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Progress Report 2018

Country Profile

SPAIN

Research and Innovation

EUROPEAN COMMISSION

Directorate-General for Research and Innovation
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COUNTRY SNAPSHOT

	Indicator	Performance					Progress since ERA monitoring 2016				
	Name	Reference year	Score	Cluster	Lead/Gap (Δ %)	EU-28	Reference Period	CAGR	Lead/Gap (Δ % pt)	EU-28	Trend (2007-18)
Priority 1	**Adjusted Research Excellence Indicator (AREI)**	**2016**	**35.1**	**2**	**-22**	**45.0**	**2013-16**	**3.5%**	**0.3**	**3.2%**	
	GBARD as share of GDP	2017	0.51%	2	-19	0.63%	2014-17	-3.0%	-1.4	-1.7%	
	EIS Summary Innovation Index (SII)	2017	0.400	3	-21	0.504	2015-17	7.4%	5.4	1.9%	
Priority 2	**A - GBARD to transnatl coop (EUR/researcher)**	**2016**	**2,842**	**2**	**-24**	**3,739**	**2014-16**	**9.2%**	**5.3**	**3.9%**	
	A - Collab papers w/ERA per 1 000 researchers	2016	67	3	-5	71	2014-16	3.2%	-0.1	3.3%	
	A - Public-to-public partnerships (EUR/researcher)	2016	513	3	-8	558	2014-16	25.1%	24.4	0.7%	
	B - Roadmap for ESFRI projects	**National roadmap implemented in 2013**									
	B - Participation in ESFRI Projects and Landmarks (combined)	**2018**	**55%**	**1**	**57**	**35%**	**2016-18**	**16.8%**	**1.8**	**15.0%**	
	B - Participation in developing ESFRI Projects	2018	50%	1	71	29%	2016-18	-2.3%	-20.9	18.6%	
	B - Participation in operational ESFRI Landmarks	2018	57%	1	52	37%	2016-18	35.2%	24.0	11.3%	
Priority 3	**EURAXESS job ads per 1 000 researchers**	**2016**	**18.7**	**3**	**-56**	**42.1**	**2014-16**	**19.9%**	**24.9**	**-5.0%**	
	Open, transparent, merit-based hiring process	2016	41%	4	-37	65%	2012-16	-1.0%	-8.5	7.5%	
	Share of doctoral students from EU countries	2016	3.8%	3	-46	7.1%	2013-16	-0.2%	-4.1	3.9%	
Priority 4	**Share of women among Grade A in HES**	**2016**	**21%**	**3**	**-10**	**24%**	**2014-16**	**0.7%**	**-0.3**	**1.0%**	
	Gender dimension in research content	2014-17(R)	1.08	2	3	1.05	2011-14 to 2014-17(R)	8.4%	5.9	2.5%	
	Share of female PhD graduates	2016	51%	3	6	48%	2013-16	0.6%	0.2	0.4%	
Priority 5	**A - Firms coop with univ, gov, res inst**	**2014**	**13.7%**	**3**	**-8**	**15.0%**	*Not computed*				
	A - Firms coop with univ	**2014**	*Not computed*				**2012-14**	**2.9%**	**2.2**	**0.7%**	
	A - Firms coop with gov, res inst	**2014**	*Not computed*				**2012-14**	**13.7%**	**9.7**	**4.0%**	
	A - Share of public R&D funded privately	2015	6.4%	3	-7	7.0%	2013-15	-2.2%	-1.0	-1.2%	
	A - Public-private collab papers per capita	2017	21.1	3	-48	40.9	2014-17	-0.3%	-0.7	0.4%	
	B - Share of papers in Open Access (Total)	**2016**	**46.4%**	**2**	**-6**	**49.3%**	*Not computed*				
	B - Share of papers in Open Access (Gold)	**2016**	**26.6%**	**3**	**-12**	**30.2%**	*Not computed*				
	B - Share of papers in Open Access (Green)	**2016**	**32.6%**	**2**	**0**	**32.5%**	*Not computed*				
	B - Share life science papers with OA dataset(s)	2017	2.7%	2	7	2.6%	2013-17	7.4%	4.8	2.6%	
Priority 6	**Collab papers w/non-ERA per 1 000 researchers**	**2016**	**54**	**2**	**0**	**54**	**2014-16**	**5.9%**	**1.6**	**4.4%**	
	Share of doctoral students from outside EU	2016	11.6%	3	-16	13.9%	2013-16	-1.8%	-5.6	3.8%	
	Share med & high tech product export	2017	47%	3	-17	57%	2015-17	-0.6%	-1.0	0.4%	
	Share Knowledge intensive service export	2016	*33%*	4	-52	69%	2014-16	*3.7%*	3.0	0.6%	

Note: (:) = missing data, more notes and flags can be found in the "Annex: Methodological notes".
(R) = rolling averages (e.g. average scores across 2007–2010, 2008–2011… 2014–2017) have been used to measure performance and growth due to pronounced short-term fluctuations.
Refer to the "Annex: Guide to reading the quantitative results tables (country snapshots)" for guidance in interpreting the data presented above. Further information on the presented indicators is available in the 2018 ERA Monitoring Handbook.

