EU MUST HELP EUROPEAN COUNTRIES TO INVEST 0.75 % OF GDP IN GOVERNMENT RESEARCH

Proposal for a *20-year Programme of EU* for the years 2026-2045

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INTRODUCTION AND EXECUTIVE SUMMARY

Numerous studies have demonstrated that investments in public research—approximately two-thirds allocated to basic research and one-third to applied research within the European Union—have highly positive effects on GDP**.** A recent study, analyzing economic data from OECD countries, found that: "*In the period from 2000 to 2016, an increase in the share of research and development (Government) expenditure in GDP by 1% caused a GDP growth of 2.83% in 35 countries of the OECD....The results obtained in the study are consistent with theoretical and empirical findings of previous studies*." [1]

The ratio of 'public research investment' to 'Gross Domestic Product' is referred to as '*Government R&D intensity*' and is defined by EUROSTAT as the ratio between GBARD ('*Government Budget Allocations for R&D'*)—the total investment made by the Government in 'basic research' and 'applied research'[2]—and GDP:

$$\text{(Government R\&D intensity in the k-th year)} = \mathbf{I_k} = \text{GBARD}_k \,/\, \text{GDP}_k \quad \text{.....(1)}$$

The study shows that—in the specific case of the 35 OECD countries over a period of 17 years—an increase in public research intensity resulted in a *GDP percentage increase 2.8 times greater*. The conclusion is clear and well-known: investing in public research is a necessary and reliable way to promote long-term economic development[3].

Unfortunately, Government research is insufficiently funded in 70% of European Union countries: in 2022, the European average was 0.75%, but the two 'virtuous' countries (Germany and Finland) averaged 1.0%, while the two most lagging countries (Ireland and Romania) were at 0.165%, a value nearly *six times lower*.

When considering state expenditures on Health and Education, the average of the two lagging countries is *half that of the two virtuous co*untries; this disparity is understandable. However, it is unacceptable that the ratio for Government research is one-sixth, i.e., *three times lower*, because this implies that the majority of the 27 EU countries lack the necessary funds and research infrastructures to produce quality science and adequately train their young researchers, preparing them to compete for European Research Council funds, which are awarded based on scientific merit. Beyond being an injustice, this is a waste.

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[1] Maman A. Moustapha and Qian Yu, *Innovation effect through research and development on economic growth in 35 OECD Countries*, Journal on Innovation and Sustainability, 11 (2020) 160. https://revistas.pucsp.br/index.php/risus/article/view/52011/34055

[2] In the EU, public research funding is typically allocated in a 2-to-1 ratio: two-thirds for basic research and one-third for applied research.

[3] The increase in GDP resulting from public research is, of course, also influenced by many other factors, which are listed on page 7.

To remedy this situation, this document proposes a '*Twenty-Year Program for EU Government Research*' aimed at gradually increasing the Government R&D intensify in the 20 EU countries that currently invest the least, bringing it to *0.75% over twenty years.*

In 2025, a new issue emerged on the global public research scene: the stance taken by the Trump administration against science and the independence of scientists, which will have serious consequences not only for the future of the United States but for the entire world, given that the American research system has so far attracted the best minds and invested significant capital in international collaborations. At the same time, however, this policy offers a unique opportunity to all scientifically lagging countries from which researchers have emigrated and continue to emigrate to the United States in search of better working conditions: with a rapid investment plan and targeted incentives, many will be encouraged to return and will contribute to raising the level of Government research in their country of origin.

On May 5, 2025, French President Emmanuel Macron organized a meeting at the Sorbonne titled "*Choose Europe for Science*" and European Commission President Ursula von der Leyen announced a new initiative of the same name, endowed with €500 million in funds for the years 2025–2027, aimed at attracting the best minds to Europe[4].

