ERA LEARN

COUNTRY REPORT

Belgium

ERA-LEARN:
enabling systematic interaction with the P2P community

June 2020

Project no.	811171
Project acronym	ERA-LEARN
Project full title	Strengthening partnership programmes in Europe
Funding scheme	CSA
Start date of project	July 1st, 2018
Duration	48 months
Deliverable D5.3	ERA-LEARN Country Report Spain
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Date of deliverable	June 2020
Dissemination Level	Public

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Preface

The Belgian context in research and innovation

Belgium's economic growth is estimated to have decreased to 1.4% in 2019 after a robust economic expansion of 1.5% in 2018 and a steady growth at an average rate of 1.8% per year between 2014 and 2017. Future projections, before the COVID-19 breakout, expect growth to broadly stabilise at 1.5% until 2021 and then decrease to about 1.1% as population ageing puts high burden on labour force.[1]

According to the European Innovation Scoreboard (EIS) 2019[2], Belgium is a strong innovator with an increasing performance since 2011. Belgium scores particularly well in all the indicators related to 'linkages', 'innovators' and 'attractive research systems'. The lowest scores appear in 'employment impacts' and 'intellectual assets'. Due to the highly decentralised system in Belgium, it is worth looking into the profiles of the various entities (in the Regions and Communities) in charge of research funding in the country to specify the strongest and weakest points of Belgium's performance.

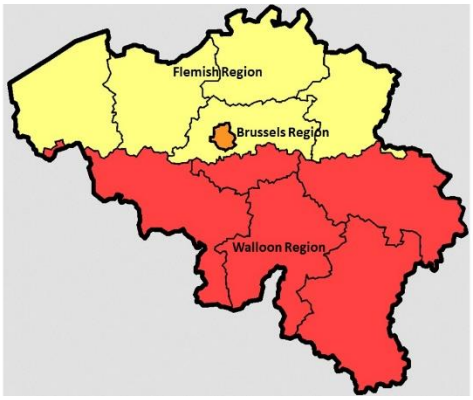
Belgium is a federation with two types of federated entities: Regions and Communities. It is composed of three regions (the Flemish Region, the Walloon Region, and the Brussels-Capital region) and three communities (the Flemish Community, the German Community, and the French Community, called the Brussels-Wallonia Federation, FW-B). Each Region and each Community has its own legislative body and its own government but they decide on different matters. The Community governments and legislative bodies decide upon matters such as culture, education, language, or health care, while the Regional governments and legislative bodies deal with topics in relation to housing, economy, transportation, public works, the environment, spatial planning, energy, land use, etc. While the Walloon Region and French Community (Wallonia-Brussels Federation, FW-B) remain separate, the Flemish Community and Region merged their institutions into one Parliament, one Government and one public administration and adopted a single label 'Vlaamse overheid' (even if legally speaking both entities remain with their different competencies).[3]

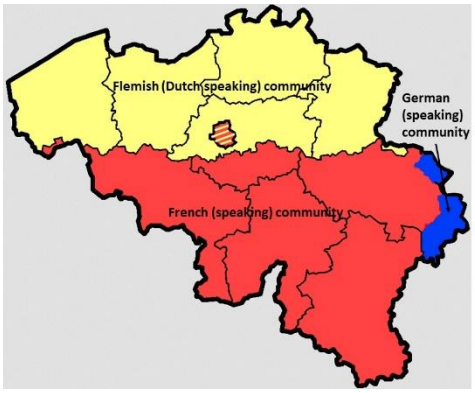
[1] 2020 European Semester Country Report Belgium.

[2] https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

[3] Based on information provided by EWI.

The Belgian Regions and Communities





Based on the Regional Innovation Scoreboard (2019)[4], the Brussels-Capital region is an 'innovation leader –' with an increase in innovation performance of 13.5% since 2011. The capital region performs better than the EU average in a number of indicators both in relation to research and innovation outputs, namely, 'innovative SMEs collaborating with others', 'SMEs innovating in-house', 'sales new-to-market/firm innovations', and 'product/process innovations', as well as 'public-private co-publications', 'international scientific co-publications' and 'tertiary education'. The weakest points are 'PCT patent applications' and 'design applications'. In relation to structural differences with the country average, the capital region is more densely populated, as expected. Employment is higher in public administration and services and totally lacks positions in relation to agriculture and mining. The capital region also presents a much higher GDP per capita (PPS, 2017).

Vlaams Gewest (the Flemish Region/Community - Flanders) is a 'strong +' innovator with an increase of 2.2% in innovation performance since 2011. Flanders presents much higher scores than the EU average in 'innovative SMEs collaborating with others', 'SMEs innovating in-house', 'product/process innovations', 'public-private' and 'international co-publications'. The weakest points are 'design applications', although not as weak as in the case of the capital region, and life-long learning. Flanders does not present many differences compared to the national level apart from a slightly denser population and employment in manufacturing.

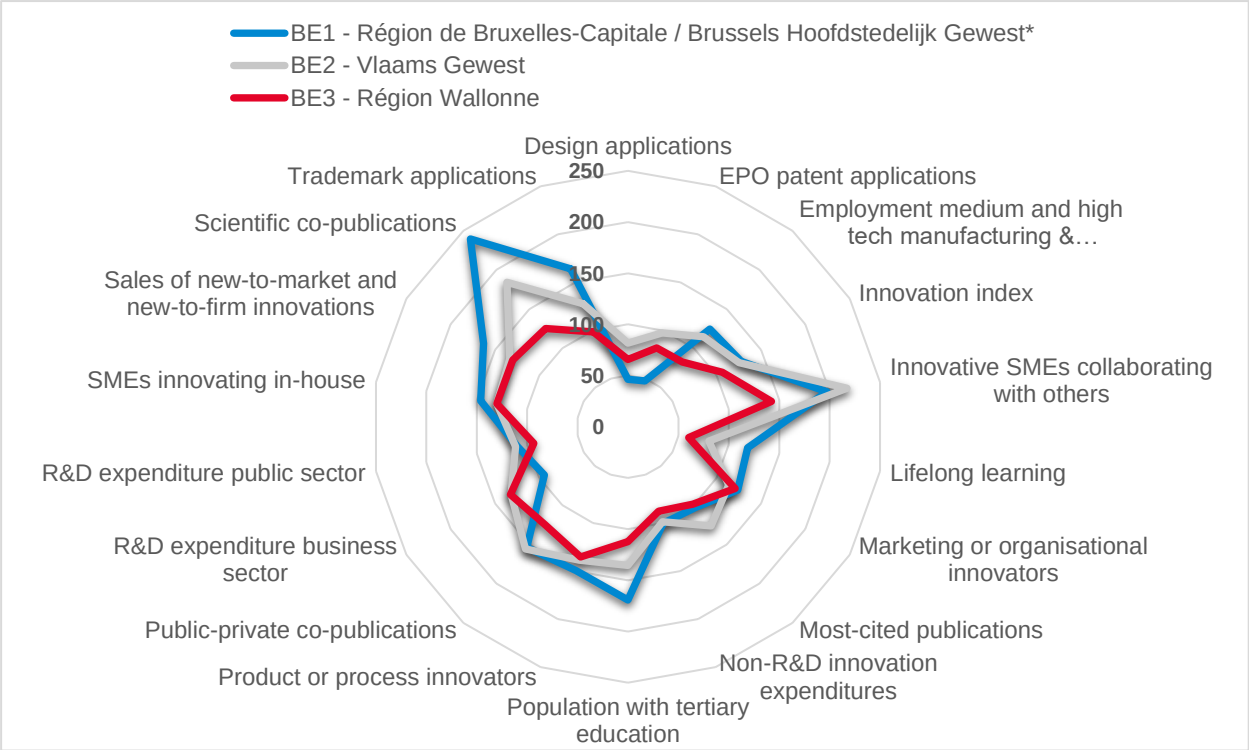
The Walloon Region is a 'strong Innovator', after years of being classified as a follower, with an increase of 5.6% in innovation performance since 2011. Wallonia presents a strong position compared to the EU in terms of 'innovative SMEs collaborating with others', 'SMEs innovating in-house', 'marketing/organisation', 'product/process innovations', 'public-private co-publications', 'sales new-to-market/firm Innovations' and 'R&D expenditures in the business sector'. The Walloon Region's weak points relate to 'patent', 'trademark' and 'design' applications, 'employment in knowledge-intensive activities' and 'life-long learning'. Structurally, the Walloon Region is not as densely populated as the country as a whole and has a slightly larger presence

[4] https://ec.europa.eu/growth/industry/policy/innovation/regional_en

of the manufacturing sector in terms of employment and a lower than average GDP per capita (PPS, 2017).

When the three regions are compared to each other, the Brussels and Flemish Regions are forerunners in terms of the growth observed since 2011 in relation to research outputs (scientific and public-private co-publications) and 'population with tertiary education'. The Walloon Region also shows the highest increase in innovative SMEs. 'Design applications' is the indicator with the lowest increase in all three regions along with lifelong learning, although at different levels across the regions.

Figure 1: Comparison of Belgian Regions with respect to change of innovation performance since 2011 (RIS 2019)



Source: author's elaboration based on RIS 2019 data https://interactivetool.eu/RIS/RIS_2.html#

The Belgian R&D intensity (GERD as % of GDP) reached 2.76% (2018). The target of 3% set for 2020 seems realistic considering the annual increase of around 3.7% since 2015. Yet, the implications of the COVID-19 crisis (as of March 2020) have yet to unfold and it is uncertain how they will affect R&I funds although there may be a strong increase in R&D expenditure in pursue of an effective therapy and vaccine. Most of the R&D investments come from the private sector that presents a research intensity (BERD as % of GDP) of 1.95% in 2018 following an upward trend since 2005. The high R&D expenditures in businesses is one of the strengths of the Belgian R&I system, although innovation diffusion remains limited.

Overall, Belgium is strong in R&I due to an excellent public science base, high-quality education system and highly-skilled workforce, as well as the linkages between public research and industry and the presence of attractive research centres including some that are part of multinational

companies. The weaknesses relate to a shortage and mismatch of human resources for R&I, which possibly explains the limited number of knowledge-intensive start-ups, and a less than excellent performance in patents, innovative products creation and high-tech exports that is not proportionally analogous to the high R&D expenditure.

In relation to transnational collaboration through public European R&I Partnerships, Belgium is among the most active countries. Based on the ERA Progress Report 2018[5], Belgium presented a share of GBARD allocated to transnational cooperation (expressed in euros per FTE researcher in the public sector) that was more than double that of the EU-28 (2016 data). It ranked second among the EU countries on that indicator (Cluster 1: Switzerland, Belgium, Italy, Iceland, Austria and Sweden). For the two complementary indicators – 'collaborative papers with researchers from the ERA per 1000 researchers' and 'public-to-public partnerships (EUR/researcher)' – Belgium shows a rather steady performance for the former (since 2010) that is above the unweighted ERA average and an increasing trend for the latter since 2014 that is also well above EU28 scores.

Both the Federal State and the Federated Entities recognise the benefits of international cooperation in R&I. This is reflected in the latest ERA Roadmap (2016-2020)[6]. At the federal level, BELSPO has taken initiatives to inform Belgian researchers of the opportunities and promote their participation in transnational networks. This will also continue in the future with extra support to project beneficiaries in project management with a special unit, ERApro, created inside BELSPO. Flanders acknowledges the grand challenges in the Flemish long-term strategy document called "Vision 2050"[7] as important challenges for the Flemish society. Flanders puts efforts to improve coordination of participation at regional level, finding a balance between bottom-up and top-down priorities identification and securing more funds for the partnerships. Wallonia expresses concerns about the low level of participation of local actors, the wide variety of rules of participation, the eligibility criteria that have to be followed and the consequent demand for additional resources needed also for the management of participation in these partnerships. Yet, the Wallonia-Brussels Federation (FW-B) acknowledges the importance of international cooperation. The F.R.S.-FNRS has defined it as one of the priorities in its PHARE II and PHARE 20.25 strategic plans and intends to continue to support participation putting efforts to improve their management and maintaining the financial resources to continue to meet the needs of researchers.

The Brussels-Capital Region expressed concerns about the limited coordination across the regions and between the sectoral ministries that are involved in joint programming process. The creation of an intra-Belgium concertation group (CIS/GPC)[8] that is also linked to the ERA-GPC, where representatives of all the major funding agencies and Ministries from the federal,

[5] https://ec.europa.eu/info/publications/era-progress-report-2018_en

[6] https://www.belspo.be/belspo/coordination/doc/scienPol/20160428%20National%20ERA%20Roadmap%20VF.pdf

[7] https://www.vlaanderen.be/publicaties/vision-2050-a-long-term-strategy-for-flanders-0

[8] https://www.belspo.be/belspo/coordination/addgrp.asp?l=nl&group=CIS/GPC

community and regional levels participate, was a step in the right direction, particularly in enhancing strategic planning in line with European standards. In addition, there are thematic committees for international cooperation that mirror the H2020 Programme Committees. These committees, also involving sectorial ministries, are consulted when necessary about partnership-related matters.

The highly decentralised system of Belgium may be a disadvantage in terms of the ability to combine different budget lines across regions/communities and thus create a larger pool of resources for beneficiaries and consequently a higher level of negotiating power in the partnerships. At the same time, however, it makes all individual agencies try for the most they can achieve in terms of funds and participation in partnerships and supported projects. Overall, there is good collaboration among the funding agencies across the Wallonia-Brussels Federation, the three Regions and the Federal level. There are partnerships where more than one funding agencies take part in a complementary mode. In addition, in September 2018, the funding agencies supporting industrial research and innovation from the three regions signed a Memorandum of Understanding (MoU) with the aim to support trans-regional collaboration. The first operational call was launched in the field of sustainable chemistry.

In this report, the performance of Belgium is compared to that of Denmark, Finland, the Netherlands and Sweden. The selection of these countries is based on

- similar levels of total researchers (full-time equivalent – FTE average 2014-2017) (DK, SE),
- similar levels of gross expenditure in R&D (GERD) (FI)
- diverse levels of P2P involvement (NL).

These countries will be referred to in the report as Belgium's comparator group of countries.

Table 1: Belgium's comparator group of countries in relation to performance in public European R&I Partnerships

	GERD/GDP (2018)	*Researchers FTE (2018)*	*Partnerships*
Belgium	2.76	57,678	66
Denmark	3.03	46,396	45
Finland	2.75	37,891	48
Netherlands	2.16	95,611	67
Sweden	3.32	75,151	57

Introduction

This is the fourth ERA-LEARN Country Report on participation in European R&I partnerships ('Partnerships' in short) in a series of country reports that will follow in the course of ERA-LEARN. The first three reports covered Poland, Austria and Spain; this report focuses on Belgium and further reports are planned on Romania, Germany and Finland until the end of 2020[9]. The selection of these countries is based on a combination of variables: number of partnership participations, partnership coordination and national investments made to date, based on the data provided by the partnerships to the ERA-LEARN database.

The ERA-LEARN data that is used in the report (cut-off date April 2020) mainly refer to partnerships that were launched and are supported under Horizon 2020. This data (especially the project-related and financial data) is around 75% complete, as not all required information has been fully updated by the partnerships. It is important to emphasise that the data collected in terms of pre-call budget committed or the actual investments in selected projects do not take into account the differences across countries in the eligibility of certain expenses; for example, in some countries only additional costs of a research project are eligible and not personnel costs. In addition, the in-kind contributions made by funding organisations when participating in P2Ps are not usually considered as national investments in partnerships, although this will possibly change under Horizon Europe.

The country reports provide an analysis of participation and try to explain the 'performance' of a country in European R&I Partnerships within the context of the overall situation in the national and regional research and innovation systems. In this regard, data and analysis available in other reports are considered such as the RIO (Research Innovation Observatory) country reports, EU Semester national reports, ERA Progress Reports, European Innovation Scoreboard and Regional Innovation Scoreboard, Regional Innovation Monitor Plus, H2020 Country Reviews, OECD country reviews, OECD, RIO and EUROSTAT statistics, and special reports by the Policy Support facility, MLE (mutual learning exercise) special reports, etc.