COUNTRY NARRATIVE

Summary

Overall, Spain is making progress towards achieving European Research Area (ERA) priorities. Spain achieved its best performances in Priority 2b (Make optimal use of public investments in research infrastructures). The country's scores on each of these indicators were well above ERA average (Cluster 1). Spain's growth in participation in ESFRI initiatives was very much in line with the EU-28 trend, driven mostly by a notable increase in its participation in active Landmarks.

In a second subset of priorities, Spain's scores positioned it among countries just above (Cluster 2) or just below (Cluster 3) the ERA average. This subset included Priority 1 (More effective national research systems), Priority 2a (Transnational cooperation), Priority 4 (Gender equality and gender mainstreaming in research), Priority 5a (Knowledge transfer), and Priority 5b (Open access). Despite the variety of indicators encompassed by these priorities, a clear trend in short-term changes could be seen in this subset of priorities: growth that either kept Spain on pace with the EU-28 trend or provided a moderate lead on it.

The Spanish research system's comparatively weaker performances could be traced to Priority 3 (An open labour market for researchers) and Priority 6 (International collaboration). Here, scores were below (Cluster 3) and well below (Cluster 4) ERA average, though Priority 6 did include one score just above ERA average (Cluster 2)—and this was on the headline indicator. No clear pattern in short-term changes could be found for the indicators on these two priorities, although on the headline indicator for Priority 3 Spain notably outpaced the EU-28 trend.

To the extent that data was available, below the country profile also analyses progress with the implementation of the ERA National Action Plan. The following notable achievements could be distinguished:

- Priority 1: Regional R&I strategies were developed, taking into account regions' specific strengths. Spanish Foundation for Science and Technology (FECYT), as the technical secretariat of the R&D&I public policies network (REDIDI), followed up on the exercises to carry out the proper implementation of the RIS3 in each region.
- Priority 1: Regarding priority 1, one of the main targets established in the Spanish NAP was to have 9.5% of economic return of Spanish participation in H2020 calls. In the first four years of Horizon 2020, Spanish entities have obtained subsidies amounting to 2,816 million euros, thus achieving a return of 10% (and reaching 10.5% in 2017 with a growing trend in last years) and leading Spain to occupy the fourth position in the ranking of countries by subsidy, surpassing their ambitious goal of 9.5%.
- Priority 2b: Sub priority 2b in Spanish NAP aimed to strengthen strategic planning and coordination of infrastructures included in the ESFRI roadmap supported by Spain and the national scientific and technical infrastructures (ICTS). Progress made relates to the approval of an updated ICTS Map 2013-2016 and then, recently, new ICTS Map 2017-2020, in which existing infrastructures have been prioritised over new construction and efforts were directed towards maintenance of ICTS that are already in operation, avoiding their obsolescence.
- Priority 3: The main achievements under priority 3 in the Spanish NAP were initiatives implemented for recruitment of highly-reputed Spanish or overseas research professors into the Spanish National Science and Technology System. An alternative career path in public research organizations and universities through permanent contracts ('for distinguished researchers or scientists of great prestige') was developed. A new call for the recruitment of highly-reputed Spanish researchers with this type of contract is ongoing ("*Beatriz Galindo grants*").
- Priority 4: In Spain an increase of the share of RPOs, which have adopted Gender Equality Plans, was observed, meeting one of the targets set in the NAP under priority 4. Public universities in Spain have well-consolidated gender equality units to develop gender equality measures according to the Spanish Science, Technology and Innovation Law. Moreover, the Spanish ERA Roadmap regarding ERA priority 4 includes the development of gender equality structures in RPOs and the Research State Agency.
- Priority 5b: On OA Spain has made significant progress, as the recent PECTI includes important updates on OA to scientific publications and research data. For example, it extends National OA policy to research data and acknowledges digital skills in pre-doctoral phase for applying OA to publications and research data. Furthermore, Art. 37 is dedicated to Open Access in the Spanish Science, Technology and Innovation Law in

order to establish a framework to strengthen scientific and technical research at national level. There has also been an increasing number of RPOs that are developing their own institutional policies to foster the adoption of OA practices, whether in the form of institutional declarations, recommendations or compulsory requirements.

