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Cohesion or Widening Disparities: R&D Performance vs. EU Funding of the Regions

This comprehensive analysis investigates the effectiveness of EU funding in promoting research and innovation across various regions, with a specific focus on the Horizon Europe Programme. In this study, we employed a mixed-quantitative analysis of funding allocation data sourced from the Horizon Europe Dashboard and the Global Innovation Index. We systematically analysed the distribution of Horizon Europe funds from 2021 to 2023 across all EU Member States and their respective NUTS 2 regions, focusing on per capita and per researcher fund allocation. Additionally, a comparative analysis was conducted to assess the alignment between fund distribution and innovation indicators such as R&D intensity and innovation outputs.

The study also critically examines the EU's cohesion policy, which is fundamentally designed to reduce regional disparities and promote equal opportunities across all EU regions. Through our analysis, we aim to assess whether the current implementation of the EU's financial instruments aligns with the overarching goals of cohesion policy, particularly in terms of fostering uniform economic growth and development. This examination is crucial as it highlights the need for the values of cohesion to be more effectively integrated into the criteria systems of directly managed EU funding programs to achieve its intended objectives of regional and territorial cohesion.

The study reveals persistent and widening disparities in the distribution of funds, which accentuate regional and national inequalities within the EU. Despite significant financial allocations aimed at fostering innovation, the evidence points to a concentrated benefit in specific regions, particularly those already developed, thereby raising concerns about the equitable promotion of technological advancement and economic growth across less developed areas. The findings underscore the need for a more balanced and strategic approach to funding that ensures all regions can contribute to and benefit from Europe's innovation landscape. This research contributes crucial insights into the complexities of funding allocation, the challenges of regional disparities, and the potential pathways towards a more inclusive innovation policy within the European Union.

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Introduction

In today's rapidly evolving world, technology and innovation serve as the twin engines propelling economies forward. Nations that prioritise investments in research, education and innovation infrastructure gain a competitive edge in the global marketplace. By fostering a culture of entrepreneurship and providing incentives for risk-taking and experimentation, governments can nurture vibrant ecosystems of startups and scale-ups, driving economic dynamism and attracting talent and capital from around the world. Super-developed Science & Technology regions were born in the recent decades, while others are lagging behind.

At the same time, the European Union is not a country like its competitors, the United States and China, and it is consisted of more than 27 different nations. Therefore, the European Union shall put a greater emphasis on cohesion and unity than an average country or a federal state, where choosing between competitiveness and cohesion is mainly a regional development issue. In case of the European Union: cohesion is an existential issue. If too many Member States and regions are detached too far from the most developed countries and regions, it has serious negative impact on the unity of the Union, which lashes back to the most developed countries as regions, since they can lose their less developed markets.

In case of research and development, there are widely used objective indicators, such as the number of researchers, number of patents, which show the capabilities of results of scientific communities. This paper presents that (1) the European Union is lagging behind China and the US, (2) despite of its efforts, it distributes Horizon funds extremely unevenly among the 27 Member States and the 250 NUTS 2 regions, (3) and the distribution is not in line with the widely used objective indicators such as the number of researchers or patents. We propose to put greater emphasis on cohesion in programs such as the R&D focused Horizon in the future in the interests of the single market.

Research and innovation landscape

Technology and innovation are indispensable drivers of economic growth in the 21st century, reshaping industries, transforming societies, and unlocking new opportunities for prosperity and progress. By embracing a culture of innovation, investing in human capital, and fostering an enabling policy environment, nations can harness the full potential of technological advancements to build inclusive, sustainable, and resilient economies for the benefit of all.

Unfortunately, it is an increasingly well-known fact that the European Union is falling further and further behind in global competition, particularly in the field of Science

& Technology (S&T). The world's five biggest S&T clusters are all located in East Asia.[4] Tokyo–Yokohama (Japan) has emerged as the largest global S&T cluster, closely followed by Shenzhen–Hong Kong–Guangzhou (China and Hong Kong, China), Seoul (Republic of Korea), China's Beijing and Shanghai–Suzhou clusters. This concentration of leading clusters in East Asia signifies the region's pivotal role in shaping the global S&T domain.

The Cambridge cluster (UK), San Jose – San Francisco, CA, USA), Oxford (UK), Eindhoven (Netherlands) and Boston–Cambridge (US) have the most intensive S&T activity, in proportion to population density in the Western World. In contrast, the European Union appears to be receding in the global S&T competition, as evidenced by the absence of any EU-based S&T clusters in the top ten, globally. This trend underscores a critical need for the EU to enhance its infrastructure and policy frameworks to foster a more robust S&T environment. Notably, China has overtaken the United States in the number of top 100 S&T clusters. The WIPO published Global Innovation Index (GII) identifies 24 S&T clusters in China, 21 in the US, and 9 in Germany, highlighting the shifting dynamics of global S&T leadership.[5]

S&T clusters located in other emerging economies besides China also show remarkable growth in their S&T output, notably in India, which has four top S&T clusters, with Chennai and Bengaluru experiencing the biggest increases in density of inventors and scientific authors. S&T clusters in certain emerging economies grew at a particularly fast pace, including Brazil, India, Türkiye and, beyond the top 100, in Argentina, Egypt, Thailand and others.[6]

Regarding the Global Innovation Index 2023 (GII) rank in the top 20 countries, seven EU Member States are found: Sweden, Finland, Netherlands, Germany, Denmark, France, Estonia and Austria. It is worth mentioning that this group is completed by five non-EU members: Switzerland, United Kingdom, Israel, Norway, and Iceland, who are part of the Horizon program.

Table 1: TOP 20 innovative countries based on the Global Innovation Index 2023

GII rank	Country	GII rank	Country
1	Switzerland	**11**	**France**
2	**Sweden**	12	China
3	United States	13	Japan
4	United Kingdom	14	Israel
5	Singapore	15	Canada
6	**Finland**	**16**	**Estonia**
7	**Netherlands**	17	Hong Kong, China
8	**Germany**	**18**	**Austria**
9	**Denmark**	19	Norway
10	Republic of Korea	20	Iceland

Source: compiled by the authors based on data of the Global Innovation Index 2023 rankings.

