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ERA Country Report 2023
Belgium

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Report

Research and Innovation

ERA Country Report 2023: Belgium

European Commission
Directorate-General for Research and Innovation
Directorate A — ERA & Innovation
Unit A2 — ERA, Spreading Excellence and Research Careers
Contact Manuel Aleixo, Head of Unit A.2
Heiko Prange-Gstoehl
Marlene Schoder-Kienbeck
Email RTD-ERA-FORUM@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

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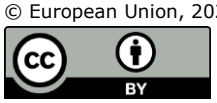

EUROPEAN COMMISSION

ERA Country Report 2023
Belgium

Edited by Claire Nauwelaers (Independent Science, Technology and Innovation policy expert)

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ERA COUNTRY REPORT 2023: BELGIUM

Key takeaways:

- Belgium is an innovation leader, displaying strong R&D intensity exceeding the 3% target, with a well-endowed research and innovation system both on the public and private sides, and ample availability of human resources.
- All Belgian federated entities and the federal authority (Belspo) put a key focus on R&I for societal challenges, including green and digital transition with mission-oriented policies flourishing. Indicators measuring knowledge valorisation and public-private linkages display remarkably high values.
- Openness is a significant strength of the Belgian R&I system and is at the core of all strategies: the country scores extremely high on public funding for EU cooperation (twice the EU average; international co-publications with non-EU partners (6 times the EU average) and participation in EU research infrastructures; it is also performing well in terms of foreign doctoral students and publications in open access.
- Two ERA dimensions in which Belgium is not a front-runner are: gender equality and environment-related R&I. For both, new measures are in the pipeline, notably as part of the Recovery and Resilience Plan.

1. National context

1.1. Overview of the ERA policy agenda implementation

Belgium as a whole has committed to all ERA actions.[1] However, since there is a division of responsibilities for ERA actions according to institutional responsibilities of the various federated entities and the federal authority (Belspo) operating in full autonomy, not all of them are committed to all actions. Within the frame of their responsibilities for economic development, only the three Regions commit to Action 12 on accelerating the green and digital transition of industrial ecosystems, while the Communities subscribe to Action 4, the issue of research careers as this is delineated by their respective exclusive competences. Together, all entities forming the Belgian R&I landscape show a full commitment to the entire ERA policy agenda.

As an **'Innovation Leader'**, Belgium is part of the top league in the 2023 European Innovation Scoreboard (EIS).[2]

[1] The number of commitments to ERA Actions does not imply any judgment about the country's performance in achieving the ERA priorities.
[2] European Commission (2023). EIS 2023. Country profile Belgium. Publications Office of the EU. Available at: https://ec.europa.eu/assets/rtd/eis/2023/ec_rtd_eis-country-profile-be.pdf

1.2. Policy context

Belgium is a **federal country** where responsibilities, budgets and policy instruments for research and innovation have been devolved to its 3 Communities and 3 Regions,[3] with the Federal State retaining some competences without having authority on the federated entities and the federal authority. Regulatory frameworks, strategies and actions relevant to the ERA objectives co-exist in all entities, each according to its autonomous competences. Boldly summarised: the Regions are competent for R&I for economic development as well as for research related to their competences and support research institutions, companies, organisations and programmes for these purposes; the Communities are competent for education and scientific research at universities and university colleges and for research related to their competences (culture, education, health, etc.) and are responsible for funding the Higher Education system, in which universities are the dominating actors; the Federal State has its own Federal Scientific Institutes active in federal matters such as space, defence and cultural heritage and is also responsible for federal tax incentives for R&D. In 2021, 81% of total government budgetary appropriations for R&D (GBARD) originated from Communities and Regions.[4]

Key R&I policy and strategy documents setting out high-level priorities relevant to the ERA policy agenda are found in each of the federated entities and the federal authority in Belgium.[5] They generally emphasise an increased role for R&I to address societal challenges and their governments' priorities: this is notably the guiding principle of Belgium's national and regional **Recovery and Resilience Plan (RRP).**[6] Without being exhaustive, the following can be cited: At the **federal level**, the **2022-2024 Strategic Plan for the Federal Science Policy Office**[7] emphasises its open data and open science strategy and a new role for citizens in federal scientific institutions. **Flanders'** ambition is to climb amongst the top five in the European Regional Innovation Scoreboard; in this region, a new innovation model is adopted, following a mission-oriented innovation policy, placing greater emphasis on participative 'quadruple helix' processes, and administrative reforms are planned in order to achieve better synergies between policy domains. In **Wallonia,** the **Smart Specialisation Strategy**[8] provides a backbone to support R&I and new **Strategic Innovation Initiatives (IIS)** have been defined to operationalise the strategy, with an important emphasis on new skills for societal challenges. Efforts are continuing to reform the Walloon innovation support system. A central strategy for the **Region of Brussels-Capital** is its **2021-2027 Smart Specialisation Strategy**[9] with the aim to tackle environmental, social, and economic challenges through innovation, prioritising skills, digitalisation and the green transition. The Wallonia-Brussels Federation places priority on open science and harmonisation of the legal framework for research careers.

[3] In the rest of this report, the situation is described for five entities: the federal state, Flanders (which incorporates both the Region and the Flemish-speaking Community), the Region of Wallonia, the Wallonia-Brussels Federation (which holds the competences of the French-speaking Community) and the Brussels-Capital Region. Given the restricted size set for this report, it is impossible to report on all initiatives taken by all entities across all the ERA Policy Agenda. An effort has been made to select the main initiatives for each Action for each entity.

[4] Commission for federal cooperation and international cooperation of the Inter ministerial conference for science policy (2022). ERA actions fiches for Belgium. Brussels: BELSPO Publications.

[5] See list in annex.

[6] Office of the Secretary of State for Recovery and Strategic Investments, in charge of Science Policy (2023). National Recovery and Resilience Plan Belgium, https://nextgenbelgium.be

[7] Belgian Science Policy Office (BELSPO) (2022). Management Agreement 2022-2024. Brussels: BELSPO Publications. https://www.belspo.be/belspo/organisation/about_managAgree_en.stm

[8] Walloon Strategy for Intelligent Specialisation (S3), available at https://s3.wallonie.be/home.html

[9] 'Regional Innovation Plan 2021-2027' available at https://innoviris.brussels/fr/plan-regional-innovation

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

This section covers the main efforts deployed by Belgian authorities to implement the ERA Policy Agenda. The key sources for this section include Belgium's latest European Semester Report, Belgium's country page from European Innovation Scoreboard, contributions from Belgium to the OECD STIP survey, ERA actions fiches for Belgium compiled by the Federal Science Policy Office, key documents at federal level and for each Region and the two main Communities.

It includes four sub-sections, one for each of the main ERA Priorities. For each Priority: a first part provides a description of the initiatives relevant to all ERA actions by all Belgian federated entities and the federal authority; and a second part summarises the most recent data available as evidence for evolutions observed from the quantitative indicators of the ERA Scoreboard and ERA Dashboard (to be found in Annex 1)[10]. However, in some cases, the data available pre-dates the ERA Policy Agenda. This report will serve as a baseline for reporting in the future. Therefore, the longer-term trends covering the last ten years are presented. The indicators falling under each ERA priority are presented below, and the general indicators are outlined in Table 1. More detailed information on the data and graphs can be found in Annex 1.

Table 1. General ERA Scoreboard and ERA Dashboard indicators[11]

Indicator	Most recent EU average	Most Recent Metric
Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP	2.26 (2021)	3.22 (2021)
Government Budget Allocations for R&D (GBARD) as a share of GDP	0.76 (2021)	0.73 (2021)
Researchers (in full-time equivalent) per million inhabitants	4,483.4 (2021)	6,604.4 (2021)
Business Enterprise expenditure on R&D (BERD) as a percentage of GDP	1.49 (2021)	2.4 (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

ERA Action 1: *Enable Open Science, including through the European Open Science Cloud (EOSC)* is a strong priority in Belgium. The European directive on Open Data, which includes publicly funded scientific research results, has been transposed to Belgian law. **Open Data and Open Science (OS)** are mainstreamed in *federal level* programmes, by notably rewarding these practices in proposal evaluations. A federal law for 'secondary publication rights' allows authors of scientific publications to retain their authors' rights notwithstanding contractual requirements. Rendering the said publication public by depositing it in a

[10] https://european-research-area.ec.europa.eu/era-monitoring-reports
[11] Further information on the trends can be found in Annex 1

recognised Open Access repository can therefore no longer be contested by the publisher. Federal Open Science policies are being crafted and reviewed by the Federal Open Access Strategy Committee. The federal authority also coordinates the OS consultation commission involving the Regions, and manages **Belnet**, the **Belgian National Research and Education Network,**[12] providing OS services, such as the Federal Scientific Institutes with the Orfeo federal Open Access repository and a Data Management Plan template and disseminating OS good practices to the research community. At the *federal level*, there is also support and guidance regarding the integration of the Federal Scientific Institutes in EOSC. *Flanders* develops and maintains the **Flanders Research Information Space**[13] containing the **Flemish Open Science Board,**[14] publicly funded, which advises on open science policy measures. All Flemish universities have data stewards to exchange experiences and build best practices, and report on Flanders' KPIs on Open Science, Open Access, DMP and Open Data. Additionally, as collected through the **EOSC 2021 Survey**, the **Flemish Research Data Network (FRDN)** is a key initiative to exchange and reuse (**FAIR**) research (meta)data.[15]

Finally, the **Flemish Open Science Board** and the **Flemish Open Science Policy** have been identified as best practices by EOSC as use case of co-creation of Open Science policy and Key Performance Indicators (KPIs).[16] The *Brussels-Capital Region* has since 2022 also embarked on the development of an ambitious new package of measures on open data and open access. The *Wallonia-Brussels Federation* (WBF) has updated its **OS Roadmap in 2021**, extending the focus on Open Access to publications to other dimensions of OS - in **particular Open Research Data and Data Management Plans**, with **FAIRification** of data and participation to EOSC as important targets. Work is going on to incorporate OS practice in evaluation of researchers. The F.R.S. and FNRS Fund are currently reviewing its open access policy to implement the decree issued by the WBF on this matter. According to the current **Fund rules and regulations,**[17] recipients of new fundings from the F.R.S.-FNRS or associated funds, commit to submitting a data management plan (DMP) written in the same language as the research plan. Additionally, in October 2023, the F.R.S.-FNRS has launched its project to develop a public web platform harvesting publication data from the 6 WFB universities.

On **ERA Action 2:** *Propose an EU copyright and data legislative framework for research* at *federal level*, the **Belgian Science Policy Office (BELSPO)**[18] reports to the **Federal Public Service of Economic Affairs**, responsible for copyrights, based on consultations with its **Federal Scientific Institutions**. All *Flemish* universities are active in international networks and/or projects and have internal committees that work on copyright, open access legislation and open science.