1. More effective national research systems

Spain's scores on the headline indicator—the Adjusted Research Excellence Indicator (AREI)—as well as on GBARD as a share of GDP, positioned the country in Cluster 2. At the same time, these scores were below the EU-28 benchmarks; Spain's AREI performance of 35 compared to a figure of 45 for Member States overall. GBARD as a share of GDP was 0.51 %, compared to 0.63 % for the Member States overall. The country's score on the EIS Summary Innovation Index (SII) was also below EU-28 benchmark, and it placed the country below ERA average (Cluster 3).

The country has seen yearly increases that average 7.4 % on its SII score since the last ERA monitoring exercise. This compared to a trend of almost 2 % at the EU-28 level, meaning Spain has reduced its gap to other Member States since the last ERA monitoring exercise. The country's short-term changes in scores have not deviated significantly from the EU-28 trajectory on the other two indicators.

Spain, as a decentralised country, has its R&I policy shared with regions. As discussed in the Spanish NAP, the Strategy is the context for the mid-to-long term planning of RDI policies for both central and regional governments This practice encourages the growth of regions and better cooperation efforts between them on the basis of matching priorities. In 2014, all 17 Spanish regions adopted their RIS3 strategy. Regional strategies were developed, taking into account regions' specific strengths, although some regions focused on similar priorities as provided in the national strategy (Fernandez-Zubieta, Ramos-Vielba & Zachariewicz, 2017). Spanish Foundation for Science and Technology (FECYT), as the technical secretariat of the R&D&I public policies network (REDIDI), followed up on the exercises to carry out the proper implementation of the RIS3 in each region. They have found that all regions carried out the following practical steps:

1. Analysing the innovation potential;
2. Setting out the RIS3 process and governance;
3. Developing a shared vision;
4. Identifying the priorities;
5. Defining an action plan with a coherent policy mix;
6. Monitoring and evaluating.

In December 2017, the new Spanish State Plan for Scientific and Technical Research and Innovation (PECTI) PECTI 2017-2020 was approved and it remains aligned with ERA priorities. The PECTI is the main instrument of the central government for developing and achieving the objectives of Spanish Strategy for Science, Technology and Innovation (EESTI) 2013-2020 and establishes R&I priorities, programmes, coordination mechanisms, costs and sources of funding. The Annual Programs of Action are the budgetary planning instrument of the State Plan and they include the actions of the State Plan that are convened each year and the multi-year commitments foreseen in each of the public calls. The specific objectives of the State Plan for the period 2017-2020 are closely related to those of the 2013-2016 period as they are associated with the Spanish Strategy of Science and Technology and Innovation 2013-2020.

Spanish system of R&D tax incentives is based on a combination of three different elements: (1) Tax deduction for R&D and Innovation activities; (2) Income reduction for transferring intangible assets ("Patent Box") and (3) Social security benefits for full-time R&D personnel (Fernández-Zubieta, Ramos-Vielba, Zacharewicz, 2018; OECD, 2016).

Regarding priority 1, one of the main targets established in the Spanish NAP was to have 9.5% of economic return of Spanish participation in H2020 calls. In the first four years of Horizon 2020, Spanish entities have obtained subsidies amounting to 2,816 million euros, thus achieving a return of 10% (and reaching 10.5% in 2017 with a growing trend in last years) and leading Spain to occupy the fourth position in the ranking of countries by subsidy, surpassing their ambitious goal of 9.5%. Another related goal defined in the NAP was to increase the number of projects granted by European Research Council (ERC). Spain increased the number of ERC funded projects from 2015, by having 24 projects funded in 2016 and 22 in 2017. There is mixed progress

regarding the consolidation of RDI public national budget through a gradual and sustained increase. The central government's budget law for 2016 has slightly increased funding for the implementation of the national strategy for science, technology and innovation and the national plan for research and innovation, although overall investment remained below pre-crisis levels (it should be taken into account that central government budget for 2018 was 8% larger than in 2017).

2. Optimal transnational co-operation and competition

a. Transnational cooperation

On GBARD allocated to transnational cooperation, the headline indicator for this priority, Spain's score placed it in Cluster 2 and below the EU-28 benchmark. Its number of collaborative papers with other ERA researchers, 67 papers per 1 000 researchers, placed the country in Cluster 3 but slightly below the EU-28 benchmark (71 papers per 1 000 researchers). Spain spent 513 € per researcher on public-to-public partnerships in 2016, also slightly below the EU-28 score (558 € per researcher) as well as the ERA average.

