



European  
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# ERA Country Report 2023

## Hungary



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Report

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## **ERA Country Report 2023: Hungary**

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# **ERA Country Report 2023**

## **Hungary**

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# ERA COUNTRY REPORT 2023: HUNGARY

## Key takeaways:

- National priorities relevant to the ERA Actions are outlined in the National Research, Development, and Innovation Strategy 2021-2030.
- Hungary is considered a Moderate Innovator, according to the European Innovation Scoreboard 2023 (EIS).
- The main R&I funding instruments are the European Structural and Investment Funds (i.e. European Social Fund, European Regional Development Fund, etc...), Horizon Europe, the national NRD Fund, and the Recovery and Resilience Plan.
- Hungary has particularly progressed in open science, business-research collaboration, and the number of researchers working in the country, while challenges remain regarding academic freedom and R&I expenditure in the public sector.

## 1. National context

### 1.1. Overview of the ERA policy agenda implementation

According to the European Innovation Scoreboard, Hungary belongs to the group of **'Moderate Innovators'** in 2023, with a performance of 70.4%. Compared to the EU average, Hungary has lower per capita income but a faster growing economy with a high share of non-innovators with the potential to innovate.<sup>1</sup>

Hungary has committed to 14 out of 17 ERA actions, which implementation is supported by national strategies, including the **National Research, Development, and Innovation Strategy 2021-2030 (NRDI Strategy)**, and the **National Smart Specialisation Strategy 2021-2027 (S3 Strategy)**. The NRD Strategy defined three overarching objectives of innovation policy in Hungary beyond 2021: (1) Increasing the practical use of research results of state research organisations (i.e., research institutes and HEIs); (2) Improving the innovation performance of domestic enterprises, particularly SMEs and (3) Strengthening cooperation between stakeholders of the research, development and innovation ecosystem (i.e., research, academia and business). Most recently, the Ministry of Culture and Innovation launched the country's innovation strategy, the **John von Neumann Program 2023**, which identifies 4 key areas to focus the country's resources on: 1) Digital transformation of economy and society, 2) Healthy living, 3) Green transition and circular economy, and 4) Security and defence. The Program focuses on building linkages with universities, research institutions and economic actors.

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<sup>1</sup> 'European Innovation Scoreboard' on the European Commission website, available at [https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard\\_en](https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en).

## 1.2. Policy context

The policy coordination of Hungary's R&I strategy for 2021 and 2027 lies with the **Ministry of Culture and Innovation**. Since 2014, the **National Research, Development and Innovation Office** (NRDI Office) has supported the monitoring of policy implementation (by collecting and analysing relevant data) and the providing innovation services.<sup>2</sup> The NRDI Office has also developed a unified competitive tender system, which provides infrastructure for the use of EU (i.e., European Social Fund (ESF), Recovery and Resilience Facility (RRF)) and national funding sources. As outlined in the S3 strategy, the NRDI Office coordinates the implementation of regional (e.g. knowledge-regions, industrial regions) and national specialisation objectives (e.g. intelligent manufacturing) as well as sectoral (e.g. renewable energy) and horizontal priorities (e.g. sustainable society).<sup>3</sup>

Moreover, in July 2023, the **National Innovation Agency (Nemzeti Innovációs Ügynökség)** was created as a service-provider agency responsible for the validation of innovative projects, and the measurement, monitoring and impact assessment in the R&I sector, among others. In addition to a centrally coordinated R&I policy, since 2019, **Territorial Innovation Platforms**<sup>4</sup> (TIP) has played a role in bringing together local and international stakeholders of the innovation ecosystem. The initiative is supported by several Hungarian universities and national stakeholders, such as social partners and the civil society.

## 2. Assessment of the Implementation of the ERA Policy Agenda and ERA Priorities

This section presents an overview of relevant national policies and initiatives in order to assess Hungary's implementation of the ERA Policy Agenda related to the 14 ERA Actions it has committed to.<sup>5</sup> Information presented in this section is based on data gathered through the OECD STIP Survey, information available on the website of the National Research, Development and Innovation Office and other national sources as well as EU-level comparative and country reports, e.g. European Semester Reports, European Innovation Scoreboard. In addition, quantitative data included in the analysis are based on the ERA Scoreboard and Dashboard indicators.<sup>6</sup> Figures described throughout this section are included in Annex 1.

The quantitative information presents the most recent data available for the ERA Scoreboard and Dashboard indicators, for which the longer-term trends covering the last ten years are presented. More detailed information on the data and graphs can be found in Annex 1. This report will serve as a baseline for reporting in the future.

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<sup>2</sup> Hungary's Research, Development and Innovation Strategy 2021-2031.

<sup>3</sup> Planning for calls for funding the NRDI Office website, available at: <https://nkfih.gov.hu/hivatalrol/kfi-szakpolitikai/versenypalyazati>.

<sup>4</sup> Territorial Innovation Platforms on the NRDI Office website, available at: <https://nkfih.gov.hu/palyazoknak/innovacios-okosizsztema/teruleti-innovacios>.

<sup>5</sup> European Commission (2021). European Research Area Policy Agenda, available at: [https://research-and-innovation.ec.europa.eu/system/files/2021-11/ec\\_rtd\\_era-policy-agenda-2021.pdf](https://research-and-innovation.ec.europa.eu/system/files/2021-11/ec_rtd_era-policy-agenda-2021.pdf).

<sup>6</sup> See <https://european-research-area.ec.europa.eu/era-monitoring-reports>.

**Table 1. General ERA Scoreboard and ERA Dashboard indicators<sup>7</sup>**

Indicator	Most recent EU average	Most Recent Metric
Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP	2.26 (2021)	1.65 (2021)
Government Budget Allocations for R&D (GBARD) as a share of GDP	0.76 (2021)	0.45 (2021)
Researchers (in full-time equivalent) per million inhabitants	4,483.4 (2021)	4,452.3 (2021)
Business Enterprise expenditure on R&D (BERD) as a percentage of GDP	1.49 (2021)	1.2 (2021)

Source: compiled by research team based on the ERA Scoreboard and ERA Dashboard indicators.

## 2.1. ERA Priority 1: Deepening a truly functional internal market for knowledge

### 2.1.1. State of play in the implementation of the ERA Actions

In relation to the **ERA Action 1: Enable Open Science, including through the European Open Science Cloud (EOSC)**, Hungary established a **National Open Science Advisory Board** in 2021. Since then, the Board has published a national position paper on Open Science, supported by the government and several other Hungarian universities, committing to practices that ensure open access and FAIR information systems and repositories in line with the EOSC, including the **Electronic Information Service National Program**.<sup>8</sup> In addition, **Hungary's Artificial Intelligence Strategy**<sup>9</sup> (2020) and **National Digitalisation Strategy**<sup>10</sup> (2022) support open access to data in several domains, including the health sector, education, public administration and start-ups.

Hungary has also implemented several projects and partnerships that facilitate the collaboration of public and private R&I actors. Under the **National Laboratories Programme**,<sup>11</sup> scientific knowledge-hubs foster collaboration between various actors of the R&I ecosystem (e.g., researchers, business) in fields that are particularly promising for the national economy and align with the challenges of the 21<sup>st</sup> century. For example, the **Artificial Intelligence National Laboratory (MILAB)** aims to act as a coordinating body between the AI research scene, businesses and the international research community, including Hungarian researchers working abroad. Partnerships are also facilitated by **Territorial Innovation Platforms**, aiming to connect HEIs and local actors of the innovation ecosystem, and providing them with innovation services, research infrastructure, or resources.

<sup>7</sup> Further information on the trends can be found in Annex 1

<sup>8</sup> Position paper on open science on the NRDI Office website, available at: <https://nkfih.gov.hu/nyilt-tudomany>.

<sup>9</sup> Hungary's Artificial Intelligence Strategy 2020-2030. Available at: <https://ai-hungary.com/api/v1/companies/15/files/137203/view>.

<sup>10</sup> National Digitalisation Strategy 2022-2030, available at: <https://cdn.kormany.hu/uploads/document/6/60/602/60242669c9f12756a2b104f8295b866a8bb8f684.pdf>.

<sup>11</sup> National laboratories on the NRDI Office website, available at: <https://nkfih.gov.hu/nemzeti-laboratoriumok-program>.

Relevant to **ERA Action 2: Propose an EU copyright and data legislative and regulatory framework fit for research**, in Hungary there is a **National Intellectual Property Council**<sup>12</sup> which acts as a professional advisory body assisting the President of the Hungarian Intellectual Property Office. The Council delivers opinions on draft measures (i.e., EU legal provisions) and participates in the elaboration of the national strategy on intellectual property protection, as well as monitor and facilitate its implementation.

Regarding **ERA Action 3: Reform the Assessment System for research, researchers and institutions**, according to the **Government Decree No. 344/2019. (XII.23)**<sup>13</sup>, the NRD Office is responsible for providing methodological assistance for the collection of statistical data on research, development, and innovation and for establishing indicators to be used for evaluation of research proposals. Moreover, the country has set up a **Health Science Advisory Board**<sup>14</sup> and a **Defence Innovation Board**<sup>15</sup>. In addition, three Advisory Boards were set up in the framework of the John von Neumann Programme in three focus areas: healthy living, green transition and development of circular economy and digital transition of the economy and society. However, information on how research quality is assessed within these groups could not be identified as part of this research.

As regards **ERA Action 4: Promote attractive research careers, talent circulation and mobility**, the country has implemented several initiatives to support international, transdisciplinary and intersectoral mobility. For example, the Ministry of Culture and Innovation launched a **Cooperative Doctoral Programme**<sup>16</sup> in 2020, aiming to further increase the number of researchers in the field of STEM (Science, Technology, Engineering and Mathematics). The programme provides support to those who, in addition to their doctoral student status, carry out research work in other workplaces that promote the practical utilisation of their scientific results. Research excellence is also supported through the **Research Excellence Council**, which is responsible for preparing research excellence funding calls targeted at researchers. Another initiative is the **Hungarian Startup University Program**<sup>17</sup> which is the first course of its kind in the country and can be taken for up to two semesters by students across several universities. Recent funding programmes include, for example, **'Internship programmes for Hungarian students studying abroad'**<sup>18</sup> available for those who participate in research, development and innovation activities of businesses or research organisations in the United Kingdom, Germany, the Netherlands, Austria, Denmark and France. Additionally, in 2024 the Hungarian government has decided to increase the funding for excellence-based research projects, going from HUF 13,5 billion to HUF 19 billion.

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<sup>12</sup> Intellectual Property National Council/Intellectual Property National Office. Available at: <https://www.sztnh.gov.hu/hu/sztnh/szellemi-tulajdon-vedelmi-testulek/szellemi-tulajdon-nemzeti-tanacs>.

<sup>13</sup> Government Decree 344/2019 of 23 December on the National Research, Development and Innovation Office and on the appointment of the managing body of the National Research, Development and Innovation Fund, available at: <https://net.jogtar.hu/jogszabaly?docid=a1900344.kor>.