The goal of the country reports is to provide an overall picture in partnership participation of a particular country, comparing this also to a number of other countries of interest as well as the EU14[10], EU13 and EU27 overall averages. This may be useful for individual organisations in the specific country as they might only have a fragmented picture of the situation or they might lack explanations for certain features that may be found in the wider R&I context of the country. The report may also be useful for organisations in other countries that wish to learn the reasons behind the 'position' of a particular country and/or learn from other countries' exemplary performances.

[9] All the Country Reports are on the ERA-LEARN website https://www.era-learn.eu/documents/documents-listing

[10] As of 1 February 2020 with the withdrawal of the UK from the EU.

Acknowledgements

We owe special thanks to EWI and in particular Peter Spyns (also member of the ERAC/GPC and TFRIP) for providing background material and helping to organise the interviews with key stakeholders. We would also like to thank all the interviewees that shared with us valuable insights, data and information about their experience in participating in European R&I Partnerships under H2020. In particular,

- Olivier Boehme, Alain Deleener and Toon Monbaliu (FWO)
- Martine Vanderstraeten (BELSPO, ERAC/GPC Member)
- Didier Flagothier and Nicolas Delsaux (SPW)
- Florence Quist and Joel Groeneveld (F.R.S. - FNRS)
- Beata Bibrowska, Stijn Maas and Sophie Lemahieu (INNOVIRIS)
- Maarten Sileghem and Elsie De Clercq (VLAIO)
- as well as the project beneficiaries Prof. Dr. Jamal Shahin and Dr Imre Keseru (VUB), Prof. Gert Matthijs (UZ Leuven) and Dirk Vandenbroucke (AGFA)

Special thanks are also due to Optimat, ERA-LEARN partner, and particularly Katrina Watson for supporting the data elaboration and the whole ERA-LEARN consortium for commenting earlier versions of the report and helping to improve it.

Key Highlights

Belgium is one of the most active countries in public European R&I Partnerships, having started participation since the launch of the first ERA-NET scheme in 2004. Currently, in H2020, Belgium is fifth after France, Spain, Germany and the Netherlands in terms of the number of partnerships the country is represented in (Figure 2). Given the highly decentralised R&I system in Belgium, the number of Belgian participations in Partnerships outnumbers all the countries except Germany with 146 participations (Table 2) meaning that on average the country is represented by at least two funding organisations in each of the 66 Partnerships that the country takes part.

Belgium agencies are in the lead in two public European R&I Partnerships, namely AAL 2 and BiodivClim Cofund. Out of the 227 joint calls that have been launched under Horizon 2020 until now, Belgium has participated in 137, i.e. more than those of the comparator countries, and has supported 336 projects (Table 2). Belgium shows engagement in more partnerships and calls than its comparator countries, although it scores lower in terms of the resulting supported projects when compared to the Netherlands, a country with lower R&D intensity[11]. Belgium outnumbers Finland in all indicators in Table 2, a country with similar R&D intensity but fewer researchers.

Table 2: Participation in H2020 public European R&I Partnerships

	BE	DK	FI	NL	SE	EU13 average	EU14 average	EU27 average
Number of partnerships	66	45	48	67	57	28	54	41
Total partnership participations	146	59	61	101	82	30	94	62
Partnership coordinations	2	2	1	7	1	1	5	5
Call participations	137	71	76	111	89	64	106	86
Supported projects	336(*)	286	177	653	416	69	366	223

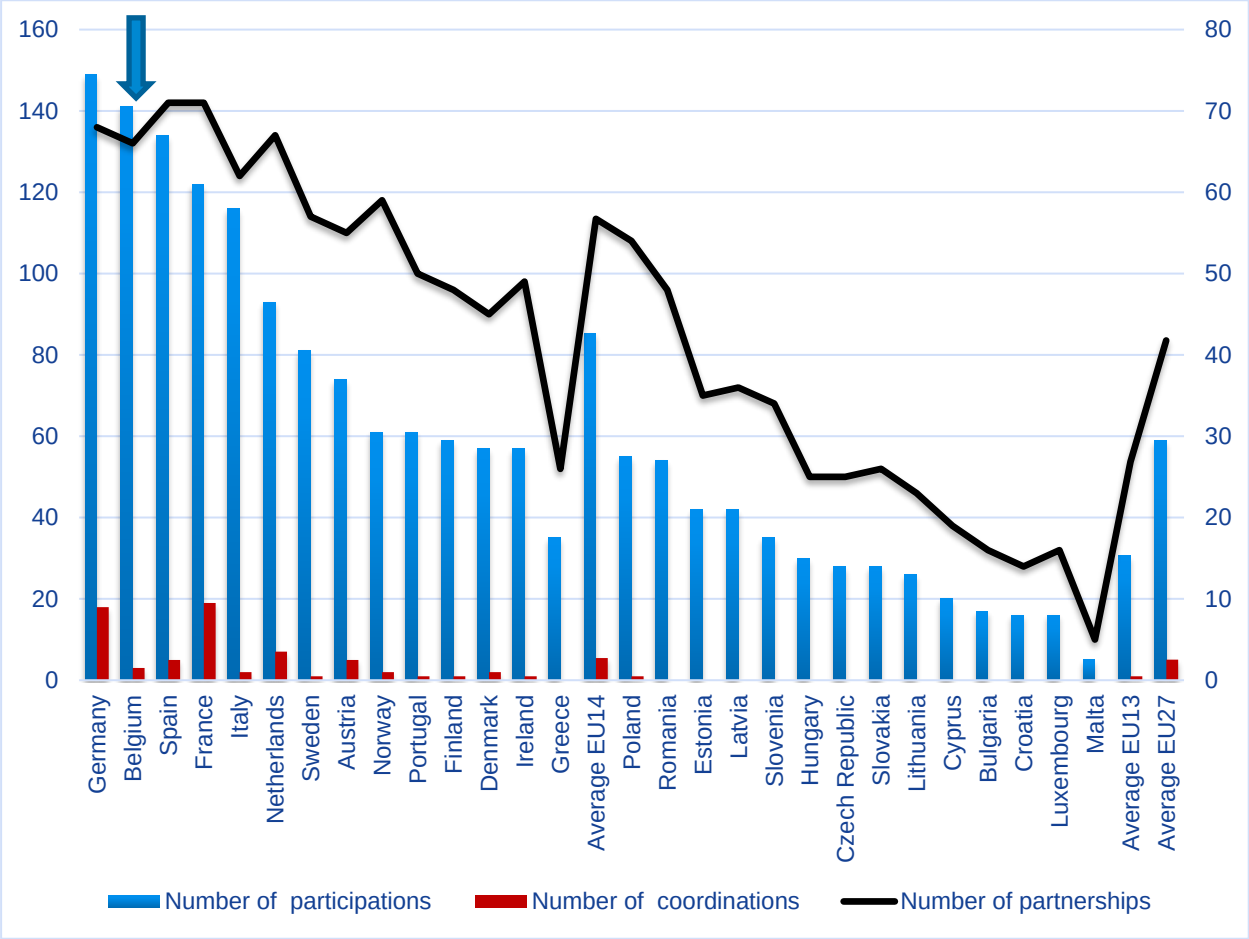
Source: ERA-LEARN database[12] (cut-off date April 2020).

(*) Based on the data provided by the Belgian funding agencies for the preparation of this report. The data for the other countries come from the ERA-LEARN database that is missing around 25-30% of the project and finance data.

[11] Gross expenditure in R&D (GERD, 2018) as a share of GDP. Belgium, 2.76; Denmark, 3.03; Finland, 2.75; Netherlands, 2.16; Sweden, 3.32. Researchers' FTE (average 2014-2017): Belgium, 53,586.25; Denmark, 43,581.75; Finland, 37,188.00; Netherlands, 80,450.25; Sweden, 69,749.00

[12] These figures are actually higher considering that around 25-30% of the financial data of the H2020 P2Ps have still to be updated by the P2P networks in the ERA-LEARN database.

Figure 2: Participations and coordinations of Partnerships by country and number of Partnerships by country in H2020

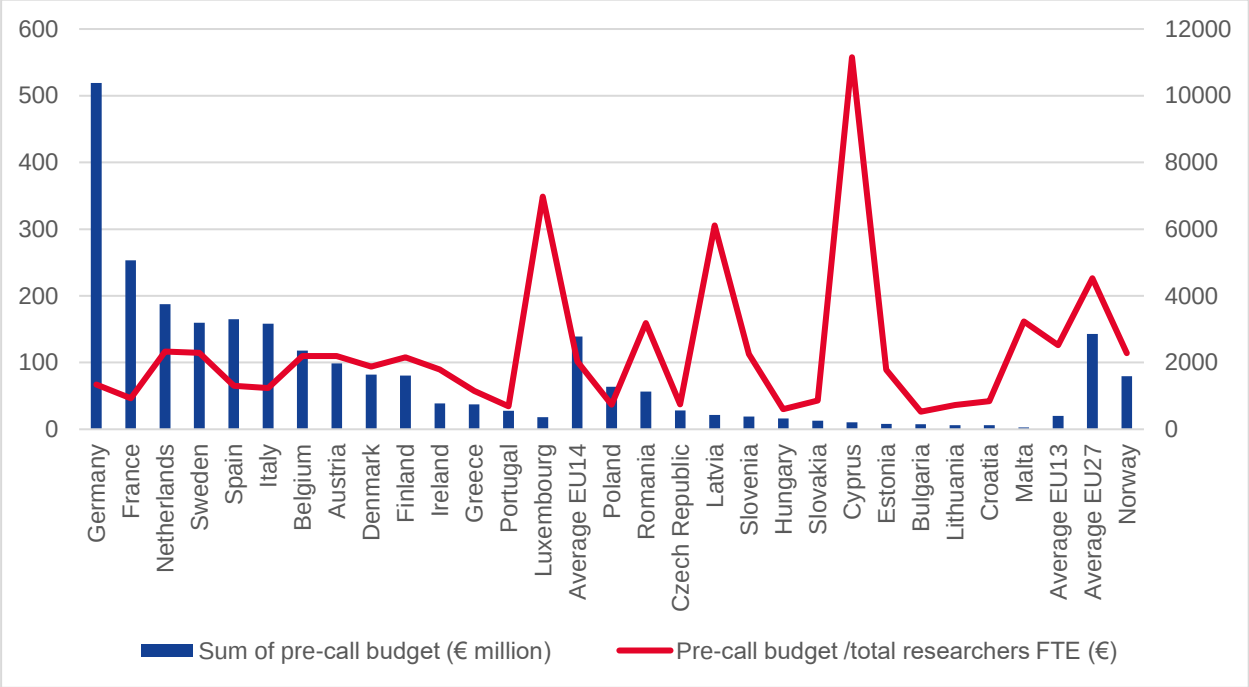


Source: ERA-LEARN database (cut-off date April 2020).
(*) Network coordinations: number of networks a specific country coordinates. Network participations: number of networks a specific country takes part as participant. Total network participations: number of networks a specific country participates in with any role (i.e. coordinator, participant, observer, other).

Considering the national funds made available to fund research proposals (total pre-call budget), Belgium's contributions are comparable to those of Denmark and Finland but lower than those of the Netherlands and Sweden (Figure 3). However, when the pre-call budget is normalised by the number of researchers (FTE), the money that Belgium allocates per researcher is comparable to that of the comparator countries: Netherlands (€ 2213.57), Sweden (€ 2134.50), Belgium (€ 1805.07), Denmark (€ 1692.43) and Finland (€ 1913.07) (Figure 3).

This money, allocated pre-call, eventually gets spent although at different degrees across the agencies. At the federal level, BELSPO spent around 87% of the funds they made available pre-call in the calls that were launched under H2020. This percentage reached 74% for INNOVIRIS in the Brussels-Capital Region, while it dropped to 66% for Flanders based on the financial data of the two major research funders, FWO and VLAIO. SPW spends more than 100% (111%) of the funds earmarked before the call. As for the F.R.S.–FNRS, it spent around 65% of its committed amount. These shares vary widely from one partnership to another and whereas it is a matter of budget planning and of the level of interest of the local research community to the specific call topic, these shares also bring to the fore factors that are not related to the quality of proposals but affect the number of granted projects as discussed in detail is Section1.

Figure 3: Pre-call national commitments, in total (€ million), and per researcher FTE (average 2014-2017) (in €)



Source: ERA-LEARN database (cut-off date April 2020)
(*) Pre-call budget is the money committed by each country before the launch of a joint call.
(**) Pre-call budget for each researcher is the total pre-call budget committed by a country divided by the total researchers in the country estimated in full-time equivalents (FTE). The average is for the years 2014-207, and not 2018, as some data are missing for certain countries.

European R&I Partnerships are highly appreciated in Belgium. Belgian funding agencies and ministries are quite active, although so far they do not undertake leading roles within the partnerships as they do not have enough resources to dedicate to such tasks. Notwithstanding, the Belgian funding agencies are valued for their experience and knowledge. They are considered important contributors and are often invited to take part in partnerships. The same is valid for the Belgian research community that is renowned for their performance in several research areas such as aeronautics, pharmaceuticals, environmental research and climate change. This is reflected in the participation statistics in both European R&I Partnerships as well as H2020 projects where Belgium also enjoys one of the leading positions together with Germany, France, Spain, Italy and the Netherlands.

It is widely acknowledged that participation in European R&I Partnerships is an important path in view of international recognition and establishing networks to enter wider calls (H2020), but also in becoming more visible in the European R&I strategic agenda setting. Both the Belgian funders and researchers wish to see those instruments maintained in the future as in some cases they are unique in filling in important gaps. Yet, there are certain challenges that need to be addressed in relation to the administration of the partnerships and the overpopulation of the partnership landscape. The changes currently discussed in view of Horizon Europe are in the right direction.

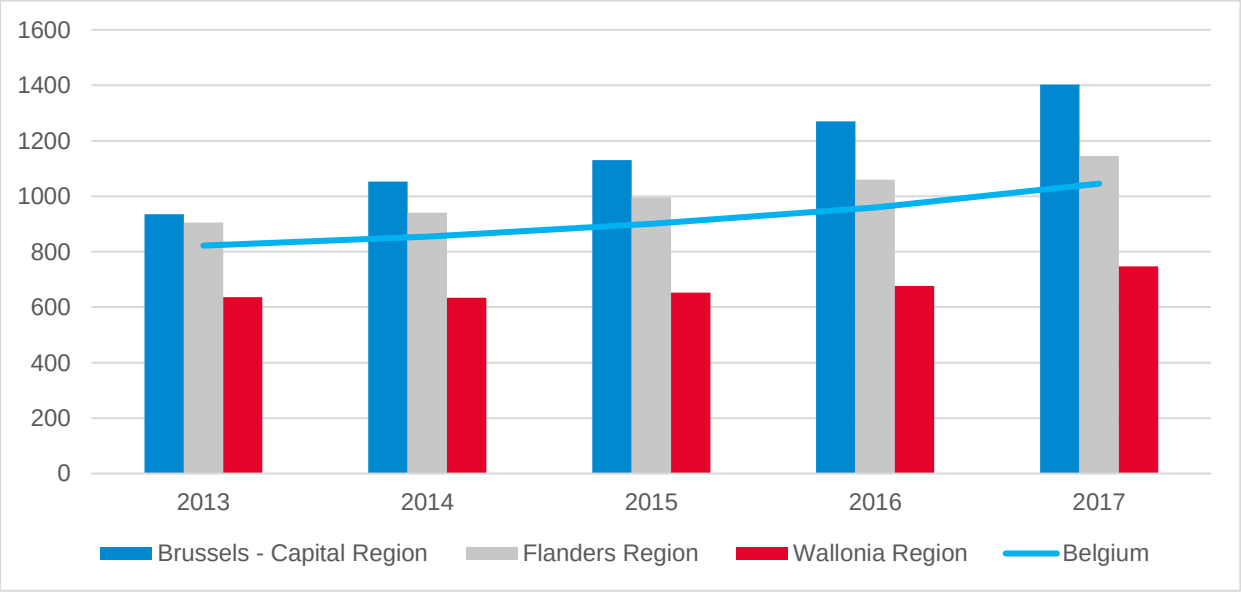
Belgian funding agencies and ministries are among the most engaged in public European R&I Partnerships, investing significant amounts similarly to the comparator countries and benefiting from a considerable number of funded projects. Belgium holds a solid position that European R&I Partnerships are beneficial and is determined to retain a strong engagement. Certain complexities and administrative rigidities that exist may deter the full exploitation of the opportunities offered. Hopefully, these will be effectively addressed in Horizon Europe.