To ensure that the funds are well spent, two additional actions are necessary:

a) *Financing 3–5-year plans*—funded by individual countries in addition to the European initiative—to seize this opportunity and more rapidly bring scientists back to *all European countries*, or at least to those that already invest adequately in research;

b) *Approving the Twenty-Year Plan* described here, aimed at bringing all European countries to a level of public research investment at least equal to 0.75% of GDP

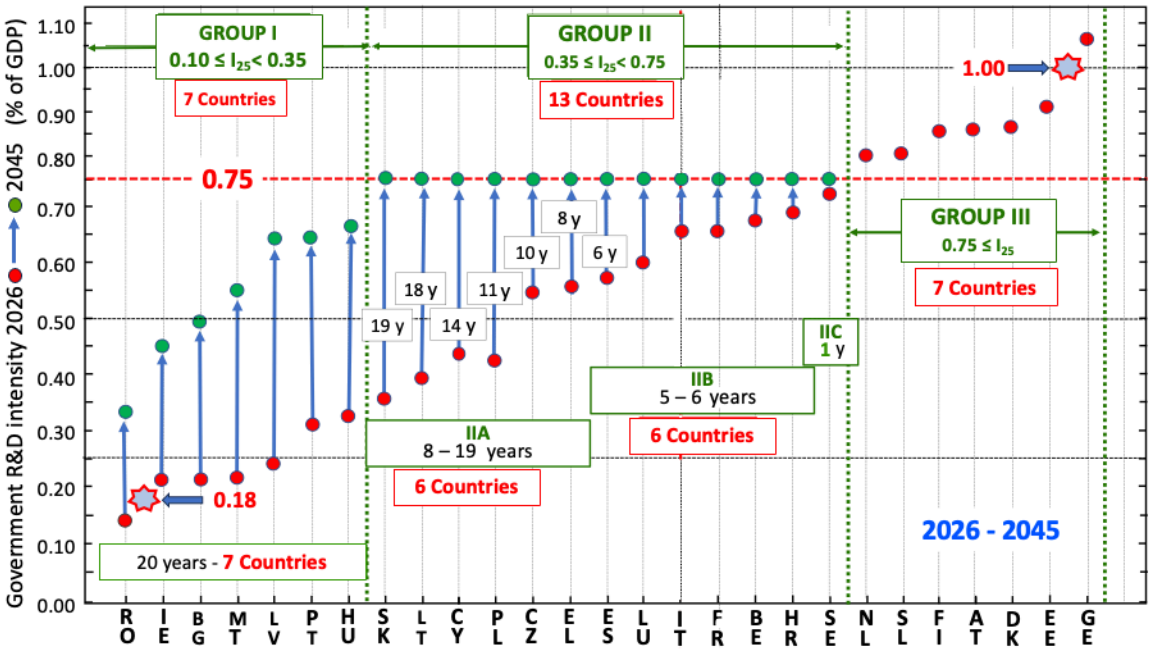
Without the second intervention, the wanted 'brain return' would be destined to fail *in more than half* of the European Union countries, because their public research is already underfinanced and the arrival of new scientists would strain already scarce resources. Instead, the funds made available by the proposed Programme will allow, if well used, for prospects for both current researchers and those returning to the system.

The Twenty-Year Programme envisages the joint commitment of individual countries to increase investments toward a common *minimum goal of 0.75%* of GDP, with the support of the European Union, which would contribute by covering *50% of the increase* in Government research investment: each country will autonomously define, year by year, the increase in its investment, and the Union will reimburse half of the allocated funds the following year.

The first figure on the next page shows the effects of this investment program on the Government R&D intensity of the seven countries of the so-called '*Group I*'—which will not manage to reach 0.75% in twenty years—and the twelve countries of '*Group II*'—which will reach the target in times ranging from *five to nineteen years*.