<sup>14</sup> 'Health Sciences Expert Board' on the NRD Office website, available at: <https://nkfi.gov.hu/english-2017/assessment-bodies/health-sciences-expert-board>.

<sup>15</sup> 'Defence Innovation Board' on the NRD Office website, available at: <https://nkfi.gov.hu/english-2017/assessment-bodies/defence-innovation-board>.

<sup>16</sup> 'Cooperative Doctoral Programme' on the NRD Office website, available at: <https://nkfi.gov.hu/english/open-calls/nrdi-fund/cooperative-doctoral-programme-kdp-2021/call-for-applications#:~:text=The%20Cooperative%20Doctoral%20Programme%20aims,of%20their%20expertise%20to%20the>.

<sup>17</sup> 'Hungarian Startup University Program' on the NRD Office website, available at: <https://hsup.nkfi.gov.hu/>.

<sup>18</sup> Support for summer internships of Hungarian students pursuing university studies abroad on the NRD Office website, available at: <https://nkfi.gov.hu/palyazoknak/nkfi-alap/egyetem-tanulmanyokat-kulfoldon-folytato-magyar-hallgato-nyari-gyakorlata-2022-123-gyak/palyazati-felhivas>.



With regard to **ERA Action 6: *Protect academic freedom in Europe***, the mission of the **Hungarian Research Network**<sup>19</sup> (former *Eötvös Loránd Research Network*) was established in 2019 is to operate Hungary's publicly funded research network. The network comprises of 11 research centres, 7 research institutes and 116 additional supported research groups operating at universities and other public institutions in various disciplines. The activity of HUN-REN is in accordance with the common principles stated in the Bonn Declaration on the European Research Area adopted in Bonn on 20 October 2020. The network is led by a Governing Board, the President of which is appointed by the Prime Minister based on the mutual recommendation of the MTA President and the minister responsible for science policy coordination.<sup>20</sup>

As regards **ERA Action 7: *Upgrade EU guidance for a better knowledge valorisation***, the NRDI Office launched a programme for '**Fostering participation in international cooperations**'<sup>21</sup> which aims to support the participation of Hungarian undertakings in international programmes (i.e., EUREKA, EUROSTARS) that facilitate the international R&I cooperation in SMEs. By supporting close-to-the-market projects, the initiative helps the development of prototypes, new products or services that ensure the practical use of scientific knowledge. Recently, Hungary's NRDI Office participated in the Horizon 2020 GO-SME project, the aim of which was to share best practices of participating research funding organisations (RFOs) in designing national and regional programmes which support innovative SMEs and start-ups in an initial assessment of their ideas so that they can progress to more advanced stages of innovation development. The project was selected as a best practice example in 2021.<sup>22</sup> Another highly relevant initiative is the establishment of eight **Higher Education and Industry Centres** (FIEKs)<sup>23</sup> between 2017 and 2021. FIEKs demonstrated well established cooperation between science and industry through the development of construction of laboratories supporting company needs.<sup>24</sup> The NRDI Fund's Programme Strategy for 2024 introduces supports measures on university and research collaboration and supports start-ups which grow out of research results in universities (Spin-off Program).<sup>25</sup> Finally, Hungary has been actively participating in relevant EU initiatives (e.g.: Mutual Learning Exercise on Knowledge Valorisation and the event of Multilateral Dialogue on Principles and Values in International Research and Innovation Cooperation Workshop on Knowledge Valorisation).

With regard to **ERA Action 8: *Strengthen research infrastructures*** several initiatives were implemented. In 2018, the **National Research Infrastructure Roadmap**<sup>26</sup> identified research and development needs in the country and presented the current situation of

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<sup>19</sup> Website of the Hungarian Research Network (Magyar Kutatási Hálózat), available at: <https://hun-ren.hu/en>.

<sup>20</sup> 'Governing Board' on the website of the Hungarian Research Network, available at: <https://hun-ren.hu/en/about-hun-ren/governing-board>.

<sup>21</sup> 'Az EUREKA programban való magyar részvétel támogatása' (Support for Hungarian participation in the EUREKA program) on the NRDI Office website, available at: <https://nkfih.gov.hu/palyazoknak/nkfi-alap/eureka-programban-valo-magyar-reszvetel-tamogatasa-2022-124-eureka/palyazati-felhivas>.

<sup>22</sup> 'Sharing the best practices of research funding organisations' on the website of the European Commission, available at: <https://ec.europa.eu/research-and-innovation/en/research-area/industrial-research-and-innovation/eu-valorisation-policy/knowledge-valorisation-platform/repository/sharing-best-practices-research-funding-organisations>.

<sup>23</sup> See, for example: Budapest University of Technology and Economics, Siemens, Richter Gedeon, Nokia, MVM Group, available at: <https://fiek.bme.hu/>.

<sup>24</sup> European Commission (2023). European Semester Country Report – Hungary.

<sup>25</sup> Kulturális és Innovációs Minisztérium (2024), A nemzeti kutatási, fejlesztési és innovációs alap 2024. évi programstratégiája (The NRDI Fund's Programme Strategy 2024), available at: <https://nkfih.gov.hu/hivatalrol/hivatal-hirei/kihirdettek-nkfi-alap-2024-es-programstrategiajat>.

<sup>26</sup> 'Nemzeti Kutatási Infrastruktúra Útiterv' (National Research Infrastructure Roadmap) on the NRDI Office website, available at: <https://nkfih.gov.hu/hivatalrol/strategia-alkotas/nemzeti-kutatasi-infrastruktura-utiterv>.

domestic research infrastructures and their connection to major international research infrastructures. Since 2021, the NRD Office is also implementing a **monitoring system** to have updated information on Hungary's memberships in international research infrastructures. In parallel with this activity, a nationwide survey was launched to identify the TOP 50 national research infrastructures in Hungary with international strategic relevance.<sup>27</sup> Over the last years, Hungary has joined several international research infrastructure ecosystems, e.g., BBMRI ERIC, ICOS ERIC, EuPRAXIA, GUIDE (EuroCohort).<sup>28</sup> In order to boost international cooperation, Hungary is also implementing the scheme called '**Supporting the use of international and national research infrastructures**'<sup>29</sup> which reimburses costs of outgoing and incoming international researchers, PhD, or MSc students related to the use of international research infrastructures. Supported costs also include the dissemination of research results achieved in the project and participation in international conferences. Furthermore, Hungary is part of the **Extreme Light Infrastructure (ELI)**, an international infrastructure investigating the interaction between light and matter.<sup>30</sup> It is developed in a programme of trans-European collaboration with the scientific community at a worldwide level.

In relation to **ERA 9: Promote international cooperation**, an existing initiative important to mention is the **Network of Science & Technology (S&T) attachés**, whose responsibility is to nurture intergovernmental S&T relations with key partner countries, including those outside the EU (e.g. UK, US, China, Japan, etc...). Attachés are responsible for promoting the Hungarian scientific results and to monitor partner countries' policies and achievements, among other responsibilities.<sup>31</sup> Similarly, Hungary cooperates with Austria and Slovenia on the **ZalaZone self-driving test track**, an initiative that works on the development of new technologies with a main focus on self-driving and electric vehicles.<sup>32</sup>

### 2.1.2. Progress towards achieving ERA Priorities

With regard to progress towards **Sub-priority 1.1: Open science**, the indicator **share of publications available in open access** in Hungary almost doubled in the past ten years. In 2019, more than 50% of publications were published with open access, well above the EU-27 average of around 35% (Figure 5 in Annex 1). In addition, in March 2023, an EOSC national tripartite event took place with the participation of the European Commission, EOSC Association and EOSC Board as well as representatives of the Hungarian OS community.

Related to **Sub-priority 1.2: Research infrastructures**, the **share of national public R&D expenditure allocated to European research infrastructures 2022** for Hungary is of 4.73%, surpassing considerably the EU average.<sup>33</sup> Moreover, the **number of European**

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<sup>27</sup> 'TOP Research Infrastructures in Hungary 2021' on the NRD Office website, available at: <https://nkfih.gov.hu/english/top-rife-hungary2021>.

<sup>28</sup> 'Magyarország az európai kutatási infrastruktúra térképén - nemzetközi csúcstalálkozó Budapesten' (Hungary on the European research infrastructure map - international summit in Budapest) on the NRD Office website, available at: <https://nkfih.gov.hu/hivatalrol/hivatal-hirei/magyarorszag-europai>.

<sup>29</sup> 'Support to utilise international research infrastructures' on the NRD Office website, available at: <https://nkfih.gov.hu/english/nrdi-fund/support-for-the-use-of-international-national-research-infrastructures-2021-412-nemz-ki/call-for-applications>.

<sup>30</sup> Extreme Light Infrastructure. ELI. <https://eli-laser.eu>

<sup>31</sup> Bilateral Scientific and technology (S&T) relations. NRD Office. <https://nkfih.gov.hu/hivatalrol/ketoldalukapcsolatok/ketoldalutudomanyos>.

<sup>32</sup> ZalaZone self-driving test track. Agreement between Hungary, Austria and Slovenia. <https://avlzalazone.com/>

<sup>33</sup> The EU average for this indicator is calculated considering the contributions of the 15 EU Member States for which data is available, which includes: Belgium, Bulgaria, Spain, France, Greece, Hungary, Italy, Latvia,

**research infrastructures (RI) in which Hungary participated** (financially contributed to operations) in 2021 was 15 which is just slightly below the EU-27 average in the same year (Figure 6 in Annex 1).

Related to **Sub-priority 1.3: Gender equality, equal opportunities for all and inclusiveness**, the **proportion of women among doctoral graduates by narrow fields of STEM** was 45% in 2020, which is the same as the EU-27 results (Figure 8 in Annex 1). However, when it comes to the **share of women in grade A positions in higher education institutions**, the country has been consistently performing below the EU-27 average (22% compared to 26% in 2018) (Figure 7 in Annex 1). While the **proportion of papers with mixed gender authorship** has been gradually increasing since 2010, this remains 7 percentage points below the EU-27 results of 62.5% (Figure 9 in Annex 1). The **proportion of women in authorship of the 10% most cited publications** has improved over the last ten years, reaching the EU-27 average of 32% in 2018 (Figure 10 in Annex 1). Nevertheless, in 2022, the **Women in Digital Index** (assessing Member States' performance in the areas of internet use, internet user skills, specialist skills and employment based on 12 indicators) was 49% as opposed to 54.86% in the EU-27 (Figure 11 in Annex 1).