[4] Dutta et al. 2023a.
[5] Dutta et al. 2023b.
[6] Dutta et al. 2023c.

Within the EU, the Nordic countries are the leading ones: Sweden, Finland and Estonia. Notably, Estonia stands out among other former communist EU Member States, being the only one in the top 20, which illustrates the disparate progress in embracing innovation and technology after transitioning from communist regimes. Other former communist EU Member States are only in the top 40: the Czech Republic (31), Slovenia (33), Lithuania (34), Hungary (35), Latvia (37) and Bulgaria (38).

The data presented offer a detailed insight into the current landscape of global Science & Technology (S&T) clusters, emphasising the geographical distribution of innovation and the varying levels of competitive performance among regions.

This complex and evolving picture underscores the importance of strategic policy interventions and investments in S&T to ensure competitive parity on the global stage. As such, these insights could significantly inform policy-making aimed at enhancing national and regional innovation systems, fostering economic growth, and maintaining global competitiveness in the rapidly advancing field of science and technology.

Regional innovation disparities and cohesion policy

Referring to the theory of the "Blue Banana"[7] of the broken corridor of urbanisation in Western and Central Europe, it may be interesting to see how the distribution of innovation centres in the European Union is shaped. We see that the depth and nature of economic disparities was already complex in the 1990s. On the one hand, for geographical and historical reasons, some regions have experienced strong industrialisation and growth, while others are lagging behind. On the other hand, policy decisions and economic strategies contribute to maintaining or reducing disparities.[8] The term "Blue Banana", coined by French geographers, represented a region at the economic and demographic heart (or elsewhere the backbone) of Europe, often seen as the axis of economic success. Used as a similar metaphor, but with a different meaning, the "European bunch of grapes"[9] conjures up an image of a more evenly developed Europe along polycentric circles.[10] The European S&T environment presented above is closer to the cluster approach.

The issue of regional disparities is a major challenge in the European Union, where economic, social and infrastructural inequalities between different Member States and regions remain significant. According to the latest European Innovation Scoreboard, there are significant differences in innovation performance between Member States, reflected in differences in GDP per capita, employment rates and quality of life indices.[11] In addition to economic disparities, social and infrastructural inequalities also hamper cohesion between regions. The spatial distribution of educational opportunities and access to healthcare is also unequal, exacerbating social exclusion.[12]

7 Hospers 2003.
8 Rodríguez-Pose 2018.
9 Kunzmann–Wegener 1991.
10 Kunzmann–Wegener 1991.
11 European Commission Directorate-General for Research and Innovation 2023.
12 Becker et al. 2010.

The European Union has already taken a number of measures to reduce regional disparities. A landmark 1992 Maastricht Treaty required the Council of the European Union to set up a Cohesion Fund to provide financial support for environmental, energy, telecommunications and transport infrastructure projects. The regulation, which set the criteria, looked at per capita gross national income and gave preference to those with a GDP below 90% of the EU average, so aid was given to Greece, Ireland, Spain and Portugal, which at the time had a GDP below 90% of the EU average.

The Treaty brought the first cohesion policy reform, giving national governments more flexibility. It firmly enshrined economic and social cohesion among the fundamental objectives of the European Union, alongside the internal market and Economic and Monetary Union. The Delors II package, adopted by the Edinburgh European Council in December 1992, doubled the financial resources devoted to cohesion policy from 1994 to 1999, with the result that the policy accounted for one third of the EU budget, as it does today. Cohesion policy and the Structural Funds aim to help less developed regions to catch up economically.[13] However, critics argue that these measures do not always have the desired effect and are not always targeted at the regions most in need.[14]

Efforts to address these challenges include regional innovation strategies that build on unique regional resources and competences and contribute to the diversification of local economies. One such innovation strategy is smart specialisation, which encourages regions and countries to identify and develop their own competitive advantages and areas of specialisation by focusing resources on the most promising growth opportunities. It aims to foster knowledge-based economic growth by promoting innovation and resource efficiency by aligning research and innovation efforts with regional and national economic development strategies.[15]

While innovation can drive regional development, there are also challenges associated with the disparities. One challenge is access to capital, as many startups and small businesses struggle to secure the funding they need to grow and expand. Another challenge is access to talent, as many local economies struggle to attract and retain skilled workers.

The EU faces significant regional disparities, with certain regions experiencing acute demographic changes, notably a rapid decline in the working-age population and a stagnation or decline in the number of people with tertiary education. These issues are compounded in regions that also see a significant departure of young people, which, if unaddressed, can lead to growing territorial disparities, undermining the EU's resilience and competitiveness. This demographic challenge is occurring in a global context where the competition for talent is intense, further exacerbated by other structural transformations like the transition to a climate-neutral economy and technological change.

Innovation hubs play a crucial role in addressing these disparities by fostering regional development. They act as dynamic centres that harness and nurture local talents, enhancing economic diversification and innovation capacity, leading to create sustainable, competitive, and knowledge-based economies. Specifically, the EU

13 McCann–Varga 2015.
14 Laguna 2024.
15 Rusu 2013.

emphasises the importance of leveraging regional assets such as universities, vocational education and training (VET) institutions, and small business clusters to support long-term regional development. The implementation of smart specialisation strategies and the mobilisation of national and regional levels are critical to revitalising these regions, making them attractive for living, working, and investing.

Furthermore, targeted measures outlined by the EU, including the promotion, retention, and attraction of talent, are essential for transforming all regions into dynamic talent-driven locations. The success of these measures depends on the collaboration of the national and regional levels, focusing on innovation and education as pivotal elements for regional attractiveness and development.[16]

A supportive regulatory environment, infrastructure and policies are also needed to promote entrepreneurship and innovation. Overcoming these challenges requires a collaborative effort between businesses, government, academic institutions and local communities.