Belgian Communities and Regions are active in **ERA Action 3:** *Reform the Assessment System for research, researchers and institutions.* The *Wallonia-Brussels Federation*, through its main research funding agency, the **National Fund for Scientific Research**

[12] Belgian National Research and Education Network. BELNET. https://belnet.be/
[13] Flanders Research Information Space. https://www.ewi-vlaanderen.be/en/fris-flanders-research-information-space
[14] https://www.fwo.be/en/the-fwo/organisation/administration/flemish-open-science-board/
[15] O'Neill, G. and Martziou, S. (2022). *Data of Survey on National Contributions to EOSC 2021.* EOSC Observatory. Available at: https://doi.org/10.5281/zenodo.7431678
[16] Neidenmark, T., O'Neill, G. and Karasz, I. (2023). *EOSC Catalogue of Best Practices*. EOSC Observatory. Available at: https://doi.org/10.5281/zenodo.7574165
[17] Fund rules and regulations. FRS-FNRS. https://www.frs-fnrs.be/docs/Reglement_OPEN_ACCESS_EN.pdfFrom 2022
[18] Belgian Science Policy Office. BELSPO. https://www.belspo.be/

(Fonds de la Recherche Scientifique - FNRS)[19] has endorsed the **Declaration on Research Assessment (DORA),**[20] **the Coalition for Advancing Research Assessment (CoARA)**[21] and participates in EU expert groups on research evaluation to incorporate relevant principles in its funding tools. *Flanders'* research institutions are reviewing their practices and regulations concerning selection, promotion and evaluation procedures for staff and project funding applications, in line with the DORA principles. Its research funding agency, **Research Foundation - Flanders** *(Fonds Wetenschappelijk Onderzoek - Vlaanderen - FWO)* [22] participates in **DORA, CoARA, and to the Science Europe Working Group** on research assessment. Ongoing evaluations of Flemish research policy instruments and actors such as the **Strategic Research Centres,** include efforts to incorporate new practices for research assessment. In *Brussels-Capital Region* new criteria is introduced in project evaluations, in line with the Region's goal to direct all public support for businesses towards socially and ecologically responsible activities by 2030.

ERA Action 4: *Promote attractive research careers, talent circulation and mobility* is another priority, especially for the Belgian Communities. Universities hold the **Human Resources Strategy for Researchers (HRS4R)**[23] label and are part of **European University Alliances** and share information on research careers. *Flanders* has adopted the '**Flemish Framework of measures to support young researchers'** and the **FWO** specifically targets its support towards inter-sectoral mobility of junior researchers, while improving its procedures to achieve more diverse researcher profiles. Another priority is to better prepare doctoral students for a career outside the academic world, as the **Flemish Agency for Innovation and Entrepreneurship (Agentschap Innoveren & Ondernemen – VLAIO)**[24] that supports young researchers to work. Improving and promoting research careers remains high on the agenda of the *Wallonia-Brussels Federation*. Funded by the WBF and integrated in the F.R.S.-FNRS, the **Observatory of Research and Scientific Careers**[25] was set up in 2018. The Observatory aims to track and analyse the careers of researchers in the FWB through surveys and data cross-referencing. In addition, it develops knowledge on the doctoral and postdoctoral processes, and offers recommendations to facilitate the job transition of PhD holders. Another programme is "**TEAM Mentorat**"[26] to promote the careers of future PhDs.

ERA Action 5: *Promote gender equality and foster inclusiveness* is subject to attention and initiatives by all Belgian federated entities and the federal authority. Gender equality has been integrated as a criterion into the investment projects of the **Belgian Recovery and Resilience Plan.** [27] Additionally**,** authorities and research performing organisations are involved in networks and projects on gender equality and inclusiveness and R&D Funding agencies have adopted or are developing gender equality plans. Belgian authorities, research performing organisations (RPOs) and research funding organisations (RFOs) are involved in European networks and projects on gender equality and inclusiveness. Most of them have also adopted gender equality plans. At the *federal level*, all federated entities on gender equality policy in R&I, including for the ERA forum subgroup on Gender Equality, are coordinated within the international and inter-federal coordination mechanism, CIS-CFS Gender. Flanders' **Strategic Research Centres** are all active on gender and inclusiveness,

[19] National Fund for Scientific Research (Fonds de la Recherche Scientifique - FNRS). https://www.frs-fnrs.be/fr/
[20] Belgium Declaration on Research Assessment (DORA). https://sfdora.org/
[21] https://coara.eu/
[22] Research Foundation - Flanders (Fonds Wetenschappelijk Onderzoek - Vlaanderen). https://www.fwo.be/
[23] Human Resources Strategy for Researchers (HRS4R). https://euraxess.ec.europa.eu/jobs/hrs4r
[24] Flemish Agency for Innovation and Entrepreneurship. https://www.vlaio.be/nl/over-ons/vlaio
[25] https://observatoire.frs-fnrs.be/
[26] Team Mentorat Belgium. https://www.teammentorship.be/
[27] Office of the Secretary of State for Recovery and Strategic Investments, in charge of Science Policy (2023). National Recovery and Resilience Plan, available at https://nextgenbelgium.be

through initiatives as **VITO**[28]. **Imec,**[29] the Flemish interuniversity microelectronics research centre, has an inclusive workplace policy since 2021. Similarly, the **Flemish Interuniversity Council VLIR**[30] has working groups on gender and on diversity. The *Brussels-Capital Region*'s **Regional Innovation Plan 2021-2027**[31] incorporates the development of a gender and equality policy. The *Wallonia-Brussels Federation* created two committees dedicated to gender, the Women and Science Committee, and the Gender Commission in Gender Education. It has also established a network of Contact Persons for Gender in the French-speaking universities and in the RFO for the French-speaking Community. Finally, it has introduced a **Commission on Gender in Higher Education**, which oversees the implementation of gender policies in HEIs. It has established a network of **Contact Persons for Gender in French-speaking universities** and introduced new selection criteria about gender equality in its funding schemes for science communication projects. *Wallonia*'s recovery plan includes a priority action on strengthening employment and studies in STEAM, in which the gender dimension is mainstreamed.

Belgian commitment to **ERA Action 6:** *Protect academic freedom in Europe* can be illustrated through the engagement of *Flemish* universities into activities such as hosting scholars at risk, organising seminars and a survey to academic staff on the topic, preventive screening of institutional collaborations, and the inclusion of a 'human rights clause' in all institutional agreements. The academic freedom issue is also covered in the work of the **Superior Council for Scientific Integrity**[32] in the *Wallonia - Brussels Federation* inaugurated in 2021.

ERA Action 7: *Upgrade EU guidance for a better knowledge valorisation* is a long-standing priority in Belgium, at the core of R&I policies of all 3 Regions. This is evidenced by the choice of knowledge valorisation as one priority for the **Belgian Presidency** and the preparation of Council Conclusions on the topic for 2024. All Regions are deploying a whole range of instruments, such as support to technology transfer offices, collaborative research grants, start-ups and spin-off support, science-industry mobility schemes, clusters etc., which vary in design, size and implementation modalities between the three authorities. The challenge of better valorising knowledge in SMEs is emphasised across the country. Reforming the regional policy mixes to better cover the whole innovation value-chain and higher TRL levels is on the agenda too, with e.g. *Flanders* developing a framework for reinforcing pilot and demonstration plants and *Brussels-Capital* putting priority on testing labs and living labs. Universities themselves are also active with e.g. *Wallonia's* support to the **LIEU**[33] **network** of French-speaking universities' technology transfer offices providing a step-by-step interactive guide on knowledge transfer for their researchers. University colleges are part of the movement, they have jointly created **Synhera**, [34] a non-profit organisation funded by Wallonia, the Wallonia-Brussels Federation and Brussels-Capital, which provides training and support in a variety of topics including on research results valorisation. The *federal authority* is enhancing its support to **Federal Scientific Institutes** [35] to improve their valorisation practices by offering guidance on research related areas. The policy framework in *Flanders* puts a new emphasis on increasing the involvement of Flemish companies in strategic basic research, technology transfer offices and research infrastructure.

On **ERA Action 8:** *Strengthen research infrastructures* the *federal authority*, through **BELSPO**, pays membership fees to large-scale research infrastructures, the **European**

[28] Vision on technology for a better world in Belgium. https://vito.be
[29] Flemish interuniversity microelectronics research centre. https://www.imec.be
[30] Flemish Interuniversity Council. https://vlir.be/
[31] 'Regional Innovation Plan 2021-2027' available at https://innoviris.brussels/fr/plan-regional-innovation
[32] Superior Council for Scientific Integrity. https://www.integrite-scientifique.be/
[33] https://reseaulieu.be
[34] SynHERA. European Cluster Collaboration Platforms. https://synhera.be/
[35] Federal Scientific Institutes in Belgium. BELSPO Index. https://www.belspo.be/belspo/fsi/index_en.stm

Strategy Forum on Research Infrastructures (ESFRI) research infrastructures and to large intergovernmental organisations such as the **Intergovernmental Panel on Climate Change (IPCC)**, for the benefit of the whole Belgian research community. Additionally, all *federal entities* engage with the international and inter-federal concertation group on research infrastructures (CIS Infra) with the purpose of coordinating the various perspectives. To better steer its participation in international research infrastructure, *Flanders* has set up a cooperative '**Europe Platform',**[36] which notably covers the issue of research infrastructures' needs and opportunities for universities and research centres. While *Flanders* has orchestrated funding lines to co-fund access to large research infrastructures, the *Wallonia - Brussels Federation* is planning a **Big Science Fund** for this purpose. The latter authority is preparing a joint ESFRI "roadmap" together with *Wallonia*.

Concerning **ERA Action 9:** *Promote international cooperation***,** science diplomacy, cooperation and mobility activities are deployed by all entities in Belgium, in full autonomy. It is supported by **BELSPO's** efforts towards coordinated approaches for awareness raising on research and knowledge security and regarding engagement in multilateral initiatives. BELSPO pays particular attention to reciprocity and the creation of a level playing field in bilateral cooperation agreements/activities and is committed to responsible and sustainable international cooperation in line with values and principles in the **2022 Marseille Declaration.** [37] Additionally, the **federal level and Flanders** participate actively in the Multilateral Dialogue process with 3rd countries and the Team Europe initiatives[38] on China and Africa. The development process of the European Science Diplomacy is well followed, with active participation in the strategic WG 1, from end 2023 onwards. A key domain for international cooperation at *federal level* is space research: Belgium was one of the founding members of the **European Space Agency** (ESA) and is currently its fifth largest contributor. *Flanders* also participates in the ERA sub-group on science diplomacy; **FWO** is committed to responsible and sustainable international cooperation in line with principles in the **2022 Marseille Declaration;** and Flemish universities have a screening procedure in place for potential high-risk collaborations that are handled by an internal ethics committee. The *Wallonia-Brussels Federation* has adopted in 2020 a strategy articulated around three themes: 1) diplomacy for science to foster scientific cooperation; 2) science for diplomacy, making use of scientific cooperation to improve international relations; and 3) the use of science to support diplomatic action. All *federated entities and the federal authority* coordinate their perspectives on the topic in the international and inter-federal coordination mechanism, CIS Inter, which is facilitated by the federal authority.

2.1.2. Progress towards achieving ERA Priorities

With respect to **Sub-priority 1.1:** *Open Science*, in line with the openness of its R&I system, Belgium consistently performs ahead the EU-27 average with respect to ***the share of publications available in open access*** (Figure 5 in Annex 1).

When looking at **Sub-priority 1.2***: Research infrastructures,* Belgium registers a 0.97% in terms of the ***share of national public R&D expenditure allocated to European research***

[36] Europe Platform. Belgium Profile. https://www.ewi-vlaanderen.be/onze-opdracht/excellerend-onderzoek/eu-platform

[37] 2022 Marseille Declaration. https://www.cesaer.org/content/10-library/2022/en-marseille-declaration-17075.pdf

[38] Team Europe Initiatives - European Commission. https://international-partnerships.ec.europa.eu/policies/team-europe-initiatives_en

infrastructures 2022, standing below the EU average.[39] However, the picture is more positive regarding the ***participation in European research infrastructures*** in 2021 (Figure 6 in Annex 1), where Belgium stands well above the EU-27 average.