Hungary has made progress towards **Sub-priority 1.4: Researchers' careers and mobility and research assessment and reward systems**. The **share of foreign doctorate students as a percentage of all doctorate students** has increased 5 percentage points since 2018 and reached an overall 25% in 2020, just above the EU-27 average (Figure 12 in Annex 1). While the **number of new doctorate graduates per 1,000 inhabitants aged 25-34** has increased to around 0.4% in 2021, this remains below the EU-27 average of 0.8% (Figure 13 in Annex 1). In terms of **job-to-job mobility of human resources in Science and Technology**, Hungary has achieved a significant improvement between 2018 (5%) and 2020 (6.7%), when it almost reached the EU-27 average of 6.8%. However, this is also due to a slight decrease in the EU-27 results (Figure 14 in Annex 1).

Regarding **Sub-priority 1.5: Knowledge valorisation**, the indicator **share of public-private co-publications** doubled between 2011 and 2021 when it registered 154, above the EU-27 average of 134 (Figure 15 in Annex 1). The **number of PCT patent applications divided by GDP in million Euros** has remained relatively stable along with the EU-27 average of 0.0025 (Figure 16 in Annex 1). The percentage of **business enterprise researchers in full-time equivalent per thousand employees in industry** has slightly increased since 2018, and closed the gap with EU-27 results with an increase to 30% in Hungary in 2020. The percentage of **business enterprise researchers percentage of the national researchers** has been slightly increasing since 2018 and is slightly above EU-27 average, with 58.5% in 2020 (Figure 17 in Annex 1). The number of business enterprise researchers (in FTE) employed in the industry was the same as the EU-27 average (5 per 1000) (Figure 18 in Annex 1). Finally, the **share of innovative firms collaborating with higher education institutions or public/private research institutions** nationally has also been stable and in 2020 was the same as the EU-27 average with around 12.5% (Figure 19 in Annex 1).

In relation to **Sub-priority 1.6: Scientific leadership**, the **Academic Freedom Index (AFI)** in Hungary has been decreasing over the years from around 0.7 in 2010 to around 0.3 in 2022. The EU average remained around 0.85 (Figure 21 in Annex 1). The **number of publications among the top-10% most cited publications worldwide** has shown a slightly upward trend

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Malta, The Netherlands, Poland, Portugal, Romania, Slovenia and Slovakia. In addition, the data is also available for two Associated Countries: Iceland and Norway.

between 2016 and 2019, with around 6% in 2019, as opposed to a stable trend in the EU-27 around 10%, which was the EU-27 average in the same period (Figure 20 in Annex 1).

With regard to **Sub-priority 1.7: Global engagement**, the country has been performing well below the EU-27 average in the **number of international co-publications with non-EU partners per 1,000 researchers in the public sector**, which has increased from 382 in 2010 to 757 in 2022, as opposed to the EU-27 average of 1278 in 2021 (Figure 22 in Annex 1). Data regarding the **number of European and international co-patenting in EPO applications** is only available between 2010 and 2013, according to which the country was still behind other EU-27 countries (Figure 23 in Annex 1).

## 2.2. ERA Priority 2: Taking up together the challenges posed by the twin green and digital transition and increasing society's participation in the ERA

### 2.2.1. State of play in the implementation of the ERA Actions

With regard to **ERA Action 10: Make EU research and innovation missions and partnerships key contributors to the ERA**, there are several calls that foster Hungarian participation in European and international **Horizon Europe, ERA-NET, EJP COFUND, Key Digital Technologies and EUROSTARS initiatives**.<sup>34</sup> These currently open (or recently closed) calls provide national funding to Hungarian organisations, including non-profit organisations, and SMEs participating in the above mentioned programs with the objective of strengthening strategic partnerships, providing access to partnerships' networks, capacity building and gaining expertise in applying for Horizon Europe calls. The calls provide funding in relation to initiatives as part of the five established missions (i.e., cancer, climate resilience, oceans and waters, smart cities and soil) e.g. Biodiversa+, Water4All, Clean Energy Transition Partnership, TRANSCAN3, etc.

While Hungary has not committed to **ERA Actions 11: An ERA for green energy transformation** and **ERA Action 12: Accelerate the green/digital transition of Europe's key industrial ecosystems**. However, the country has implemented some initiatives in this regard. The **John von Neumann Programme** is a strategic action developed by the Ministry of Culture and Innovation of Hungary.<sup>35</sup> Published in 2023, it focuses the resources for research and innovation in three main areas: the digital transformation, healthy living, and the green transition or circular economy. In addition, it also mentions the importance of security and defence in the R&I environment. Moreover, the **National Smart Specialisation Strategy** and several recently published strategic policy documents (e.g., National Energy Strategy 2030, National Energy and Climate plan) include relevant objectives. These are, for example, the stability and resilience of power grids through innovation or conducting research and preparatory tasks to promote the uptake of alternative (electric, hydrogen) vehicle propulsion in Hungary. The Hungarian **Recovery and Resilience Plan (RRP)** includes comprehensive measures on renewable energy and digital transformation of the economy. According to the European Semester Report in 2023, however, the green transition is partly slowed by policies focusing on industrialisation and cheap energy from fossil fuels.<sup>36</sup>

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<sup>34</sup> 'Open calls for proposals on the NRDI Office website, available at: <https://www.horizonteuropa.nkfi.gov.hu/palyazas/aktualis-felhivasok-211209?save=1&cimke=he1>.

<sup>35</sup> Government of Hungary (2023). John von Neumann Programme. <https://www.nkfi.gov.hu/english/news-of-the-office/parliament-adopts-the-neumann-janos-programme>

<sup>36</sup> European Commission (2023). European Semester Country Report – Hungary.

Hungary has provided several funding opportunities for higher education institutions in line with **ERA Action 13: Empower higher education institutions**. One example is the **Thematic Excellence Program**<sup>37</sup> (2021) of the NRD Office, which provides funding for university knowledge centres and research centres for development and innovation activities until the end of 2025. Moreover, the **New National Excellence Program**<sup>38</sup> aims to enhance innovation in HEIs by supporting researchers (e.g., funding new researchers, employing researchers from other countries, or sustaining the support for existing research teams), and fostering multi- and inter-disciplinary research programmes. Another example is the **Hungarian Startup University Programme**,<sup>39</sup> an e-learning course aiming to promote innovation among university students. The programme also helps to foster a cultural shift towards a more innovational mindset, while aiming to revitalise inactive startups and guide innovative SMEs towards the startup sphere. This is facilitated by an annual startup event. National Laboratories (as described under ERA Action 1) and Science Parks set up in universities serve as scientific hubs for higher education institutions, strengthening their role in knowledge transfer in the Hungarian innovation ecosystem.

In relation to **ERA Action 14: Bring science closer to citizens**, an important achievement is the first **Hungarian Citizen Science open mailing list** which was created as a result of a two-day Policy Support Facility Mutual Learning Exercise (PSF MLE) which was held in Hungary between 11-13 September 2022, and hosted by the NRD Office and co-organised by the University of Pannonia and Eötvös Loránd University. This will in the future serve as a professional forum to inform recipients about news, events and calls for proposals related to citizen science. The workshop also highlighted several ongoing citizen science initiatives which are coordinated by Hungarian universities and research institutions.<sup>40</sup> For example, as part of the Lake Balaton Monitoring project of the Budapest University of Technology and Economics, citizens are asked to report on unusual environmental events on the lake through photos, which are further analysed by the university. The new data and the corresponding analysis are made public, and the ecological map of Lake Balaton is updated. Moreover, the new National Innovation Agency is a partner of the Plastic Pirates EU-wide campaign, which involves school classes and youth groups in the collection of plastic waste, as well as research on the pollution of bodies of water.<sup>41</sup>

### 2.2.2. Progress towards achieving ERA Priorities

Concerning **Sub-priority 2.1: Challenge-based ERA actions** the country's progress is reflected in the **Government budget allocations for R&D (GBARD)** in energy; environment; transport, and telecommunications and other infrastructure. Evidence shows that expenditure in these areas is well below the EU-27 average (Figure 24 in Annex 1). **R&I investments allocated to Europewide transnational, bilateral or multilateral, public R&I programmes per FTE researcher in the public sector** have also been significantly below the EU-27 average in 2010-2020 with around EUR 200 million as opposed to EUR 2,000 million across the EU-27 (Figure 25 in Annex 1). The **number of national public and private investments** as suggested in the SET PLAN progress report 2021 have also been slightly decreasing in the last decade, except for a peak in 2017 (Figure 27 in Annex 1). On the other hand, the

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<sup>37</sup> 'Thematic Excellence Program 2021' on the NRD Office website, available at: <https://nkfih.gov.hu/palyazoknak/nkfi-alap/temateruleti-kivalosagi-program-tpk2021>.

<sup>38</sup> New National Excellence Programme on the NRD Office website, available at: <https://nkfih.gov.hu/palyazoknak/nkfi-alap/unkp-23-tamogatott-intezmenyek>.

<sup>39</sup> 'Hungarian Startup University Program'.

<sup>40</sup> 'The first nationwide Citizen Science collaboration network has been created' (Létrejött az első országos szintű Citizen Science együttműködési hálózat) on the NRD Office website, available at: <https://nkfih.gov.hu/english/news-of-the-office/the-first-nationwide-citizen-science-collaboration-network>.

<sup>41</sup> 'Partners' on the Plastic Pirates website, available at: <https://www.plastic-pirates.eu/en/about>.

**Hungarian government's environmentally related R&I budget as percentage of total R&I** spending has doubled between 2018 and 2020, reaching above 4% compared to just above 2% in the EU-27 (Figure 26 in Annex 1). The **number of OECD patents on environmental technologies** show on average over the years a stable trend since 2010 (Figure 28 in Annex 1).

While data regarding **Sub-priority 2.2: Synergies with education and the European Skills Agenda** is only available for 2016 and 2019, Hungary has been performing well in terms of the **share of researchers receiving transferable skills training**, which was nearly 75% in 2019, well above the EU-27 average of below 50% (Figure 29 in Annex 1).

As regards **Sub-priority 2.3: Synergies with sectorial policies and industrial policy, in order to boost innovation ecosystems**, Hungary has increased its performance in recent years. The **direct government support and indirect government support through R&I tax incentives as a percentage of GDP** has been gradually increasing between 2016 and 2018, however, has stagnated since then. Nevertheless, the country's result was just above 0.2% in 2020 which is slightly higher than EU-27 average (Figure 30 in Annex 1).

Finally, related to **Sub-priority 2.4: An active citizen and societal engagement in R&I in all its dimensions**, the **trust in science** indicator shows that in 2021 this was over 50%, around ten percentage points higher than in the EU-27 on average (Figure 31 in Annex 1). However, **research on social innovation** (publications on 'social innovation' or 'social entrepreneurship') **per million population** has remained under EU-27 average. While there was a slight increase between 2018 and 2020, it decreased in 2021. This decline is in line with EU trends, which saw a drop in the same year (Figure 32 in Annex 1).