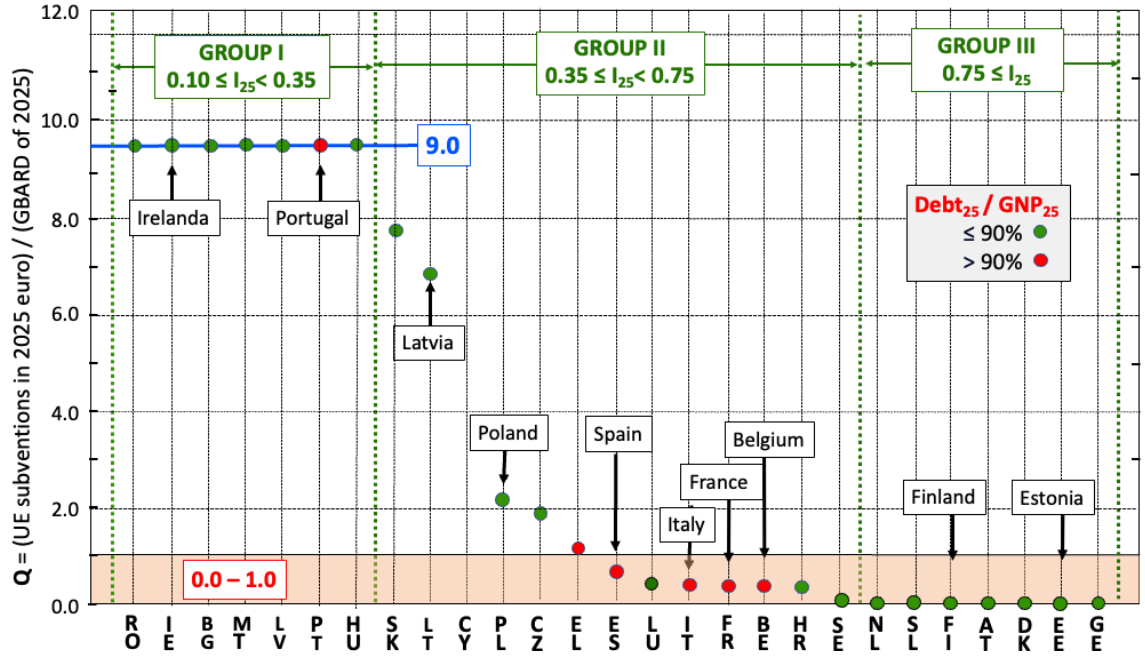
Quantitatively, to achieve the objective, a *total investment of €180 billion* is required over the twenty-year period from 2026 to 2045.

[4] https://www.the-guild.eu/news-and-blog/blog/von-der-leyen-and-macron%E2%80%99s-words-on-science-must-b.html



According to the proposal, *half* of this amount, i.e. *€90 billion*, will be financed by the European Union. Countries with the lowest ratios of public research investment to GDP will benefit the most.

The second figure presents the ratio Q between the total multi-year EU refunds (in 2025 euros) and the 2025 Government research investment $GBARD_{2025}$. For the Group I countries, the most lagging in public research investments, the *ratio is 9*[5]. In contrast, for countries not far from the target—*Belgium, France, Italy*—the figure shows that the ratio is Q = 0.5, which is *eighteen times smaller*.



[5] In the economic model adopted, GBARD increases by *a maximum* of **7% per year**, while nominal GDP grows by 3% annually, of which 2% is due to inflation and 2.2% to the increase in real GDP. The maximum growth rate of public R&D intensity for each country is therefore 3.88%: 1.07/1.03 = 1.0388. If 6% per year was chosen for the GBARD maximum growth rate, the needed investment would be *smaller* than 180 billion, but Slovakia and Lithuania would pass from Group II to Group I.

Taking inflation into account, over the period 2026–2045, the EU's average investment will amount to *€3.7 billion per year*, expressed in 2025 euros. This effort, equal to *one and a half* times the annual funding of the *European Research Council*, is only a small correction compared to the €750–800 billion that, according to the Draghi Report, Europe will need to invest each year to improve productivity, support the ecological transition, and maintain sovereignty.

It is a small annual investment, compared also to those currently planned by EU countries to address the serious economic and geopolitical situation, dedicated to "rearming" our historical and cultural values by promoting education and creativity as powerful peaceful weapons capable of generating lasting well-being.

The entire continent would benefit, drawing on the contribution of all countries – including those that currently cannot afford it due to a lack of public research funding – while strengthening our global competitiveness.

A more integrated and better-supported research effort will unite the peoples of Europe, helping them face present and future challenges. Fostering knowledge multiplies energy and hope and is also an essential step to save the planet[6]..