Regional disparities are a major obstacle to EU integration efforts and economic growth. While many of the EU's initiatives represent significant progress, the critics and current achievements highlight the need for further action. For the EU to be successful in the long term, it needs to adopt a strategic and targeted approach that delivers real help to lagging regions.

EU measures supporting innovation

Mission of the Horizon Europe Programme

In addition to the cohesive measures discussed in the previous chapter, the European Union's Horizon Europe Programme stands as a flagship initiative dedicated to promoting research, innovation, and technological advancement across the Union. Central to its mission, Horizon Europe strives to catalyse scientific excellence and tackle societal challenges by fostering collaborative research and innovation endeavours. The program aims to propel the frontiers of scientific knowledge and technological innovation by funding cutting-edge research and collaborative projects. These projects bring together researchers, academics and industry partners from across Europe and beyond, thereby promoting interdisciplinary collaboration and facilitating the exchange of ideas and expertise.

Horizon Europe is structured to directly confront key societal challenges, including climate change, energy transition, digital transformation, health and well-being and the building of inclusive societies. It addresses these issues through targeted funding schemes and initiatives that aim to develop innovative solutions contributing to sustainable development, economic growth, and social cohesion. By doing so, the program seeks to make tangible impacts that resonate across societal dimensions.

16 European Commission 2023.

Moreover, Horizon Europe is committed to driving innovation and enhancing competitiveness within the European context. The program supports the development and commercialisation of breakthrough technologies, products and services. It invests in research-driven innovation, technology transfer and entrepreneurship, enhancing Europe's competitive stance in the global marketplace. This investment is expected to create new opportunities for economic growth and job creation, thereby reinforcing the European innovation ecosystem.

Furthermore, Horizon Europe places a strong emphasis on promoting international collaboration. The program actively engages with research and innovation stakeholders worldwide through joint research projects, mobility schemes, and partnerships with non-EU countries. This international engagement facilitates the exchange of knowledge, talent and best practices, which is pivotal in strengthening Europe's position as a global leader in research and innovation.

Overall, the mission of the Horizon programme is to drive scientific excellence, address societal challenges, drive innovation and competitiveness and promote international collaboration to build a more prosperous, sustainable and inclusive future for Europe and the world.

Considering that Horizon Europe is the leading innovation and research programme of the EU, represents the largest directly managed EU funding initiative with its €95,5 billion for this programming period (2020–2027), we are analysing the 2023 data on participation by EU Member States in Horizon Europe. This analysis is conducted to identify regional disparities in science and innovation funding within the European Union.

Widening participation and spreading excellence

The Widening sub-program of Horizon Europe acknowledges the uneven development of research and innovation ecosystems across the European Union. While some regions boast advanced infrastructures and robust investment in research and development (R&D), others are constrained by limitations such as inadequate research facilities, insufficient R&D funding, and a scarcity of skilled personnel. These disparities can impede their full participation in European research and innovation initiatives and limit their access to EU funding opportunities. The sub-program aims to mitigate these regional imbalances by enhancing participation and fostering excellence in research and innovation across diverse EU regions.

From the total budget of €95.5 billion allocated to Horizon Europe for the period 2021–2027, slightly less than €3.4 billion – equating to 3.5% of the total program budget – is dedicated to the Widening sub-program. This allocation underscores the EU's commitment to addressing disparities in research and innovation performance within its borders.

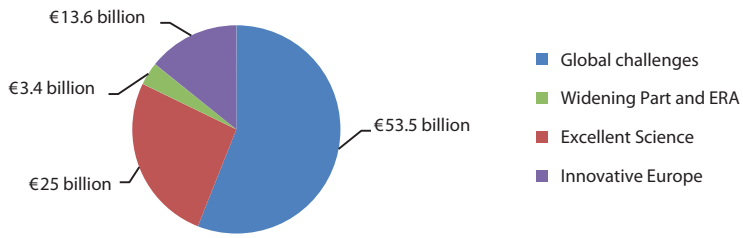

Figure 1: Horizon Europe Budget distribution in the 2021–2027 Programming Period in billion € (total: €95.5 billion)

Source: European Commission

Tables 2 and 3 show that, in Hungary, the proportion of selected (retained) to eligible proposals under the Horizon program over the past three years stands at 22%. For the Widera Calls, also spanning the last three years and funded by the Widening sub-program – designed specifically to enhance participation of widening countries in the Horizon program – the selection rate of proposals in Hungary is marginally higher at 24%. This increase suggests that there is no significant difference in success rates within the context of the Widening sub-program. Consequently, it can be inferred that the Widening sub-program not only allocates a modest budget, representing merely 3.5% of the total Horizon funds, but also that its implementation has fallen short of achieving its intended objectives.

Table 2: Hungary's results in Horizon between 2021 and 2023

Call Deadline Year	Eligible Proposals	Selected Proposals	Selected Proposals (%)	Non-Successful Eligible Proposals
2021	576	125	22	451
2022	831	169	20	662
2023	405	110	27	295
TOTAL	**1 812**	**404**	**22**	**1 408**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

Table 3: Hungary's results in Widera between 2021 and 2023

Call Deadline Year	Eligible Proposals	Successful Proposals	Selected Proposals (%)	Non-Successful Eligible Proposals
WIDERA 2021	24	6	25	18
WIDERA 2022	50	10	20	40
WIDERA 2023	17	6	35	11
TOTAL	**91**	**22**	**24**	**69**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

Regional innovation gap

Distribution of Horizon grants among EU Member States

On the basis of the above facts and mission of EU's Horizon program, it is worth examining the distribution of Horizon grants among the EU Member States. All data of Horizon grants were taken from the Horizon Dashboard, which was updated on 20 December 2023 by RTD.