Concerning **Sub-priority 1.3:** *Gender equality*, Belgium displays a mixed picture. The country lags behind EU-27 achievements with respect to the *presence* of women in the research system, this gap with EU-27 having remained constant over the last decade. The gap is somewhat larger for the ***share of women in grade A positions in HEIs*** than for the ***proportion of women among doctoral graduates by narrow fields of Science, Technology, Engineering and Mathematics (STEM)*** (Figures 8 and 7 in Annex 1). However, regarding the contribution of Belgian women in scientific work, the performance is better than EU-27 average with respect to ***mixed authorship***, and similar to EU-27 average with respect to quality of publications, as measured by the ***proportion of women in authorships of the top 10% most cited publications*** (Figure 9 and 10 in Annex 1 correspondingly). The '***Women in Digital Index'*** displays no significant difference between the Belgian and EU-27 average situation in 2022 (Figure 11 in Annex 1).

Under **Sub-priority 1.4:** *Researchers' careers and mobility and research assessment and reward systems*, Belgium is successful in attracting ***foreign doctorate students***, even though the situation is volatile from year to year and the share of these students has never reached the peak achieved in 2015 when more than 50% of doctoral students in Belgium were of foreign origin, the most recent figures being closer to 25% or 30% (Figure 12 in Annex 1). With the exception of one year (2017), the ***number of new doctorate graduates per 1,000 inhabitants aged 25-34*** in Belgium was stable during the period 2015-2021, around the EU-27 average (Figure 13 in Annex 1). The dynamics of ***job-to-job mobility*** of Human Resources in Science and Technology in Belgium tend to decrease compared to EU-27 dynamics over the past decade (Figure 14 in Annex 1).

Belgium is performing very well on all indicators measuring **Sub-priority 1.5:** *Knowledge valorisation*. The ***share of public-private co-publications*** is much higher than the average share in EU-27, and it is growing faster (Figure 15 in Annex 1). ***Patenting intensity*** is also consistently higher than EU-27 average, following a similar stable or slightly downward trend (Figure 16 in Annex 1). The country is well-endowed with ***business enterprise researchers per thousand employees in industry*** with a growing number that reached a value of 11 in 2020, compared to 7 at EU-27 level (Figures 17 and 18 in Annex 1). ***Collaboration between innovating firms and higher education institutions or public/private research institutions*** is also higher in Belgium than for the EU-27, although figures are decreasing in recent years as compared to the period 2010-2014 (Figure 19 in Annex 1).

Under **Sub-priority 1.6:** *Scientific leadership*, Belgium's performance is high. Its ***Academic Freedom Index*** remains on top (Figure 20 in Annex 1) and the quality of scientific publications, measured by the ***number of scientific publications among the top-10% most cited publications*** worldwide as a percentage of all publications, is also higher than the EU-27 average, with little variations (Figure 21 in Annex 1).

Trends under **Sub-priority 1.7:** *Global engagement* depict a very active Belgian scientific community on the international scene: ***international co-publications with non-EU partners per 1,000 researchers in the public sector*** is growing much faster and is about 2 times

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

higher than the EU-27 average in 2021 (Figure 23 in Annex 1). The picture is the opposite for ***European and international co-patenting in EPO applications at national and EU level***, where Belgium's performance consistently lies below EU-27 average (Figure 22 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

ERA Action 10: *Make EU research and innovation missions and partnerships key contributors to the ERA* is a key priority for Belgium as a whole. In a 2020 joint paper by all federated entities and the federal authority on the future or ERA, the Belgian position was that "*an evolution is needed to take account of new challenges such as the Green Deal, digitalisation and the risk of further health pandemics*".[40] Nowadays, federated entities and the federal authority refer to the Sustainable Development Goals (SDGs) and Regions rely on a participatory process of "entrepreneurial discovery" to define priorities in line with societal challenges. The Federated entities and the federal authority provide representation within the Mission Climate and the coordination of the Belgian position is done in the thematic **CIS Mission Climate adaptation** and climate resilient cities. *Flanders* explicitly adopts a mission-oriented innovation policy framework in which R&I efforts are oriented in particular towards **Industry 4.0**. A concrete implementation is the Flanders Industry Innovation **Moonshot initiative,**[41] focused on reducing its CO2 emissions and meeting its climate commitments. The Region will also adapt its EU platform to better cover initiatives that span multiple policy domains. In the *Brussels-Capital Region,* "*an important debate is developing around the policy balance. Research, development and innovation (RDI) policy increasingly focuses on developing challenge-oriented, top-down policy instruments*".[42] Concretely, the Region intends to incorporate social sciences increasingly in its R&I support programmes. *Wallonia* started from societal challenges to build up its **Smart Specialisation Strategy (S3).**[43] The priority domains translate into **19 Strategic Innovation Initiatives (Initiatives d'Innovation Stratégiques – IIS)** with a strong international dimension and supported through a bundle of funding mechanisms. The *federal* authority adopts "*a cross-functional research strategy, based on the search for synergies, to best respond to societal and governmental priorities*",[44] a concrete example being the newly established **Belgian Climate Centre,**[45] providing climate services to respond to the needs of policy makers and different sectors. The *Wallonia-Brussels Federation* introduces SDGs into the criterion 'potential societal impact' in projects evaluation[46] and F.R.S.-FNRS planned the **ClimAX[47] initiative** for climate research in 2019. In addition, its **Strategic Research Fund** is oriented towards research supporting Walloon competitiveness poles, and selection criteria have been adjusted to better capture expected societal impacts. All three regions promote participation

[40] Belgian Science Policy Office (2021). Belgian Report on Science Technology and Innovation 2021. BELSPO. https://www.belspo.be/belspo/organisation/publ/pub_ostc/BRISTI/FWB_rapport_2021_en.pdf
[41] https://moonshotflanders.be/moonshot/
[42] European Commission / OECD (2023). STIP Compass Belgium Overview, generated from https://stip.oecd.org/stip/interactive-dashboards/countries/Iceland on 25 July 2023.
[43] 'Wallonia's Intelligent Specialisation Strategy (S3)', available at https://s3.wallonie.be/home.html
[44] Ibid
[45] Belgian Climate Centre. https://eo.belspo.be/en/news/belgium-launch-centre-excellence-climate
[46] https://www.frs-fnrs.be/fr/reglements-guides
[47] ClimAX initiative for climate research (2019). https://www.frs-fnrs.be/fr/l-actualite-fnrs/274-climax-communique-de-presse-du-fnrs

in the EU Missions; *Brussels-Capital* being itself a signatory of the Cities Mission while *Wallonia* and the *Wallonia-Brussels Federation* have been fully involved in the **Climate Adaptation Mission**. All entities participate in EU partnerships, for which an intra-Belgian concertation platform exists to foster synergies.

ERA Action 11: *An ERA for green transformation* is also at the core of new Belgian R&I policies. *Flanders* and *Wallonia* are actively involved in the European Strategic Energy Technology Plan, which has taken up the implementation of ERA Action 11. They are both involved in the SET Plan Steering Group and several SET Plan Implementation Working Groups.[48] In addition, the **Belgian Resilience & Recovery Plan**[49] focuses on this goal, in particular in supporting **Research Infrastructure Projects for Green Hydrogen**. At the *federal level,* the **Strategic Research and Innovation Agenda (SRIA)** of the ERA Pilot on Green Hydrogen is crucial. **BELSPO** hosts the Central Secretariat (CS) of the JPI Climate. Since 2011, it has been bringing together major climate research, funding organisations in Europe while strengthening global collaboration via a series of flagship programmes related to Horizon 2020.

Building upon those strategic developments, several members of the JPI Climate have been granted with a new Horizon CSA project "**MAGICA**"[50] (Maximising the synergy of European research governance and innovation for climate action). The JPI Climate CS together with BELSPO as Research Funding Organisation and with the support of the upcoming new Belgian Climate Centre are expected to implement key tasks of the MAGICA project. *Flanders*[51] is involved in numerous hydrogen transnational projects, contributes to the **Clean Hydrogen Partnership** and is involved in several projects in the **IPCEI "Hydrogen technologies and Systems"**. Additionally, its knowledge and expertise platform in hydrogen (WaterstofNet)[52] coordinates the **"Hydrogen Industry Cluster",**[53] including members from Belgium and the Netherlands. *Wallonia* has defined Sustainable Energy systems and building as one of its **S3's Strategic Innovation Areas**, with several **Strategic Innovation Initiatives** selected to operationalise these priorities. Both Wallonia and Flanders are involved in the **Vanguard Initiative network**, aiming at developing interregional collaboration based on smart specialisation complementarities, under which a pilot project about hydrogen is launched. The *Wallonia-Brussels Federation* is setting up an interdisciplinary and "trans-technological" research platform in the field of energy transition with French-speaking universities. In *Brussels-Capital*, **Innoviris** is coordinating the **Climate City Contract** under the **EU Smart and Climate Neutral Cities Mission of Horizon Europe**, where the goal is to achieve carbon neutrality by 2030. All federated entities and the federal authority coordinate on the issue of the green transition within the international and interfederal coordination mechanism, CIS Climate.

Under **ERA Action 12:** *Accelerate the green/digital transition of Europe's key industrial ecosystems*, within the national Recovery and Resilience Plan, R&I projects will support the green and digital transitions of industrial ecosystems. This will amplify a strong priority in the 3 Regions' R&I policies, especially Flanders and Wallonia where enhancing competitiveness and sustainability of industry is a top priority. Main instruments in *Flanders* are its 4 strategic

[48] SET Plan Implementation Working Groups. https://publications.jrc.ec.europa.eu/repository/handle/JRC135396 (SET plan progress report 2023)
[49] Office of the Secretary of State for Recovery and Strategic Investments, in charge of Science Policy (2023). National Recovery and Resilience Plan - NRRP, available at https://nextgenbelgium.be
[50] MAGICA – JPI Climate (jpi-climate.eu). Project under under HORIZON-CL5-2021-D1-01-03
[51] In addition to the large Moonshot project on decarbonisation of industry, mentioned under ERA Action 10, with an important component on carbon capture usage and storage.
[52] WaterstofNet. https://www.waterstofnet.eu/en/about-the-waterstof-industrie-cluster/about-the-cluster
[53] Ibid

research centres in various domains: **Imecimec** (nanotechnology/nanoelectronics); **VIB**[54] (Biotechnology, life sciences), **VITO** (environment, energy and remote sensing), **Flanders Make**[55] (smart manufacturing), whose knowledge and technology infrastructure are made available to stakeholders, in particular companies and SMEs. **VLAIO**, the **Flanders Innovation and Entrepreneurship Agency** deploys various funding lines supporting research in green and digital transition for the benefit of industry. An initiative from such a spearhead cluster, in which at later stage innovation infrastructure is supported is the **Moonshot[56] program**, working towards Flemish industries being carbon circular and low in CO2 by 2050. In *Wallonia*, a reform of the regional research centres is ongoing in view of achieving excellence and optimising their contribution to industry transformation. Industrial technologies roadmaps addressing topics related to circular and low carbon industrial and business models, are being prepared in collaboration with the competitiveness clusters in the framework of the Smart Specialisation Strategy. **Digital Wallonia[57]** supports digitalisation in SMEs and industry, but also in public sector and by citizens. The *Brussels-Capital* region's innovation strategy aims to contribute to the ecological transition towards a zero-carbon region and better resource management through circular economy. R&D projects funded by the region's thematic calls target green and digital transition. In 2022, the F.R.S.-FNRS set up the WEL-T programme,[58] which aims to promote new and important discoveries with potential applications to foster sustainable transition, a strategic sector for Wallonia, in areas as renewable energy, new materials, recyclable materials and safe production methods.

Concerning **ERA Action 13:** *Empower Higher Education Institutions*, both Flemish and French-speaking universities are active members in European Universities. The *Flemish* Government supports them in their engagement in the R&I agenda of these European University Initiatives with a co-funding for each university and universities of applied sciences and arts. Both Communities are responsible for funding Higher Education Institutions (HEIs), through block funding and dedicated funding lines channels for fundamental and strategic research, which contribute to research excellence at these HEIs.