*The "*Overview*" section on page 16 provides further useful information for readers who do not wish to go into the details*.

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CONTENTS

[6] On April 12, 2025, *Corriere della Sera* published an appeal – signed by the authors of this Report - denouncing the unacceptable disparity and proposing the twenty-year Programme described in this Report. See: www.lincei.it/it/notizie/appello-la-ricerca-pubblica-dellunione-europea

1. An unacceptable disparity

A Government finances '**public**' research - the combination of '**basic**' and '**applied**' research - by investing an annual sum called **GBARD** = *'Government Budget Allocation for R&D'*. Universities produce mainly basic research while specialised Agencies devote themselves to both basic and applied research. Eq. (1) says that the ratio of **GBARD to nominal GDP** (i.e. GDP at current prices) is the ***'Government R&D intensity'*** For brevity in this Report the term 'government' is almost always dropped.

Businesses do both 'applied' research and 'experimental development', with the aim of improving products, and for all these activities they invest resources globally called BERD = *Business Enterprise R&D*. This, divided by nominal GDP, gives the **'Business R&D intensity**'.

$$(\textit{Business}\ \text{R\&D intensity in the k}^{th}\ \text{year}) = \mathbf{J_k} = \text{BERD}_k / \text{GDP}_k. \qquad (2)$$

The sum of the two intensities is what is usually called 'R&D intensity':

$$(\text{R\&D intensity in the k}^{th}\ \text{year}) = \mathbf{I_k} + \mathbf{J_k}. \qquad (3)$$

In 2000, the EU Heads of State and of Government used this economic parameter in launching the 'Lisbon Strategy' with which Europe would "*become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion*."

Three targets were chosen:

- an average European employment rate of 70%;
- an employment rate for women of 60%;
- **a (total) R&D intensity of EU countries of no less than 3 %.**

In 2002, the Commission published a Communication: *'More Research in Europe – Towards 3% of GDP*'. In 2005, the new Commission published another Communication: *'More Research and Innovation - A Common Approach*'[7]. The seventh guideline[8] stated "*To increase and improve investment in R & D, in particular by private business, the overall objective for 2010 of 3 % of GDP is confirmed with an adequate split between private and public investments"*. It should be noted that, although not explicitly stated in official documents, it is generally implied that the 3% target should be met with **one-third from the Government ($\mathbf{I_k}$ = 1%) and two-thirds from businesses ($\mathbf{J_k}$ = 2%)**."

Five years later, in 2010, the new *'Europe 2020*' strategy still wanted "*to reach the target of investing 3% of GDP in R&D, in particular by improving the conditions for the private sector to invest in R&D*"[9].

In 2020, the final '*Europe 2020*'[10] report recognised that: "*The (total) R&D intensity' reached 2.32%, a 15% improvement on the 2.02% in 2013 but below the overall target of 3%*". An increase of 15% with a target of 50% testifies a complete failure.

Table 1 shows that the 1% has not been reached even 22 years after Lisbon.

[7] https://ec.europa.eu/invest-in-research/pdf/download_en/mep_en01bat3_051219.pdf
[8] Page 33 of https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:205:0028:0037:EN:PDF
[9] Page 32 of https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF
[10] Pages 58-59 of https://eur-lex.europa.eu/resource.html?uri=cellar:b5a1da8b-be92-11ee-b164-01aa75ed71a1.0001.02/DOC_1&format=PDF

Table 1: *After 22 years, the Lisbon target for European government R&D intensity has not been reached while the other two are surpassed.*

	Total employment	Female employment	R&D government intensity
Target 2022	**70%**	**60%**	**1.0%**
EU 2000[11]	63.1%	53.8%	0.61%
EU 2022[12]	74.6%	69.3%	0.74%
Fraction in 2022	**106%**	**116%**	**74%**

In the following years EU has deliberately forgotten the failure to the extent that in the 42-page presentation of the current *'Horizon Europe*' programme[13] - which covers the years 2021-2027 and is depicted on the next page in Fig. 1 - the **3% figure is not mentioned**, not even under *'Reforming and strengthening the European research system*'.