Table 4: Distribution of Horizon grants among EU Member States in 2023

Country	Net EU contribution of the EU27 (%)	Member States' rank in net EU contribution	Net EU contribution (€)	SME Net EU contribution (€)	Total cost (€)
Germany	17.51	1	4 614 563 346	589 735 444	5 486 496 461
France	12.28	2	3 234 591 959	556 438 526	4 449 188 229
Spain	11.82	3	3 113 675 336	680 812 548	3 672 176 087
Netherlands	10.08	4	2 656 335 475	471 344 035	3 267 145 924
Italy	9.54	5	2 513 506 855	394 400 140	3 166 860 514
Belgium	7.60	6	2 002 648 153	364 669 157	2 444 314 766
Greece	4.33	7	1 141 638 828	277 706 892	1 273 181 046
Sweden	3.68	8	970 490 665	149 754 892	1 280 194 801
Austria	3.53	9	929 360 151	148 148 910	1 156 141 632
Finland	3.17	10	836 216 309	121 409 696	974 216 077
Denmark	3.15	11	831 127 441	118 989 150	998 218 822
Portugal	2.49	12	656 759 686	154 121 157	739 021 162
Ireland	2.39	13	628 596 793	184 138 473	714 471 061
Poland	1.53	14	402 718 629	92 490 035	497 438 785
Czechia	1.27	15	335 064 765	38 974 218	407 983 161
Slovenia	0.92	16	242 980 161	35 372 908	504 334 201
Cyprus	0.74	17	196 201 649	87 203 642	224 130 440
Romania	0.73	18	192 100 915	39 769 810	241 679 857
Estonia	0.60	19	157 741 308	46 011 838	181 374 499
Luxembourg	0.52	20	138 104 000	21 505 593	200 109 226
Hungary	**0.49**	**21**	**128 155 758**	**36 213 816**	**151 452 307**
Lithuania	0.38	22	€ 99 717 969	31 547 646	117 294 464
Bulgaria	0.35	23	€ 92 761 541	32 953 140	112 065 977
Croatia	0.29	24	76 222 144	17 207 447	158 790 229
Slovakia	0.24	25	62 083 592	12 594 055	73 320 199
Latvia	0.22	26	56 858 753	8 472 387	74 494 519
Malta	0.14	27	36 417 182	10 611 780	46 012 367
TOTAL EU27	**100.00**		**26 346 639 362**	**4 722 597 334**	**32 612 106 814**
TOTAL EU14	**92.10**		**24 267 614 997**	**4 233 174 612**	**29 821 735 809**
TOTAL EU13	**7.89**		**2 079 024 365**	**489 422 723**	**2 790 371 005**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

The Horizon Europe, established to enhance research and innovation across the European Union, has exhibited significant disparities in fund distribution among Member States, as highlighted by the Horizon Dashboard over the program's initial three-year phase from 2021 to 2023.

Contrary to the mission and aims of the Horizon program and its Widening subprogram, a striking imbalance is evident in the allocation of funds, where only a small fraction, 7.89%, was awarded to the 13 countries that joined the EU after 2004 (EU13). This is in stark contrast to the older Member States (EU14), which secured 92.10% of the total funding, despite EU13 countries comprising 23% of the EU's population. Such a distribution pattern underscores potential inefficiencies in the strategic intent of the Widening initiative, which aims to integrate newer Member States more fully into the European research landscape.

The World Intellectual Property Organization on the Global Innovation Index (GII) 2023 was discussed in the first chapter, where further analysis of Spain's innovation position shows that the country is ranked 17th in the EU and 29th globally, meanwhile Spain is emerged as the third largest beneficiary of the Horizon program. This outcome is notable, as Spain received almost the same level of funding as France. However, the contribution from Spanish entities amounted to only €558 million of their own resources against the €3.1 billion received from the EU, a ratio significantly lower than that of French entities, who received over €1.2 billion to their €3.2 billion from EU funds.

Additionally, Greece, with its relatively modest R&D intensity ranking of 15th in the EU and 42nd on the GII 2023, surprisingly became the 8th largest beneficiary by receiving €1.1 billion in EU funding, while contributing only €131 million in own resources. Notably, Greece received more Horizon funds than Sweden and Austria, countries with similar populations but higher rankings in R&D intensity. This disproportionate allocation highlights further discrepancies, as Greece with its 10.3 million inhabitants alone received more than half of the total funds allocated to the entire EU13 bloc, which has a combined population of 101 million.

Hungary's experience within the Horizon framework further illustrates these disparities as it is seen in Table 5. With a receipt of €128 million, Hungary ranked 21st in fund allocation among EU countries, representing a mere 0.49% of the total Horizon funds. This figure is indicative of the challenges faced by smaller EU states in accessing competitive research funding.

Table 5: Distribution of researchers within Member States compared by NET EU contribution from Horizon Europe Programme

Country	Researcher's ratio– Researchers (FTE) per million of population	Top cited publications rate (%)	Patent applications rate	R&D Intensity (%)	R&D Intensity Ranking	Net EU contribution per capita (€)	Net EU contribution per researcher (€)
Austria	6 131	10.6	2.8	3.19	3	102	16 648
Belgium	6 569	12.1	2.4	3.22	2	170	25 938
Bulgaria	2 373	1.8	2.0	0.77	24	14	6 062

Country	Researcher's ratio– Researchers (FTE) per million of population	Top cited publi-cations rate (%)	Patent appli-cations rate	R&D Intensity (%)	R&D Intensity Ranking	Net EU contribu-tion per capita (€)	Net EU contribu-tion per researcher (€)
Croatia	2 462	3.4	1.8	1.24	18	20	8 040
Cyprus	1 796	7.9	1.3	0.87	23	213	118 642
Czechia	4 572	4.3	1.3	1.77	10	31	6 769
Denmark	7 665	14.0	3.0	2.81	6	140	18 278
Estonia	4 032	8.3	2.2	1.75	11	115	28 641
Finland	7 850	12.2	3.9	2.99	5	150	19 145
France	5 009	8.7	2.9	2.21	8	48	9 486
Germany	5 533	10.4	3.3	3.13	4	55	9 887
Greece	4 237	8.6	2.1	1.45	15	110	25 924
Hungary	**4 471**	**5.8**	**2.6**	**1.65**	**13**	**13**	**2 986**
Ireland	4 544	11.4	0.9	1.06	20	121	26 633
Italy	2 926	10.8	2.5	1.48	14	43	14 597
Latvia	2 413	2.2	2.1	0.69	25	30	12 514
Lithuania	3 926	5.0	1.3	1.11	19	35	8 889
Luxembourg	4 967	14.2	0.8	1.02	21	209	42 072
Malta	2 040	4.4	1.8	0.64	26	67	32 927
Netherlands	6 030	15.3	2.7	2.25	7	149	24 734
Poland	3 603	4.3	1.5	1.44	16	11	3 042
Portugal	5 445	8.9	2.1	1.68	12	63	11 524
Romania	1 004	4.9	1.0	0.47	27	10	10 046
Slovakia	3 224	3.8	1.7	0.93	22	11	3 548
Slovenia	5 254	7.3	2.3	2.14	9	115	21 848
Spain	3 249	8.9	2.2	1.43	17	65	19 939
Sweden	9 573	12.7	3.7	3.35	1	92	9 635
TOTAL EU27	**4 639**	**11.1**	**3.3**	**2.30**	**–**	**59**	**12 667**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