The goal of **ERA Action 14:** *Bring Science closer to citizens* is a top-priority and thus subject to multiple initiatives in Belgium, each federated and federal entity considering this as a vital part of their strategies, and a necessary complement to their new orientation towards societal challenges, as depicted under ERA Action 10. At the *federal level* work is being carried out on a new approach towards the public by integrating them as stakeholders in the research and development activities of the **11 Federal Scientific Institutions**. BELSPO will offer an information and knowledge sharing platform for the projects of the Federal Scientific Institutes. It also publishes a magazine, "**Science Connection**"[59] aimed at popularising science. In the *Region of Brussels-Capital* the preparation of the **Smart Specialisation Strategy** relied on extensive consultations of civil society and the innovation ecosystem and includes a strong commitment to include citizens in STI governance. A new focus is placed on new research methods, such as co-operative and co-creative research that bring together different research actors, including academics, businesses, public bodies and citizens. The Region provides funding for projects that raise awareness on science among young students, women, and weaker and under-represented socio-economic groups. Both *Wallonia* and the *Wallonia-Brussels Federation* provide funding for local science awareness actions as well as actions towards the promotion of STEAM (Science, Technologies, Engineering, Arts and

[54] Flanders Institute for Biotechnology. https://vib.be. For IMEC and VITO see footnote under ERA Action 5.
[55] Flanders Make. https://www.flandersmake.be
[56] Flanders Industry Innovation Moonshot. https://moonshotflanders.be/lsi-projects/
[57] Digital Wallonia. https://www.digitalwallonia.be/fr/
[58] Opening of the WEL-T Investigator Programme 2022 call for proposals. https://www.frs-fnrs.be/fr/l-actualite-fnrs/2420-the-wel-t-investigator-programme-2022-call-is-now-open
[59] BELSPO. https://www.belspo.be/belspo/organisation/publ_science_fr.stm

Mathematics). Wallonia also diffuses a **science popularisation magazine (ATHENA)**[60] and supports various science contests. *Flanders* supports **Scivil,**[61] the Flemish Knowledge Centre on citizens science with the mandate to develop, test and validate new forms of citizen engagement and empowerment. There **were several calls for Citizen Science project proposals** since 2018; and in 2020 a new STEM policy plan has been launched: the **STEM-agenda 2030,**[62] focusing on 'STEM literacy' and aiming at establishing a "STEM Academy" in municipalities. Flemish universities have concluded an agreement with the Flemish administration for their science communication and dissemination activities. The *Wallonia-Brussels Federation* is also intensifying its communication activities and the promotion of researchers' activities.

2.2.2. Progress towards achieving ERA Priorities

Indicators under **Sub-priority 2.1:** *Challenge-based ERA actions* provide more evidence for the openness of the Belgian R&I system, which allocates significant ***funding to R&I investments for transnational cooperation*** in the EU-27: these remain at high level, at the double of the amounts allocated on average by EU-27 countries (Figure 25 in Annex 1). In contrast, all indicators measuring environment-related efforts show a relatively bleak picture for Belgium: ***environmentally related government R&D budget as percentage of total government R&D*** remains consistently below the EU-27 average and shows a significant decline between 2017 and 2020, not experienced at EU-27 level (Figure 26 in Annex 1). Belgian ***investments suggested under the Strategic Energy Technology Plan*** are markedly trailing behind those performed elsewhere in the EU-27 between 2010 and 2020, however, along time the EU-27 value decreases while the data for Belgium increases and hence, the gap is reduced (Figure 27 in Annex 1). ***Patents on environment technologies*** are fewer in Belgium than in EU-27, however the gap has been narrowing down between 2011 and 2018 (Figure 28 in Annex 1). Moreover, as Figure 23 in Annex 1 demonstrates, the Belgian performance in relation to ***Government Budget Allocations for R&D (GBARD) by NABS*** in energy; environment; transport, and telecommunications and other infrastructure is lower than the European average in all three aspects. Among them, the investment in energy is the only sector in which the value has increased.

The indicator under **Sub-priority 2.2:** *Synergies with education and the European Skills Agenda*, the ***share of researchers receiving transferable skills training***, provides a bright picture: the value of this indicator for Belgium is significantly higher than in the EU-27, though the data show a similar decrease in both cases between 2016 and 2019 (Figure 29 in Annex 1).

Concerning **Sub-priority 2.3:** *Synergies with sectoral policies and industrial policy, in order to boost innovation ecosystems*, as already mentioned in section 2.1, investments in R&D are growing faster in Belgium than the average of the EU-27, except for GBARD with values and trends similar to EU-27 average. However, when both ***direct government support and indirect government support through R&D tax incentives*** are considered, then Belgium stands again ahead of the EU-27 average, with remarkable growth of public support to R&D in recent years (Figure 30 in Annex 1).

Under **Sub-priority 2.4:** *An active citizen and societal engagement in R&I in all its dimensions,* ***trust in science*** stands at a lower level in Belgium compared to the EU-27 average in 2021 (Figure 31 in Annex 1). Trends in intensity of ***research on social innovation*** tend to be relatively similar for Belgium and the EU-27, with the country's intensity standing

[60] Science popularisation magazine (ATHENA). https://recherche.wallonie.be/magazine-athena
[61] Scivil. https://www.scivil.be
[62] Wat is de STEM-agenda 2030?. Vlaanderen. https://onderwijs.vlaanderen.be/nl/directies-en-administraties/onderwijsinhoud-en-leerlingenbegeleiding/secundair-onderwijs/stem-science-technology-engineering-mathematics/stem-actieplan/wat-is-de-stem-agenda-2030#actieplan

higher than the EU-27 average for the whole period 2010-2021, with peaks in the period 2018-2020 (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

In relation to **ERA Action 16***: Improve EU-wide access to excellence*, Belgian authorities are reviewing their R&I support systems in view of raising research excellence and relevance, as well as boosting innovation. The *Federal* **Science Policy** has concluded a review of its R&D funding programmes to enhance their effectiveness in the face of budget constraints and has established a new centre of excellence on Climate, joining forces of several of its Federal Scientific Institutes. The trend towards broader multi-disciplinary research approaches will also be fostered by greater cooperation between the Federal Scientific Institutes and universities in all Belgian regions and communities. Another aspect is the **Excellence of Science (EOS) programme** [63] launched in 2017 to promote joint research between researchers in the Flemish and French-speaking communities, as well as foreign researchers. A priority project for the *Walloon* Government under the RRP is to structure, optimise or coordinate the service offer of the Walloon research centres in the form of **Strategic Innovation Centres (SIC)** with a cross-sectoral ambition, creating critical mass in a limited number of priority areas for Wallonia. Mergers and reorganisations of support organisations have been deployed to create a one-stop shop for entrepreneurship, innovation, and financial support for businesses. The *Brussels-Capital Region* is also working on establishing integrated excellence research centres focused on Artificial Intelligence and on cancer research. In *Flanders,* the establishment of the **Flemish Innovation and Entrepreneurship Agency VLAIO** involved the merger of formerly separate agencies to create a single point of contact for companies related to innovation and entrepreneurship.

ERA Action 17: *Enhance public research institutions' strategic capacity* is implemented through funding models which increasingly reward performance. **Knowledge transfer Offices** at universities are funded structurally by the Regions, providing structural support to capacity in research management and knowledge valorisation.

2.3.2. Progress towards achieving ERA Priorities

Concerning **Sub-priority 3.1:** *More investments and reforms in countries and regions with lower R&I performance,* the Belgian figures on ***increase of total R&D expenditure expressed as a percentage of GDP*** show that particular efforts have been made by the country to increase its overall R&D intensity during the period 2016-2020, exceeding the 3% threshold in 2019. In 2021, increases have been less intense than the EU-27 average (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

Advances in **ERA Action 19:** *Establish an ERA monitoring system* rely on data and information to be provided at national level. In Belgium this information is collected by each entity separately, and the differences in capacity between the responsible organisations

[63] EOS. The Excellence of Science. http://eosprogramme.be/

result in differences in production of such data and information. The official body is the **Belgian Statistical Office, Stabel**.[64] For official data, the federal level is organising the inter-federal concertation and compilation of statistics at the level of the country. However, for other data, such systematic mechanisms are not yet developed.

2.4.2. Progress towards achieving ERA Priorities

The indicator for **Sub-priority 4.1:** *Coordination of R&I investments*, ***the share of public R&D expenditures financed by the private sector*** is consistently higher in Belgium than the average in the EU-27, and these figures do not display strong variation over time (Figure 34 in Annex 1). This is in line with previous data on the extent of public-private linkages in R&D in Belgium.

3. Country-specific drivers and barriers

Belgian's main **drivers** towards contributing to the ERA include a **well-performing R&I system with a strong science base** in leading universities and strategic research centres active in frontier research with high impact, well connected to large companies of all origins performing research at international scale, and to innovative start-ups and spin-offs. Another key driver entails the **tradition of openness not only in trade but also in science and research** with excellent integration at the heart of EU networks, coupled with genuine commitments to EU orientations providing ample opportunities to reap benefits from participation in European and international projects. Finally, **high decarbonisation challenges faced by the densely populated and industrialised country** are another driving force, as solutions need to be developed in partnership with R&I actors in other EU countries.

A possible barrier for Belgian's contribution to ERA is the **intrinsic difficulty to create synergies between visions and actions of the various federated entities and the federal authority**, as cooperation only flourishes based on voluntary 'concertation' processes. There is also a **conundrum in translating new challenge-driven and mission-oriented orientations of current policy frames** into existing sets of policy instruments framed in a historic context: path-dependency and the need for a certain degree of stability in the R&I support system hamper a move towards more radical policy transformation. The last identified challenge, highlighted in the European Semester Report 2023, entails a **general lack of human resources in STEM** as well as a "*lack of* relevant *skills for the green transition creating bottlenecks in the transition to a net zero economy*".[65]

4. Final remarks

Belgium as a whole has committed to all ERA Actions. Belgium has made remarkable progress in those ERA dimensions where the country is strong, as overall R&D intensity, scientific leadership, the degree of openness and internationalisation, research infrastructure, share of foreign doctoral students, global engagement, and last but not least, the linkages between public and private sector, both in terms of scientific output and innovative outcomes.

Progress on two dimensions of the ERA Policy Agenda seems more difficult to achieve: On the one hand, gender equality continues to lag behind EU average according to indicators

[64] Statbel database. https://statbel.fgov.be/fr
[65] European Semester Country Report (2023). https://economy-finance.ec.europa.eu/publications/2023-country-report-belgium_en

and, on the other hand, ‘green’ performance is also trailing behind EU average. The summary of current developments shows that a lot is happening on those two fronts, with new efforts towards incorporating gender equality in programmes and organisations and strong incorporation of green transition in the RRP, major initiatives in green energy and increased smart orientation at the level of regional policies with climate and environment featuring as priorities.

The contribution to the ERA Policy Agenda needs to be understood as the combination of actions from 5 different entities acting in autonomy, the sub-national level representing more than 80% of GBARD. Hence, indicators at the national level cannot sufficiently display important differences between the various parts of the country.

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6. Annexes

6.1. Annex 1: Graphs

The 2023 ERA Scoreboard and ERA 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 ERA Dashboard Methodology Report. The most recent available data for each indicator has been used.