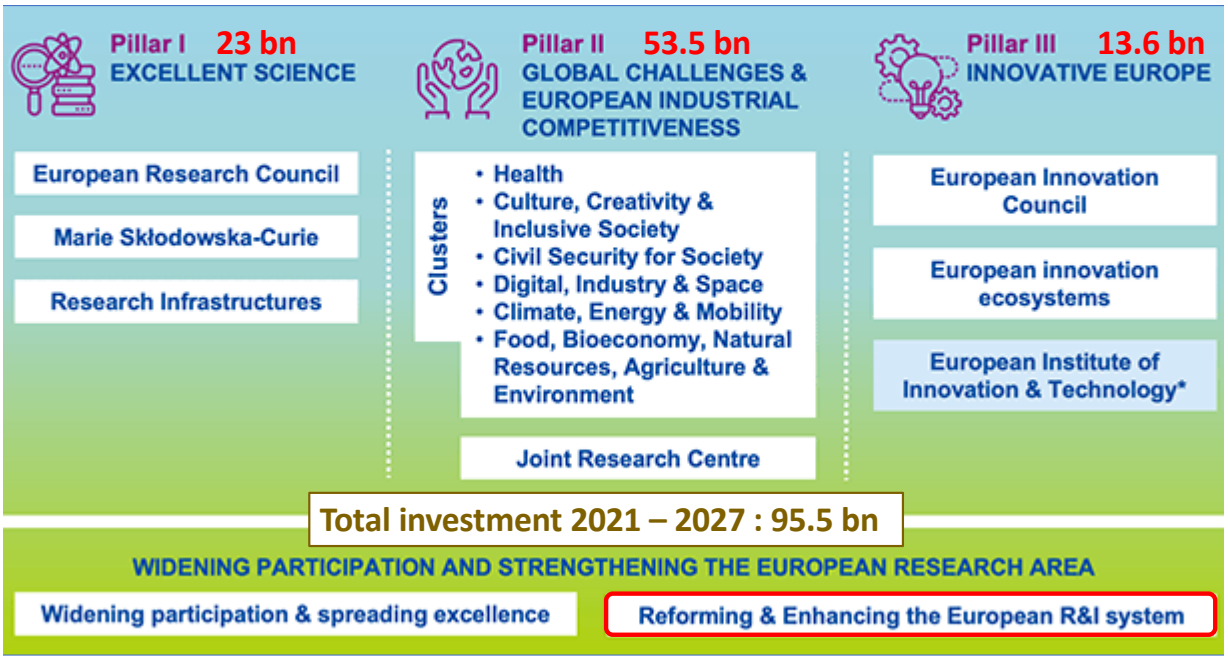

Figure 1. *Scheme of the current* 'Horizon Europe' *programme, which consists of three vertical 'pillars' (the first of which includes basic research) and one horizontal 'pillar'.*

This absence is partly justified by the fact that, over the past two decades, it has been realised that R&D intensity is important, but that the transfer of knowledge, from basic and applied research to companies and the resulting development, is determined by many factors[14]:

- the excellence of research, particularly basic research (Pillar 1 of Fig. 1, p. 4),
- the focus of government researchers on knowledge transfer,

[11] https://ec.europa.eu/eurostat/web/products-statistics-in-focus/-/ks-nk-01-008
[12] https://amblav.it/eurostat-i-tassi-di-occupazione-nel-2022-rispetto-agli-obiettivi-ue-per-il-2030/
[13] https://research-and-innovation.ec.europa.eu/system/files/2022-06/rtd-2021-00013-03-00-it-tra-01.pdf
[14] See for example: www.vttresearch.com/sites/default/files/2021-05/OECD-TIP-RD-intensity-case-studies-synthesis-report.pdf

- the tools and facilities that foster this transfer,
- the effectiveness of partnerships between universities, public research organisations and companies,
- the ability of companies to take up and use the knowledge transferred,
- their investments in applied research and experimental development,
- the quantity and quality of 'venture capitals',
- the quality and quantity of private researchers,
- the facilities granted to companies investing in R&D.