When examining the Horizon Europe Programme's funding distribution on a per capita and per researcher basis between 2021 and 2023, significant disparities reveal across the European Union. The data provides insights into the allocation efficiency and highlights notable differences in funding received by Member States. The average European Union contribution per capita across all 27 Member States (EU27) stands at €59. A closer look at the distribution shows a division between the older Member States (EU14), where the average contribution per capita is €70, and the newer Member States (EU13), with a considerably lower average of €20.

Cyprus, Luxembourg and Belgium exhibit the highest EU contributions per capita, receiving €213, €209, and €170 respectively. These figures suggest that smaller, high-income countries might be leveraging their existing research infrastructures and networks more effectively within the framework of Horizon Europe.

Conversely, several of the newer EU members such as Romania, Slovakia, Poland, Hungary and Bulgaria receive the least funding per capita, with contributions ranging from €10 to €14. In addition, Estonia and Slovenia stand out as positive anomalies among the former Eastern Bloc countries, achieving per capita funding of €115, placing them alongside the frontrunners in funding allocation. This indicates that both countries may have successfully aligned their research strategies with Horizon's funding priorities, achieving results disproportionate to their size.

In contrast, Greece's per capita receipt of €110 is notable, especially given that the country's research and development indicators, such as the researcher ratio, top cited publication rate, patent application rate and overall R&D intensity do not typically align with such a high level of funding. This anomaly in funding allocation raises questions about the factors influencing Greece's successful funding rate.

Hungary's scenario reveals further disparities when considering funding per researcher. The country receives €2,986 per researcher, merely 23.58% of the EU27 average of €12,667. Despite Hungary's researcher's ratio is close to the EU average and ranked to the 13th place on the EU's R&D Intensity Ranking, the low funding per researcher emphasises the challenges faced by some Member States in leveraging Horizon Europe funds effectively.

These findings illustrate the complexities and challenges within the Horizon Europe funding distribution mechanisms, and raise questions about the equity and strategic focus of the Programme. The significant variances in per capita and per researcher funding across different EU Member States suggest a need for a reassessment of the distribution criteria to ensure a more equitable and effective allocation of resources that aligns with the overarching objectives of the Horizon Europe.

Criticism of EU funding decisions

Previous chapters have illustrated the innovation capabilities of individual EU Member States in a global context, as well as the distribution of the largest directly managed EU funding source for innovation and research, Horizon Europe, among the Member States during the current programming period. The study has attempted to highlight the disparities in resource allocation among them, especially when normalising the allocation of funds relative to the level of innovation capability as indicated by the Global Innovation Index (GII). This chapter shifts the focus to smaller units, examining the distribution of support among NUTS 2 regions.

Distribution of Horizon grants among the NUTS 2 regions

NUTS 2 regions refer to the second level of the Nomenclature of Territorial Units for Statistics, a hierarchical system developed by the European Union to facilitate the collection, development and harmonisation of EU regional statistics. Structured under

the broader NUTS framework, which is crucial for the implementation of regional policies and the distribution of structural funds, NUTS 2 regions typically represent basic regions for the application of regional policies. These regions are pivotal for statistical analysis and policy application, serving as essential units in the assessment of socio-economic indicators across the EU. The delineation of NUTS 2 regions is primarily based on administrative boundaries and socio-economic characteristics, ensuring a relatively homogenous composition in terms of economic development and population density.

At the same time, referring to the table in Annex 1, many Western European Regions are in the second half of the 250 NUTS 2 Regions: Waser-Ems 129th, Unterfranken 130th, Oberfranken 166th, Lüneburg 179th, Kassel 181st, Niederbayern 191st, Koblenz 203rd, Trier 226th (Germany), Marche 131st, Bolzano 133th, Umbria 156th, Calabria 193rd (Italy), Kärnten 135th, Salzburg 161st, Burgenland 213th (Austria) Prov. Hainaut 137th, Prov. Namur 140th (Belgium), Picardie 155th, Haute-Normandie 159th, Lorraine 162nd, Franche-Comté 167th, Auvergne 176th, Pitou-Charentes 182nd, Basse-Normandie 192nd, Bourgogne 200th, Limousine 202nd, Champagne-Ardenne 209th (France). The disparities in resource allocation among the 250 NUTS 2 regions across the European Union reflect a broader pattern of uneven development similar to that observed among the 27 EU Member States.

Despite the structured design to ensure homogeneity in economic development and population density within these regions, the distribution of Horizon Europe funds from 2021 to 2023 demonstrates significant imbalances. Data shows that the top 20 of the 250 NUTS 2 regions received 51% of Horizon Europe resources, whereas the remaining 230 regions only received 49%. This distribution indicates a concentration of funding in a small subset of regions, which may exacerbate regional disparities in innovation and research capacity.

Interestingly, the distribution also highlights a geographical dimension to the disparities. The first NUTS 2 region from the newer EU Member States (EU13) is Slovenia, ranked 34th, followed by Warsaw. Meanwhile, Budapest is positioned as the 69th NUTS 2 region in terms of funding receipt. This suggests that newer EU Member States are generally receiving less funding compared to their counterparts.