General Indicators

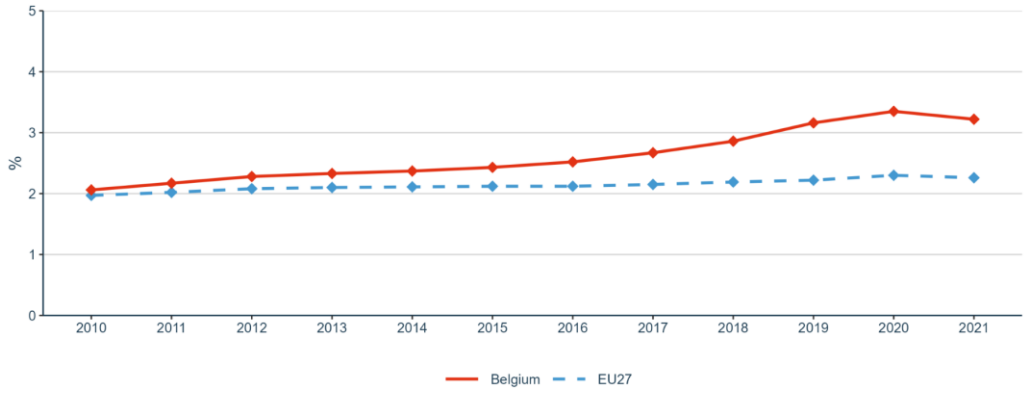

Figure 1: Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP

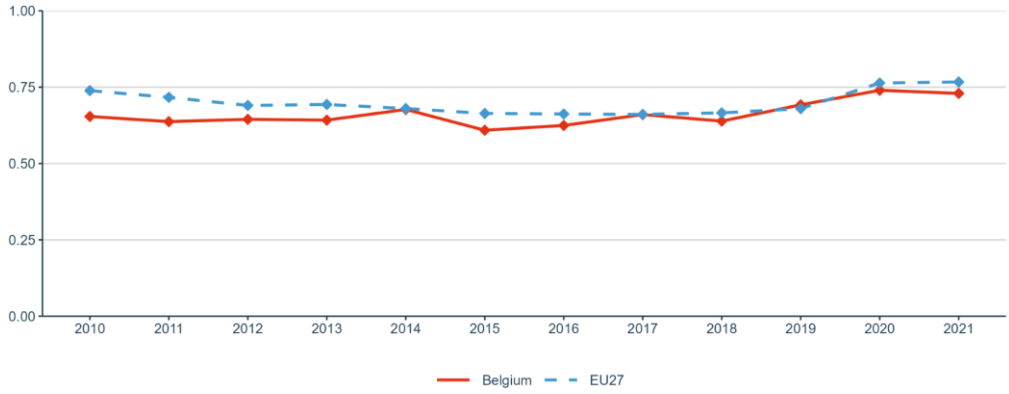

Figure 2: Government Budget Allocations for R&D (GBARD) as share of GDP

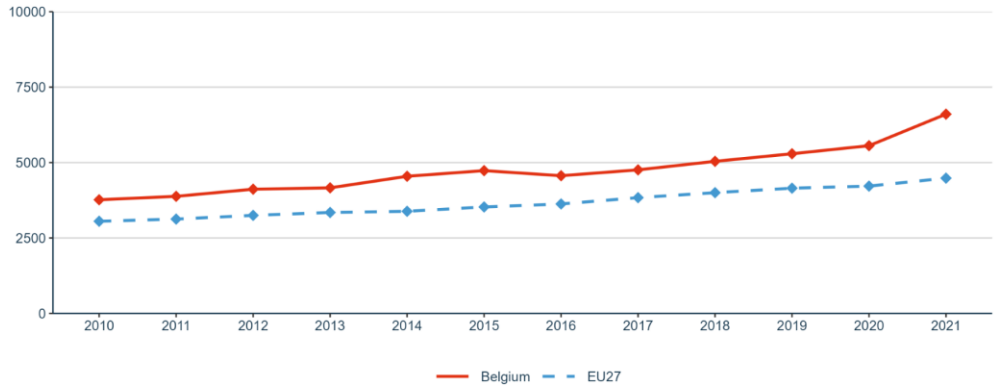

Figure 3: Researchers (in full-time equivalent) per million inhabitants

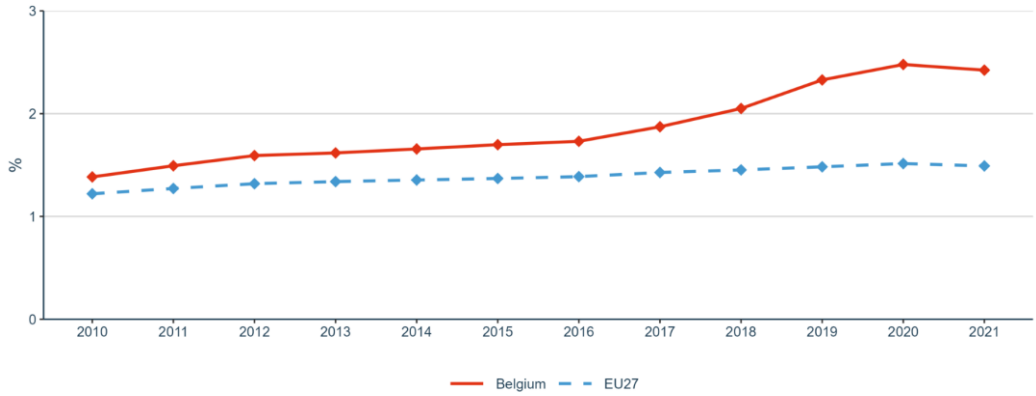

Figure 4: Business Enterprise expenditure on R&D (BERD) as a percentage of GDP

Priority 1: Deepening a truly functioning internal market for knowledge

Sub-priority 1.1: Open Science

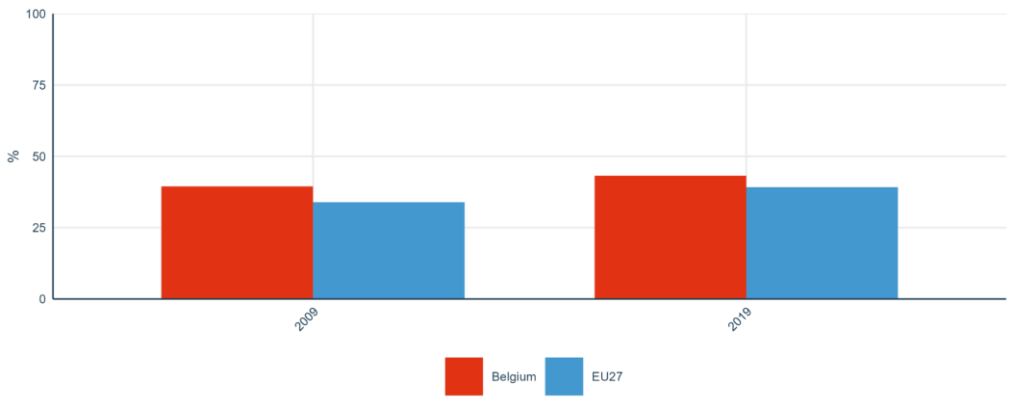

Figure 5: Share of publications available in open access

Sub-priority 1.2: Research infrastructures

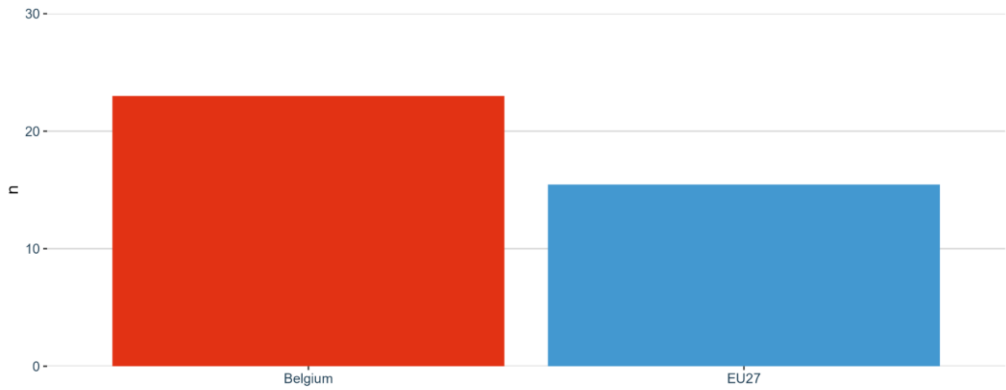

Figure 6: Number of European research infrastructures in which a Member State or an Associated Country participated (financially contributes to operations) in 2021

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

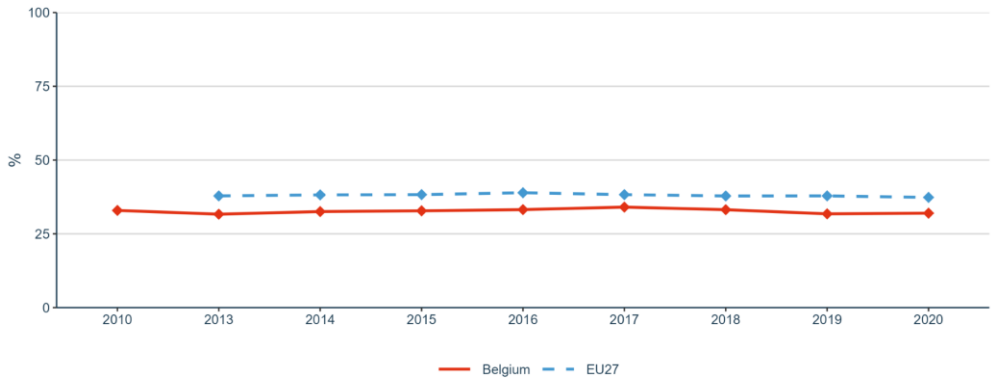

Figure 7: Proportion (%) of women among doctoral graduates by narrow fields of Science, Technology, Engineering and Mathematics (STEM)