## **2.3. ERA Priority 3: Amplifying access to research and innovation excellence across the Union**

### *2.3.1. State of play in the implementation of the ERA Actions*

As part of **ERA Action 16: Improve EU-wide access to excellence**, the objective to better integrate researchers in smart specialisation strategies in cooperation with industry was achieved in relation to Hungary's S3 strategy (2021-2027). Its objectives were defined through the **Entrepreneurial Discovery Process** (EDP), which ensured the bottom-up participation of different actors, including of local businesses, entrepreneurs, and members of the civil society.<sup>42</sup>

This is implemented through funding models which increasingly reward performance, e.g. in international cooperation or in value creation. **Knowledge Transfer Offices** at universities are funded structurally by the Regions, providing structural support to capacity in research management and knowledge valorisation.

While previous actions in relation to **ERA Action 17: Enhance the strategic capacity of Europe's public research performing organisations** were not identified, the NRD Office has organised an event on 28 November 2023 which was titled **'What are the key trends in the European Research Area? Professional support for Hungarian research excellence.'** The event touched upon the role of research managers, and current trends and directions of the research manager profession. The event also launched the Hungarian Research Management Community's Operative Group as well as a research management toolbox

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<sup>42</sup> European Commission (2023). European Semester Country Report – Hungary.

offering practical support for Hungarian research institutions to build their capacity in line with the ERA policy agenda.<sup>43</sup>

### 2.3.2. *Progress towards achieving ERA Priorities*

Regarding **Sub-priority 3.1: More investments and reforms in countries and regions with lower R&I performance** the indicator **increase (in percentage points) of total R&I expenditure expressed as a percentage of GDP** shows mixed trends in recent years. A drop from 2018 to 2019 (-0.25) was followed by a slight increase in 2020 (0.12), then a decrease in 2021 (-0.07). In 2021, spending in Hungary was slightly above the EU-27 average in this respect (Figure 33 in Annex 1).

## 2.4. ERA Priority 4: Advancing concerted research and innovation investments and reforms

### 2.4.1. *State of play in the implementation of the ERA Actions*

In relation to **ERA Action 19: Establish an ERA monitoring system**, the **Open Science Advisory Board**, which consists of 11 research institutions is responsible for developing a methodology for providing national-level information to the European Commission, including good practices related to the practical expansion of open science in Hungary. In addition, the newly established **National Innovation Agency** is tasked to conduct measurement, monitoring, and impact assessment in the R&I field in the country.

### 2.4.2. *Progress towards achieving ERA Priorities*

In relation to **Sub-priority 4.1: Coordination of R&I investments**, the **share of public R&I expenditures financed by the private sector** shows a gradually decreasing trend. Public expenditure dropped by six percentage points between 2016 and 2021. During the same period, the EU-27 average share of public R&I expenditures financed by the private sector has remained stable at 8% (Figure 34 in Annex 1).

## 3. Country-specific drivers and barriers

Over the last couple of years, Hungary has shown improvement regarding its performance on R&I policies, which has resulted in the country joining the group of 'Moderate Innovators' in the EU, according to the European Innovation Scoreboard. Initiatives and data reviewed for this analysis demonstrate that promoting **strong collaboration between higher education institutions and the public sector** both on national and regional levels (e.g. National Laboratories, TIPs) as well as the **promotion of entrepreneurial activity** (e.g. Hungarian Startup University Program) have led to positive public-private linkages. This is demonstrated by the high share of public-private co-publications and the slightly increasing number of business enterprise researchers working in the industry.

However, businesses still do not systemically seek cooperation with research organisations, which is also demonstrated by the **low private funding of R&I activities. Public expenditure on R&I financed by business enterprises** (national) as a percentage of GDP is among the EU's lowest. Moreover, the decreasing trend of patent applications in Hungary

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<sup>43</sup> What are the key trends in the European Research Area? Professional support for research excellence. <https://nkfih.gov.hu/hivatalrol/hivatal-rendezvenyei/merre-mutatnak-europai-kutatasi-terseg-trendjei>.

shows that while the innovation potential is high, foreign firms tend to repatriate results away from Hungary back to headquarters. According to the European Semester Report 2023, there is also a **shortage of skilled workers**, which, together with “the reduced academic freedom of universities [...] is having a negative impact on R&D activity.”<sup>44</sup>

#### 4. Final remarks

Hungary has demonstrated its commitment towards the ERA Policy Agenda through engaging in a high number of actions. While the country does not have a specific national plan to deliver the ERA, Hungary's Research, Development and Innovation Strategy 2021-2030 and National Smart Specialisation Strategy 2021-2027 present its approach to knowledge development, transfer and valorisation.

Overall, related to most ERA Dashboard indicators, Hungary has been performing at around the EU average. Nevertheless, the country performed above-average in certain areas, such as the implementation of Open Science principles and the relatively high share of public-private scientific co-publications in the country, almost double the EU-average. Hungary has also performed well in terms of international cooperation, indicated by the high share of foreign doctorate students in the country and the number of international co-publications with non-EU partners in the public sector.

Nonetheless, the analysis has also identified some challenges. Although the country is attractive to foreign researchers, academic freedom could still be improved. Similarly, the evidence shows a general decrease in the R&I expenditure from both the public and private sectors. Moreover, areas such as global engagement or social innovation have slightly improved but are still below the EU-27 average.

In this sense, to achieve the government's ambitious goal of becoming one of the top innovators in Europe by 2030 and improving its contribution to the ERA Policy Agenda, further efforts are needed to improve the country's R&I position.

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<sup>44</sup> European Commission (2023). European Semester Country Report – Hungary, p. 18.



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## 6. Annexes

### 6.1. Annex 1: Graphs

The 2023 ERA Scoreboard and Dashboard indicators used in the country report are presented in this annex. Detailed information on the data sources, description of the indicators, time period for which the data is available, and the necessary calculations can be found in the ERA Scoreboard and Dashboard Methodology Report. The most recent available data for each indicator has been used.