On public-to-public partnerships, the country has seen strong growth since the last ERA monitoring exercise, which might allow it to transform a performance gap to EU-28 benchmark into a lead in the very short term, if current trends continue. Spain's score on public-to-public partnerships was increasing by 25% yearly on average from 2014 to 2016 (with notable annual growth even dating back to 2012, the first year for which data is available), which compared favourably to marginal growth at the EU-28 level. Another, more modest reduction in gap to the EU-28 was also found for the GBARD allocated to transnational cooperation. Slight growth for Spain in its publication of articles with ERA co-authors followed the trend across Member States.

The recognition of benefits provided by transnational research cooperation instruments is reflected in the newest strategic priorities recently set by Spain. Active participation in JPIs, ERA-NETs and similar instruments, was one of the most frequently emphasised strategic goals in the newest national ERA roadmap. The ongoing policy initiatives aiming at that goal included PECTI 2013-2016 and PECTI 2017-2020 support for joint programming initiatives related to societal challenges. Furthermore the new PECTI continues to focus on eight societal challenges: (1) Health, demographic change and wellness; (2) Bioeconomics: sustainability of primary production systems and forestry, food safety and quality, marine and maritime research and bioproducts; (3) Safe, efficient and clean energy; (4) Sustainable, intelligent and integrated transport; (5) Climate change, the environment and natural resources; (6) Social sciences and humanities and the challenges of Spanish society; (7) Digital economy, society and culture; and (8) Security, protection and defence (Fernández-Zubieta, Ramos-Vielba, Zacharewicz, 2018).

Under sub priority 2a, Spanish NAP had one of the main goals achieved, the design of a web based information and communication system for the joint programming thematic priorities. The system aims for greater openness and involvement of the research community.

b. Make optimal use of public investments in research infrastructures

Spain performed best on this set of indicators. In 2018, it participated in 50 % of then-current developing Projects, and 57 % of Landmarks. These scores placed it well above both ERA averages (Cluster 1) and the EU-28 benchmarks.

Spain's participation rates in 2016 were 52 % for developing ESFRI Projects and 31 % for Landmarks. In other words, Spain has seen a slight decrease on the first indicator and marked growth for the second. (Worth noting is that these indicators measure the share of Projects and Landmarks in which a country participates; Spain's proportionate decrease in Project participation is thus a slight drop in percentage but not in absolute number of projects.) Spain's decrease in developing Project participation means it is losing ground to the Member States overall, who increased their participation by nearly 20 % since the last ERA monitoring exercise. However, Spain has seen yearly average increases in Landmark participation of a much greater magnitude than at the EU-28 level, extending its lead over the EU-28.

Note that large countries are generally advantaged on this priority since the indicators are not normalised to account for differences in the size of countries.

Sub priority 2b in Spanish NAP aimed to strengthen strategic planning and coordination of infrastructures included in the ESFRI roadmap supported by Spain and the national scientific and technical infrastructures (ICTS). Progress made relates to the approval of an updated ICTS Map 2013-2016 and then, recently, new ICTS Map 2017-2020, in which existing infrastructures have been prioritised over new construction and efforts were directed towards maintenance of ICTS that are already in operation, avoiding their obsolescence. Another key goal defined in the Spanish NAP was promoting the opening of the infrastructure to the productive environment and business collaboration. On a very positive side, this resulted in a clear progress in promoting the access to these infrastructures to the greatest possible number of agents, including businesses. Despite improvements over the past few years, partly supported by initiatives to increase business representation on university governing boards, cooperation between universities and businesses in Spain remains a challenge, certain obstacle for cooperation between industry and academia seem to persist (e.g. rigidity of the university governance system, the administrative barriers).

3. An open labour market for researchers

Priority 3 was Spain's most challenging area. Spain's counts of EURAXESS academic job ads is almost 19 per 1 000 researchers, well below the EU-28 benchmark of 42 ads. This score positioned the country in Cluster 3. Spain obtained a score of 41 % on the share of researchers satisfied that academic hiring processes were open, transparent and merit-based. This compared to 65 % in the Member States overall. Spain's score was therefore below the EU-28 benchmark here, but well below ERA average (Cluster 4).