Many of these topics are addressed by the *'Horizon Europe*' Programme (**Fig. 1**, p. 6), which is a very positive thing. However, diverting attention, and for so many years, from the Government R&D intensity has created a seriously unbalanced situation, as is illustrated by **Fig. 2** (p. 8), in which the intensities of the 27 European Countries are *uniformly* distributed between 0.14 and 1.1. In 2022 the weighted average of the EU's (government) R&D intensity **was 0.74% in 20**22, a value obtained by adding the GBARDs of countries with very different intensities: 1.11% of Germany and 0.14% of Romania.

The average values between the two Countries, having maximum and minimum intensities, are reported In column (3) of Table 2. The second row of column (4) shows that **6.1 is the ratio between the I_{22}^{max}** value (av. of two countries) and the I_{22}^{min} value (two countries).

Table 2. *Indices of expenditure variability in three fields of Government intervention*[15].

	(1) Countries	(2) min max	(3) % of GDP (*) $I_{22}^{average}$	(4) Ratio $\frac{I_{22}^{max}}{I_{22}^{min}}$	(5) Normalized ratio	(6) σ / aver. (**)	(7) Normalized σ / aver.
R&D intensity. [16]	Ireland+Romania	min	0.165%	**6.10**	**3.05**	**0.375**	**3.40**
	Finland+Germany	max	1.005%				
Education [17]	Ireland+Romania	min	2.95%	**2.15**	**1.05**	**0.11**	**1.00**
	Belgium+Sweden	max	6.30%				
Health [18]	Hungary+Latvia	min	4.60%	**2.00**	**1.00**	**0.18**	**1.65**
	Austria+ Czechia	max	9.20%				

(*). Average of the countries of column (1).

(**) These three ratios have been computed by excluding the countries of column (1).

The second and third row present the max/min ratios for two important Government activities: **Education** and **Health**, used as a comparison in column (5) by normalising the three figures to the minimum value. One can conclude that, among the 27 Countries, the *disparity in the funds devoted to research* **is three times larger** *than the ones in Education and Health***.**

[15] The quantities in columns (5) and (7) do not depend on the purchasing power in the different countries.

[16] Table 3, p. 7.

[17] - https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Government_expenditure_on_education

[18] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Government_expenditure_on_health