#### General Indicators

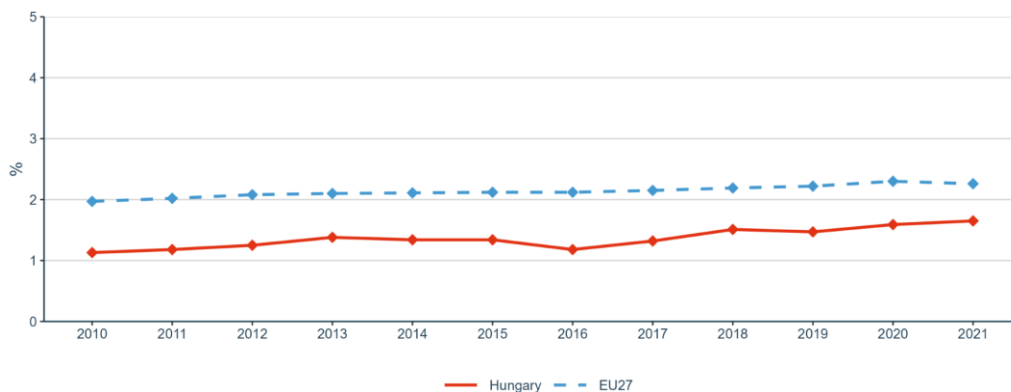


Figure 1: Gross Domestic Expenditure on R&I (GERD) as a percentage of GDP

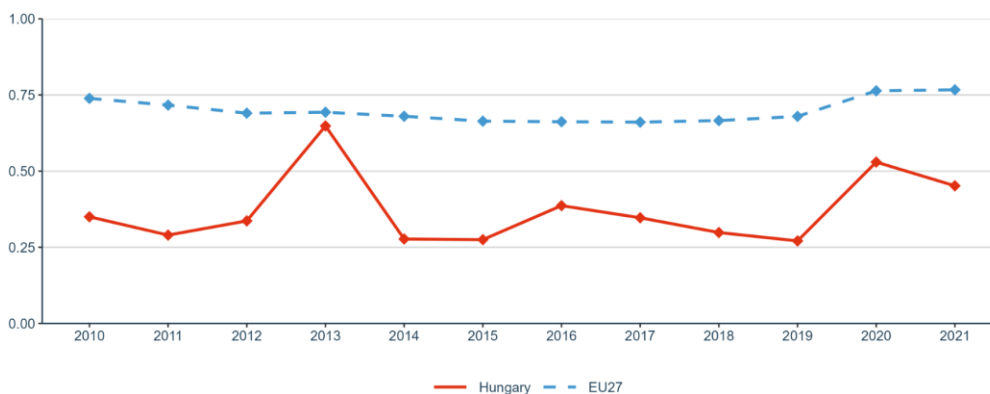


Figure 2: Government Budget Allocations for R&I (GBARD) as share of GDP

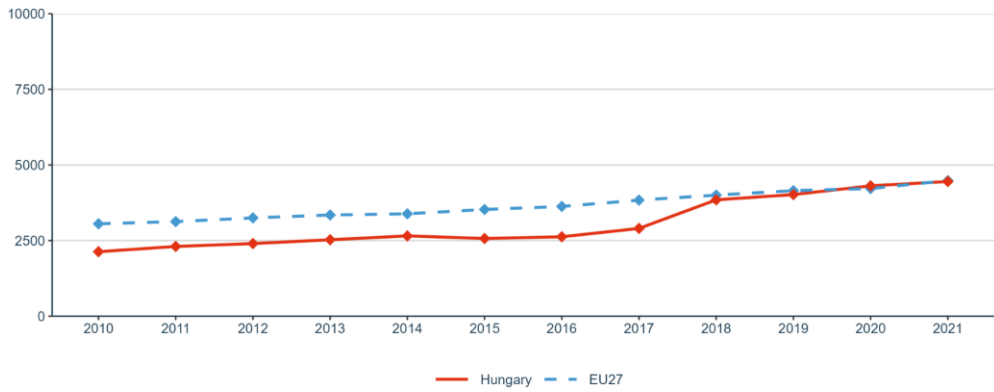


Figure 3: Researchers (in full-time equivalent) per million inhabitants

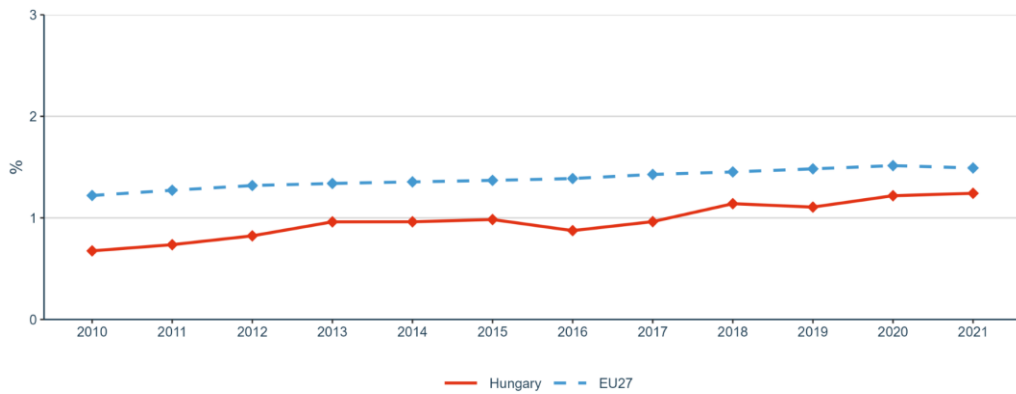


Figure 4: Business Enterprise expenditure on R&I (BERD) as a percentage of GDP

## Priority 1: Deepening a truly functioning internal market for knowledge

### Sub-priority 1.1: Open Science

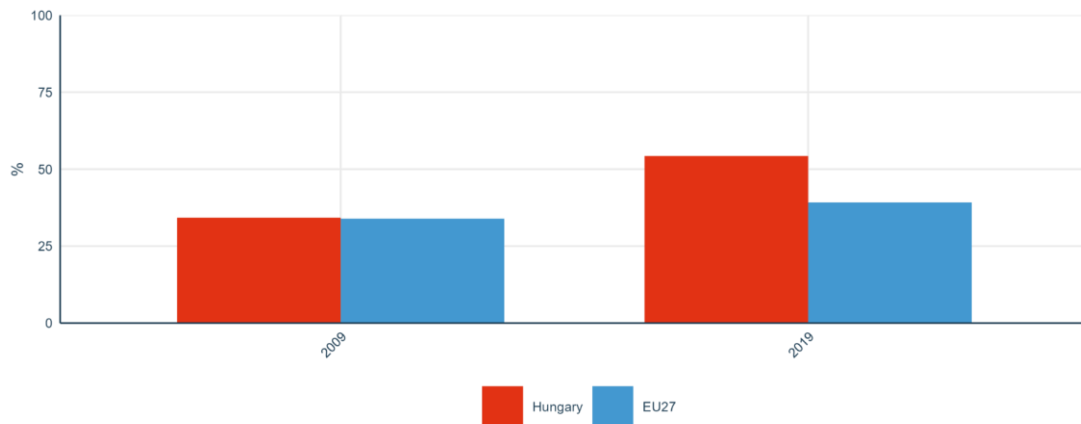


Figure 5: Share of publications available in open access

### Sub-priority 1.2: Research infrastructures

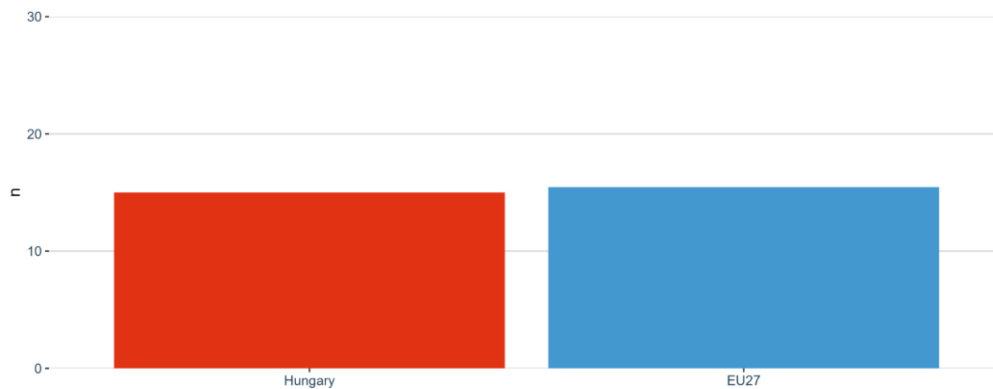


Figure 6: Number of European research infrastructures in which a Member State or an Associated Country participated (financially contributes to operations) in 2021

Sub-priority 1.3: Gender equality, equal opportunities for all and inclusiveness

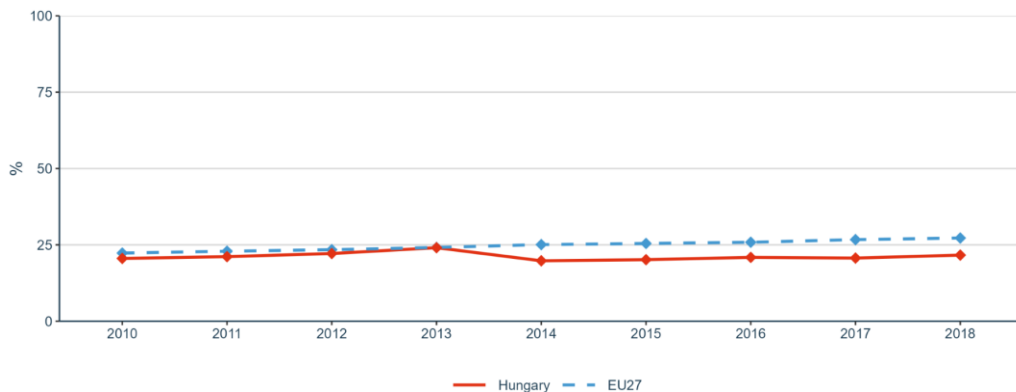


Figure 7: Share of women in grade A positions in HEIs

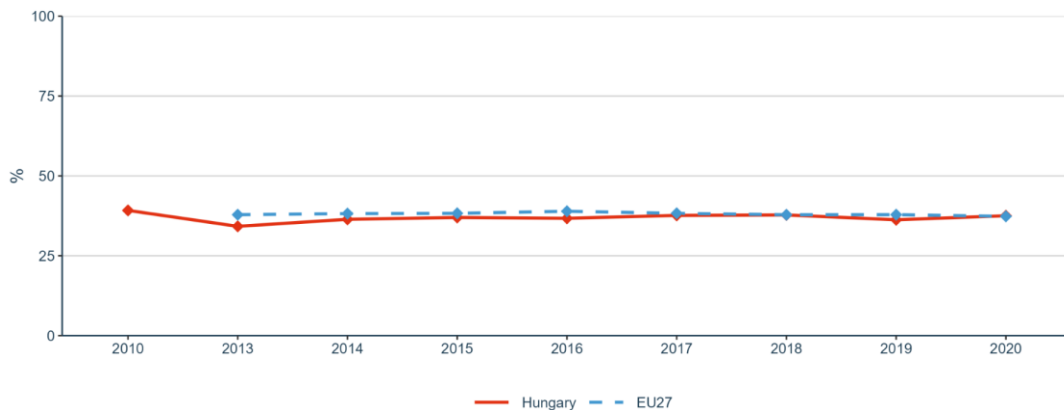


Figure 8: Proportion (%) of women among doctoral graduates by narrow fields of Science, Technology, Engineering and Mathematics (STEM)

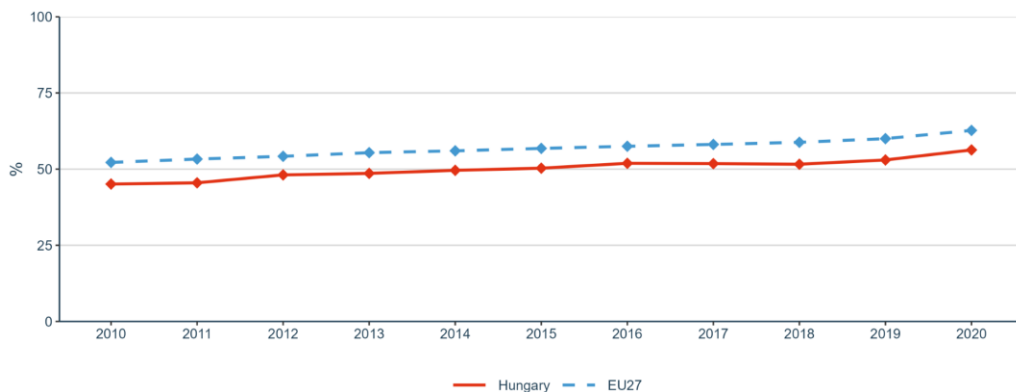


Figure 9: Proportion of papers with mixed gender authorship, 2000–2020

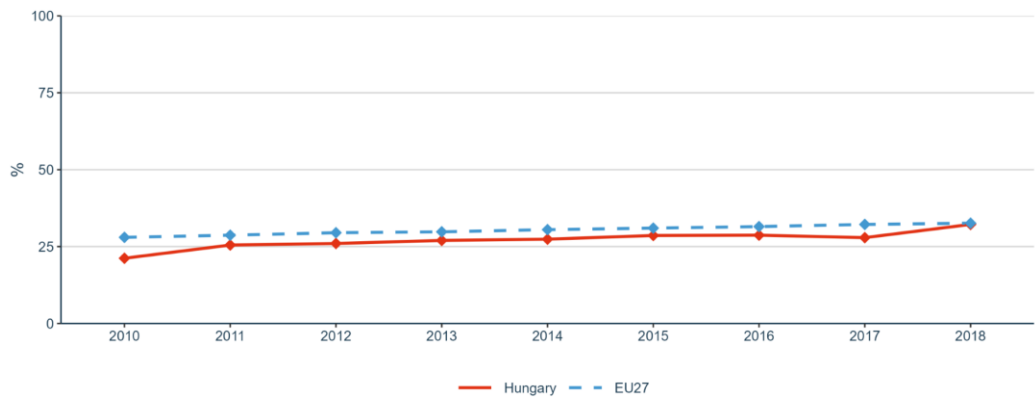


Figure 10: Proportion of women in authorships of the top 10% most cited publications, 2000–2018

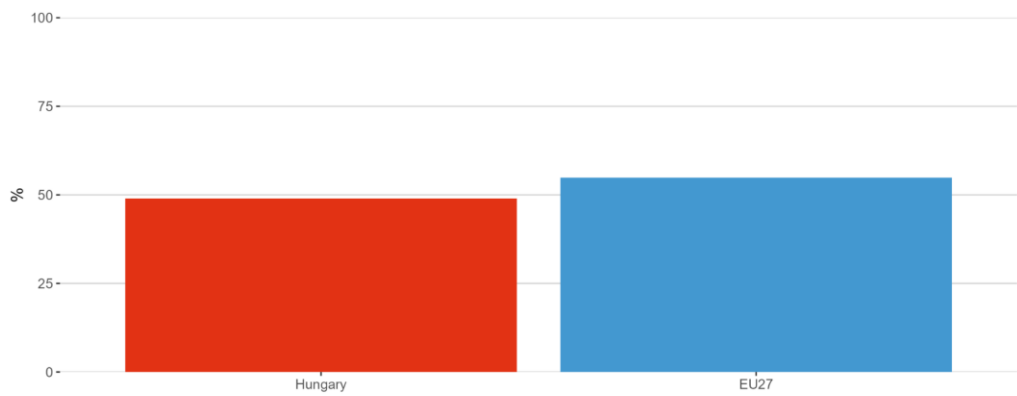


Figure 11: Women in Digital Index in 2022



Sub-priority 1.4: Researchers' careers and mobility and research assessment and reward systems

