioned among one of the objectives to support the development of the transport field, in particular, the integration of new transport technologies, and fostering international science collaboration.
All EDG areas	Ukraine Facility Plan[190]	Approved by the Cabinet of Ministers on 18/03/2024, approved by the European Commission	No	Envisages the development and approval of an Integrated National Energy and Climate Plan, the Law of Ukraine "On the Basic Principles of State Climate Policy, the Strategy for Implementing Circular Economy Principles and its Action Plan, and the National Waste Management Plan until 2033. The Plan gives an important place to compliance with climate and environmental goals. Thus, at least	

[189] Cabinet of ministers of Ukraine (2018). *Government endorses National Transport Strategy by 2030,* https://www.kmu.gov.ua/en/news/uryad-shvaliv-nacionalnu-transportnu-strategiyu-do-2030-roku (May 2024).
[190] Government of Ukraine (2024). Plan for Ukraine Facility 2024-2027, https://www.ukrainefacility.me.gov.ua/wp-content/uploads/2024/03/plan-ukraine-facility.pdf (May 2024).

				20% of the funds will be dedicated to climate mitigation and adaptation, environmental protection, including the preservation of biodiversity, and the green transformation of Ukraine.	
Energy and climate	National Energy and Climate Plan	Developed by the dedicated inter-ministerial WG headed by the VM and Minister of Economy, adopted in 2024	No	It sets objectives and proposes measures to support Ukraine's compliance with its international climate commitments across several areas, such as decarbonisation, energy efficiency, energy market, and energy security. Among these areas is the research and innovation, which sets three objectives: development and financing of R&I in cleantech, renewable energy, and low-carbon production; promotion of clean and low-carbon technologies; and enhancing the competitiveness of Ukrainian clean and low-carbon tech. The draft Plan suggests measures aimed at addressing the skills gap for green transition and renewable energy through upgrading of educational programmes, ensuring grant financing for R&I in renewable energy and climate innovation, promotion of corporate investments in climate technologies and RES, and ensuring the competitiveness of Ukrainian economy while implementing the technical regulations to align with EU acquis. In the medium to longer term perspective, it is planned to boost VC funding for climate and RES innovations and develop the export of climate technologies and RES technologies. The modernization of the material and technical support base/ assets of scientific and educational institutions, which is used for the training of specialists in the field of energy, and the creation of international partnerships in this direction are put forward as important objectives.	To enhance access for R&I organisations to financing of activities related to climate mitigation and adaptation, the NECP highlights the opportunities available in the framework of "Horizon Europe", in particular under Pillar II focused on "climate, energy and mobility".

Funding of EGD-related R&D	Government Priority Activities Plan for 2024 [191]	Approved by the Cabinet of Ministers 16/02/2024	No	Contains measures on EU integration, digitalisation of public administration and services, energy independence (including introduction of guarantees on origin of electric energy produced from renewable sources and promotion of renewable energy, introduction of smart grids for energy efficiency, ensuring operation of energy efficiency programmes providing household grants, development of requirements for near-zero emissions buildings (NZEB), creation of database on energy and exploitation of buildings).Development of the and submission to the Cabinet of Ministers of draft order of the Cabinet Ministers of Ukraine regarding approval of the Integrated national energy and climate plan. **In the area of science and innovation**, development of the draft law "On support and development of innovative activity", provision of grants by the Ukrainian Start-Up fund along the priority areas for R&I, development of the proposal for experimental network of business incubators and- accelerators within universities and educational establishment to promote the development of technological start-ups. **In the area of climate change**, the priority is to develop a draft document on principles of the state policy in the area of climate change, development of the Action Plan on creation of a national system for GHGs trading quotas, alignment with the EU chemical products packaging, other EU Acquis in the area of environment protection (i.e., Annex I to Council Directive 91/676/EEC of 12 December 1991

[191] Кабінет міністрів Укпаїни (2024). *Кабінет Міністрів України - Про затвердження плану пріоритетних дій Уряду на 2024 рік,* https://www.kmu.gov.ua/npas/pro-zatverdzhennia-planu-priorytetnykh-dii-uriadu-na-2024-rik-137r-160224 (May 2024).

		on the protection of waters against pollution caused by nitrate pollution from agricultural sources).

Annex 2. EU approximation assessment for Ukraine *(Chapter 25 of the EU Association Agreement)*

Relevant EU legal document (only key directives and regulations relevant for the R&I area)	Existing national law	Planned national law (including drafted, but not adopted)	Status of transposition (fully, partially, not transposed)	Further steps in transposition	Competent Authority	Comments: issues/difficulties that can create problems for further transposition
Council Regulation (EC) No. 2100/94 of 27 July 1994 on Community plant variety rights; Commission Regulation (EC) No. 1238/95 of 31 May 1995 establishing implementing rules for the application of Council Regulation (EC) No 2100/94 as regards the fees payable to the Community Plant Variety Office.	Adopted on 16 November 2022	Law of Ukraine No. 2763-IX "On Amendments to Certain Legislative Acts of Ukraine on Bringing Legislation in the Field of Protection of Rights to Plant Varieties, Seed Production and Nurseries into Compliance with the Provisions of the European Union Acquis"	Fully transposed		Ministry of Education and Science	
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of	Adopted on 29 October 2010 and ratified by the Verkhovna Rada of Ukraine on 2 December 2021	Law of Ukraine "On Ratification of the Nagoya	Fully transposed			

Benefits Arising from their Utilization to the Convention on Biological Diversity		Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits"				
EU Directives 2019/1024 and 2018/790, in terms of placing in open access scientific results and scientific and technical information obtained during the implementation of fundamental and applied scientific research financed from the state budget, as well as harmonization of scientific and R&D terminology.	No.	Planned under the National Plan for Open Science (approved by the Cabinet of Ministers on 8 October 2022) Draft law on Amendments to some legislative acts of Ukraine regarding the implementation of the state policy on open science 2024	Not transposed	Development of the Draft Law, its adoption by the Verkhovna Rada	MoES, Ministry of Economy, and National Academy of Sciences (upon agreement)	
EU standards and norms for on application of the principles of proper management of scientific data (FAIR principles) and the use of optimized scientific data (FAIR data), their use in the process of conducting scientific research, which is	No	Planned under the National Plan for Open Science (approved by the Cabinet of Ministers on 8 October 2022)[192] Draft Law on Amendments to some legislative acts of Ukraine regarding the implementation of the state policy on open science 2026	Not transposed	Development of the draft law and its adoption by the Verkhovna Rada	MoES	

[192] *Про затвердження національного плану щодо відкритої науки* (2022). *Офіційний вебпортал парламенту України,* https://zakon.rada.gov.ua/go/892-2022-%D1%80 (May 2024).

financed from the state budget						
Principles of the European Citizen Science Association (ESCA)	No	Planned under the National Plan for Open Science (approved by the Cabinet of Ministers on 8 October 2022) Decree by the MoES on Action Plan to popularize science based on principles of ESCA for 2024-2030	Not transposed	Development of the relevant Action Plan and the decree by MoES on approving the Action Plan	MoES National Academy of Sciences (upon agreement)	