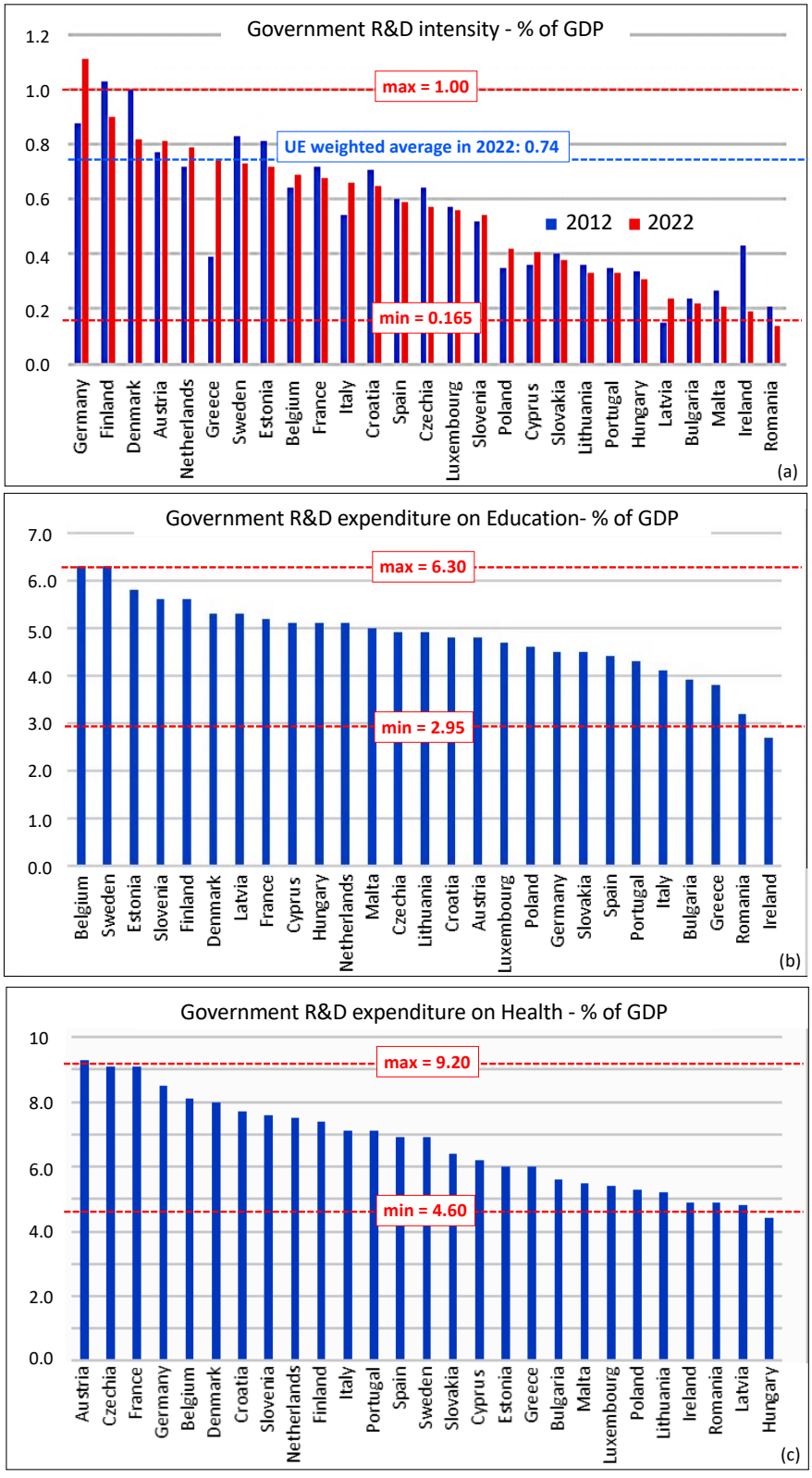

***Figure 2**. (a) Between 2012 and 2022, government R&D intensity increased in 14 countries - including Greece, Germany, and Italy - and decreased in 13 other countries - including Denmark, Finland, Ireland, and Sweden. Ireland and Romania also decreased and are at their lowest. (b) The same two countries are also at a minimum in government Education while for Public Health they are Latvia and Hungary. In Education, Belgium and Sweden are at the maximum. (c) In government Health, Austria and the Czech Republic are at the maximum.*

In Table 2 as second parameter, the ratio of **standard deviation σ** to the **mean** was chosen; the ratio was calculated by discarding the two maximum and minimum intensity values so that the normalized ratios in column (7) are independent of those in column (5). The value 3.40 of the last column says that also funds for Government research *vary from country to country* **three times more** *than those devoted to Education and Health*.

A **three times greater disparity** in Government research between countries than in Education and Health **is unacceptable** because it implies that many European countries

1. do not have the *means* and *research fac*ilities to contribute to Europe's development;
2. cannot train their young researchers while preparing them to compete for *European Research Counci*l grants, which are awarded on the basis of scientific quality alone;
3. are not able to offer their *research teams* the minimum conditions to do good research and to participate in European calls for proposals with a reasonable chance of success.

To remedy this situation– also in view of the return to Europe of many scientists who at present work in the States – in the present Report a **20-year Programme** is proposed in the remainder of this Report, partially financed by the EU, which subsidises the **21 countries** to bring them, in no more than 20 years, **to either 0.75%** or close to this value[19].

2. Resources needed for the 20-year Programme

Since the latest GBARD figures published by EUROSTAT are from 2023, in the following the 2023 GBARD values are used for **2025, chosen as reference year**. With this choice, **,** on page 10 lists – for the 27 countries of the Union:

- in column (3): the $Debt_{25}$/GDP25 ratio (**D_{25}**) in 2025[20],
- in column (4): the GBARD for 2025 (**G_{25}**), expressed in millions of euros[21].