1. Who are the key R&I funders in Belgium?

The R&I system is highly decentralised in Belgium. The Regions are responsible for technological development and applied research as well as all valorisation tasks, including strategic research centres and other knowledge centres. The Communities are responsible for education and fundamental research (including strategic basic research) at universities and higher education establishments as well as the Community scientific institutes. Strategy development and R&I funding falls under the responsibility of the Regions or Communities depending on the type of research addressed. In addition, the Federal Government is in charge of the federal scientific institutes, intellectual property (IP) law, standardisation, fundamental metrology, nuclear energy research, polar research, defence research, public health research, corporate taxation, employment legislation and social security. The Federal Government also acts on behalf of all entities regarding research that is part of international agreements if Belgium as a country is involved (Kelchtermans, and Robledo-Bottcher 2017).

Based on EUROSTAT data, the Gross Expenditure in R&D (GERD) across the three regions has increased between 2013 and 2017 (measured as Euro per inhabitant). The Regions that have contributed the most to this increase are the Brussels-Capital Region (33% increase) and Flanders (22%). Flanders accounts for almost two thirds of GERD for the whole of Belgium. This is followed by the Walloon Region that contributes by 23.2% to the overall GERD and the Brussels-Capital Region with 13.2% (EUROSTAT, 2015 data). In terms of research capacity (i.e. researchers FTE) again the Capital region and Flanders presented the largest increase since 2013 (27% for Brussels-Capital and 21% for Flanders).

Figure 4: GERD in Belgium and the three Regions (as Euro per inhabitant)



Source: Author's elaboration based on EUROSTAT data

1.1. Federal level

The Belgian Federal Science Policy Office (BELSPO) is the federal government body responsible for research policy in Belgium. BELSPO's mission is to prepare, execute and evaluate science policy. BELSPO is also responsible for the implementation of programmes, operations and research networks at the Belgian level and internationally. BELSPO takes part in partnerships that are of interest to federal competences as reflected in the thematic focus of the federal research institutes (FRIs) and federal administrations, in particular:

- JPI Climate (hosting the secretariat) and the related ERA4CS, AXIS, SOLSTICE and CSA SINCERE (lead by BELSPO);
- JPI Oceans and related ERA-NET Cofund Aquatic Pollutants, joint actions on microplastics and deep see mining, and the JPI climate-JPI oceans joint call on Next Generation Climate Science in Europe for Oceans;
- JPI Cultural Heritage;
- JPI More Years Better Lives;
- ERA-NET Biodiversa (until 2016) and related calls (Biodivclim, Biodivscen) as well as
- Norface, ERAFRICA, LEAP-agri, EU-LAC I&II.

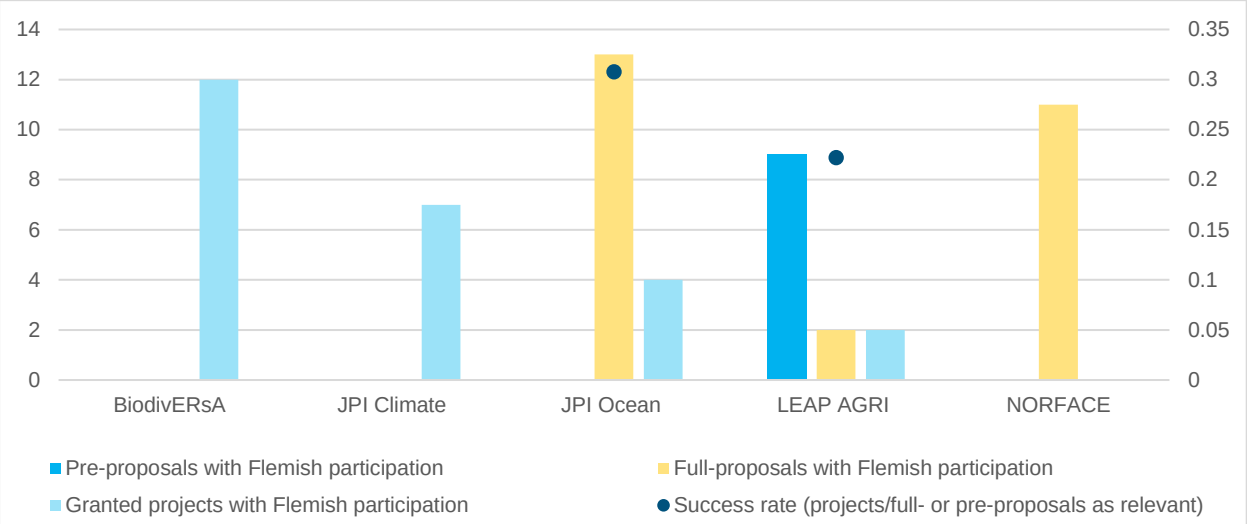
BELSPO selects the ERA-NETs and joint calls by consulting the committees of the Federal BRAIN programmes[13] and stakeholders from FSI's with regard to their interests and needs for R&D cooperation in Europe and beyond. The topics of the initiatives to join need to be compatible with the priorities included in the BRAIN programmes or BELSPO's general strategic objectives with regard to international R&I cooperation.

Taking part on European R&I Partnerships is an important element of international collaboration. BELSPO tries to engage in as many as possible activities despite the limited capacities as this comes on top of managing national calls and research programmes. The funds to support participation come from the budget of the Federal BRAIN programmes. Usually the funds made available per call are around € 400,000-500,000 and can fund two or three research teams. This is limited, although it accounts for around 20-25% of the overall BRAIN annual call budget (around € 2 to 2.5 million). Yet, there are cases where more research teams are successful but unfortunately, their projects cannot be funded due to the unavailability of additional funds – an issue that is also faced by other countries. The EU top-up that enables supporting more projects is much appreciated in this regard. BELSPO has so far managed to increase the funding in the future in order to cover most successful proposals.

[13] The currently running BRAIN-2 includes 3 pillars: Pillar 1: Challenges and knowledge of the living (e.g. evolution) and non-living world (e.g. components of the earth and universe system); Pillar 2: Heritage science, and Pillar 3: Federal societal challenges, not covered by the other pillars (e.g. health, security, ageing, economy...) and that are considered a priority by the federal authority and that align with international and European research agendas.

BELSPO participated in calls under five Partnerships under H2020 (see Figure 5). This resulted in a total of 25 projects granted with Belgian participations. As certain data are missing on the number of proposals submitted in BiodivERsA and JPI Climate, success rates (granted projects/full or pre-proposals as relevant) are estimated for JPI Oceans (30.77%) and LEAP AGRI (22.22%).

Figure 5: Number of proposals submitted and approved and success rates under partnerships managed by BELSPO during H2020



Source: Author's elaboration based on BELSPO data

(*) Biodiversa and JPI Climate: missing certain data on the number of full proposals submitted. Norface: proposal evaluation results are pending

The absorption rate, i.e. the share of the actual national funds required after the selection of proposals to the total of national funds made available before the call reaches 88.43%, although it exceeds 100% in the case of BiodivERsA (103.4%). The largest number of full proposals were submitted in the case of JPI Ocean (13 proposals) where the number of projects with Belgian participation accounts for more than half of the total granted projects (4 out of 7). Overall, the total amount spent by BELSPO for participation in public European R&I Partnerships during H2020 reaches € 5.5 million, although the initial budget earmarked was € 6.2 million.

The highly decentralised R&I system allows BELSPO to be independent in the choices they make about which partnerships to join. When the topics may interest others, than the federal level, they communicate with the respective regions/communities in order to collaborate. This is the case of JPI Climate and JPI Oceans, for instance, where both BELSPO and Flanders take part. Overall, the coordination is quite effective between the federal level and the federated entities.

BELSPO appreciates the opportunities offered by European R&I partnerships in terms of access to research expertise that may not be found in-house, as well as to a larger pool of funds by providing only the national contribution. There is also the added value of carrying out research at the European scale. In addition, the call topics are developed through consultation, workshops, etc. i.e. a methodology for identification of priorities that is implemented by joining resources that

may not be available in a small country. The co-learning benefits are also evident in terms of organising and implementing calls. Overall,

> *"in the past it was easier working with only the national programme but international collaboration is very important resulting in more knowledge and collaboration with the best teams in Europe. This is acknowledged although we have to work harder to spend the same amount of money" (BELSPO official)*

The downside relates to the challenge of showing the impacts of the funded research, which is not only specific to partnerships. Responding to short-term needs through research is difficult but even in these cases long-term research is needed (e.g. climate modelling). This emphasises the need for long-term science policy. However, this is missing both in the national and EU programmes (Horizon 2020 and Horizon Europe).

At the same time, the management of on-going projects is important to motivate beneficiaries to communicate and/or exploit/valorise their results. Resources need to be dedicated to such activities that are also crucial for identifying and demonstrating impacts.

Another area of improvement that directly relates to the partnerships is the way that calls are organised in each partnership. Valuable time is lost when calls are organised differently, although it may have a positive learning effect. For a small country, to follow all partnership activities on top of national calls is a big burden.

> Moreover, *"participation in P2Ps is not only about providing funds; it is also about making science policy, prioritising and shaping certain fields of research. If we spend less time in actual call organisation and implementation then we would be investing more time in these activities." (BELSPO official)*

In relation to the submission system, potential Belgian beneficiaries need to submit proposals to the central secretariat of the partnership and also to the respective funding agency in order to go through an eligibility check. In addition, in case of approval the proposal will form part of the contract they will sign with the funding agency and thus has to be in the official language of the country. Overall, the submission system is considered complementary though, rather than overlapping, across the partnership's central secretariat and the federal/regional procedures. In terms of scientific evaluation, the funding agencies trust the partnership processes. In terms of monitoring progress of projects, the federal/regional agencies ask for the financial reporting, while the technical progress reporting is done at the partnership level.

1.2. Brussels – Capital Region

The Brussels-Capital Region is located at the centre of the country. Brussels is the most densely populated and the richest region in Belgium in terms of GDP per capita, while it only covers 162 km2 and has a population of over 1.2 million. The Brussels-Capital region presented the highest increase in GERD since 2013 (Figure 4).

Research and innovation matters fall under the mandate of Secretary of State for Research and Innovation. In July 2016, the Government of the Brussels Capital Region approved the new Regional Innovation Plan 2016-2020 that has identified three strategic priority areas, namely health and personalised medicine, environment and the green economy, and ICT and the digital economy. With this plan, Brussels aims to become the capital of innovation. (Kelchtermans, and Robledo-Bottcher, 2017) The Region also hosts six Clusters with missions aligned with the Specialisation Strategy and with the Regional policies on socio-economic development. Particularly they focus on: the circular economy, sustainable construction, tourism and culture, medical devices & e-health, audiovisual sector and the software industry.

The main funding agency, INNOVIRIS, is a public organisation established in 2004. Its mission is to support and encourage research, development and innovation through the funding of innovative projects of companies, research organisations and the non-profit sector. INNOVIRIS implements the research and innovation policy by managing R&I funding at regional and EU level.[14] The agency has experience in JPI Urban Europe (UE), AAL, five ERA-NET Cofunds as well as ECSEL, EUREKA and Eurostars. Motivations primarily reflect the areas of interest and importance for the Brussels region in compatibility with the Region's Innovation Plan and Strategy. INNOVIRIS has been very active in JI UE and currently takes part in the preparations of the future Cofunded Partnership "Driving Urban Transitions". AAL, addressing the silver economy, has not been very rewarding for companies in the region although associations and other organisations have been supported. Thus, INNOVIRIS has decided to withdraw and instead join the JU Innovative Medicines Initiative and its foreseen successor partnership. ECSEL and EUREKA are very important as the Brussels eco-system is very oriented towards SMEs and there are many companies engaged in the ICT and the nano industries. For ECSEL the Brussels region align with the Flemish partners under a very good collaboration.

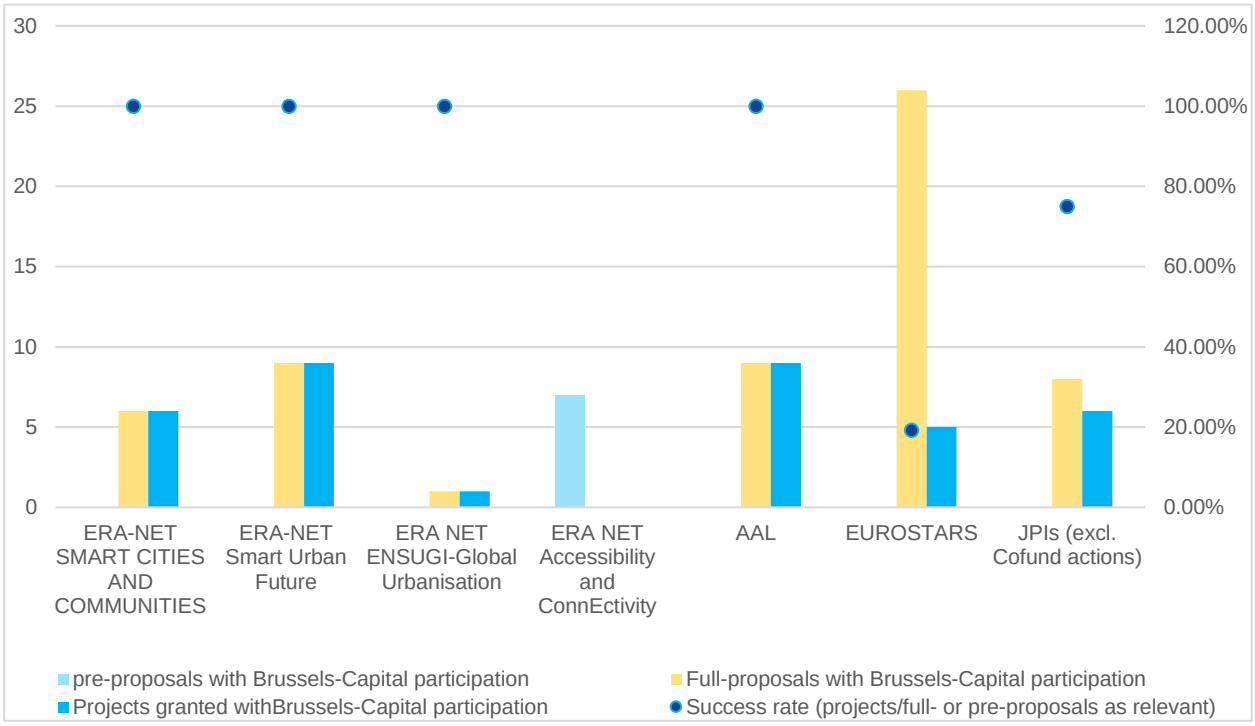
For the new period (2021-2027) INNOVIRIS is observing the performance and interest of the region's R&I actors and what new opportunities emerge in terms of partnerships. In addition, they try to better align with European priorities and integrate the European dimension in their strategy to facilitate relevance and thus participation of regional actors in projects supported by the

[14] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/news/innovation-policy-insights-regional-visit-brussels-capital-region

partnerships and other instruments like H2020. Decisions on which partnerships to join are taken based on the proposal prepared by INNOVIRIS and usually approved by the Region's political authority (Secretary of State for R&I) considering the performance of businesses and knowledge in the specific areas addressed by the partnership. As the Secretary of State is also responsible for the economic transition in the region they are in a good place to negotiate their budget and the part allocated to partnerships.