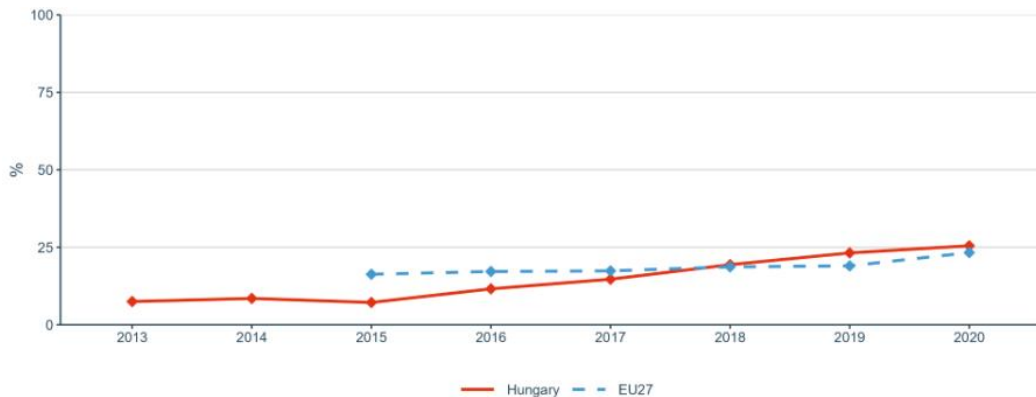


Figure 12: Share of foreign doctorate students as a percentage of all doctorate students

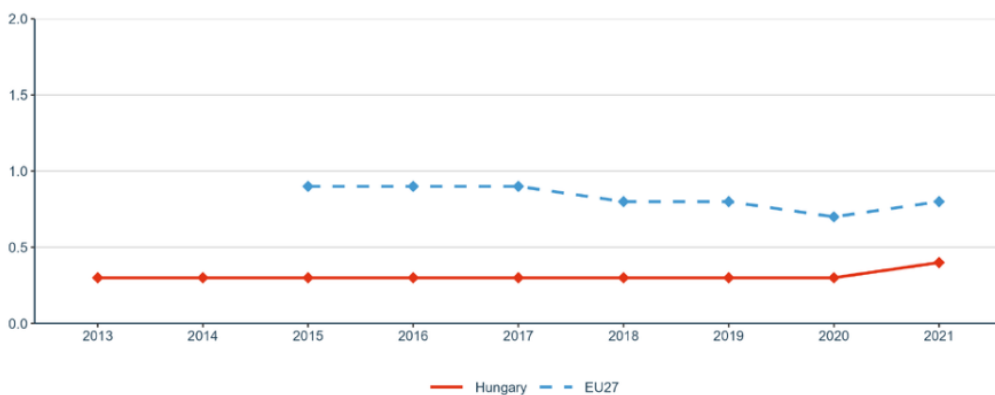


Figure 13: New doctorate graduates per 1,000 inhabitants aged 25-34

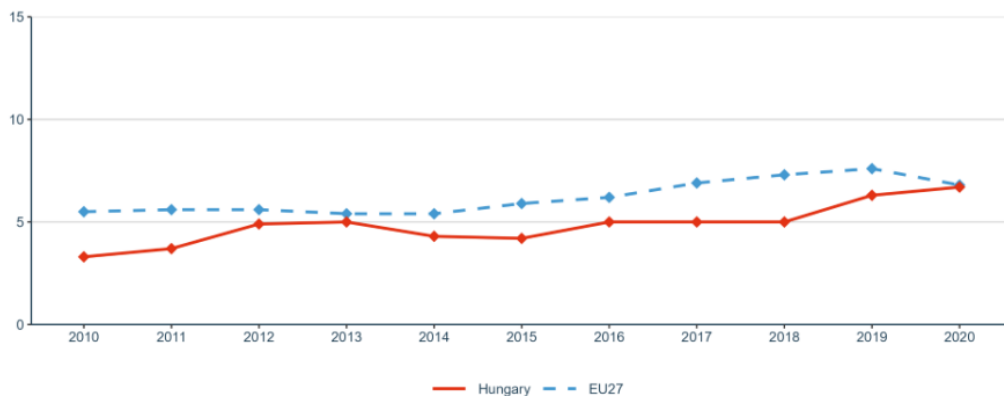


Figure 14: Job-to-job mobility of Human Resources in Science and Technology

### Sub-priority 1.5: Knowledge valorisation

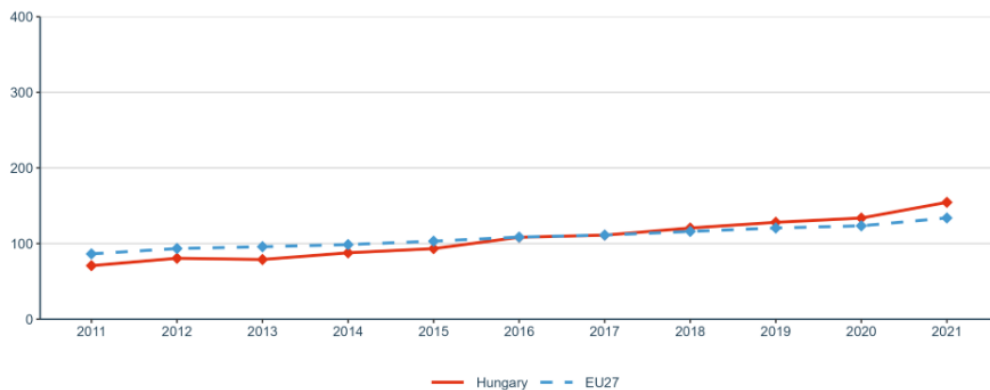


Figure 15: Share of public-private co-publications per 1 mio inhabitants

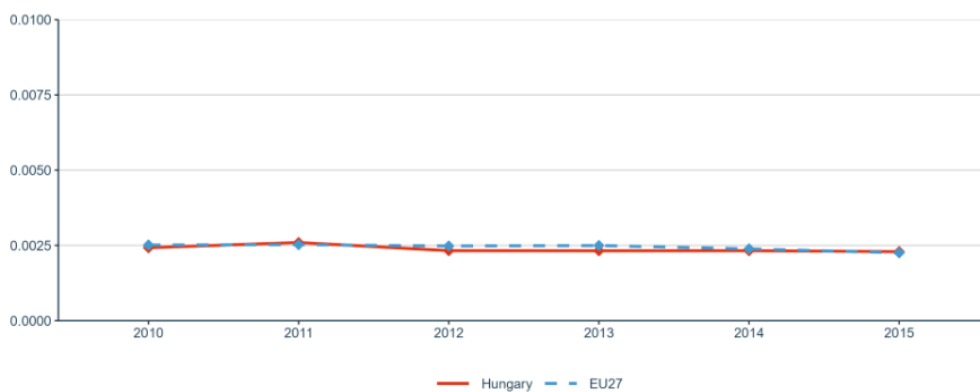


Figure 16: Number of PCT patent applications divided by GDP in million Euros

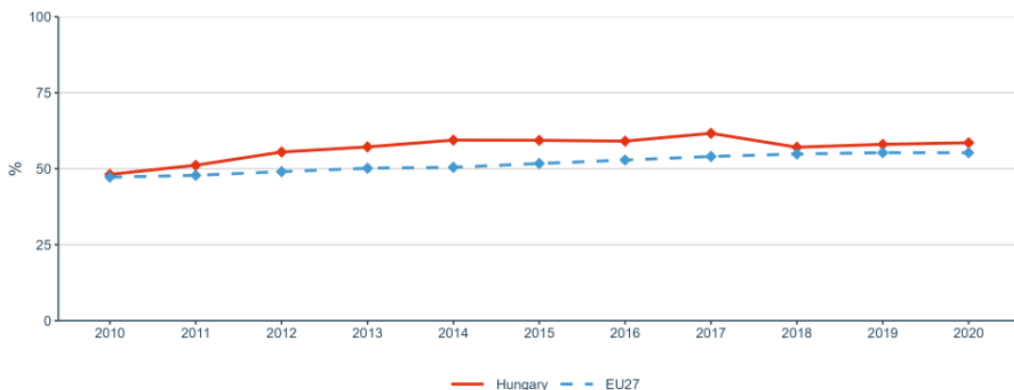


Figure 17: Business enterprise researchers as % of national researchers

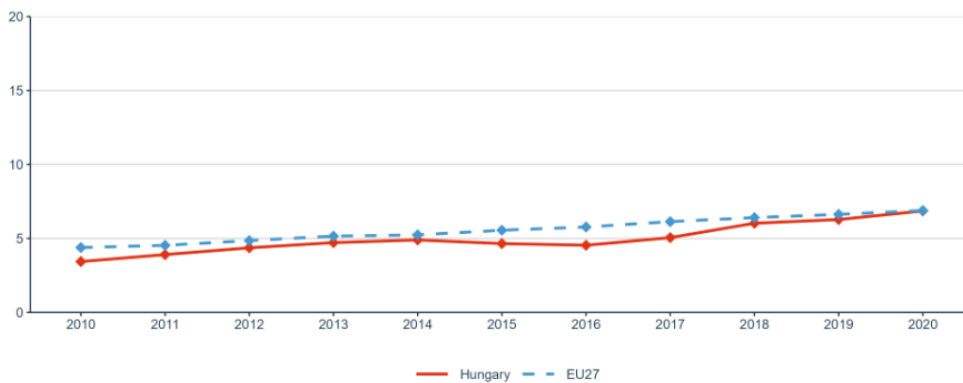


Figure 18: Business enterprise researchers in full-time equivalent per thousand employees in industry

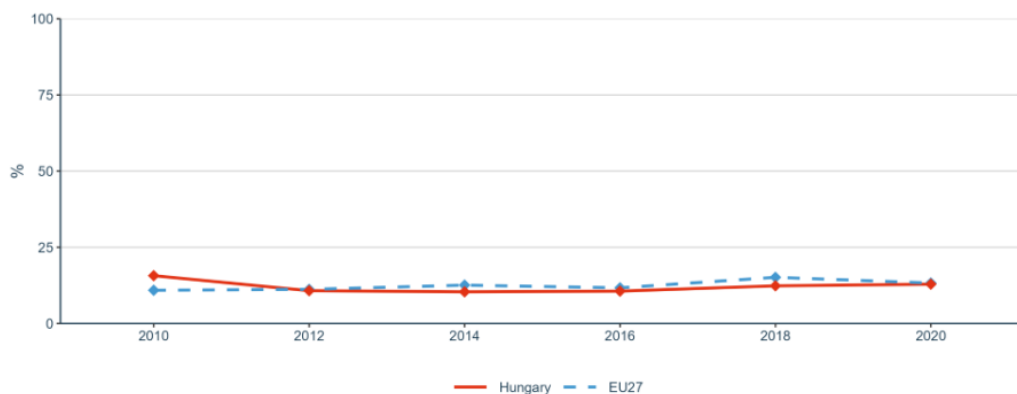


Figure 19: Share of innovating firms collaborating with higher education institutions or public/private research institutions