Moreover, many Western European regions are positioned in the lower half of the 250 NUTS 2 regions in terms of funding allocation. This unexpected ranking of some Western European regions could indicate a complex interplay of factors influencing funding allocation that goes beyond simple geographic or economic considerations.

These findings suggest that while the NUTS 2 regions are designed to streamline and harmonise the statistical and administrative application of EU policies, the actual distribution of funds such as those from Horizon Europe are not effectively targeting regional disparities. This could potentially lead to increased economic divergence between regions, undermining the EU's objective of socio-economic cohesion. Thus, it is essential for policy adjustments to more equitably distribute resources and address the underlying factors contributing to these disparities.

Disparities within Member State level

Beyond the comparative analysis of NUTS 2 regions, this chapter extends its focus to examine the internal disparities within Austria, Hungary and Greece. The study aims to highlight the developmental differences within these Member States by analysing the data on Horizon Europe fund allocations. This investigation is conducted to underscore the existence of regional disparities not only at the EU level but also within individual Member States, emphasising the complex layering of regional development that influences the distribution and utilisation of EU funds. The analysis seeks to illustrate how regional inequalities affect the overall cohesion and economic development of Member States, potentially influencing their capacity to fully leverage the opportunities presented by EU funding mechanisms like Horizon Europe.

The selection of the three countries is justified by the study's intent to centre on Hungary, while also examining the regional disparities in Austria, which shows better performance in innovation capabilities, and the resource allocation differences in Greece, particularly due to the unexpectedly high ranking of the Athens region in Horizon Fund allocations discussed in the previous chapter. This approach is taken to investigate whether the uniformity of fund allocation is dependent on the level of development within these three Member States. The analysis aims to explore the intricate relationship between regional developmental stages and the equitable distribution of EU funds, thus providing deeper insights into the factors that influence funding outcomes across different regions within the Member States.

Table 6: Austria's regions Horizon Europe fund allocation

NUTS 2 Name	Rank in net EU contribution	Net EU contribution (€)	SME Net EU contribution (€)	Total cost (€)
Wien	**16**	**483 393 600**	**54 575 209**	**610 337 726**
Steiermark	38	187 861 364	41 684 822	228 363 165
Niederösterreich	63	108 557 595	21 592 745	122 407 460
Tirol	101	53 770 646	16 536 705	64 539 522
Oberösterreich	104	50 745 489	8 503 298	58 380 057
Kärnten	135	25 032 904	3 616 256	50 130 184
Salzburg	161	15 096 191	1 488 359	16 392 700
Burgenland	213	2 920 593	64 641	3 455 808
Vorarlberg	222	1 981 769	86 875	2 135 010
Austria	**9**	**929 360 151**	**148 148 910**	**1 156 141 632**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

Table 7: Hungary's regions Horizon Europe fund allocation

NUTS 2 Name	Rank in net EU contribution	Net EU contribution (€)	SME net EU contribution (€)	Total cost (€)
Budapest	**69**	**100 373 813**	**25 597 394**	**121 205 917**
Dél-Alföld	171	11 898 427	6 501 440	12 803 127
Dél-Dunántúl	205	4 483 203	1 138 974	5 019 945
Nyugat-Dunántúl	206	3 955 296	265 650	4 835 575
Pest	218	2 435 497	1 511 629	2 568 846
Közép-Dunántúl	221	1 987 791	1 101 094	1 987 791
Észak-Magyarország	227	1 522 238	0	1 522 238
Észak-Alföld	229	1 499 494	97 635	1 508 869
Hungary	**21**	**128 155 758**	**36 213 816**	**151 452 307**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

Table 8: Greece's regions Horizon Europe fund allocation

NUTS 2 Name	Rank in net EU contribution	Net EU contribution (€)	SME net EU contribution (€)	Total cost (€)
Αττική (Attiki)	**8**	**650 757 188**	**188 988 639**	**746 664 899**
Κεντρική Μακεδονία (Kentriki Makedonia)	26	242 494 461	43 838 002	265 621 676
Κρήτη (Kriti)	57	115 487 346	11 440 237	120 388 663
Δυτική Ελλάδα (Dytiki Ellada)	94	59 268 246	11 087 805	61 844 041
Στερεά Ελλάδα (Sterea Ellada)	145	20 423 943	8 423 618	22 430 948
Θεσσαλία (Thessalia)	150	19 228 818	3 212 986	20 156 255
Δυτική Μακεδονία (Dytiki Makedonia)	177	9 550 136	6 486 976	10 338 649
Ήπειρος (Ipeiros)	184	7 732 239	1 738 962	8 039 365
Βόρειο Αιγαίο (Voreio Aigaio)	194	6 349 912	379 375	6 349 912
Ανατολική Μακεδονία, Θράκη (Anatoliki Makedonia, Thraki)	195	6 300 108	406 600	7 045 499
Πελοπόννησος (Peloponnisos)	220	2 339 929	725 813	2 399 072
Ιόνια Νησιά (Ionia Nisia)	233	858 913	565 413	914 938
Νότιο Αιγαίο (Notio Aigaio)	236	760 716	325 591	900 255
–	248	86 875	86 875	86 875
Greece	**7**	**1 141 638 828**	**277 706 892**	**1 273 181 046**

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)

This analysis highlighted striking contrasts in how funds are allocated within these countries, revealing a significant concentration of resources in specific metropolitan areas.

In Austria, the Wien (Vienna) region alone receives 52% of the country's total Horizon Europe funds. This substantial allocation to the capital region underscores the centralisation of research and innovation activities, potentially overshadowing other regions within Austria. The heavy investment in Vienna reflects its status as an innovation hub but raises questions about the equitable distribution of opportunities across the entire nation.