Overall, around 10% of the INNOVIRIS budget is allocated to participation in partnerships. The success rate in terms of granted projects as a share of full-proposals is 100% in the cases of the ERA-NETs – showing a clear specialisation in the areas of smart cities and urbanisation - and AAL. This falls in Eurostars where only 5 out of 26 full proposals were approved for funding.

Figure 5: Number of proposals submitted and approved with Brussels-Capital participation and success rates under Partnership calls during H2020 (excluding Art 187)



Source: Author's elaboration based on INNOVIRIS data

(*) ERA-NET Accessibility and Connectivity 11 pre-proposals were submitted that are currently under evaluation

The absorption rate, i.e. the share of the actual national funds required after the selection of proposals to the total of national funds made available before the call, reaches 150% in ERA-NET Smart Urban Future and 116% in ERA-NET Smart Cities and Communities. This means that the initial budget earmarked before the calls should be increased in the future. In Eurostars the absorption rate is 67%. Overall, during H2020, INNOVIRIS earmarked € 16 million (including € 6 million for JU ECSEL) and invested €11.89 million (including €4.5 million for JU ECSEL) thus reaching an overall absorption rate of 74.3%.

> Based on the interviews, *"ERA-NETs and R&I partnerships overall, are interesting starting points for further collaboration at international or EU level, while industrial PPPs open new markets and opportunities for internationalisation." (INNOVIRIS official)*

European R&I Partnerships have generally higher success rates than H2020 projects and offer an opportunity for local stakeholders to leverage the European or international dimension in R&I collaboration. They are also contributing to greater cooperation between funding agencies across countries and offer hands-on experience and training.

> On the other hand, "*partnerships have long preparation and realisation time. From the definition of the call topic and launching the call for proposals to grant allocation it can take up to 2-3 years; this is too long especially for private partnerships*." (INNOVIRIS official)

The national contributions made available for projects that are considerably different across the participating countries can also be problematic. A minimum standard national budget should be considered to avoid situations where high-quality proposals are not eventually funded due to insufficient funding from specific countries, or situations where the EU top-up funding is unfairly distributed.

In the future, INNOVIRIS sees the simplification of the partnerships as an important issue to address, while the efforts for aligning the different national funding programmes, research strategies and funding conditions should be continued across countries. At the same time, complementarity and synergies with Horizon Europe as well as ESIF needs to be achieved. The valorisation of the project results is another area of improvement through a structured and dedicated mechanism.

As mentioned by all the funding agencies across the various Belgian entities, the fact that each partnership is free to decide upon their own rules in relation to specific features (how the 'black box' will be applied, the distribution of the EU top-up funding, and certain evaluation elements) makes the management of participation even more resource-intensive. The lack of additional administrative capacity is the main reason why they do not usually take up any task responsibilities or coordination role.

1.3. Vlaams Gewest (Flanders)

Flanders covers 44.5% of Belgium's territory and represents the majority of the country's industry and workforce; the region provides 59.2% of the national GDP based on Eurostat (2019) and is ranked second (after the Brussels-Capital region) in terms of GDP per capita. Flanders represented almost two-thirds of the GERD for the whole of Belgium in 2015 and ranked higher than the Netherlands, France and the EU average. [15]

Research and innovation policy in Flanders is under the responsibility of the Flemish Department of Economics, Science and Innovation (EWI). Basic research funding is administered by the Research Foundation Flanders (FWO) while innovation support is governed by Flanders Innovation & Entrepreneurship (VLAIO) that acts as a one-stop-shop for all guidance and support for businesses. Strategic priorities in applied research and innovation are identified in the Flanders Smart Specialisation Strategy, adopted in 2014, that is closely aligned with the cluster policy of the region (through the five 'spearhead' clusters that were created) and the four strategic research centres (SRCs) (Kelchtermans, and Robledo-Bottcher 2017). Seven priority transition areas for Flanders exist with a time horizon up to 2025: Digital Society 2025; Food 2025; Health and Well-Being 2025; Smart Resource Management 2025; Urban Planning, Mobility Dynamics and Logistics 2025; New Energy Demand and Delivery 2025; and Society 2025. The S3 and the cluster policy are instrumental in realizing the long-term "Vision 2050" published in March 2016.

Flanders is very active in public European R&I Partnerships. In the cases where there is a considerable number of full proposals submitted with Flemish participations (i.e. more than 9, which is the median of the number of full proposals) the highest success rates (granted projects/full or pre-proposals as relevant) are found in AAL (40%), BiodivERsA and FLAG-ERA II and III Human Brain project (both with 32%), FLAG-ERA I & II Graphene (38%), Eurostars (30%) and FACCE SURPLUS (28%). The lowest success rates are found in HERA UP with 2 approved proposals out of 17 full and 79 pre-proposals, JPco-fuND (I and 2) with 4 granted projects out of 11 full or 44 pre-proposals, NORFACE (3 projects out of 10 full or 32 pre-proposals) and SusAn FACCE (1 project out of 14 full proposals).

As explained by FWO officials, HERA and NORFACE indeed present rather low success rates. In these networks, although they cover broad thematic fields (humanities and social sciences research respectively) that are expected to accommodate the researchers' bottom-up interests, the co-fund calls eventually respond to more focussed and 'niche' thematic areas as identified in the H2020 work-programmes. This might have contributed to the lower success rate.

Moreover, the success rate is always dependent on the levels of available budgets as well as the 'behaviour' of the other countries involved in the call. For instance, the participation of Flemish

[15] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/flanders

researchers in the cofund call of HERA UP attracted 605 pre-proposals (83 with FWO involvement). However, the committed national budgets were too low to respond to the level of oversubscription, resulting in only 17 granted projects. This, along with the fact that some countries used up all the top-up funding very early in the ranking list, led to the inability to continue filling in the 'financial' gaps. FWO had some projects ranked just under the funding threshold, which could have been successful if more adequate funds was made available by some funders.

The absorption rate, i.e. the share of the actual national funds required after the selection of proposals to the total of national funds made available before the call, reaches 65.90%, although this varies considerably from one partnership to another. There are cases where the initial budget earmarked doubles or even triples after the call (e.g. BiodivERsA, E-RARE 4, NEURON, ENSUF UE and LEAP-AGRI). Interestingly, apart from ENSUF UE, these partnerships attract a high number of full proposals (from 13 for LEAP-AGRI to 28 for BiodivERsA). Thus, the interest from the research community is clearly much more than anticipated. Even though the success rates in these partnerships are not of the highest ones (except BiodivERsA) they end up requiring national funds that considerably exceed initial budgeting.

The lowest absorption rates are found in partnerships that present low success rates and attracting relatively smaller number of proposals such as M.ERA-NET II, SusAn FACCE and BlueBio but also ICT-AGRI 3, with a relatively high success rate (33%).

Some clarifications need to be made at this point. As noted by FWO officials, the two major funders in Flanders, FWO and VLAIO, address two different types of stakeholders (academia and industry respectively). In BlueBio, FWO funded 2 projects, using approximately € 450,000 of the € 700,000 committed, whereas VLAIO committed more than double (€ 1.5 million) but no projects were approved for funding. For BlueBio, as in other cases, the national commitments of some countries were inadequate, which also implies that several well-ranked proposals could not eventually be funded. Furthermore, the bottom-up process followed by FWO does not allow to support certain thematic networks more than others. This might also have resulted to a lower success. At the same time, as claimed by VLAIO officials, the evaluation committees are usually composed of academics who are less familiar with the context of industrial projects, in particular relevant to higher TRL levels.

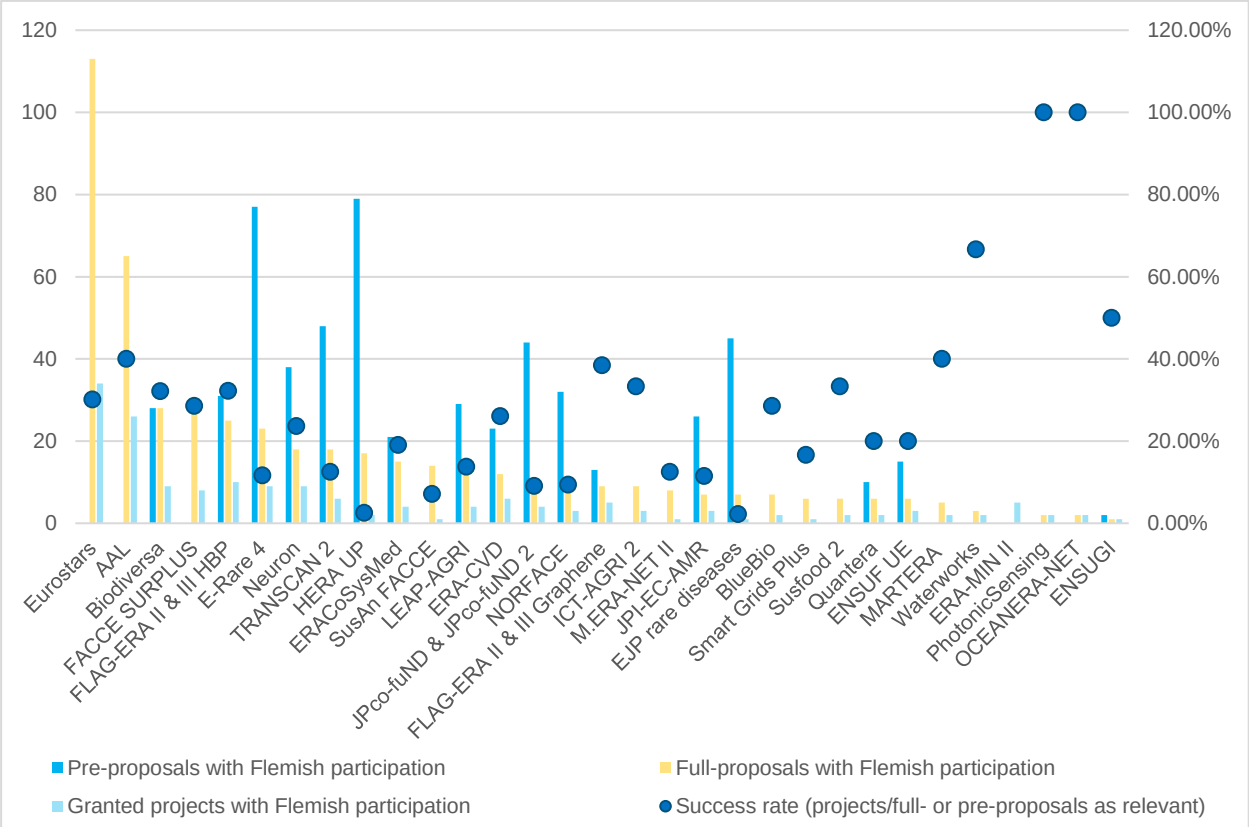
Despite that VLAIO has no specific programme for international collaboration, the necessary funds are usually ensured to cover the interest of the local business community for participation in partnership calls. The contributions mainly come from the two main regional programmes that support research and development activities of businesses and have a total budget of €250 million. There is high flexibility so that when part of the earmarked budget is not spent in the partnerships' calls, it automatically returns to the regional programmes. The underlying strategy is to earmark a sufficiently high amount to provide the Flemish companies with the maximum opportunities to participate in international calls. As a consequence the percentage spent would not be the perfect indicator to measure success of participation.

It becomes obvious that each partnership has specific features, as do the participating funding agencies, that need to be considered when data such as the number of proposals

submitted/approved and success rates are presented (Figure 6). In addition, given that there are factors that affect the final selection of projects that, however, have nothing to do with the proposals' excellence (e.g. shortage of funds in a participating country) it is questionable if the success rate (proposals submitted/projects granted) is the best indicator for assessing the performance of a country in a partnership.

Notwithstanding, the total amount spent by Flanders for participation in public European R&I Partnerships during H2020 reached € 39.5 million, comprising of € 23.5 million for ERA-NETs (including those linked to JPIs) and € 16 million for Art 185s, whereas the initial budget earmarked was around € 60 million.

Figure 6: Number of proposals submitted and approved with Flemish participation and success rates under Partnership calls during H2020 (excluding Art 187)



Source: Author's elaboration based on EWI, FWO and VLAIO data

(*) ERA-MIN II: some data is missing on the number of proposals submitted; thus no success rate is estimated

Flanders aspires increased funds made available for participation in European R&I Partnerships in the future and improved coordination of their participation in joint programming instruments based on an approach that reconciles a selective bottom-up alignment with an overall top-down strategic framework. (Belgian ERA Roadmap 2016).

According to the interviews, currently, there is no common strategy between FWO and VLAIO underpinning participation in European R&I Partnerships. FWO and VLAIO have their own selection procedures and criteria. In particular, FWO follows a bottom up approach in research funding and applies for entering certain partnerships after consulting with their Programme

Committee. The priorities of the region in basic research are reflected in the topics addressed by the local research institutes. Given the more strategic orientation promoted for partnerships under Horizon Europe, FWO is adding a new dimension to its approach, i.e. through the involvement of a wider variety of stakeholders in the consultation process. VLAIO, on the other hand, focuses on certain areas of specialisation and is more proactive by regularly examining their portfolio (every 3-5 years) and assessing which partnerships are worthy of continuing their participation and which new ones are worth joining. There is a key difference between the strategy of VLAIO and FWO in relation to participation. VLAIO deliberately aims for a restricted number of partnerships, each having a strong potential to yield a sufficient number of projects. FWO tries to support as many relevant topics as possible and thus more thinly. VLAIO also applies conditional eligibility, i.e. it is only decided if a company is eligible or not after the proposals are screened in terms of financial viability and the prospects for business deployment, i.e. if there is enough potential for valorisation in the Flemish region.

Currently, FWO takes part in around 40 ERA-NETs. The main motivation is the great interest from the local research community, creating synergies with counterparts in the rest of the world and facilitating their inclusion in international consortia enabling them to take part in larger projects such as those supported by H2020. FWO allocates around 6% of its total annual project budget to P2Ps (ERA-NET and EJP). In the beginning the need was not self-evident to fund more than one project, as the funds were taken from the 'general' project budget of the national programme. In order to maximize the funding, a 'ring fenced' budget was applied for ERA-NET participation, which has allowed FWO to fund two or more projects by shifting money from less to more successful calls, for example. Thus, more attention is paid to ensuring enough of the available funds to support as many approved projects as possible due to the increasing interest of the research community.

> *"This has been a major change over the years; the ring-fenced budget allows for more budgetary flexibility and a higher number of fundable projects." (FWO officials)*

For VLAIO, the main motivation for taking part is to further boost the international profile of local businesses and provide them with opportunities to increase competitiveness through R&I. The thematic priorities are embedded in the Smart Specialisation Strategy that is agreed at policy level involving all the major stakeholders. These thematic priorities of the Flemish government that are reflected in the thematic focus of the Spearhead Clusters, the strategic research centres, the transition priorities and other specific initiatives. As a result, VLAIO selects the partnerships to join based on the above strategic priorities or interests of local stakeholders. This is complemented by additional criteria assessing the 'quality' of the partnership, i.e. the relevance of the consortium, the availability of resources in VLAIO for the management of the participation, the level of efficiency in implementation, the cooperation model and the decision-making process. The overall decisions are made based on the expected output in terms of R&D projects, the strategic added value for Flanders, the alignment with the Flemish priorities as mentioned above, the active involvement of intermediary actors and the level of complementarity with the existing portfolio. In accordance with these criteria, larger networks with a wide scope are preferred by VLAIO in the portfolio make-up.

Around € 20 million is invested by VLAIO annually in ERA-NETs, Article 185s and Art 187 initiatives. In relation to Art 187s, the case of ECSEL needs to be mentioned as it is particularly important for VLAIO in demonstrating its support to trans-national collaboration[16]. ECSEL is an important network for Flemish companies. During the period 2014 - 2019 the support granted to Flemish companies in ECSEL projects was €30.8 million, consisting of €12.5 million by VLAIO (Hermes fund) and €18.3 million by the EU. In addition to this funding, the Flemish contribution also contains an allocation from the dotation of strategic research centers to enable multi partner projects. This yielded an additional EU funding of €75.5 million matched with a Flemish commitment of €69.5 million. In total, €93.8 million funding was mobilized from the EU to Flanders under ECSEL while €82 million was granted on the Flemish side.