Short-term trends on this priority were split. On the headline indicator, Spain recorded strong growth, meaning it has markedly reduced its gap in performances to other Member States since the last ERA Monitoring exercise. Spain's CAGR was almost 25 percentage points above the EU-28 trend (which was slightly negative). Small yearly average decreases were recorded for Spain on the two complementary indicators, but Member States overall have seen slight or moderate growth for those. In other words, Spain's gap to other Member States has increased for those two indicators.

The main achievements under priority 3 in the Spanish NAP were initiatives implemented for recruitment of highly-reputed Spanish or overseas research professors into the Spanish National Science and Technology System. An alternative career path in public research organizations and universities through permanent contracts ('for distinguished researchers or scientists of great prestige') was developed. A new call for the recruitment of highly-reputed Spanish researchers with this type of contract is ongoing ("*Beatriz Galindo grants*"). However, permanent positions, as they are related to public servant status and conditions, create some barriers for recruitment of foreigner researchers. Another accomplishment related to priority 3 was an increase of RPOs up taking of Charter and Code in their policies and practices and awarded the "HRS4R" logo. This process is expected to influence positively on the publication job offers and researcher satisfaction on the academic hitting processes in the immediate future.

4. Gender equality and gender mainstreaming in research

Spain showed a score above ERA average (Cluster 2) for its inclusion of a gender dimension in research content, on par with the EU-28 benchmark. On the headline indicator, the share of women among Grade A positions in the higher education system, its performance placed it in Cluster 3 and below the EU-28 score. It closely followed the EU-28 trend on the last indicator in this priority, the share of female PhD graduates.

Spain has consolidated its position ahead of other Member States for gender dimension in research content. Yearly average increases of 8.4 % contrasted to the EU-28 trend of 2.5 %, extending Spain's lead. Spain's scores were basically stable for the other two indicators, mirroring the EU-28 trend.

Spain has implemented specific provisions requiring Research Performing Organisations (RPOs) to implement structured Gender Equality Plans (GEPs) (EIGE, 2016a) and Research Funding Organisations (RFOs) have implemented measures regarding gender equal opportunities for scientists and/or gender dimension in research content in the evaluation criteria. Work-life balance has also been explicitly mentioned in national policy documents (EIGE, 2016b). Regarding the integration of a gender dimension in research content and/or teaching, Spain has

implemented policies to promote it and universities and accreditation agencies have been key actors for mainstreaming gender analysis in curricula (EIGE, 2016a).

In Spain an increase of the share of RPOs, which have adopted Gender Equality Plans, was observed, meeting one of the targets set in the NAP under priority 4. Public universities in Spain have well-consolidated gender equality units to develop gender equality measures according to the Spanish Science, Technology and Innovation Law. Moreover, the Spanish ERA Roadmap regarding ERA priority 4 includes the development of gender equality structures in Research Performing Organisations and the Research State Agency. In this regard, and with the aim of fostering the presence of women in scientific and university life, the Council of Ministers has set up on November 2018 a new Observatory "Women, Science and Innovation for Gender Equality", on which nine ministerial departments will collaborate.

5. Optimal circulation, access to and transfer of scientific knowledge including via digital ERA

a. Knowledge transfer

Spanish firms cooperated with either universities or higher education institutions; or governmental, public or private research institutes at a rate of 13.7 %. This score was below the EU-28 benchmark (15.0 %) and below the ERA average (placing in Cluster 3). The country's performance was weaker for its count of public-private collaborative papers per capita. A score of 21 such papers was well below the EU-28 benchmark (at 41) and placed the country again in Cluster 3.

Short-term changes were of a noteworthy magnitude for one indicator only: firm cooperation with governmental, public and private research institutes. Here, the country recorded a CAGR of 13.7 %, almost 10 percentage points above the EU-28 trend and contributing to a reduction of the performance gap to other Member States since the last ERA Monitoring Exercise. On the other indicators in this priority, marginal yearly changes did not meaningfully alter Spain's position relative to the other Member States.

A growing number of organisations across ERA countries are promoting knowledge transfer and uptake of scientific findings. Spain has designed a large number of support schemes to foster R&D activities. Under sub priority 5a the Spanish NAP recognised strengthening collaboration between public research and industry as a general goal. A number of new initiatives encouraging knowledge circulation appeared as a result:

- A new tool for recognition of non-academic research activity ("sexenio de transferencia").
- A new programme aimed at promoting applied research and public-private collaboration through technology centres ("Red Cervera").
- A working group of experts for promoting transfer of knowledge and innovation.

b. Open access

Of the Spanish scientific articles published in 2016, 46 % were released in some OA modality. This compared to 49 % for the EU-28 benchmark. It performed similarly to the EU-28 level for Green OA, positioning the country above ERA average. Spain's score showed a greater gap to the EU-28 benchmark on Gold OA, placing the country in Cluster 3. Spain placed above both the ERA average and the EU-28 score for its share of life science papers with OA datasets. Furthermore, the country has been extending its lead on other Member States since the last ERA Monitoring Report: a CAGR of 7.4 % was found, almost 5 percentage points above the EU-28 trend.