Sub-priority 1.6: Scientific leadership

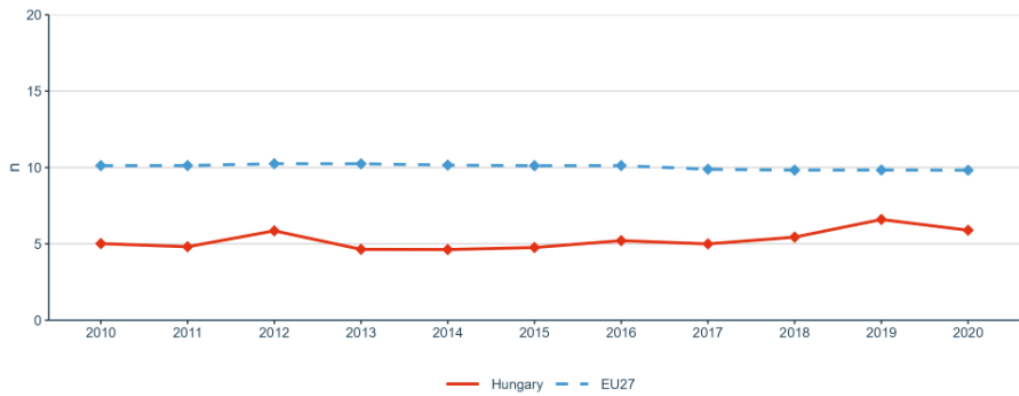


Figure 20: Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications

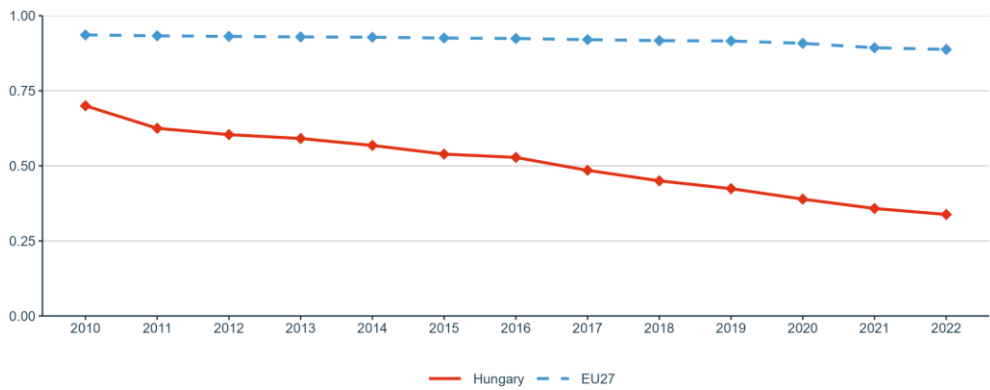


Figure 21: Academic Freedom Index (AFI)

Sub-priority 1.7: Global engagement

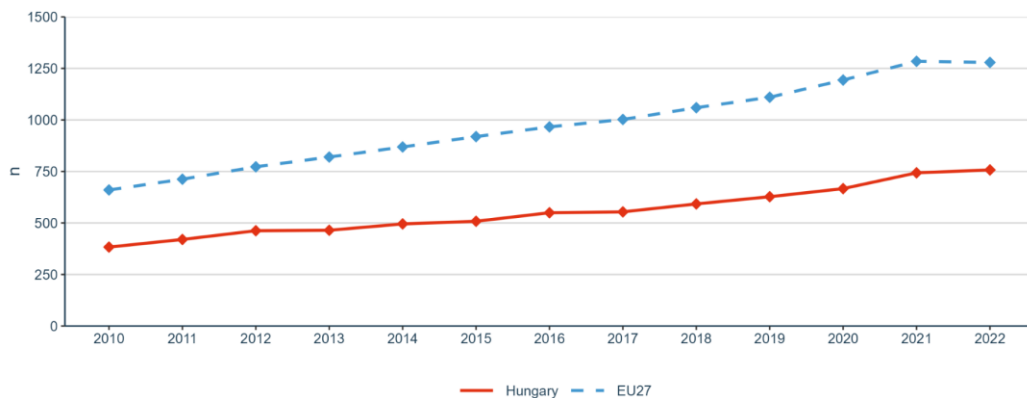


Figure 22: International co-publications with non-EU partners per 1,000 researchers in the public sector

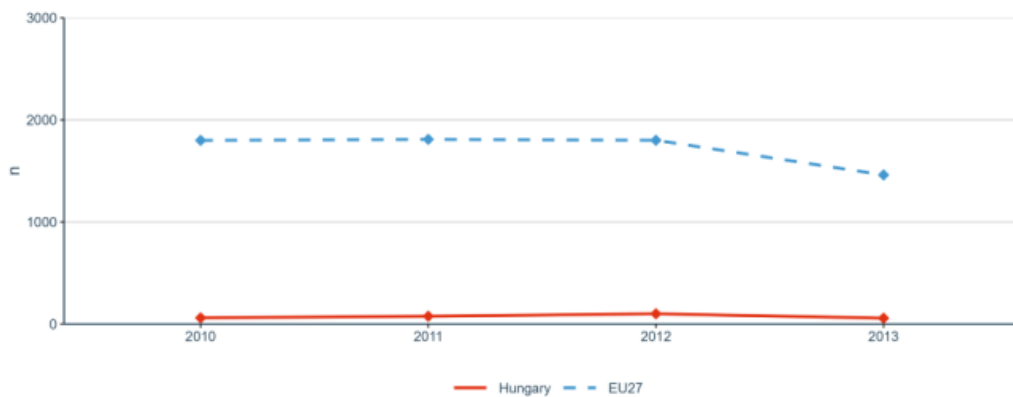


Figure 23: European and international co-patenting in EPO applications at national and EU level

**Priority 2: Taking up together the challenges posed by the twin green and digital transition and increasing society’s participation in the ERA**

**Sub-priority 2.1: Challenge-based ERA actions**

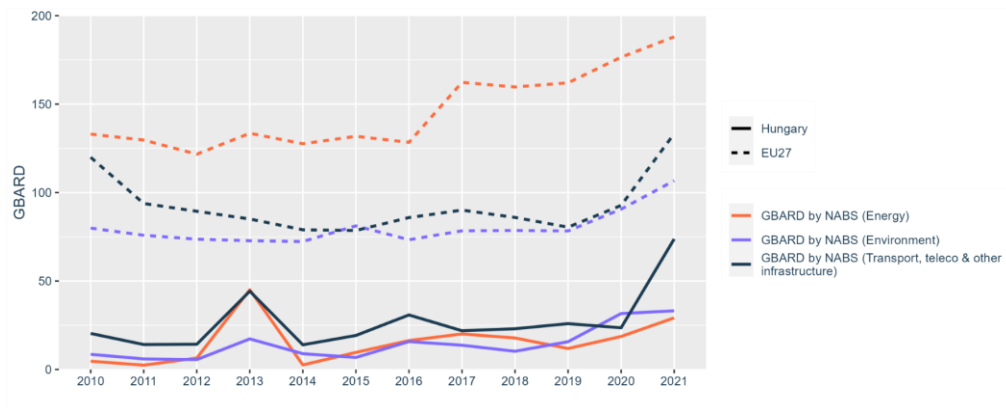


Figure 24: Government budget allocations for R&I (GBARD) by NABS

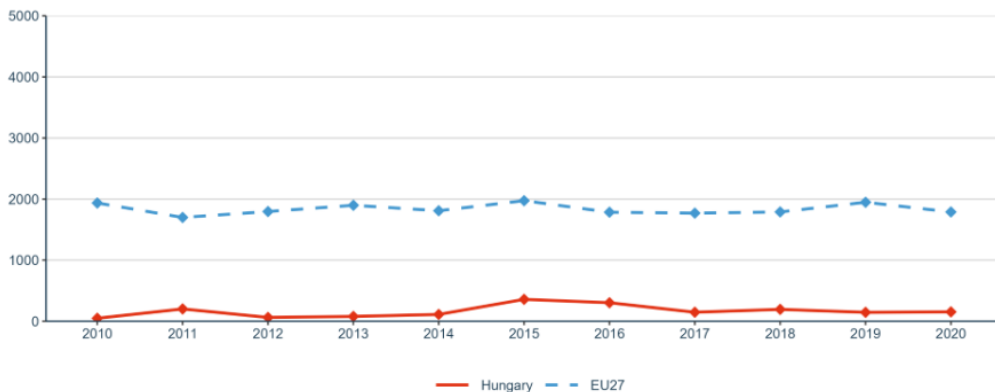


Figure 25: R&I investments (transnational cooperation): GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&I programmes per FTE researcher in the public sector

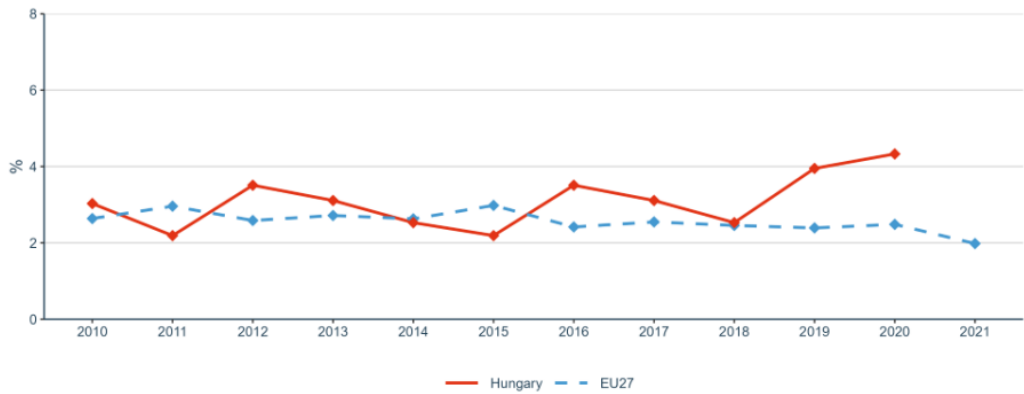


Figure 26: Environmentally related government R&I budget as percentage of total government R&I

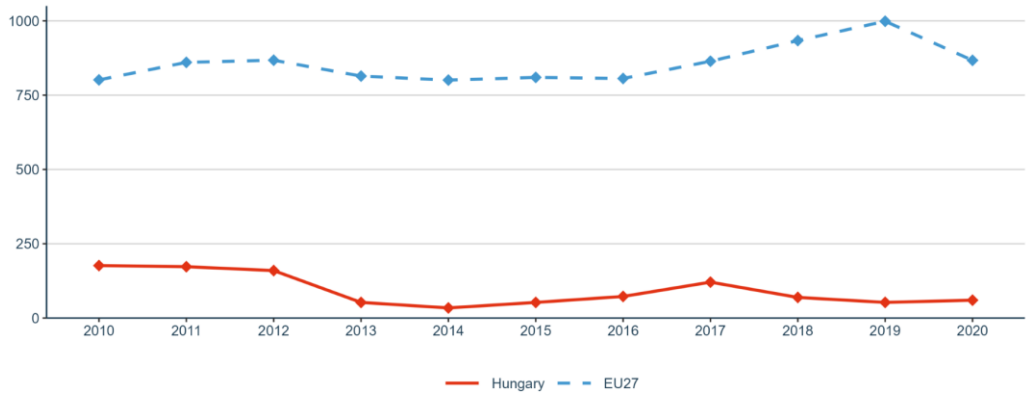


Figure 27: National public and private investments as suggested in the SET Plan progress report 2021