International collaboration is not restricted to the partnerships mentioned above. Companies can alternatively collaborate with international research organisations through the regional programmes outside the context of the partnerships. The Flemish programmes are open to foreign participation; they fund foreign research organisations, but they are not entitled to fund foreign companies as project partners.

In terms of perceived benefits, interviewees highlight that Partnerships offer important opportunities for international collaboration with sometimes higher success rates than in H2020. International collaboration is offered with lower thresholds for participation, which is of great importance for SMEs. Partnerships provide access to a joint programme that is supported by a budget that is several times higher the contributions made by any single country or region, thus creating a high leverage effect. In addition,

> *"P2P participation is a step up for newcomers to get into the European R&I scene, learn from and get known to others. Further, for more experienced actors it is important to know what is going on internationally. Sometimes it is easier to get your project funded in P2Ps than H2020 for instance." (EWI official)*

> *"Getting in contact with colleagues internationally through which you learn a lot of things is very important, even though this may not be among the primary objectives of the partnerships… Younger researchers are pulled in by stronger teams and this is highly beneficial in building or strengthening research capacities." (FWO officials)*

> *"An important element next to the research side is that participating companies get in contact with counterparts in other countries with whom they compete in the market, but are actually getting to collaborate with each other under the projects…Moreover, it offers the opportunity to companies, in particular SMEs, to participate in international value chains" (VLAIO officials)*

Nonetheless, several issues need to be addressed. Some partnerships do not cover all European countries and this might be a problem for building the best possible project consortia. Participation

[16] ECSEL is not included in Figure 6 however for consistency purposes as Art 187 initiatives are not addressed under ERA-LEARN, although this may change in the future.

in Partnerships takes time. Any partnership is relatively free to apply their own rules for participation, which is counterproductive as it puts an additional, yet unnecessary, burden on agencies. More efforts are also needed to ensure a fair play in the distribution of the EU top-up funding. All partners should make better estimations of the potential interest of their researchers in calls and should ensure the necessary funds. This will help avoid blocking high-quality proposals and the unfair distribution of the EU top-up. The evaluation process and criteria might not do justice to high-quality proposals addressing higher TRLs. An adequate number of industrial experts should be included in the evaluation process, or alternative evaluation schemes should be defined for development and innovation projects.

The new types of partnerships planned under Horizon Europe are in the right direction considering the lessons learnt so far. Overall, to be able to respond to the needs for Horizon Europe, an exercise took place in Flanders to estimate the levels of funding over the past 10 years in areas structured along the Horizon Europe areas. The results were then brought to consultation with stakeholders. In this way they managed to have an overview of trends in the specific research areas addressed by Horizon Europe. This can also be a step towards forming a clear strategy for international cooperation. Such a strategy should also consider ESFRI, EIT-KICs, etc. and engage all ministries going beyond the existing policy silos. In addition,

> *"A new and more flexible funding channel is needed in order to be able to support research in all stages of innovation as a combined and multi-disciplinary approach is required to solve societal challenges. Governance structures of partnerships but also of the Flemish system needs to be adjusted to this." (EWI official)*

1.4. Wallonie (Wallonia)

Wallonia accounts for 55% of Belgium's territory, but only a third of its population. Despite the slight increase since 2013 in (Figure 4), GERD in the Walloon Region remains below the 3% target of GDP dedicated to R&D. Yet, more than three-quarters of the R&D expenditures in Wallonia are incurred by the business sector against 70% in Belgium and 65% in EU.[17] Wallonia hosts Competitiveness Clusters in the areas of energy, aeronautics, agro-food, bioeconomy, pharmaceutical research, medical devices and micro-electronics.

Based on the interviews, the administration in Wallonia[18] has a positive culture for international collaborative research that can be justified by the "small" size of the region, the lack of critical mass in research capacity as well as financial resources and the need to access complementary expertise that is not found in-house.

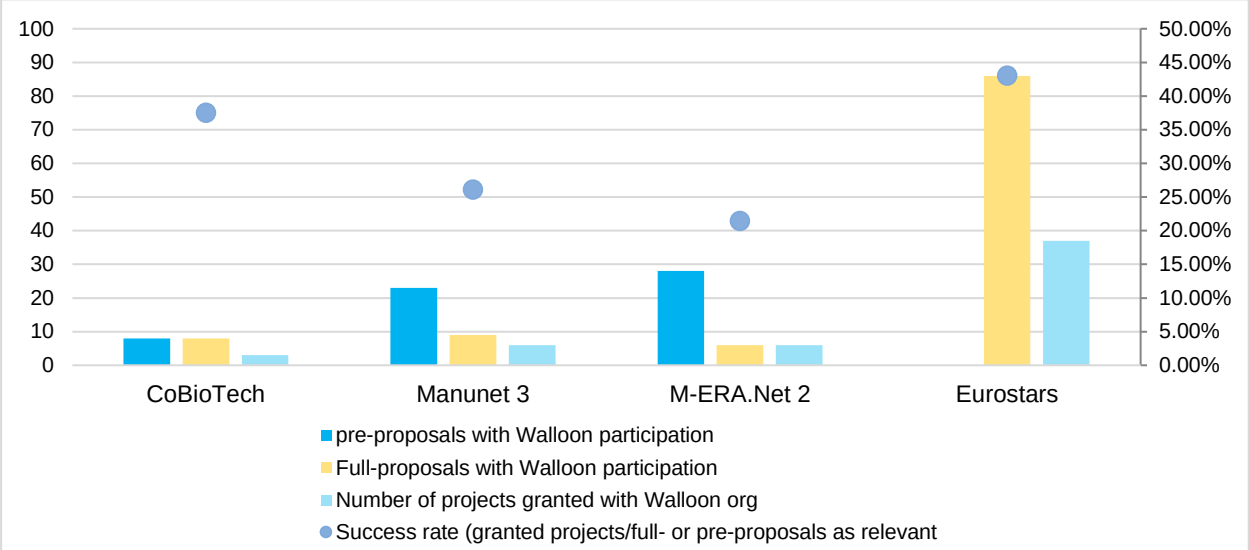
SPW Economy, one of the seven operational directorates of the Walloon Public Service (SPW), is the key policy-design and implementing body for regional research and innovation policy. Its mission is to implement and monitor the aid granted in the field of economic policy - including the support granted within the framework of EU programmes- and to encourage the development of enterprises, especially SMEs. SPW Economy oversees the participation of Walloon research actors in European and international research programmes including the ERA-Net, Programming Initiatives, the Eurostars programme, the EUREKA initiative, the ESFRI forum or the COST programme. (ERA Roadmap 2016).

SPW Economy is also a programme owner and currently takes part in 5 ERA-NETs, 2 self-supporting partnerships (ERA-SME, CORNET), and Eurostars/EUREKA. With a total annual budget of € 300 million, SPW Economy allocates around €9 million each year to international partnerships. The general principle is to secure the necessary funds to support all A-list proposals and this has been the case until now. The main motivation for taking part in Partnerships is to help the local business and research community improve their standing internationally and benefit from access to additional knowledge and potential new markets. ERA-NETs are seen as a first step for preparing local participants for larger projects as those in H2020. Under H2020 Walloon organisations participated in five ERA-NETs and Eurostars with the support of SPW Economy. The highest success rates (granted projects/full or pre-proposals as relevant) are found in Eurostars (43%) followed by CoBiotech (37.5%). The lowest success rate is for M-ERA.Net 2 (21%).

[17] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/wallonia

[18] 'Wallonia' refers to both the Walloon Region and the Wallonia-Brussels Federation.

Figure 7: Number of proposals submitted and approved with Walloon participation and success rates under Partnership calls during H2020 (excluding Art 187) (*)



Source: Author's elaboration based on SPW data

(*) Excluding 2 ERA-MIN 2 pre-proposals and 1 ICRAD pre-proposal with Walloon participations that are in the evaluation stage

The absorption rate, i.e. the share of the actual national funds required after the selection of proposals to the total of national funds made available before the call, is almost double in the case of Eurostars (173.34%). This means that the SPW funds eventually required to cover the participation of Walloon companies in the Eurostars selected projects are 1.7 times more than what is earmarked before the call. Given that Eurostars attracts a large number of proposals, this is a matter of planning. However, in the case of the ERA-NETs the absorption rate varies between 42% (M-ERA.NET 2) or 86.8% (for Manunet 3).

Whereas the interest in Eurostars seems to be well-established, ERA-Nets do not attract as many proposals. Based on the interviews, there are several regional programmes that Walloon companies can apply for funding. Local beneficiaries may choose these programmes instead of ERA-NETs or H2020 although they do not allow direct international collaboration. More efforts are needed to persuade local companies of the value of international collaboration. Whereas, this is the case for the smaller SMEs, there is a group of SMEs that are very active in ERA-NETs and H2020.

> *"The bulk of them are discouraged by low success rates in H2020 and large efforts needed to prepare a proposal and manage project participation." (SPW Economy official)*

Overall, the total amount spent by SPW Economy for participation in public European R&I Partnerships during H2020 reaches € 39.5 million, comprising of € 22.6 million although the initial budget earmarked was around € 20.25 million.

SPW Economy selects which partnerships to participate in by examining the added-value of such participation for the local stakeholders. This means that the themes addressed needs to be compatible with the S3 priorities including material sciences, biotech, aeronautics, etc. The usual practice is to identify the calls in the Partnership work-programmes and consult, among others,

the Competitiveness Clusters that involve companies about the potential interest in the specific topics. In addition, the geographical coverage needs to include the countries that regional actors mostly collaborate with, i.e. neighbouring countries and large countries (France, Germany, Spain, and the Netherlands) or with countries / regions with a profile similar to Wallonia at sectoral level.

The experience from participation in Partnerships has been mainly positive until now.

> *"ERA-NETs are a good first step to prepare beneficiaries for larger programmes like H2020 and they have a higher success rate– although the geographical scope may be limiting sometimes. In addition for project beneficiaries, participation offers openness to other markets, other methods, opportunity to integrate European value chains, other sources of financing which, intelligently used, can have a real impact on socio-economic development." (SPW Economy Official)*

The disadvantages lie in the different rules that exist from one partnership to the other (eligibility rules, geographical coverage and small differences in evaluation). Thus, a centralised secretariat and evaluation system funded by the EU would be ideal. The standardisation envisaged (in evaluation and cost models) in the immediate future is also a step in the right direction. The new approach to partnerships is also a positive evolution in terms of rationalising the Partnerships' landscape. The human resources needed for the daily monitoring of the partnerships and attending the numerous meetings can be significant. The need to block a budget with no guarantee of seeing Walloon partners eventually funded is also difficult to handle along with the low rate of corporate participation. (ERA Roadmap 2016)

1.5. *Fédération Wallonie-Bruxelles (Wallonia-Brussels Federation)*

The Wallonia-Brussels Federation (FW-B) is an institution at the service of the French-speaking residents of Brussels and Wallonia. As already stated, the Communities are responsible for basic scientific research, while applied research is the responsibility of the Regions. The support of Wallonia-Brussels Federation to research benefits two major players: universities and the Fund for Scientific Research - FNRS (F.R.S.-FNRS).

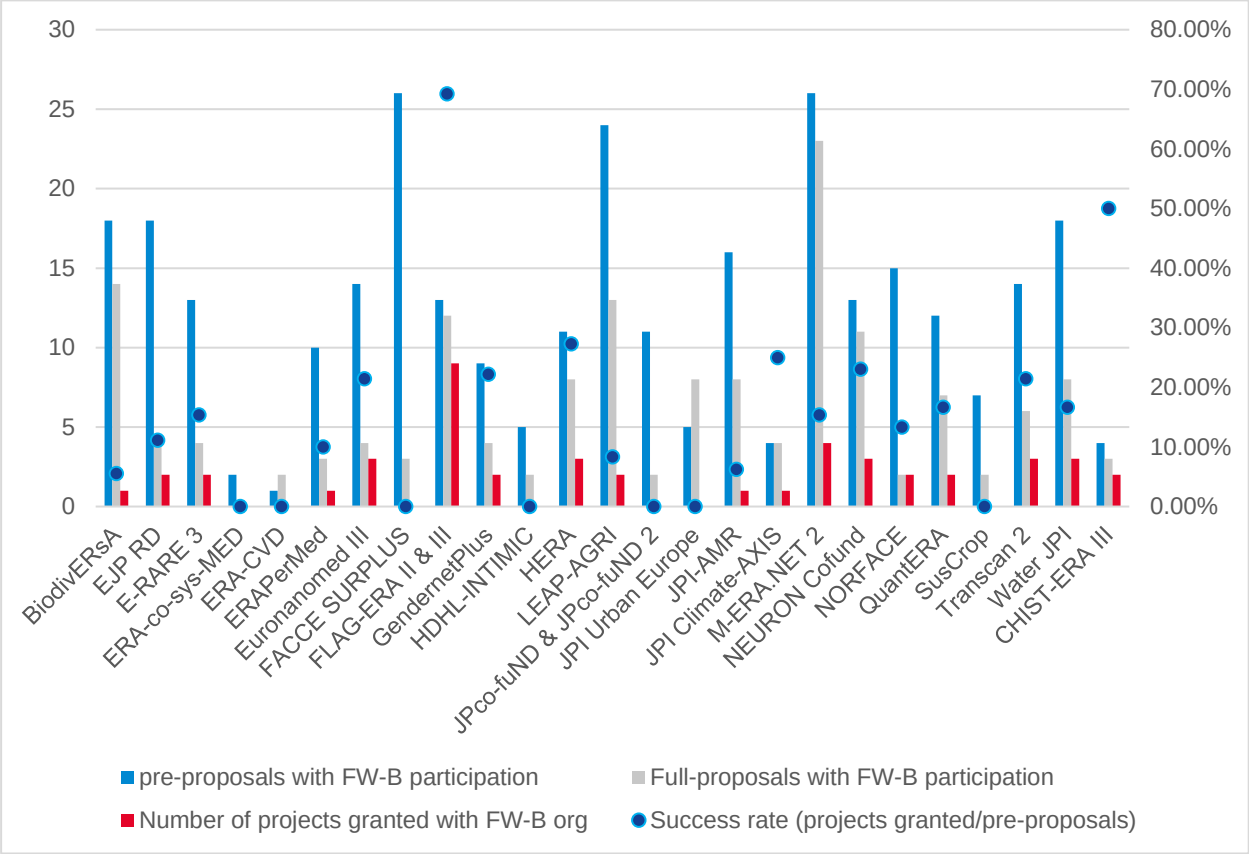
The mission of the F.R.S.-FNRS is to promote the production of knowledge through support to individual researchers as well as through research programmes carried out within laboratories and units of the universities of the Wallonia-Brussels Federation. It is worth noting that in 2018, the Government of the Wallonia-Brussels Federation decided to increase the funding of F.R.S.-FNRS by €8m, which represents about 5% of its annual budget.

F.R.S.- FNRS, currently participates in 25-30 Partnerships in total (ERA-NETs and JPIs through the Cofund-related calls). The main expectation is to be able to fund excellent research and researchers in the French Community. ERA-NETs are seen as a step leading to H2020 calls; they give an opportunity to work with other researchers in Europe and thus build networks that may prove effective later on in trying to enter larger programmes such as H2020. F.R.S.- FNRS is completely bottom up in selecting research areas to support. As in the case of FWO, there are no strategic priorities that need to be followed. Naturally, the selection of partnerships to join reflects the strengths of the local research community that mainly lies in health and natural sciences (in particular advanced materials).