One of the general aims in the NAP related to sub priority 5b was the implementation of effective OS (and innovation) policies linked to public grants. On OA Spain has made significant progress, as the recent PECTI includes important updates on OA to scientific publications and research data. For example, it extends National OA policy to research data and acknowledges digital skills in pre-doctoral phase for applying OA to publications and research data. In 2018, Spain, through FECYT, has launched the INEOS pilot project. The final aim of this project is to strengthen the national infrastructures and standards for the exchange of information for the open access policies. This project is in collaboration with 3 public research organization: CSIC, ISCIII & INIA.

Furthermore, Art. 37 is dedicated to Open Access in the Spanish Science, Technology and Innovation Law in order to establish a framework to strengthen scientific and technical research at national level. There has also been an increasing number of RPOs that are developing their own institutional policies to foster the adoption of OA practices, whether in the form of institutional declarations, recommendations or compulsory requirements. Currently, about 26 institutions have published any of those documents, and out of those, 17 universities published their own policies on OA.

6. International cooperation

Spain's count of collaborative papers with non-ERA researchers is on par with the Member States overall, at 54 papers per 1 000 researchers. This score placed the country within Cluster 2. Scores for Spain's share of doctoral students from outside the EU and its share of product exports made up of medium and high technology products placed the country in Cluster 3 and below the associated EU-28 benchmarks. Finally, Spain recorded one of its weakest performances for its share of knowledge-intensive service exports, with a score less than half of the EU-28 benchmark, positioning the country within Cluster 4. One can note that the reference year to compute Spain's score was 2015 (instead of 2016, as for other ERA countries). This datapoint, however, does not significantly diverge from the trend seen in previous years, suggesting that the difference in data availability is not driving Spain's low score here.

Spain has seen its share of doctoral students from outside the EU decrease yearly by an average of almost 2 %. This rate of change was more than 5 percentage points below the EU-28 trend, meaning that Spain has lost further ground to the other Member States since last ERA monitoring exercise. Trends in score for the three remaining indicators were within three percentage points of the EU-28 trajectories, and therefore do not substantially alter the position of Spain vis-à-vis other Member States.

Spanish RPOs employ tools to encourage international cooperation activities with third countries including national and institutional strategies for internationalisation, creation of innovation and research centres, and delegation of representatives for research and innovation. Spain has also prioritised internationalisation in its national strategy. Objectives defined in the Spanish NAP under priority 6 were met, as there has been an increase in development and participation on international programmes and activities.

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ANNEX: METHODOLOGICAL NOTES

	Indicator	Data availability	Flag							
	Name		**Exception to ref. year**	**Exception to ref. period**	**Break in time series**	**Definition differs**	**Estimated**	**Provisional**	**Potential outlier**	**Confidential**
Priority 1	**Adjusted Research Excellence Indicator (AREI)**	Available								
	GBARD as share of GDP	Available						2016-2017		
	EIS Summary Innovation Index (SII)	Available								
Priority 2	**A - GBARD to transnatl coop (EUR/researcher)**	Available								
	A - Collab papers w/ERA per 1 000 researchers	Available								
	A - Public-to-public partnerships (EUR/researcher)	Available								
	B - Roadmap for ESFRI projects									
	B - Participation in ESFRI projects and landmarks (combined)	Available								
	B - Participation in developing ESFRI projects	Available								
	B - Participation in operational ESFRI landmarks	Available								
Priority 3	**EURAXESS job ads per 1 000 researchers**	Available								
	Open, transparent, merit-based hiring process	Available								
	Share of doctoral students from EU countries	Available								
Priority 4	**Share of women among Grade A in HES**	Available								
	Gender dimension in research content	Available								
	Share of female PhD graduates	Available								
Priority 5	**A - Firms coop with univ, gov, res inst**	Available								
	A - Firms coop with univ	Available								
	A - Firms coop with gov, res inst	Available				2012				
	A - Share of public R&D funded privately	Available								
	A - Public-private collab papers per capita	Available								
	B - Share of papers in Open Access (Total)	Available								
	B - Share of papers in Open Access (Gold)	Available								
	B - Share of papers in Open Access (Green)	Available								
	B - Share life science papers with OA dataset(s)	Available								
Priority 6	**Collab papers w/non-ERA per 1 000 researchers**	Available								
	Share of doctoral students from outside EU	Available								
	Share med & high tech product export	Available								
	Share Knowledge intensive service export	Available	2015	2013-15						

Additional note: For the indicator *Share of women among Grade A in HES* the definition differs for 2014 (reference population = Academic staff). For the same indicator there is a change in reference population in the CAGR computation: Academic staff (2014) to Researchers (2016).