Hungary presents an even more pronounced example of centralised funding, with Budapest receiving a staggering 78% of the nation's Horizon funds. This figure is not only indicative of Budapest's dominant role in Hungary's innovation landscape but also highlights the stark disparities between the capital and other regions. Comparatively, Hungary receives only 11% of the Horizon funds that Austria does, illustrating significant differences in overall national funding levels. Remarkably, Vienna alone secures five times more funding than all of Hungary, emphasising the immense gap in resource allocation between these neighbouring countries.

In Greece, the situation mirrors those of Austria and Hungary, with a high concentration of funds in the Attiki region, where Athens is located. Attiki secures 57% of Greece's Horizon funds, an amount that is more than five times larger than the total funds won by Hungary from the same program. This disparity not only highlights Athens' central role in Greek scientific and research activities but also points to a potential underutilisation of capabilities in other Greek regions.

These examples illustrate the challenges of achieving regional equity in fund allocation within the European Union. The concentration of Horizon Europe funds in capital regions like Vienna, Budapest, and Athens suggests a pattern where major urban centres attract a disproportionate share of resources, potentially at the expense of broader geographical equity. This centralisation might stifle innovation potential in less funded regions, thereby exacerbating regional developmental discrepancies.

The findings suggest that the uniformity of fund allocation is indeed influenced by the level of regional development, with more developed and centrally located regions receiving greater shares of funding. This pattern raises important questions about the objectives of EU funding mechanisms like Horizon Europe, which are intended to foster widespread innovation and economic development across all regions. The current distribution model may need reevaluation to ensure a more balanced growth and the full leveraging of potential across all areas, not just those that are already well-established centres of innovation and research.

Conclusion

In today's rapidly evolving world, technology and innovation serve as the primary drivers of economic growth. Nations that invest in research, education and innovation infrastructure gain a competitive edge in the global marketplace. By fostering a culture of entrepreneurship and encouraging risk-taking and experimentation, governments

can create dynamic ecosystems of startups and scale-ups, driving economic dynamism and attracting global talent and capital. While some regions have become super-developed Science & Technology (S&T) hubs, others lag behind.

The European Union faces unique challenges compared to the United States and China. Consisting of 27 different countries, the EU must emphasise cohesion, since significant disparities between Member States can negatively impact the Union's unity, potentially affecting its most developed regions by weakening its common market.

Despite efforts, the EU is falling behind China and the US in S&T capabilities. Measured by widely recognised indices and statistical data, the distribution of Horizon funds, the EU's primary R&D funding program, is uneven among Member States and regions, not aligning with objective indicators like the number of researchers and patents. The widening disparities among the 27 Member States and the 250 regions of the EU in Horizon, their ability to win Horizon funds have a significant impact on their economic competitiveness, growth, employment and quality of life. The widening disparities in winning Horizon are far not just about the distribution of the €95.5 billion amount. It has a long term economic, social and environmental impact, which has an adverse effect on the cohesion goals of the EU.

The paper revealed, that the values of cohesion policy must be integrated into the criteria systems of directly managed EU funded programs. This is necessary not only in regard to the funds currently available but also as part of a long-term strategic programming in which every EU financial decision undergoes a cohesion test.

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Annex 1

Rank	Country	NUTS 2 name	Signed grants	Net EU contribution (%)	Net EU contribution (€)	Total cost (€)
1	France	Ile-de-France	2 313	8.35	2 199 943 432	2 983 435 822
2	Germany	Oberbayern	1 252	4.33	1 139 509 243	1 365 382 944
3	Spain	Cataluña	1 337	3.85	1 015 225 796	1 109 399 959
4	Spain	Comunidad de Madrid	1 323	3.00	789 890 086	1 043 446 850
5	Belgium	Région de Bruxelles-Capitale	1 240	2.92	769 791 056	1 003 831 678
6	Netherlands	Zuid-Holland	968	2.76	726 991 369	916 096 343
7	Netherlands	Noord-Holland	716	2.52	664 626 246	760 593 836
8	Greece	Αττική (Attiki)	1 012	2.47	650 757 188	746 664 899
9	Italy	Lazio	1 111	2.27	597 556 002	912 306 433
10	Belgium	Prov. Vlaams-Brabant	617	2.10	552 395 750	649 479 215
11	Denmark	Hovedstaden	803	2.06	542 681 122	675 899 512
12	Germany	Köln	702	1.95	513 928 392	632 520 803
13	Italy	Lombardia	916	1.94	510 984 157	598 367 620
14	Germany	Berlin	687	1.89	498 211 860	591 715 147
15	Finland	Helsinki-Uusimaa	677	1.86	490 257 577	563 999 115
16	Austria	Wien	797	1.83	483 393 600	610 337 726
17	Spain	País Vasco	579	1.41	372 144 172	433 652 879