Ninety percent of F.R.S.-FNRS budget comes from public funding (of which in 2018 the Wallonia-Brussels Federation contributed to 74%, the Federal state 17%, Wallonia 5%, and the national Lottery 4%) and the rest 10% from private funds. The total budget is around € 190 million per year. Roughly, around 5% of this goes to international collaboration and of this amount between € 1.5-2 million is allocated to ERA-NETs.

In H2020, F.R.S.-FNRS participated in the calls launched by 28 Partnerships. In the cases where the number of pre-proposals submitted with FW-B participations is above the average number of FW-B pre-proposals (12), which indicates high interest by the research community, the highest success rates are found in FLAG-ERA reaching almost 70% (9 projects were granted out of 13 pre-proposals). This shows a significant strength of the local research community in future emerging technologies. The other relatively high success rates in the most populated Partnerships with FW-B proposals are 27% (HERA), 23% (Neuron) and around 21% (Transcan 2 and Euronanomed III).

Figure 8: Number of proposals submitted and approved with FW-B participation and success rates under Partnership calls during H2020 (excluding Art 187) (*)



Source: Author's elaboration based on F.R.S.-FNRS data

(*) Excluding FOSC where 3 pre-proposals that are in the evaluation stage

F.R.S.-FNRS can only fund universities and a few other public organisations that do basic research (up to TRL 3, but mostly 1-2). As many ERA-NETs focus on TRLs between 2-5, this might be limiting the ability to increase participation. Similarly to FWO, the overall strategy is to take part in any network that has a basic research component. The basic rule is to fund one project per call, although there is flexibility to move funds from one call to another depending on success rates so as to cover all successful proposals.

Based on the interviews, partnerships are appreciated due to the possibilities they offer to researchers to join up with colleagues for cross-fertilisation of knowledge and building of networks that lead to more future collaborations.

> *"It is a small research community so it is necessary for researchers to work with peers in Europe." (F.R.S. - FNRS official)*

However, managing participation is challenging. Although all instruments have exactly the same governance rules and structures, each network tends to have their own interpretation about e.g. the black box, the governance and decision-making procedures, etc. This is very difficult to manage. A certain degree of harmonisation is necessary and a shared understanding of the rules. Yet, there is also a counterargument on the side of the smaller funding agencies. They feel that

with the standardisation of the partnership procedures (for application, evaluation, etc.) there will be no need for regular feedback and consultation and thus they will be less engaged in the way partnerships are run.

> *"If the only reason for them (smaller funding agencies) to remain in the partnerships is to provide the national funds, then this is not so different from participation in H2020 and thus the added value of partnerships is substantially limited." (F.R.S.-FNRS official)*

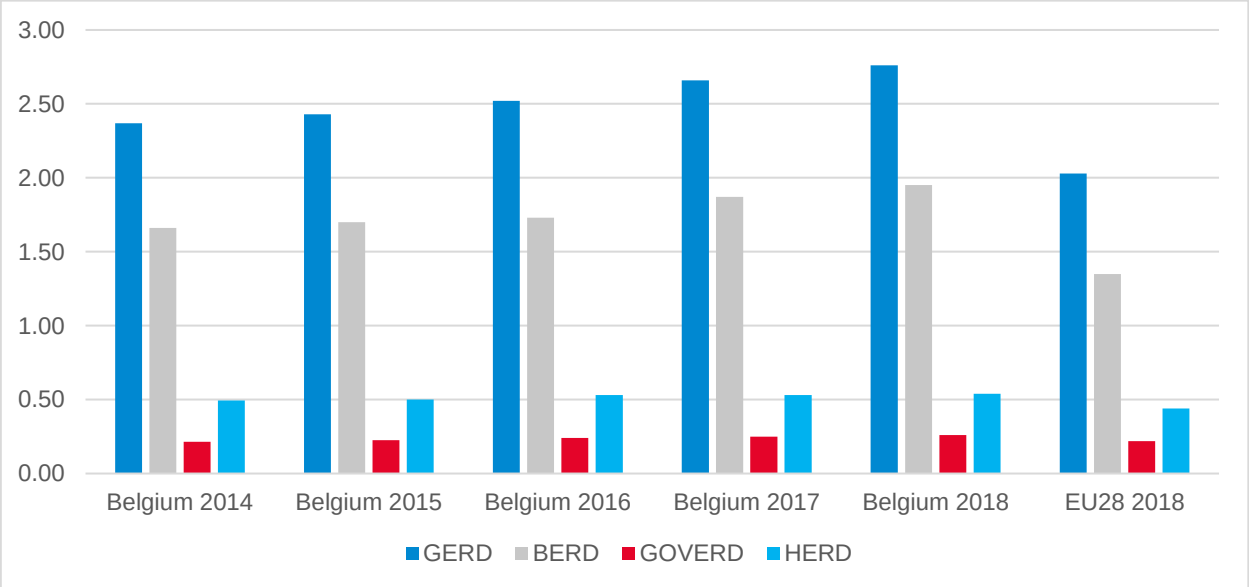
The benefits of transnational collaboration through the European R&I Partnerships are well recognised in Belgium at both the federal, community and regional levels, despite the extra administrative efforts and resources needed to manage such participations. The streamlining of procedures and the rationalisation of the landscape that is aimed at under Horizon Europe are steps in the right direction. Yet, more efforts are needed to ensure a 'fair play' and demonstrate impact. Although now policy-makers might be easier to persuade to fund trans-national calls, concerns are still relevant as the number of supported projects is not proportionally analogous to the increased membership of Belgian funding agencies in public R&I partnerships.

2. Who are the key R&I performers in Belgium?

Gross R&D expenditure in Belgium has been increasing over the years and is higher than the EU28 average since 2015. This is clearly driven by the increase in the business R&D expenditures while expenditures in the Higher Education and Public Research sectors remain rather steady (Figure 9). Based on OECD data, in 2018 Belgium's BERD (as % of GDP) was of the highest in the comparator group of countries, second only to Sweden (Annex, Main R&I indicators). The private sector is the main funder of Belgian GERD as well as the major performer. Belgium presented the highest shares of GERD funded as well as performed by the business sector in the comparator group of countries. At the same time, however, it presented the lowest shares of GERD funded by Government and GERD performed by the Higher Education sector (see Annex, Main R&I indicators).

In terms of scientific outputs (percentage of scientific publications among the top 10% most cited publications worldwide as share of total scientific publications of the country), Belgium's performance is comparable to that of Sweden and Finland but lower then Denmark and the Netherlands (2016-2017 data, Annex, Main R&I indicators). Innovation outputs as measured by the world share of PCT applications, resemble those of Finland and Denmark but are way behind the Netherlands and Sweden. (Annex, Main R&I indicators)

Figure 9: R&D expenditures in Belgium (as % GDP)



Source: OECD statistics

The sectors accounting for the largest share of BERD are pharmaceuticals and chemicals, which have very high R&D intensities. Innovation continues to be largely concentrated in industry and

large companies leaving SMEs aside. Notably, most of the large enterprises belong to multinationals, meaning that their research and innovation policy is not determined in Belgium. (Kelchtermans, and Robledo-Bottcher 2017)

Belgium has seventeen federal scientific institutes and agencies that cover a wide variety of research activities. These are managed by various policy departments and 10 of these institutes and agencies are under the overall responsibility of the federal Minister for Science, as part of the Programmatory Public Service (PPS) for Science Policy, BELSPO. (ibid.)

Brussels-Capital Region

Brussels-Capital presented the highest increase in GERD since 2013 (33%) compared to the two other regions as well as the highest increase in researchers (Figure 4). However, expenses from the business sector are below the Belgian and EU averages. Brussels-Capital host two main universities, the Université Libre de Bruxelles (ULB), a French-speaking university with about 28,000 students (2017/2018) and the Vrije Universiteit Brussel, a Dutch-speaking university with about 16,374 students (2017/2018). In addition, there are four other higher education institutes (Hautes-écoles/hogeschool), three collective research centres (partly financed by industry) and a group of technology incubators.[19]

VLAAMS GEWEST and Flemish Community (Flanders)

Flanders also presents a high increase in GERD since 2013 (Figure 4) as well as in researchers FTE and a large R&D intensity in business that mainly comes from investments in high-tech sectors such as chemicals, pharmaceuticals and biotechnology. The total investment in these sectors employing almost 60,000 people in 2017 reached €42b (ewi-vlaanderen, 2017). There are five universities in Flanders: the dutch language Catholic University of Louvain (KU Leuven), Ghent University (UGent), Antwerp University (UA), Hasselt University (UHasselt) and the Dutch-language Free University of Brussels (VUB)), thirteen University colleges, four large strategic research centres (IMEC, VIB, VITO and Flanders Make) and a number of smaller competence poles and research centres for specific (mainly sectoral) knowledge development and distribution.[20] Since 2017, there are also five Spearhead Clusters in sustainable chemistry, materials, logistics, energy and agro-food. The universities generate almost 90% of all public scientific output in Flanders (Geerts et al., 2014).

Wallonia and the Wallonia-Brussels Federation

Despite the slight increase of GERD in Wallonia since 2012, it, remains below the 3% target of GDP dedicated to R&D, although there are significant differences across sectors with some of them presenting expenses that are proportionally higher in Wallonia as compared to the national (1.72%) or European (1.31%) level (2015 data). More than three-quarters of the R&D expenditures in Wallonia are incurred by businesses against 70% in Belgium and 65% in EU28.

[19] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/brussels-capital

[20] https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/flanders

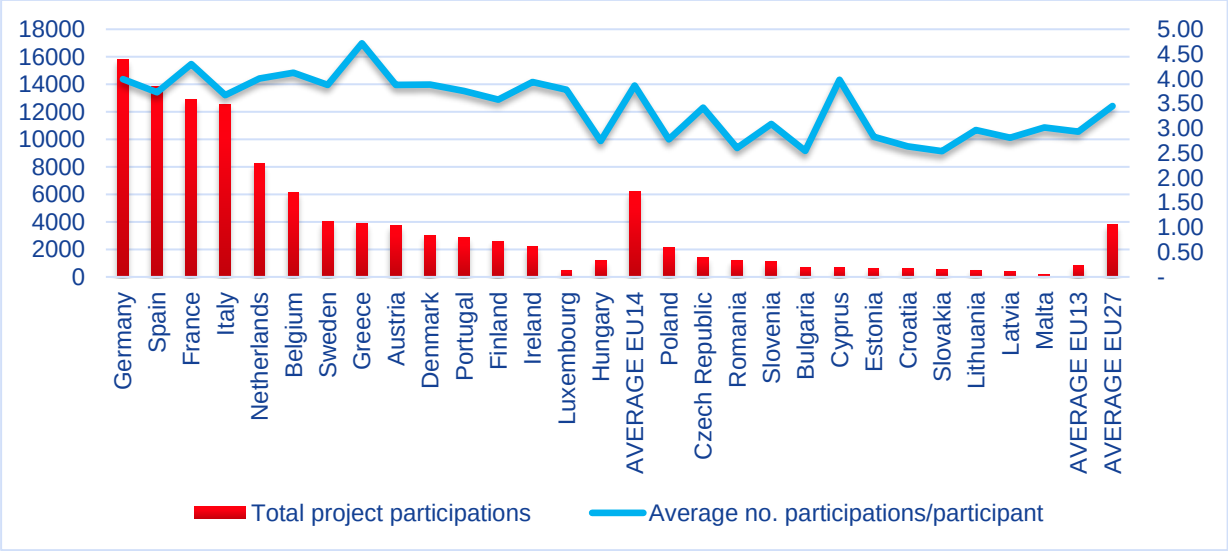
The Wallonia-Brussels Federation is host to the following universities - the Catholic University of Louvain (UCLouvain), Saint-Louis University, Brussels (USL-B), the University of Namur (UNamur), the Free University of Brussels (ULB), the University of Mons (UMons) and the University of Liège (ULiège). There are also nineteen University Colleges called, called 'Hautes écoles', of smaller size and more professionally oriented, recognised and subsidised by the Wallonia-Brussels Federation and sixteen Arts Colleges.

In relation to human resources (new doctorate graduates (ISCED 6) per 1000 population aged 25-34), Belgium shows a slight increase from 1.36 (2014) to 1.56 (2017). The proportion of tertiary education graduates in STEM fields also increased slightly (from 1.53 per 1000 population in 2010 to 1.7 in 2017, RIO data, 2019). However, there are not enough graduates with skills that are in demand in the labour market (OECD, 2017), such as in the ICT, biotech and pharma sectors as well as for civil, industrial and bio-engineer jobs. The skills mismatch and the low supply of STEM graduates has been identified as an important challenge that needs to be addressed in the latest RIO Report for Belgium. (Kelchtermans, and Robledo-Bottcher 2017)

Performance in H2020

Belgium is sixth in rank[21] in terms of total project participations in Horizon 2020, second only to the Netherlands in relation to the comparator countries. (Figure 9) Based on the H2020 dashboard[22] Belgium accounts for 4.62% of the H2020 participations and receives 4.93% of the EC contributions.

Figure 10: Total project participations and average no. participations per participant in H2020



Source: FFG based on CORDA data

The top-ten organisations receiving the largest amounts in net EC contributions per region are:

[21] Excluding the UK as of 1 February 2020 which holds the first positon in both number of distinct projects and total participations in H2020.

[22] https://webgate.ec.europa.eu/dashboard/sense/app/e8a41234-20b4-4e7e-80ef-335dd9e6ae36/sheet/941d3afe-da24-4c2e-99eb-b7fcbd8529ee/state/0

Brussels-Capital	Flanders	Walloon Region & FW-B
Vrije Universiteit Brussel	Katholieke Universiteit Leuven	Universite Catholique De Louvain
Universite Libre De Bruxelles	Interuniversitair Micro-Electronica Centrum	Universite De Liege
Sciensano	Universiteit Gent	Glaxosmithkline Biologicals Sa
Fonds Voor Wetenschappelijk Onderzoek-Vlaanderen	Universiteit Antwerpen	Service Public De Wallonie
Alcogroup	Vib Vzw	Universite De Mons
Ecole Royale Militaire - Koninklijke Militaire School	Vlaamse Instelling Voor Technologisch Onderzoek N.V.	Universite De Namur Asbl
Toyota Motor Europe Nv	Centre D'etude De L'energie Nucleaire	Sonaca Sa
A.S.T.R.I.D. Sa	Bio Base Europe Pilot Plant Vzw	Laser Engineering Applications Sa
Koninklijke Sterrenwacht Van Belgie	Universiteit Hasselt	N-Side
Technopolis Consulting Group Belgium	Eigen Vermogen Van Het Instituut Voor Landbouw- En Visserijonderzoek	Rhea System

Source: BELSPO

How are they doing in partnerships' projects?

Based on data from the ERA-LEARN database, 163 Belgium organisations took part in 336 projects supported by Partnerships in H2020 that absorbed some € 84 million[23]. The number of projects including Belgian organisations is ranked third in the comparator group of countries (Table 2) and the national commitments from Belgium is the third largest amount after that of the Netherlands and Sweden (Figure 3).

Experiences from the research community of taking part in projects supported by public European R&I Partnerships show that instruments such as the ERA-NETs (including those serving the needs of JPIs) are valuable for a number of reasons. First, they usually have higher success rates than other EU programmes such as H2020. Secondly, *"getting support and help from local agencies that you already know and can be flexible in finding solutions to problems without necessarily having to go through bureaucratical procedures and changes in Grant Agreements is quite important".* Application and reporting procedures were also easier to manage, although in some cases they were different from regular progress reports, or they varied across the different countries' funding agencies.

> *"The application process was rather straightforward. The deadlines and instructions were clear. In fact, it was much easier to apply for this grant than in other European programmes (H2020)… The reporting of the project was different; it is done be way of surveys and defending our project and results in front of the Scientific Committee. This is different than in other cases but preferable if nobody is going to read project progress reports"* (EURO-CDG 2 – E-RARE)

> *"I did not have to chase the partners in their reporting as they had to follow their national procedures and the reporting to the central secretariat of the JPI UE was much easier and shorter than traditional reports in H2020."* (PARENT – ENSCC/JPI UE)

[23] Based on the data provided by the Belgian funding agencies for the preparation of this report.