ANNEX: GUIDE TO READING THE QUANTITATIVE RESULTS TABLES (COUNTRY SNAPSHOTS)

Each profile table shows the given country's performance score and growth for all indicators used in this study. Given that specific targets were not established for each of the 24 ERA Monitoring Mechanism (EMM) indicators for each country, it is impossible to report on a country's level of compliance in achieving the ERA priorities, or the ERA policies/actions, that each of these indicators intends to measure ([1]). Instead, the level of performance in the country snapshots is compared to the EU-28 (lead/gap analysis) and ERA averages (performance clusters). These references might represent unrealistic targets for some countries, especially the smaller ones. However, care was taken to use normalised indicators (except for Priority 2b), usually by incorporating the size of a country's population or economy in the denominator of an indicator. Additionally, the EU-28 and ERA averages might in some cases be lower than the level of performance which would be optimal towards achieving the ERA; for instance, gender equality might not have been reached in all relevant aspects at the EU- and/or ERA-wide level. That said, the main goal of these comparative analyses is to help situate countries relative to the core of the EU and ERA, so as to inform decisions on the most appropriate targets and on how to achieve them.

In addition to a measurement of performance in 2017 (or the most recent reference year for which sufficient data were available at the time of producing this report ([2])), the profile table also reports on recent changes in national performance, computed as a Compound Annual Growth Rate (CAGR). The CAGR aims to assess progress made since the ERA Progress Report 2016. Accordingly, it compares the latest available year in the 2016 report to the latest available year in this report. Growth since the last monitoring exercise is also compared to the EU-28 (lead/gap analysis) to inform individual countries on the extent to which their gap with the EU-28 level of performance is closing or widening. This information is intended to help individual countries better assess the extent to which new actions are required to achieve their respective targets.

The profile table is divided in two parts: performance and growth. For performance, the reference year for each indicator is noted. If the reported year for a given country and indicator is different from the reference year, the performance score in the snapshot is highlighted using a grey font in italics. The specific year which is reported appears in the column "exception to ref. year" of the appendix table at the end of the country profile. The appendix table also lists the years for which a flag is applied to the data. The performance section of the snapshot table also provides the EU-28 scores across indicators upon which the country lead/gap, in percent difference to the EU-28 score, is computed. Furthermore, the performance clusters from the main report have also been presented here; recall that countries more than one standard deviation above the unweighted ERA average (i.e. average across member states and associated countries for which data is available for each indicator) are in Cluster 1, the strongest cluster; those at or above the unweighted ERA average but within one standard deviation are in Cluster 2; those below the unweighted average but within one standard deviation are in Cluster 3; those more than one standard deviation below the ERA unweighted average are in Cluster 4, the weakest cluster.

For growth, the reference period used in computing the Compound Annual Growth Rate (CAGR) is also presented, alongside the actual CAGR. Again, exceptions to the reference period are highlighted by using a grey font in italics to display the actual CAGRs of the corresponding country and EU-28. Information on the specific years used in these cases are again available in the appendix tables. The lead/gap analysis for growth shows the percentage point difference between the country's CAGR and the CAGR of the EU–28 average. The CAGR measures growth relative to the latest available year in the *2016 ERA Progress Report*. Since there were retrospective corrections to the scores of countries on some indicators, growth was computed based on the updated time series. Trend lines over the longest available period for a given indicator are provided to inform on longer-term patterns of progress towards realising the ERA. Empty lines in the trend indicate either that data was missing for that year, or that the country's score was zero. For one indicator where short-term fluctuations were particularly pronounced (gender dimension in research content in priority 4), rolling averages (e.g. average scores across 2007–2010, 2008–2011… 2014–2017) have been used to measure performance and growth. In such cases, the CAGR measures the year-by-year percent change in the rolling average of an indicator between the starting and ending periods (e.g. between 2011–2014 and 2014–2017). These cases are

[1] A more in-depth assessment of progress of implementation of ERA policies was rather achieved in the text of country profiles (not the snapshot tables) accounting for quantitative (where available) and qualitative (especially) elements in relation to the objectives, baselines, targets, timelines and milestones established by individual countries in their National Action Plans (NAP).