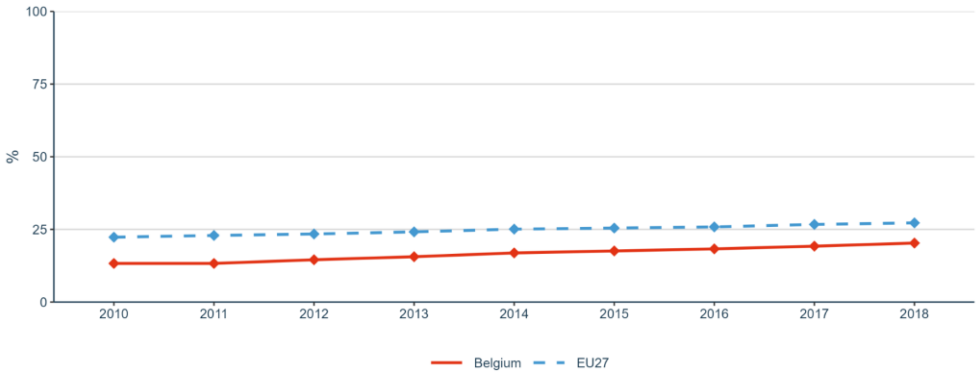

Figure 8: Share of women in grade A positions in HEIs

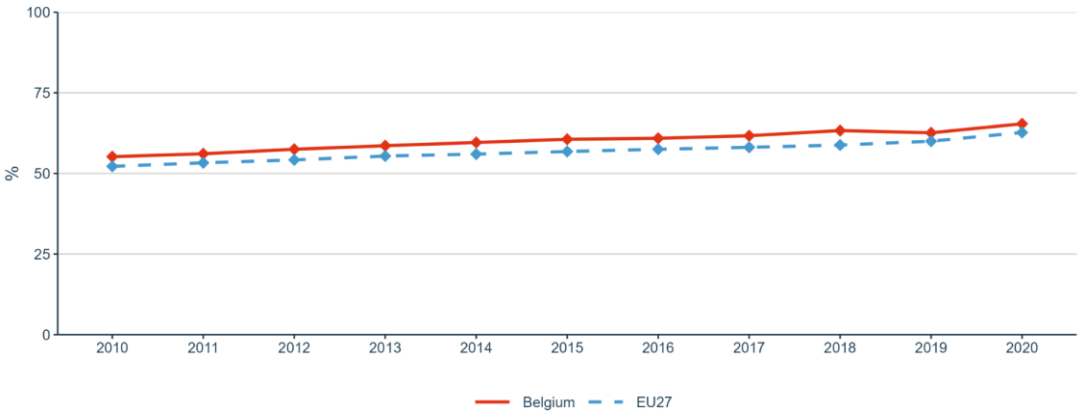

Figure 9: Proportion of papers with mixed gender authorship, 2000–2020

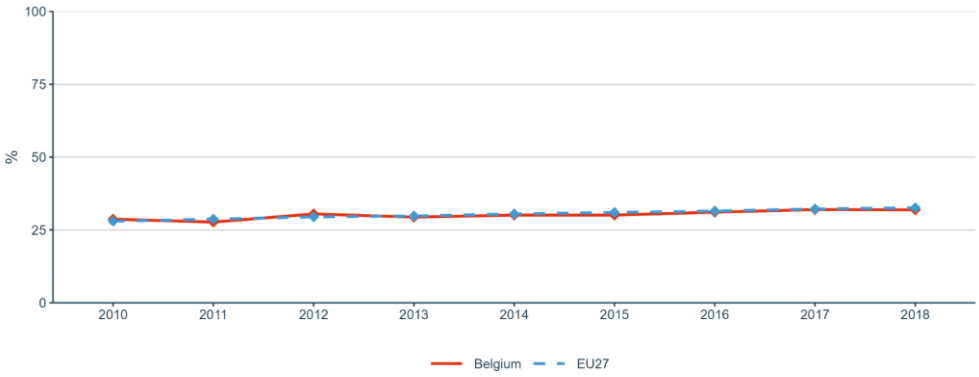

Figure 10. Proportion of women in authorships of the top 10% most cited publications, 2000–2018

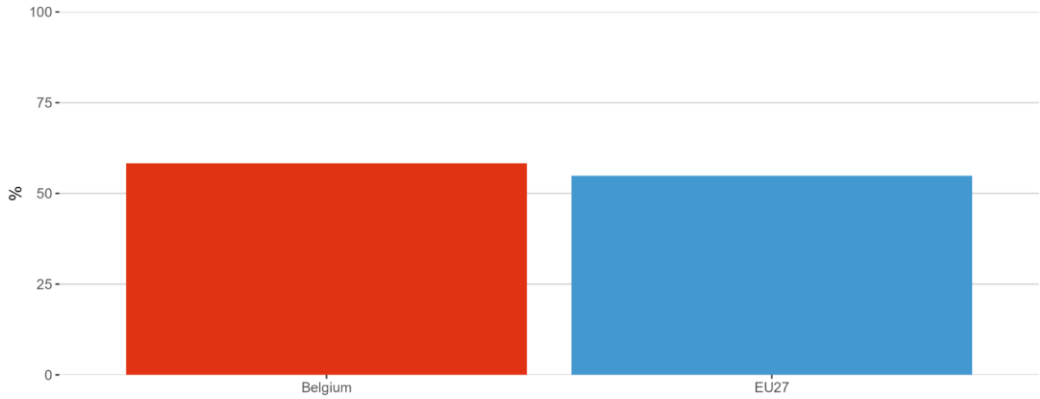

Figure 11: Women in Digital Index in 2022

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

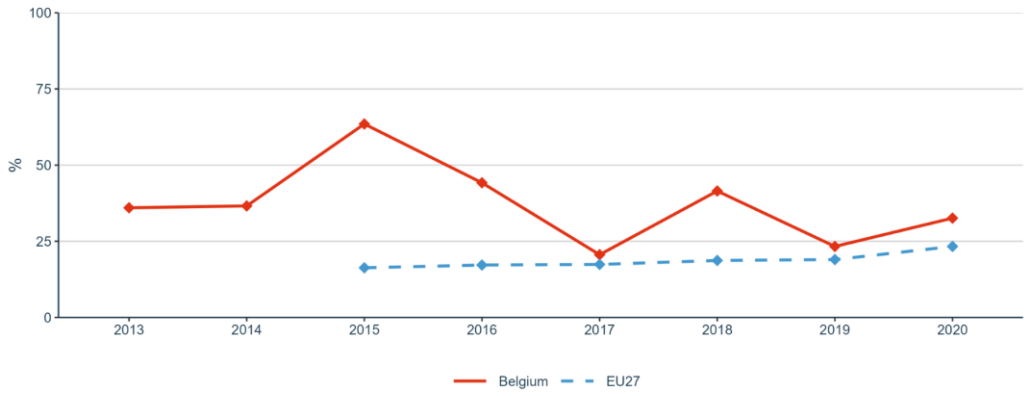

Figure 12: Share of foreign doctorate students as a percentage of all doctorate students

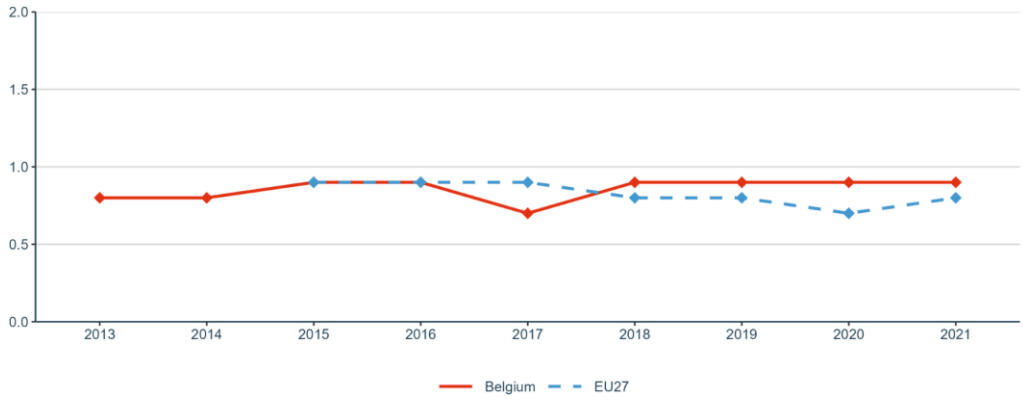

Figure 13: New doctorate graduates per 1,000 inhabitants aged 25-34

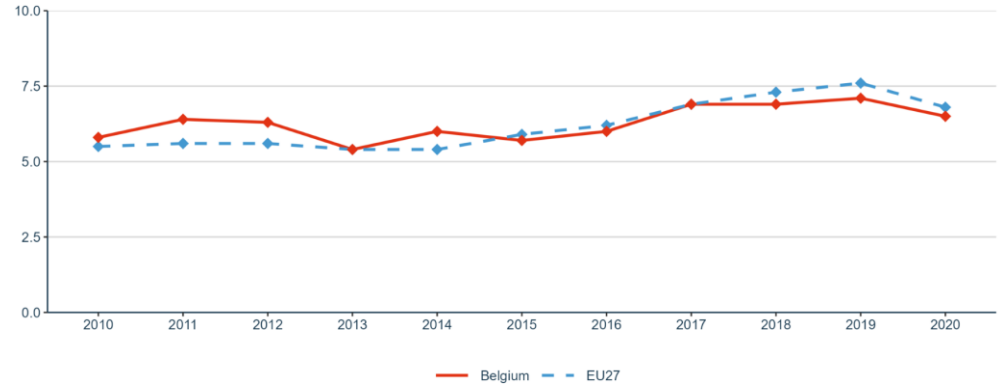

Figure 14: Job-to-job mobility of Human Resources in Science and Technology

Sub-priority 1.5: Knowledge valorisation

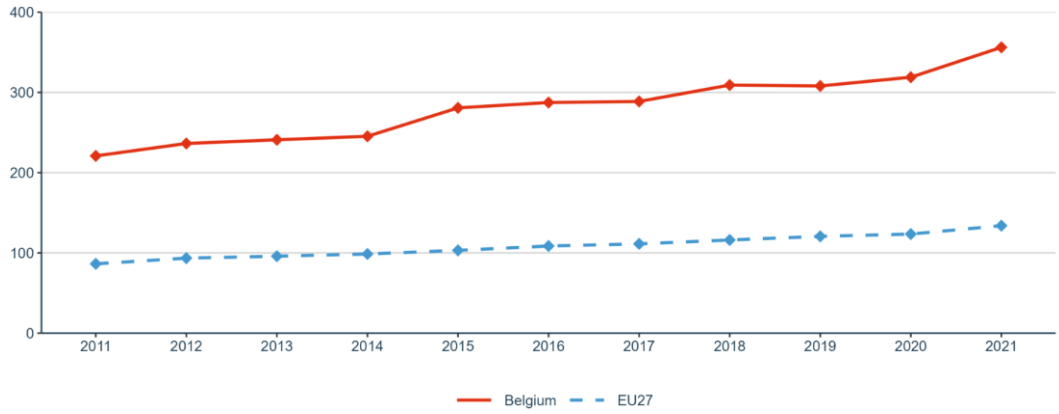

Figure 15: Share of public-private co-publications per 1 mio inhabitants

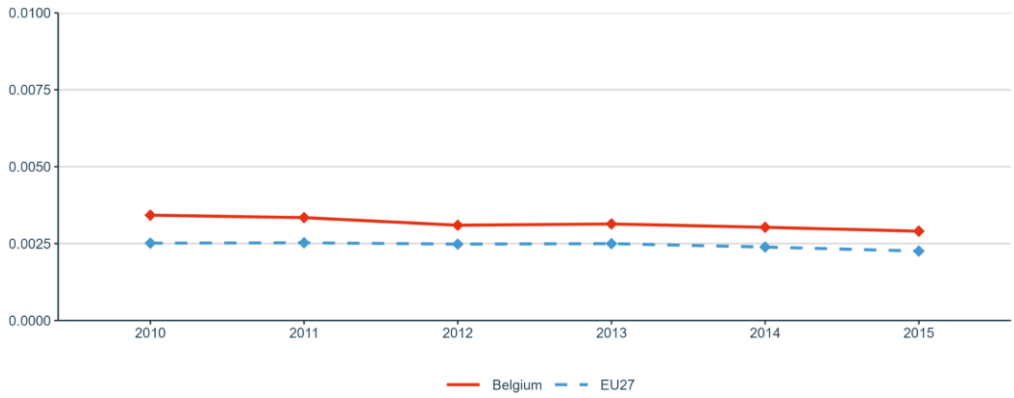

Figure 16: Number of PCT patent applications divided by GDP in million Euros

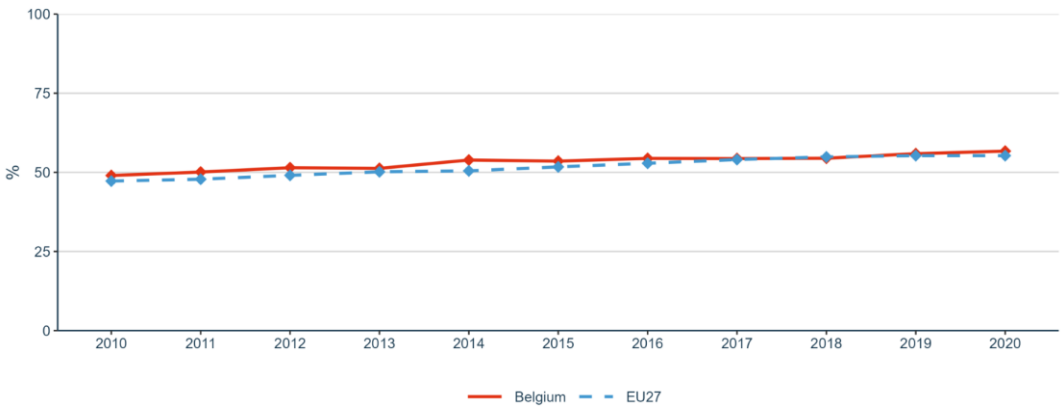

Figure 17: Business enterprise researchers as % of national researchers

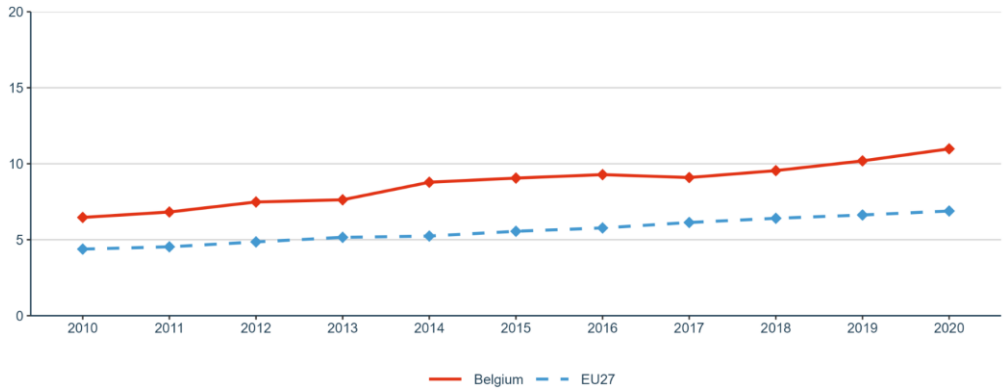

Figure 18: Business enterprise researchers in full-time equivalent per thousand employees in industry