"VLAIO, the funding agency that funded and monitored PROXIMA was very helpful in starting the project. From then on the requirements for reporting were minimum and quite manageable (once a year for technical and financial reporting based on a simple template that was fairly easy to fill in). This was not the case for the UK partner who had to put more effort in reporting about the project to their funding agencies. For the PT partner requirements for reporting were also quite manageable." (PROXIMA – PhotonicSensing)

Compared with programmes supporting research at the national/regional level, partnerships differ in the types of research they support besides the international collaboration dimension they offer.

"INNOVIRIS calls often focus on projects with a direct societal or economic benefit. In JPIs you can develop the project in a way that you can choose the type of research to do and allow a broader scope of research combining different types. In a national programme it would have to be either basic or applied and the focus is mainly at the national (rather than international) level." (LOOPER – ENSUF/JPI UE)

Supporting small research teams in relatively smaller than H2020 projects is ideal in certain areas such as rare diseases. In this regard, ERA-NETs fill an actual gap that exists at both national and EU levels.

"*E-RARE is ideal for small groups working on rare diseases. We cannot possibly compete either at national or European level. H2020 is highly competitive with much lower success rates, let alone that rare diseases are not addressed that much anyway; the bulk of money is on cancer or neurodegenerative diseases. At national level, we, as part-time researchers with a clinical commitment, have to compete with the full-time researchers at universities and research organisations like VIB…Belgian funding authorities should ensure that such instruments are maintained in the future."* (EURO-CDG 2 - E-RARE)

Partnerships also offer opportunities to access complementary expertise not found in-house and benefit from international networks working in the same area and thus providing alternative perspectives and a more holistic approach. Certain projects such as EUR-CDG 2 (E-RARE) continue their cooperation in the third successor project, EUROGLYCAN.

"… In this regard, PROXIMA has been a crucial project in an area that our company has already been working on. If we were to finance it on our own we would not probably do it in this way, i.e. it might have been with less resources. PROXIMA offered more possibilities for collaboration and made it possible for us to learn from others and better understand the competition which is an important advantage for future commercial development... We hope to have a follow-up project to take this further and develop marketable products." (PROXIMA – PhotonicSensing ERA-NET)

"There is value in blending the 'local in the global'. JPI UE gave the broader network to share these research findings that came from certain localities in different cities. It brought a wider audience to our local project. The opportunities for networking that go beyond the project results were of great value. Certain collaborations were established that go on until now." (PARENT – ENSCC/JPI UE)

> *"The value of the project was that it enabled to look at similar problems but from different (country) perspectives, bringing also different experiences and knowledge together to find solutions that can be adapted to local needs under a more holistic approach."* (LOOPER – ENSUF/JPI UE)

The difficulties and challenges that certain projects have faced relate to the different participating rules and funding cycles across the programmes that have to come together to make a joint research project a reality. For instance, in PARENT, certain partners were deemed ineligible and had to be replaced at very short notice. There was also significant delay in the funding of one of the foreign partners as also noted in the case of LOOPER, where one of the partners only managed to get their part of the funding from the national agency already two years into the life of the project. Luckily, they were able to fund their participation from the start with own resources not to delay the launch of the project. As another example, a PARENT partner went bankrupt half way through the project; this result in the loss of 23% of the project budget. Recuperating the lost funds might have been possible if this project was funded under H2020 but it was not in ENSCC.

Despite these difficulties, the project managed to start and deliver on the expected outcomes. INNOVIRIS played a crucial role in terms of being flexible, understanding and trying to find solutions together with the coordinator although the work-programme had to go through several changes due to the delays and withdrawals that took place. Keeping within the overall objectives of the project was enough for INNOVIRIS to let them adjust the work-programme as needed to produce still useful results and this was quite reassuring for the JPI UE central secretariat.

Another drawback included the limited funding made available by the Belgian funding agencies involved. In the case of EURO-CDG-2 for instance, FWO, the funding agency supporting the project, had a limit of €200K per grant and funding of only 1 project per call. This eventually increased to 350K in 2019 but in EURO-CDG-2 it meant that they had to take the resources needed for project coordination from the project's research budget.

> *"In practice, however, it meant that we coordinated the whole project with our own means (in time and financial resources)."* (EURO-CDG 2 - E-RARE)

Challenges may also relate to the ability to formulate the proper project consortia. Apart from the geographical coverage that is specific to each partnership depending on the participating countries, there are other limitations depending on the internal rules of the partnership - E-RARE for instance allows up to 6 partners plus 2 from Eastern European countries – and the funding agencies as some cannot fund certain types of organisations. For instance, it was not possible for INNOVIRIS to fund public administration organisations, although they do allow it now.

The different mandate between the funding agencies and the overall strategic mission of the partnership might also be a challenge to reconcile.

> *"In PARENT, it felt like we had two different masters: one that was very much interested in the value of the project for local businesses (INNOVIRIS) and another, the JPI UE, that was more interested in how societal challenges are the be handled."* (PARENT – ENSCC/JPI UE)

The key factors for success as witnessed by the beneficiaries interviewed included:

- Trust that needs to be established even at the proposal stage
- Setting clear objectives and establishing a thread between fundamental and basic to applied research and implementation
- Having a manageable consortium that allows work to actually be done jointly
- A coordinator that has the skills to meet what is needed in this highly demanding role ensuring agile and efficient steering from the early preparation stages.
- An aligned view among funding agencies and the partnerships on the expectations from the funded projects.
- Support and help from the funding agencies with flexibility and understanding of the challenges and ability to find solutions focusing on the essential aim of the project.
- Willingness of the funding agencies to learn from others and adjust their procedures and rules where possible.
- Alignment across the different funding agencies in terms of timing of funding.
- Knowing the partners beforehand as such collaborations hide less surprises.
- The so-called 'glue' money. The importance of such funds cannot be overestimated. This is relevant for the project coordination but also for other than research project activities like meetings and exchanges of students that strengthen the research community.

  "We always made sure all doctoral students and clinicians take part in meetings wherever it was possible. International meetings were also key for creating and maintaining linkages with a much broader research community, although again the funds foreseen were less than adequate." (EURO-CDG 2 - E-RARE)

Summing up, Belgian researchers have always enjoyed a good international standing. International co-publications score much higher than the EU average (256.4 vs. 145.4), although they fall behind in the comparator group of countries (Annex, Main R&I indicators). Participation in European R&I Partnerships helped maintain their good standing and get more prepared for larger programmes such as H2020.

Belgian researchers appreciate their involvement in projects supported by European R&I Partnerships despite the various administrative and financial barriers they have to face. Notwithstanding the various rigidities and challenges that need to be sorted, European R&I Partnerships are filling in a gap in terms of specific research areas addressed and provide a less competitive and bureaucratic environment. It is strongly recommended that they continue to be supported by the Belgian funding agencies.

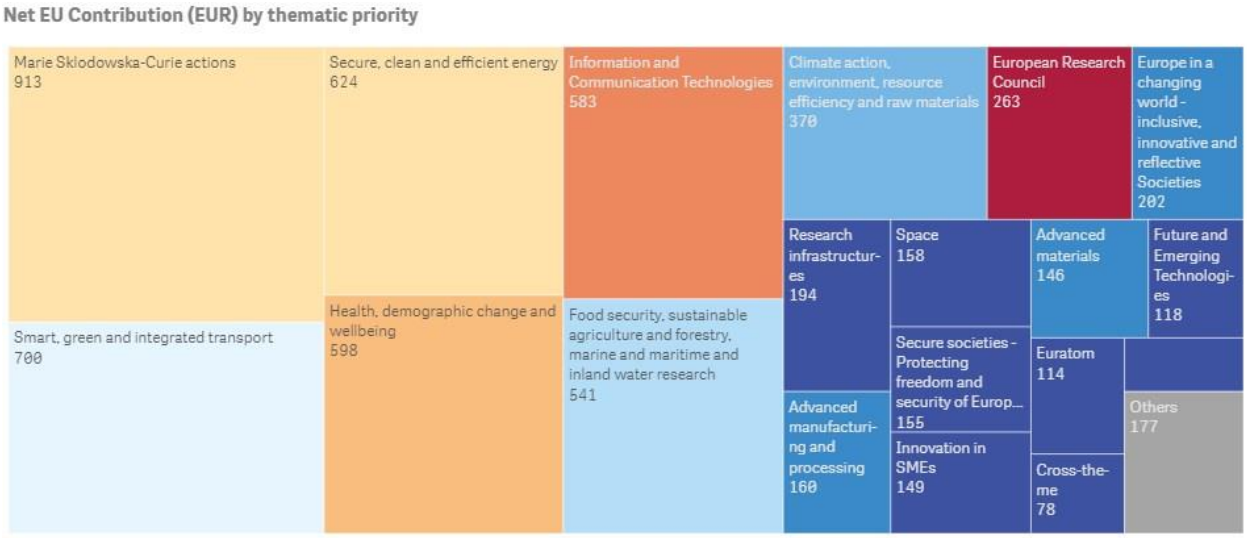
3. In which R&I areas is Belgium strong?

Collectively, the areas that the Belgian Regions thus far focus on based on their S3 strategies and strategic documentation and notwithstanding the bottom-up approach applied by the funding agencies supporting basic research (FWO, FNRS) include:

- Environment, climate and the green economy, new energy demand and delivery
- ICT and the digital economy,
- Health, well-being, ageing and personalised medicine,
- Heritage,
- Security,
- Agrofood,
- Urban planning, mobility dynamics and logistics
- Materials, biotech, aeronautics

Accordingly, the areas where Belgium benefits mostly based on the net EU contribution in H2020, apart from the MSC Actions, are transport, energy, health, ICT and food and sustainable agriculture. (Figure 11).

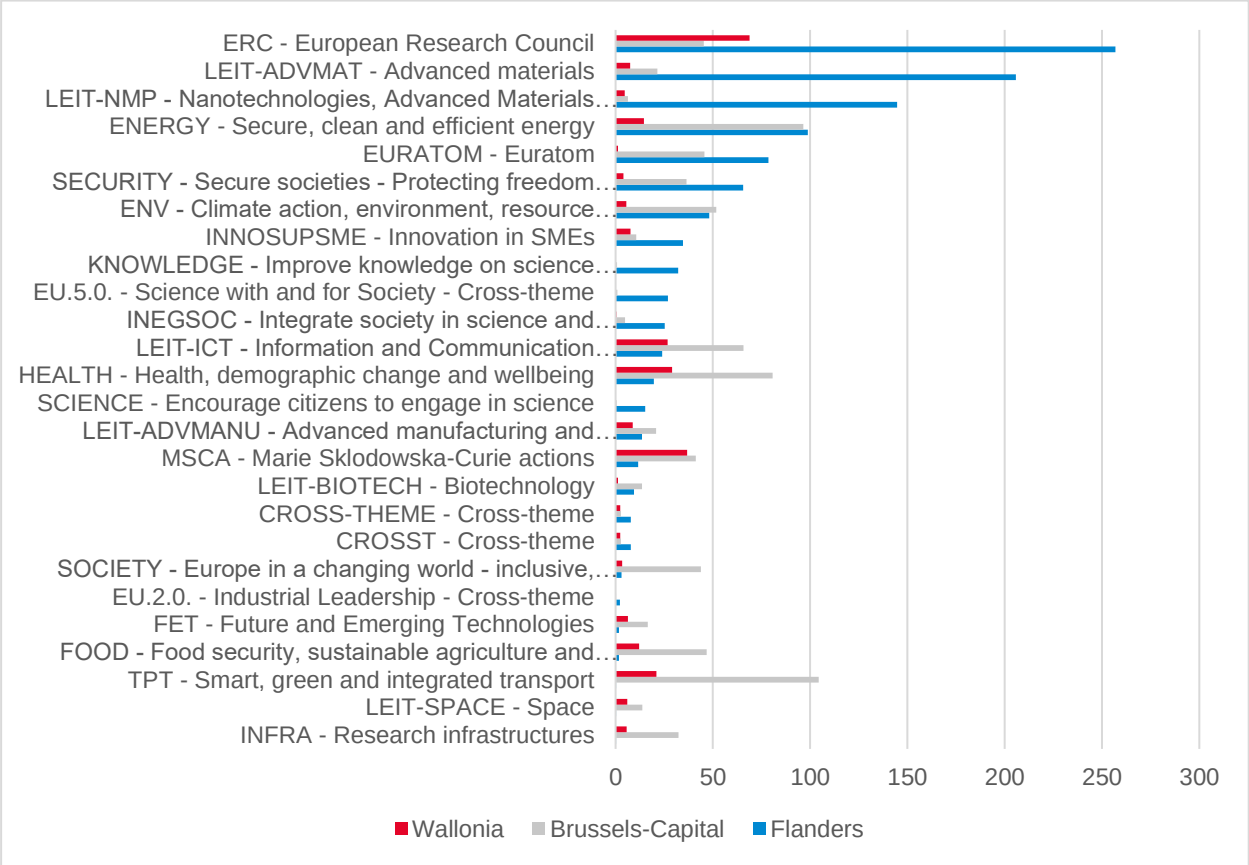
Figure 11: Net EU Contribution in H2020 for Belgium per thematic area



Source: https://webgate.ec.europa.eu/dashboard/sense/app/a976d168-2023-41d8-acec-e77640154726/sheet/d23bba31-e385-4cc0-975e-a67059972142/state/analysis

Although the various Entities share strengths in common areas (e.g. ERC bottom-up grants, MSC Actions, Health, Energy, Food, LEIT-ICT areas), certain specialisations come forth (Figure 12). The LEIT programmes in relation to advanced materials and NMP are more prominent in Flanders. Brussels benefit more than the other regions from research in the areas of Food, Health, Transport and LEIT-ICT. H2020 environmental research is less prominent in the Walloon Region but the INNOSUPSME programme features more in this than the other regions.

Figure 12: Net EU Contribution in H2020 per thematic area per Belgian Region (€ million)



Source: Author's elaboration based on H2020 data. However, H2020 regional data needs to be treated with caution as the information of some EU or international organisations may be mistakenly attributed to the Brussels-Capital Region because they are located in Brussels. In addition, some organisations located in Brussels may be federal organisations (thus, not attributable to any Region) or they may legally belong to other than the Brussels-Capital Region.