[2] Refer to the 2018 ERA Monitoring Handbook for the extraction dates of the presented data.

highlighted by the addition of the superscript (R) to the reference year (performance) and period (growth) of the concerned indicators.

The lead/gap analyses, both for performance and for growth, have been colour-coded to help visually elucidate patterns in the findings. The colour scheme for the country profiles ranges from dark blue (weakest scores) to dark orange (strongest scores), as was applied in the main report. There is, however, a key difference to note. In the main report, the colouring compared the results of different countries along a single indicator, in these country profile tables the colouring compares the results of one country along several indicators, to highlight its relative strengths and weaknesses across indicators. More specifically, in each profile, blue always indicates that a country is below the EU–28 average, and orange always indicates that it is above, but the shade of blue and orange (dark or light) is relative to the country's own performance across indicators, rather than relative to the performance of other countries.

Indicators in bold are the Headline indicators that were selected as being the most relevant in monitoring progress in achieving the ERA by the European Research Area and Innovation Committee (ERAC). Within each priority, the Headline is followed by the two complementary EMM indicators identified by ERAC. Lack of data is identified by using a symbol (:) within the table cells.

Due to changes and discontinuities in data collection, some indicators have been updated, modified or replaced. A first modification was introduced for the complementary EMM indicators of Priority 2b (Make optimal use of public investments in research infrastructures). Here, findings are now provided on a combined indicator that better illustrates how level of engagement in ESFRI developing Projects and Landmarks are connected rather than independent.

For the headline indicator of Priority 5a, the underlying data coming from Eurostat was for the first time aggregated in a manner that made it possible to present a single metric (in terms of performance) merging both of its underlying dimensions ([3]); that is the share of product and/or process innovative firms cooperating with 1) universities or higher education institutions, or 2) with government, public or private research institutes. For growth, these two dimensions still had to be kept separated in this edition.

The indicators on the share of a country's peer-reviewed scientific papers that are available in Open Access (i.e. Total, Gold and Green OA) in Priority 5b have all been impacted by a revised definition of what constitute Green Open Access papers (see Section 3.5.5 of the Main Report for a description of this change). The indicator on the inclusion of OA policies in RIO policy repositories was discontinued since the new reporting guidelines for RIO policy reports no longer ask the experts to report on OA specifically. It has been replaced by a qualitative assessment of the NAPs and other information sources. A new indicator was also added to Priority 5b to fill a data gap in the 2016 ERA Progress Report; no data was available in 2016 for the share of research performing organisations (RPOs) making their research data available in OA. The share of research performing organisations (RPOs) making their research data available in OA has been replaced by the share of life sciences papers to which a country contributed and that have at least one open dataset in Figshare.

Due to discontinued data, the indicator on "Licence and patent revenues from abroad as a share of GDP" in Priority 6 has been replaced by two new indicators: knowledge intensive services exports as percentage of total services exports and exports of medium and high technology products as a share of total product exports; this modification coincides with a similar replacement in the 2018 European Innovation Scoreboard (EIS). Changes in the data for some countries also led to changes in EU28 aggregate scores the following two indicators: the share of doctoral candidates with a citizenship of another EU Member State (Priority 3) and non-EU doctorate students as a share of all doctorate students (Priority 6). Additional modifications in the approach used in computing EU-28 aggregate scores (e.g. imputation of missing data) led to some changes in the GBARD (EUR) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher in the public sector (Priority 2a).

Finally, the composite indicators combining findings from headline and complementary indicators within and across ERA priorities have not be computed in the 2018 ERA monitoring exercise. The rationale for these changes is detailed in the 2018 ERA Monitoring Handbook.

[3] The new aggregation provided by Eurostat enabled this change by removing duplicated count of firms falling in both types of partnerships.

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The 2018 ERA Progress Report assesses the current state of the European Research Area (ERA) and the progress made on ERA implementation in 2016-2018. It is the second time in a row that progress has been measured at country level using the ERA monitoring mechanism.

Based on the overall evolution of the headline indicators, progress on ERA implementation continues, albeit at a slower pace than before. This trend calls for a renewed commitment to (i) further strengthening shared efforts at all levels; (ii) reforming national research and innovation systems; and (iii) realising a well-functioning ERA. The Commission has anticipated this need by proposing a number of programmes for the next financing period 2021-2027: these include regional funds, a European reform delivery tool, and the EU's next research and innovation framework programme — Horizon Europe, which includes a dedicated pillar to help strengthen the ERA.

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