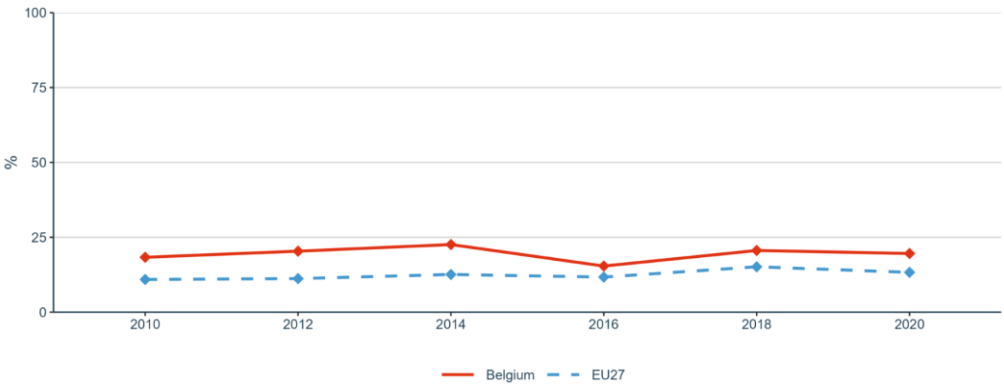

Figure 19: Share of innovating firms collaborating with higher education institutions or public/private research institutions

Sub-priority 1.6: Scientific leadership

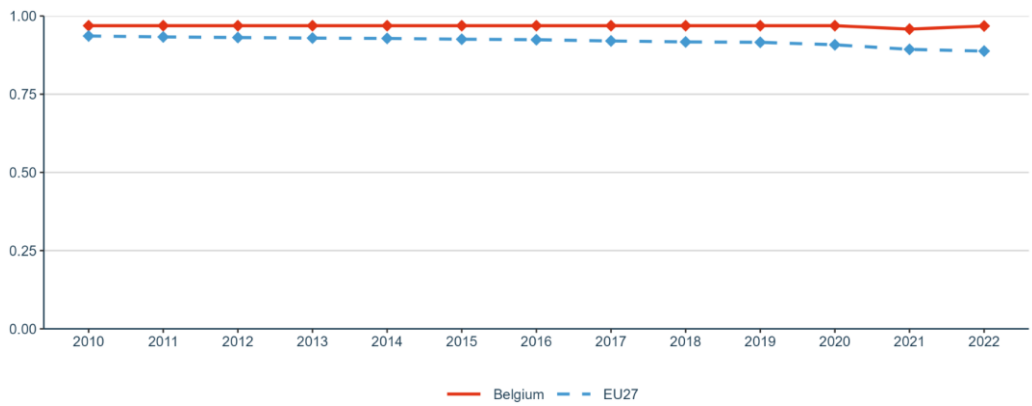

Figure 20: Academic Freedom Index (AFi)

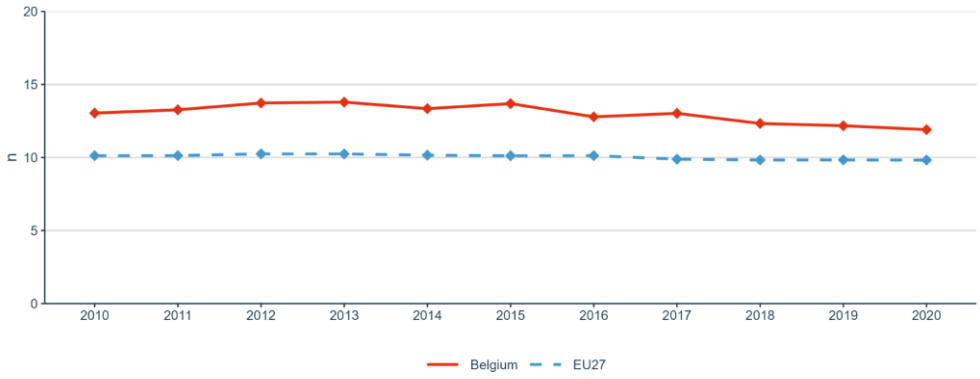

Figure 21: Number of scientific publications among the top-10% most cited publications worldwide as a percentage of all publications

Sub-priority 1.7: Global engagement

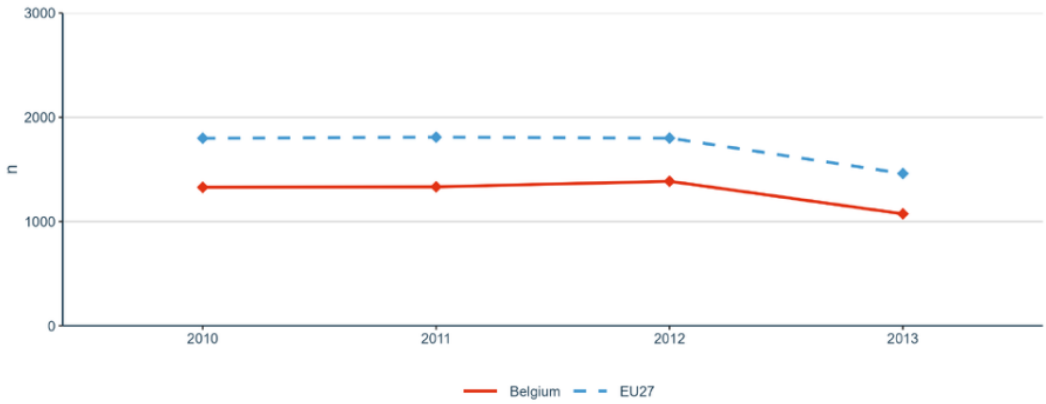

Figure 22: European and international co-patenting in EPO applications at national and EU level

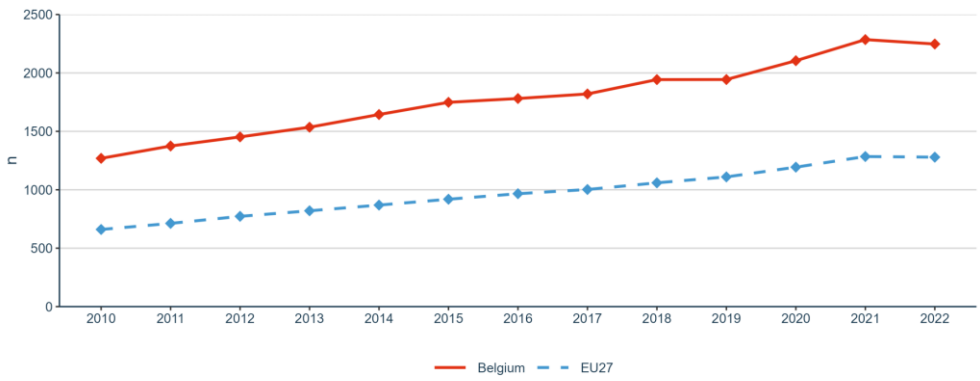

Figure 23: International co-publications with non-EU partners per 1,000 researchers in the public sector

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

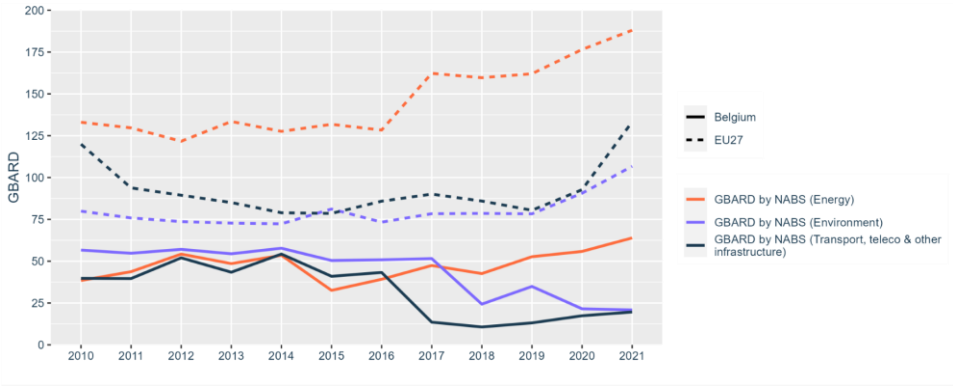

Figure 24: Government budget allocations for R&D (GBARD) by NABS

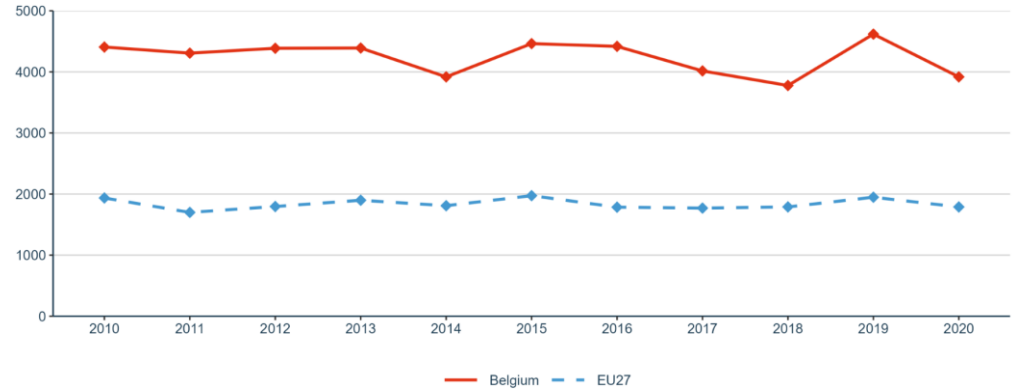

Figure 25: R&I investments (transnational cooperation): GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector

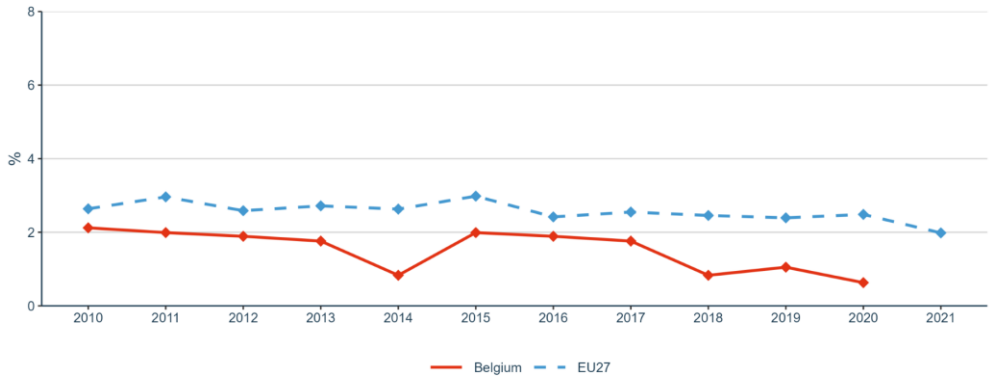

Figure 26: Environmentally related government R&D budget as percentage of total government R&D