Based on the performance in public European R&I Partnerships (section 1), at the federal level there is a clear interest in environmental and climate research and ocean research as well as biodiversity. In Brussels, the interest lies mainly in smart cities and urbanisation health, nanotechnologies and ICT. The ageing society and biodiversity issues are also among the most interesting topics for Flemish researchers, who also take part quite successfully in rare diseases and brain research. Flemish researchers are also interested in future emerging technologies such as graphene as well as agro-food and the bio-economy. Flanders seem to show high diversity in terms of research areas their researchers are interested in. Wallonia, on the other hand, presents high interest in biotechnologies, advanced manufacturing and materials. Eurostars in the case of Wallonia present the highest success and absorption rate of the three Belgian regions. In addition, Walloon researchers show interest and good performance in future emerging technologies (like graphene) but also humanities and health research. The Wallonia-Brussels Federation is

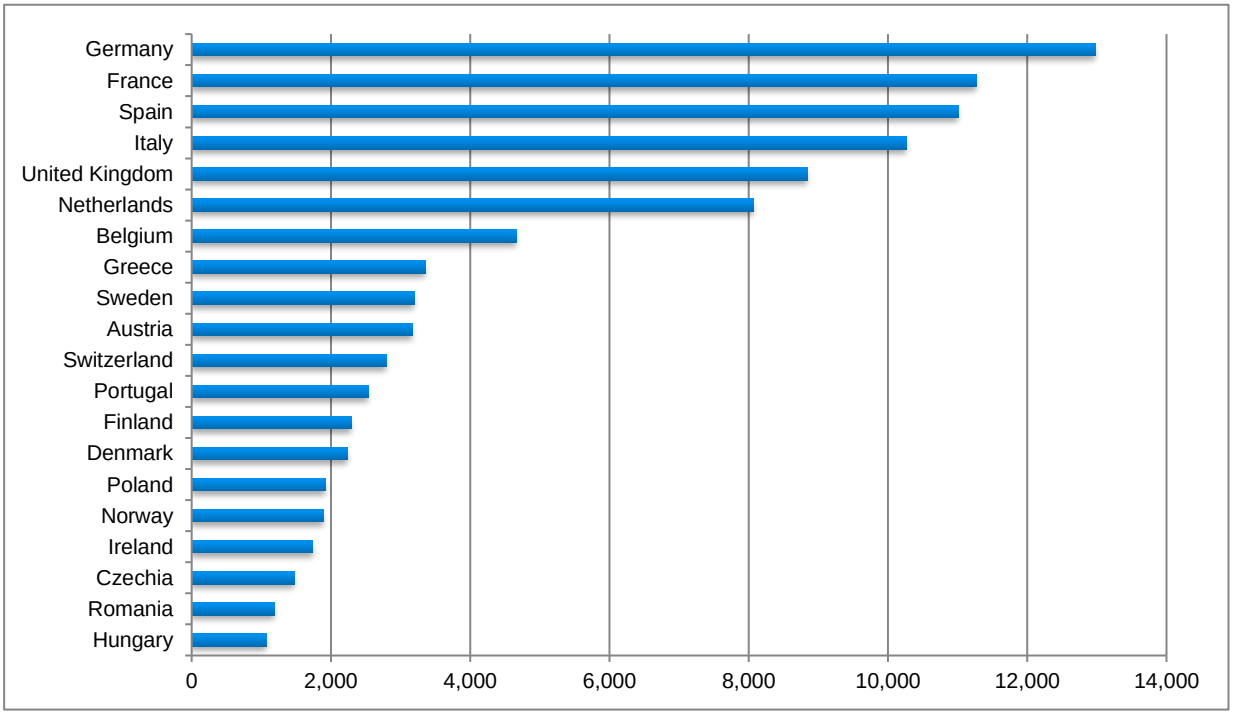
currently assessing the opportunities to invest in selected partnerships and complement the funding provided by F.R.S.-FNRS.

Overall, the performance of Belgian participants in H2020 as well as in European R&I Partnerships reflects the strengths of the Belgian research communities. The Belgian funding agencies manage to select the appropriate partnerships that correspond to local strengths in research and innovation.

4. With whom does Belgium collaborate in R&I and why?

According to the European Innovation Scoreboard (2019), Belgian's performance in international scientific co-publications is well above EU average (256.44 vs. 145.43) although it ranks last in the comparator group of countries with Denmark and Sweden taking the lead (Annex, Main R&I indicators). Based on H2020 data[24] Belgian organisations in H2020 projects collaborate mostly with counterparts from Germany, France, Spain, Italy, France, the UK and the Netherlands (Figure 13). These countries are also among the most active countries in Horizon 2020. This is largely repeated in Partnership-supported projects where, based on ERA-LEARN data, Belgian organisations collaborate mostly with researchers from Germany, France, the Netherland and the UK, followed by Spain and Italy (Figure 14).

Figure 13: Top collaborations of Belgium with other countries in H2020 projects (above 1000 links)



The interviewees mentioned that Belgian organisations want to collaborate with counterparts from neighbouring countries with similar cultures and contexts. For instance, researchers from the Wallonia-Brussels Federation tend to collaborate more with neighbouring countries: France, for historical reasons and cultural affinities, but also the Netherlands and Germany. There is also

[24] https://webgate.ec.europa.eu/dashboard/sense/app/a976d168-2023-41d8-acec-e77640154726/sheet/e1b57f9a-669b-4962-bdb9-0151c523120f/state/analysis

strong collaboration with UK researchers due to specialisation of the research community in specific research areas. Previous successful collaborations are also a key factor when building up the consortium partners. In the Brussels-Capital Region as noted by INNOVIRIS, more experienced companies usually collaborate internationally, while smaller teams are keener to collaborate with immediate neighbouring countries. Efforts are made to expose companies to other environments through country visits, exhibitions etc.

Figure 14: Collaborations of Belgian organisations in Partnership-supported projects in H2020

Source: ERA-LEARN database

Belgian organisations collaborate with counterparts in the most active countries in both H2020 and European R&I Partnerships. This is driven by where the necessary expertise is located but also by geographical proximity and similarities in cultures and contexts.

5. What are Belgium's overall S&W in R&I?

Strengths

- Flanders and Wallonia are 'strong' innovators
- The Brussels-Capital Region is an innovation leader
- Attractive research centres, high-quality education system and highly-skilled workforce
- Good interlinkages between public research and industry.
- Presence of a number of R&D centres of multinational companies
- High private R&D intensity

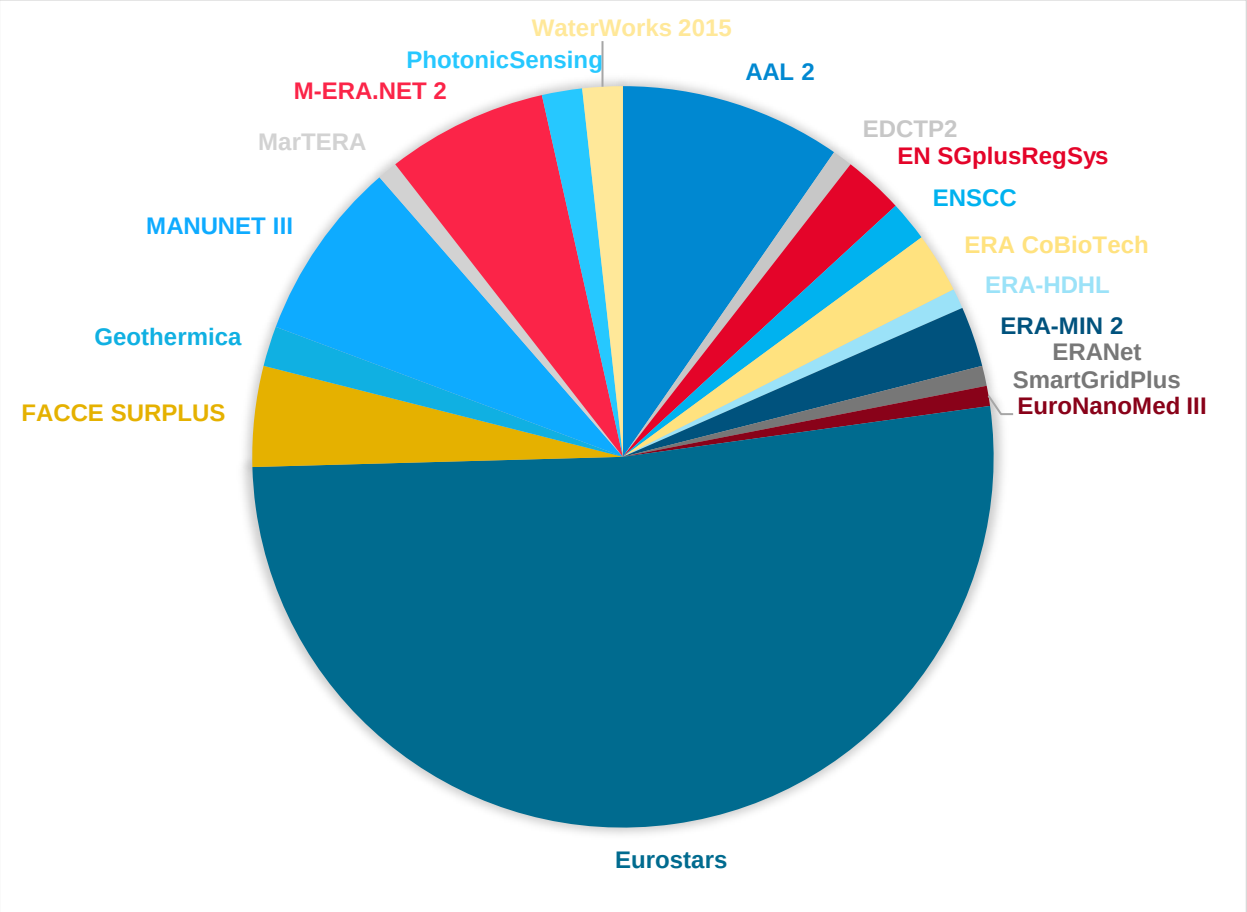
Weaknesses

- public R&D intensity can improve and is mostly driven by R&D tax incentives
- Limited supply of human resources for R&I (STEM graduates, PhD graduates);
- Skill (mis-)match with companies in need of interdisciplinary profiles for their employees
- Performance in patents, innovative products creation and high-tech exports not proportionally analogous to high R&D spending
- R&D investments concentrated in a few sectors, while innovation diffusion remains limited.

6. Topic of interest from Belgium: Businesses in public EU R&I Partnerships

Business expenditure in R&I activities in Belgium is one of the highest in the EU. As noted earlier, the business sector is the largest funder as well as the largest performer in research and innovation (Annex, Main R&I indicators). Accordingly, participation of businesses in EU R&I Partnerships is very important for Belgium. Based on the ERA-LEARN data (Figure 15) the bulk of participation of businesses (SMEs and industry) takes place under Eurostars 2 which is accountable for slightly more than 50% of total business participations from Belgium. This is followed by AAL2 (9.6%) and MANUNET III and M-ERA.NET 2 (7% each) although with much lower shares.[25]

Figure 15: Belgian business participations in public EU R&I Partnerships under H2020 (excluding Art 187)



Source: ERA-LEARN database (cut-off date April 2020)

[25] Business participation is also relevant for public-private EU R&I partnerships (such as Art 187s, JUs, etc.) and other instruments like the EUREKA Clusters which, however, are not covered by ERA-LEARN for the time being.

Eurostars supports international innovative projects led by research and development- performing small- and medium-sized enterprises (R&D-performing SMEs). Eurostars is a joint programme between EUREKA and the European Commission, co-funded from the national budgets of 36 Eurostars Participating States and Partner Countries and by the European Union through Horizon 2020. In the 2014-2020 period it has a total public budget of €1.14 billion.

All the funding agencies and ministries taking part in Eurostars (VLAIO, INNOVIRIS and SPW Economy) appreciate the opportunities offered to SMEs (including young, start-up companies) for international collaboration, both within and beyond Europe, as well as the bottom up approach in relation to the research area definition.

Flanders has many start-up and high-tech companies in various specialized sectors, such as in the field of biotechnology. This sector is strongly represented in the Flemish participation in Eurostars as around half of the Flemish Eurostars applications is related to the domain of life sciences. In the Brussels – Capital Region, SMEs are mostly engaged in Eurostars in the domains of biomedical research and ICT. Walloon SMEs are also focusing in Eurostars projects in the areas of biotech (Medtech) and ICT but also material sciences.

Collectively, the actual investments made by the Belgian agencies and ministries in Eurostars 2 between 2014 and 2020 reach almost €28 million supporting 76 projects out of 225 proposals, which shows how attractive the instrument is for local SMEs.

Annex

Main indicators for P2Ps in H2020 (*)	Belgium	Denmark	Finland	Netherlands	Sweden	EU14 average H2020	EU13 average H2020	EU27 AVERAGE
Total pre-called budget available for P2P calls (€ m)	117.8	81.9	80.3	187.6	159.8	138.8	19.9	81.5
Number of networks	66	45	48	67	57	54	28	41
Number of network coordinations	2	2	1	7	1	5	1	5
Number of funding organisations participating in P2Ps	26	16	16	29	18	24	9	17
Number of P2P calls with specific country participation	137	71	76	111	89	106	64	85
Number of full-proposals submitted to P2P calls (***)	820 (**)							
Number of eligible proposals submitted to P2P calls (***)								
Success rate (funded/full-proposals) (***)	39.4% (**)							
Number of projects funded under P2P calls	336 (**)	286	177	653	416	366	68	222
Number of participants in projects from country	163	215	63	413	234	222	34	132
EU top-up funding received (m €)(***)								
Total budget of funded projects (m €) (***)	68.3 (**)	93.5	62.11	188.8	150.8	131.7	18.5	77.2
Total requested EC contribution for projects (€) (***)								

(*) Unless otherwise specified, the figures in this table come from the ERA-LEARN database that is missing around 25-30% of the project and financial data

(**) Based on the data provided by the Belgian funding agencies in preparation of this report. (***) Data to be collected by the networks in the future.

Sources: ERA-LEARN database (cut-off date April 2020), Estimated missing data 25-30%

Main R&I indicators	Belgium				Denmark	Finland	Netherlands	Sweden	EU 28 average
	2015	2016	2017	2018	2018	2018	2018	2018	2018
GERD (as % of GDP)	1.43	2.52	2.66	2.76	3.03	2.75	2.16	3.31	2.03
Percentage of GERD funded by the business sector	58.60	..	63.49		58.52 (2017)	58.01 (2017)	51.63 (2017)	60.76 (2017)	57.60 (2017)
Percentage of GERD funded by government	22.51	..	19.96		27.21 (2017)	29.01 (2017)	31.38 (2017)	25.02 (2017)	29.72 (2017)
Percentage of GERD funded by rest of the world	16.55	..	13.04		8.92 (2017)	10.77 (2017)	14.31 (2017)	10.08 (2017)	10.01 (2017)
Percentage of GERD performed by the business sector	69.94	68.60	70.22	70.54	64.27	65.66	67.05	70.88	66.41
Percentage of GERD performed by higher education	20.33	21.16	19.83	19.38	32.43	25.22	27.17	25.38	21.87
Percentage of GERD performed by government	9.19	9.64	9.39	9.50	3.00	8.31	5.78	3.63	10.80
GOVERD (% of GDP)	0.22	0.24	0.25	0.26	0.09	0.23	0.13	0.12	0.22
percentage of GOVERD financed by the business sector	6.15	5.82	5.41		3.86 (2017)	7.36 (2017)	15.57 (2017)	6.80 (2017)	9.77 (2017)
HERD (as % of GDP)	0.49	0.53	0.53	0.54	0.98	0.69	0.59	0.84	0.44
percentage of HERD financed by the business sector	12.89	12.11	11.71		2.66 (2017)	3.18 (2017)	8.34 (2017)	3.62 (2017)	6,86 (2017)
BERD (% of GDP)	1.70	1.73	1.87	1.95	1.95	1.80	1.45	2.35	1.35
percentage of BERD fudned by the business sector	79.21	..	86.34		89.01 (2017)	86.67 (2017)	81.45 (2017)	83.57 (2017)	83.75 (2017)
percentage of BERD fudned by government	5.49	..	3.37		2.03 (2017)	3.11 (2017)	2.12 (2017)	4.7 (2017)	5.24 (2017)
percentage of BERD funded by rest of the world	15.28	..	10.24		8.21 (2017)	10.19 (2017)	15.95 (2017)	11.56 (2017)	10.78 (2017)
Total national public funding to transnationally coordinated R&D (€ million)	260.915	280.352	289.704	284.150	38.212	79.900	160.263	173.713	
National contributions to bilateral or multilateral public R&D programmes (€ million)	6.700	7.200	8.200	13.500	0.268	10.400	--	32.750	
National contributions to Europe-wide transnational public R&D programmes (including P2Ps)	201.678	223.175	230.087	217.212	12.330	10.500	102.463	100.017	
Total researchers (full-time equivalent)	53,178	54,280	54,010	57,678	46,396	37,891	95,611	75,151	
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	13.30	12.68			15.09(2016)	12.55 (2017)	15.33 (2017)	13.12 (2017)	
International co-publications				256.44	385.60	295.00	279.00	347.87	145.43
World Share of PCT applications		0.56	0.56	0.59	0.65	0.56	1.63	1.22	
ERC grantees by country per call year	11	21	12	16	14	12	46	18	

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Imprint

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With contributions from FWO, EWI, BELSPO, SPW, F.R.S.-FNRS, INNOVIRIS, FW-B and VLAIO as well as the project beneficiaries, AGFA, UZ Leuven and Vrije Universiteit Brussel.