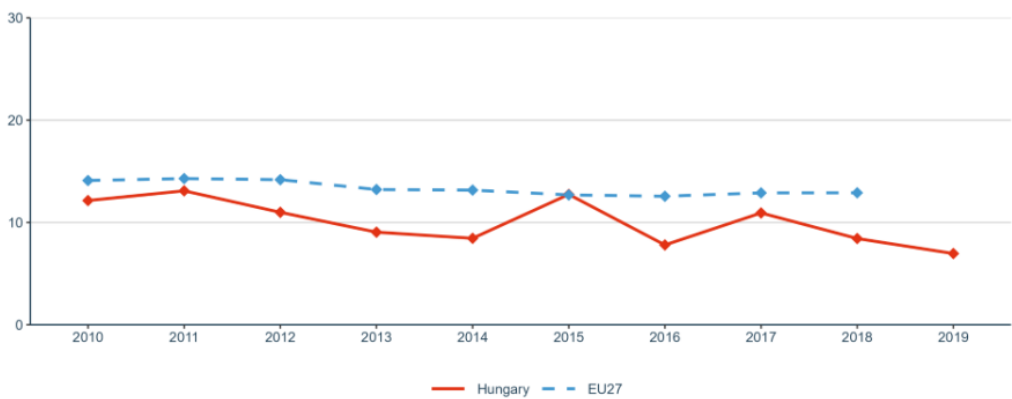


Figure 28: OECD Patents on environment technologies

**Sub-priority 2.2: Synergies with education and the European Skills Agenda**

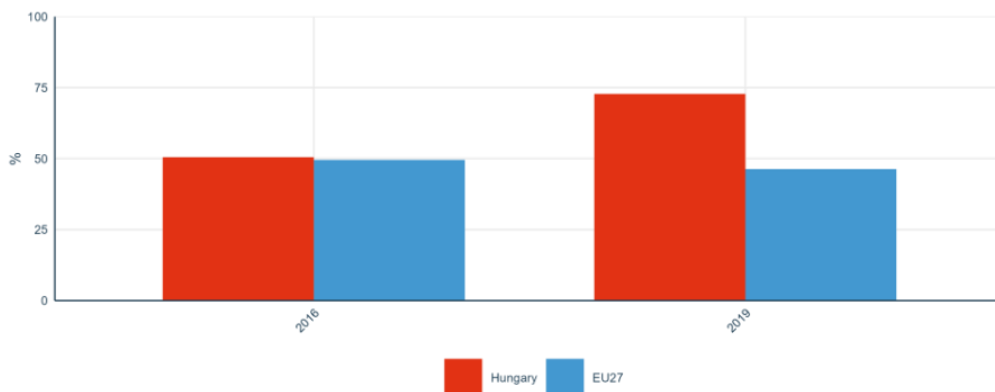


Figure 29: Share of researchers receiving transferable skills training

**Sub-priority 2.3: Synergies with sectorial policies and industrial policy, in order to boost innovation ecosystems**

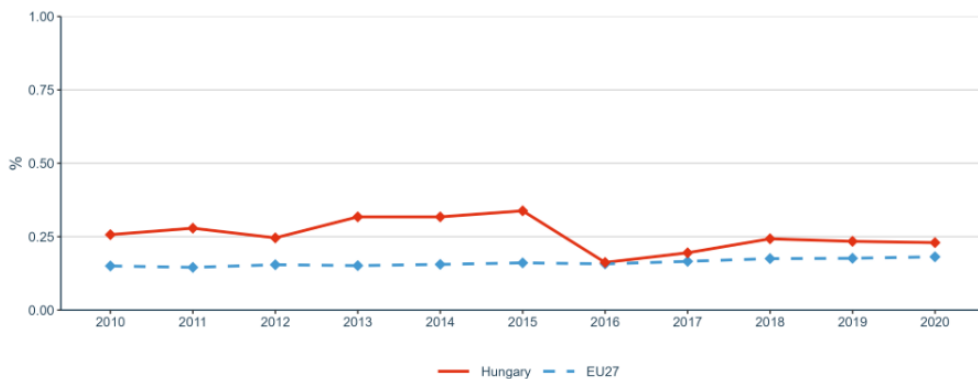


Figure 30: Direct government support and Indirect government support through R&I tax incentives as a percentage of GDP



**Sub-priority 2.4: An active citizen and societal engagement in R&I in all its dimensions**

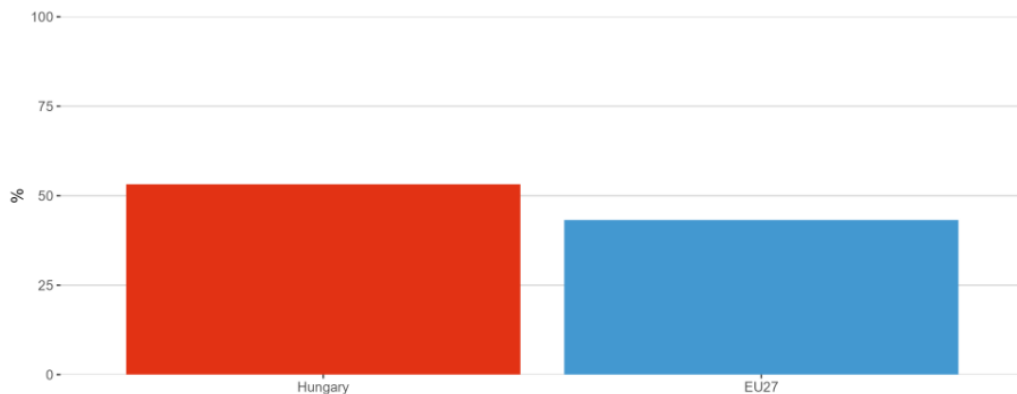


Figure 31: Trust in science in 2021

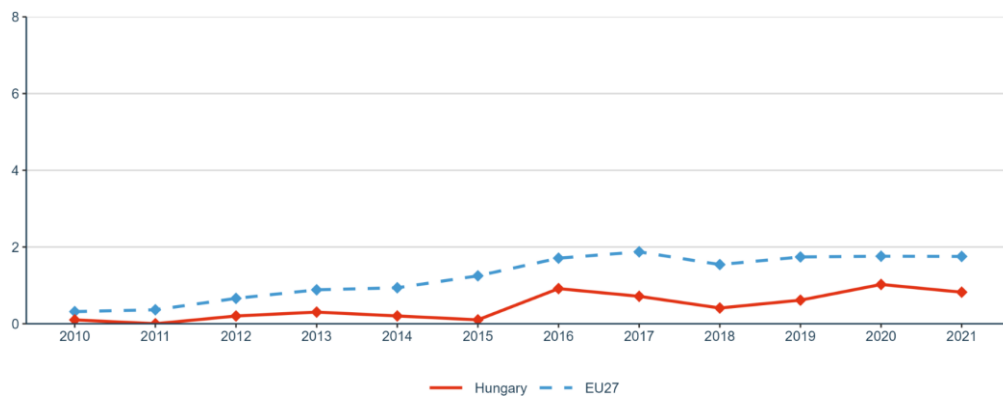


Figure 32: Research on social innovation (publications on 'social innovation' or 'social entrepreneurship') per million population

### Priority 3: Amplifying access to research and innovation excellence across the Union

#### Sub-priority 3.1: More investments and reforms in countries and regions with lower R&I performance

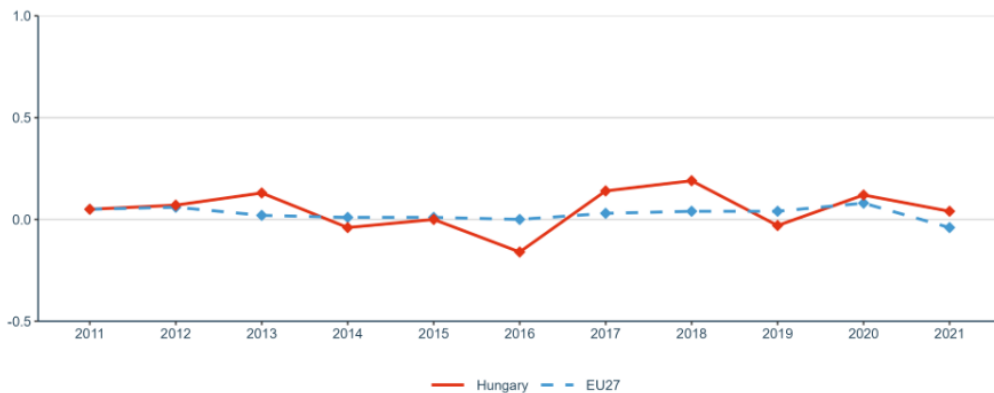


Figure 33: Increase (in percentage points) of total R&I expenditure expressed as a percentage of GDP

### Priority 4: Advancing concrete research and innovation investments and reforms

#### Sub-priority 4.1: Coordination of R&I investments

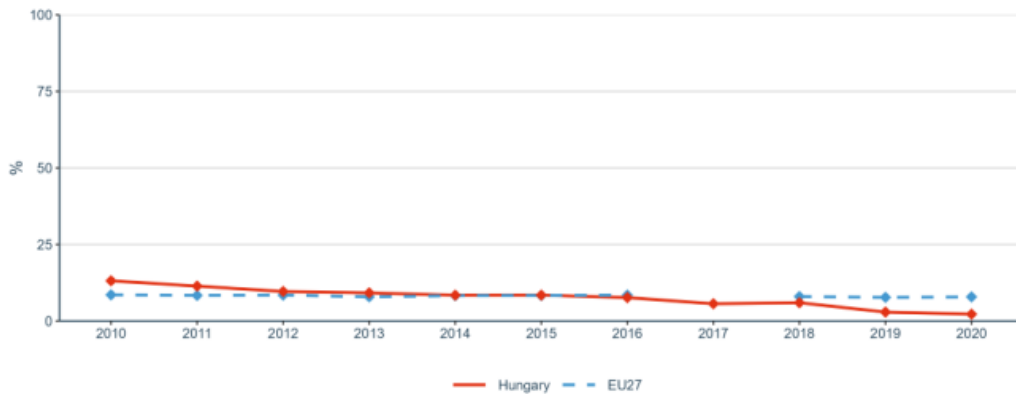


Figure 34: Share of public R&I expenditures financed by the private sector

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ERA Monitoring 2023: ERA Country Report Hungary.

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