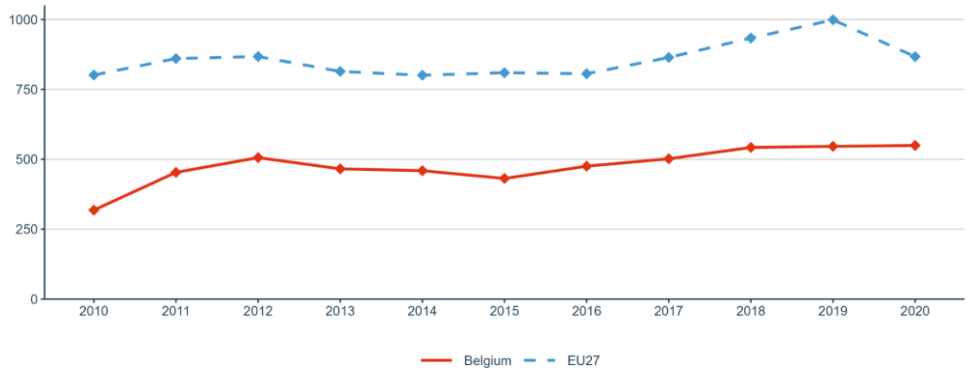

Figure 27: National public and private investments (in EUR, million) as suggested in the SET Plan progress report 2021

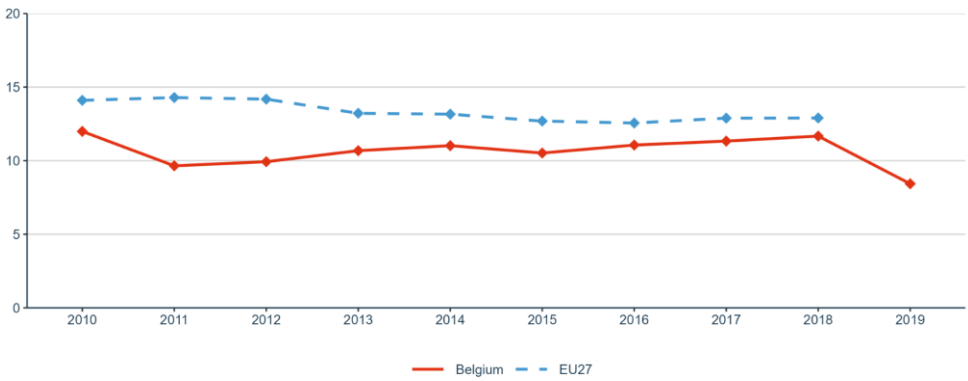

Figure 28: OECD Patents on environment technologies

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

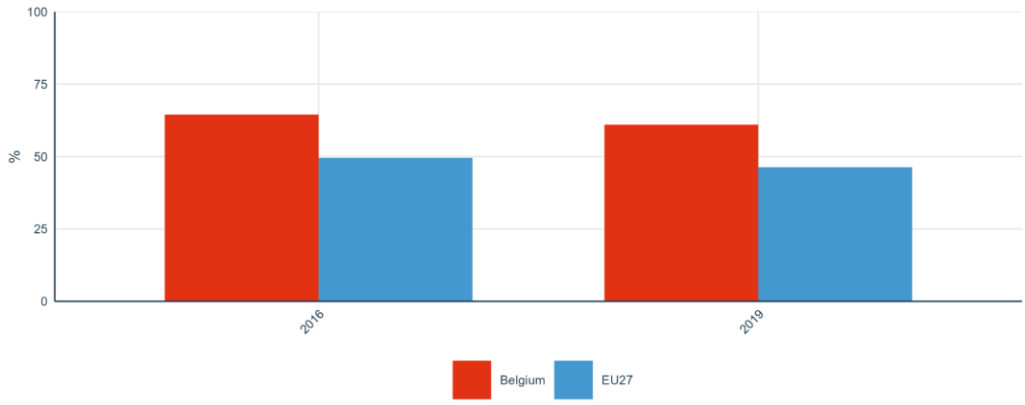

Figure 29: Share of researchers receiving transferable skills training

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

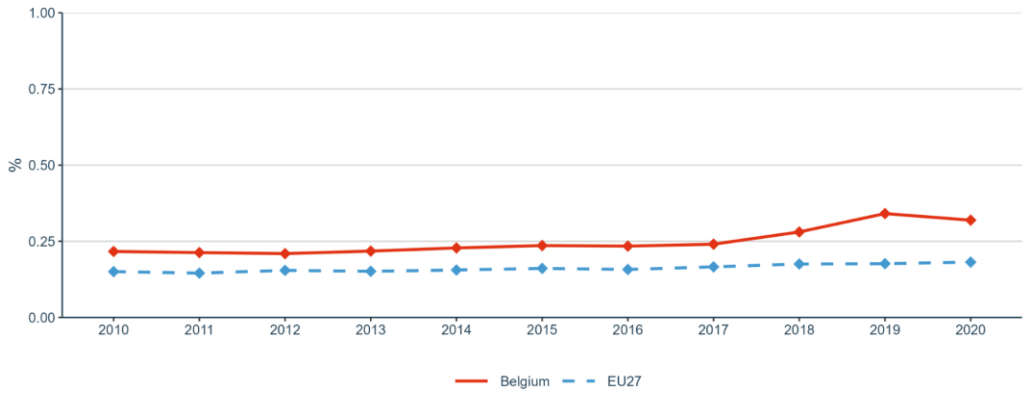

Figure 30: Direct government support and Indirect government support through R&D tax incentives as a percentage of GDP

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

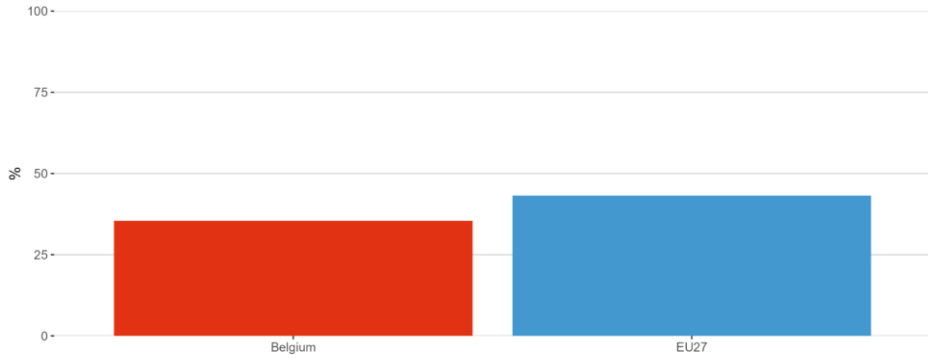

Figure 31: Trust in science in 2021

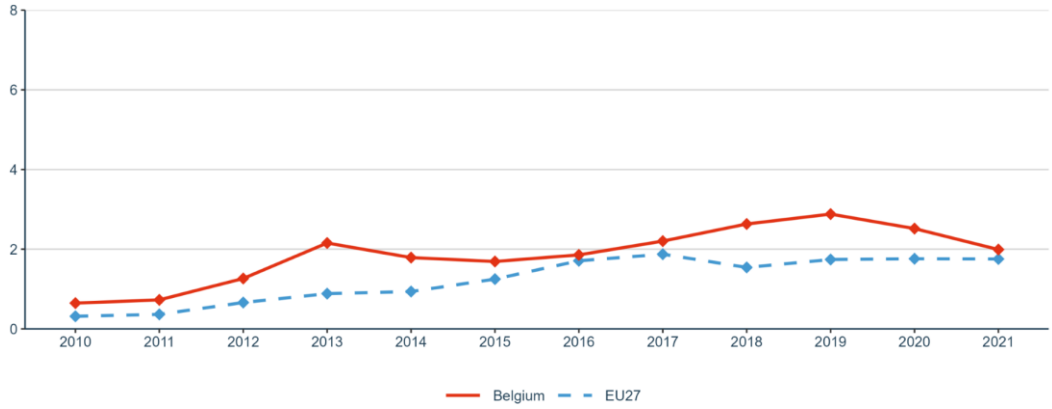

Figure 32: Research on social innovation (publications on 'social innovation' or 'social entrepreneurship') per million population

Priority 3: Enhancing 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

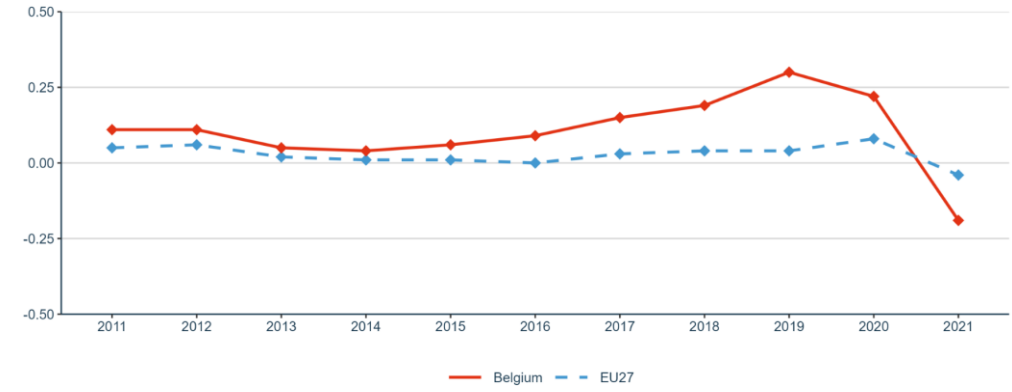

Figure 33: Increase (in percentage points) of total R&D expenditure expressed as a percentage of GDP

Priority 4: Advancing concerted research and innovation investments and reforms

Sub-priority 4.1: Coordination of R&I investments

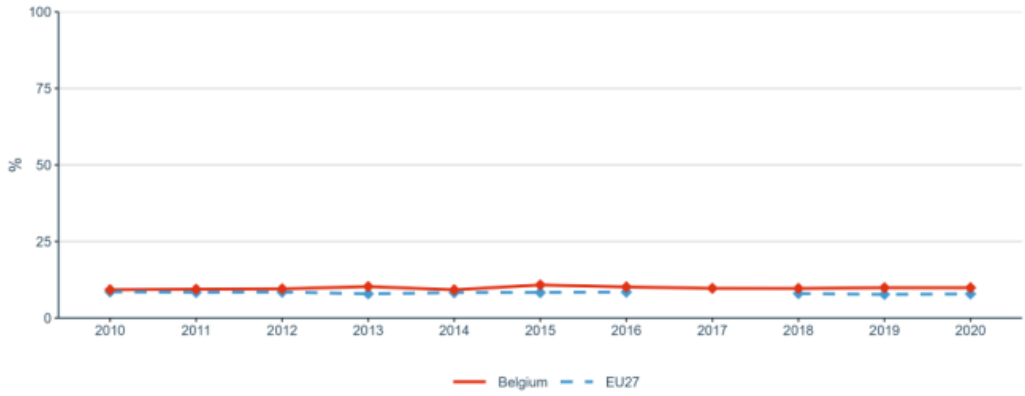

Figure 34: Share of public R&D expenditures financed by the private sector

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