Rank	Country	NUTS 2 name	Signed grants	Net EU contribution (%)	Net EU contribution (€)	Total cost (€)
18	Sweden	Stockholm	535	1.21	318 864 737	449 347 998
19	Netherlands	Gelderland	496	1.20	317 249 339	359 079 643
20	Germany	Karlsruhe	458	1.20	315 520 273	335 587 467
21	Netherlands	Utrecht	448	1.17	309 433 339	371 309 954
22	Ireland	Eastern and Midland	538	1.14	299 586 491	337 266 815
23	Netherlands	Noord-Brabant	375	1.14	299 262 867	468 936 145
24	Belgium	Prov. Oost-Vlaanderen	399	1.04	274 757 441	287 538 007
25	Portugal	Área Metropolitana de Lisboa	578	1.03	270 086 333	305 636 880
26	Greece	Κεντρική Μακεδονία (Kentriki Makedonia)	417	0.92	242 494 461	265 621 676
27	Spain	Comunidad Valenciana	439	0.90	236 284 857	277 727 833
28	Italy	Piemonte	420	0.90	235 900 104	300 184 855
29	Sweden	Västsverige	361	0.87	228 618 870	286 617 664
30	France	Rhône-Alpes	403	0.84	221 725 508	300 779 927
31	France	Midi-Pyrénées	260	0.83	218 153 092	329 824 304
32	Italy	Emilia-Romagna	484	0.82	216 178 911	239 713 531
33	Portugal	Norte	459	0.80	209 788 692	233 660 950
34	Slovenia	Zahodna Slovenija	441	0.78	204 236 662	449 941 335
35	Italy	Toscana	447	0.77	203 085 482	227 331 963
36	Poland	Warszawski stołeczny	390	0.77	203 009 292	275 062 314
37	Cyprus	Κύπρος (Kypros)	415	0.74	196 201 649	224 130 440
38	Austria	Steiermark	303	0.71	187 861 364	228 363 165
39	Germany	Darmstadt	275	0.70	184 017 401	217 061 148
40	Sweden	Östra Mellansverige	313	0.70	183 641 599	248 544 868
41	Belgium	Prov. Antwerpen	288	0.67	177 730 455	221 075 079
42	Ireland	Southern	298	0.67	175 975 434	202 366 427
43	Germany	Stuttgart	300	0.65	172 286 024	285 258 163
44	Spain	Andalucía	384	0.65	171 516 201	218 414 671
45	Italy	Veneto	359	0.63	166 346 849	182 091 702
46	Estonia	Eesti	349	0.60	157 741 308	181 374 499
47	Denmark	Midtjylland	291	0.59	155 790 040	164 959 929
48	Germany	Hamburg	224	0.57	151 307 752	178 449 343
49	Sweden	Sydsverige	239	0.57	150 233 497	186 908 750
50	Czechia	Praha	369	0.54	141 987 923	165 274 129
51	Luxembourg	Luxembourg	261	0.52	138 104 000	200 109 226

Rank	Country	NUTS 2 name	Signed grants	Net EU contribution (%)	Net EU contribution (€)	Total cost (€)
52	Italy	Liguria	275	0.50	132 565 610	154 068 555
53	Finland	Pohjois- ja Itä-Suomi	217	0.50	131 925 580	158 414 122
54	Finland	Länsi-Suomi	216	0.49	128 556 086	152 273 908
55	Ireland	Northern and Western	193	0.48	125 475 583	141 328 790
56	Germany	Brandenburg	185	0.45	118 756 481	133 147 644
57	Greece	Κρήτη (Kriti)	241	0.44	115 487 346	120 388 663
58	Germany	Dresden	169	0.43	113 879 163	141 146 233
59	Germany	Düsseldorf	235	0.43	113 758 324	131 781 165
60	France	Provence-Alpes-Côte d'Azur	268	0.43	113 523 910	138 812 372
61	Netherlands	Overijssel	191	0.43	112 802 761	133 737 232
62	Germany	Freiburg	194	0.42	109 781 299	123 276 091
63	Austria	Niederösterreich	170	0.41	108 557 595	122 407 460
64	Portugal	Centro (PT)	237	0.41	106 772 287	121 376 510
65	Romania	Bucureşti–Ilfov	308	0.40	106 618 910	144 562 862
66	Spain	Galicia	222	0.39	102 491 500	108 581 840
67	Germany	Schleswig-Holstein	142	0.39	101 985 582	121 869 432
68	Netherlands	Groningen	167	0.38	101 137 711	108 354 825
69	Hungary	Budapest	336	0.38	100 373 813	121 205 917
70	Germany	Rheinhessen-Pfalz	142	0.36	94 747 790	101 991 856
71	Spain	Aragón	172	0.35	92 898 221	101 054 093
72	Italy	Puglia	185	0.35	91 730 007	102 847 355
73	Spain	Castilla y León	182	0.34	89 738 372	96 962 376
74	Netherlands	Limburg (NL)	153	0.34	88 410 098	101 467 172
75	Germany	Braunschweig	184	0.33	88 194 281	91 126 459
76	Finland	Etelä-Suomi	158	0.32	84 912 559	98 964 425
77	Germany	Tübingen	136	0.32	83 975 183	88 114 033
78	Italy	Provincia Autonoma di Trento	168	0.32	83 902 666	87 724 931
79	Czechia	Jihovýchod	170	0.31	82 103 449	113 459 872
80	Germany	Arnsberg	145	0.30	77 971 714	86 777 901
81	Germany	Hannover	122	0.29	76 504 491	85 344 467
82	Italy	Campania	182	0.29	76 424 586	79 144 421
83	France	Aquitaine	173	0.28	74 144 083	116 690 813
84	Germany	Bremen	113	0.27	70 837 830	75 704 742
85	Italy	Friuli-Venezia Giulia	156	0.26	68 550 697	131 121 654
86	Bulgaria	Югозападен (Yugozapaden)	225	0.26	68 522 520	83 223 285
87	Germany	Saarland	100	0.26	68 481 043	75 824 977

Rank	Country	NUTS 2 name	Signed grants	Net EU contribution (%)	Net EU contribution (€)	Total cost (€)
88	France	Pays de la Loire	124	0.26	68 448 719	170 420 934
89	France	Alsace	145	0.25	65 737 167	76 560 545
90	Denmark	Syddanmark	132	0.24	64 263 080	81 971 362
91	Belgium	Prov. Brabant Wallon	99	0.24	63 790 096	76 908 019
92	France	Bretagne	143	0.24	63 421 563	80 153 998
93	Poland	Małopolskie	144	0.23	59 812 691	64 404 849
94	Greece	Δυτική Ελλάδα (Dytiki Ellada)	110	0.22	59 268 246	61 844 041
95	Germany	Mittelfranken	104	0.22	59 023 263	63 618 640
96	Denmark	Nordjylland	129	0.22	57 460 863	63 685 590
97	Sweden	Övre Norrland	101	0.21	56 193 574	61 558 270
98	Lithuania	Sostinės regionas	180	0.21	56 179 074	72 539 565
99	Belgium	Prov. Liège	107	0.21	55 801 245	73 313 808
100	Latvia	Latvija	195	0.21	55 624 080	73 206 488

Source: compiled by the authors based on Horizon Dashboard as of 21 January 2024. (The Dashboard was updated on 20 December 2023. All terms and definitions shall be interpreted as it is in the glossary of the Horizon Dashboard)