In calculating the values in Table 3, it is assumed that each country's GBARD (G_{25+k}) increases, from the previous year, by an amount **ΔG_{25+k}**, obtained by multiplying **G_{25+k-1} by $(r - 1) > 0$.** The larger r is, the more rapidly the objective will be reached, but if the new resources are too abundant, they cannot be effectively spent. Hence, a **first rule** was adopted:

A. The annual increases **ΔG_{25+k}** of GBARD over the previous year may not exceed **7% per year**:

$$1 + \Delta G_{25+k}/G_{25+k-1} = \mathbf{r \le 1.07} \qquad (1 \le k \le 20) \qquad (4)$$

so that, with the "nominal GDP" growing by 3% per year ($PIL_{25+k} = p^k\ PIL_{25}$ with **p =1.03**) – of which 2% due to inflation and 2,2% to the increase of the 'real GPD' – the "**government R&D intensity**" **I_{25+k}** = G_{25+k}/PIL_{25+k} does not increase by more than **3.88% per year** (r/p = 1.07/1.03 =1.0388).

[19] In 2022, Europe's total GBARD amounted to €117.4 billion and total GDP to €15,920 billion, yielding an intensity of public R&D (I2022) of 0.74%. In 2023, the intensity dropped to I_{2023} = 0.70%, with a total GBARD of €123.7 billion and a GDP of €17,720 billion. Thus, in just one year, intensity declined by 5.6% due to a sharp 11% increase in nominal GDP (mostly due to inflation), despite a 5.4% rise in Europe's GBARD.

[20] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Government_finance_statistics#General_government_gross_debt

[21] https://ec.europa.eu/eurostat/databrowser/view/GBA_FUNDMOD/default/table?lang=en&category=scitech.rd.gba

***Table 3**. Duration n of the programme (Column 8), **GBARD** growth rate (Column 8), and **required new resources** (Column 9) at current prices, assuming nominal GDP increases by 3% per year, of which 2.0% is due to inflation and 2.2% to real GDP growth.*

(1)	**(2)** Country (No-Euro in brackets)	**(3)** Debt/ GDP 2025 **D_{25}** (%)	**(4)** GBARD 2025 **G_{25}** (mn)	**(5)** GDP 2025 **GDP_{25}** (bn)	**(6)** R&D Inten. 2025 **I_{25}** (%)	**(7)** Years **f** Eq (5) with **r = 1.07**	**(8)** Years **n** – Growth rate of GBARD from Eq (5) **(r-1)**	**(9)** **New resources** Eq. (7) **$R_{25-(o+n)}$** (mn)
1-RO	(Romania)	48.9	493	325.4	0.152	41.9	20 – 7.00%	11 768
2-IE	Ireland	43.3	1051	510	0.206	33.9	20 – 7.00%	25 087
3-BG	(Bulgaria)	22.9	213	94.7	0.225	31.6	20 – 7.00%	5084
4-MT	Malta	47.4	53	21	0252	28.2	20 – 7.00%	1253
5-LT	Latvia	45.0	118	39.4	0.299	25.1	20 – 7.00%	2817
6-PT	Portugal	97.9	802	267.9	0.299	25.1	20 – 7.00%	19 143
7-HU	(Hungary)	73.4	616	198.0	0.311	23.1	20 – 7.00%	14 704
GRUPPO I: 7 Countries (0,10% ≤ I_{25} < 0,35%								**79 856**
8-SK	Slovakia	56.1	453	122.9	0.368	18.7	19 – 6.93%	9370
9-LT	Lithuania	37.3	278	71.8	0.387	17.3	18 – 6.86%	4961
10-CY	Cyprus	73.6	138.3	31.3	0.442	13.9	14 – 6.96%	1389
11-PL	(Poland)	49.7	3817	749.0	0.510	10.1	11 – 6.67%	21 164
12-CZ	(Czechia)	42.4	1626	317.4	0.512	10.0	10 – 7.00%	7778
13-EL	Greece	163.9	1281	225.2	0.569	7.50	8 – 6.62%	3574
GRUPPO IIA: 6 Countries (0.35% ≤ I_{25} < 0.60%)								**48 236**
14-ES	Spain	105.1	8997	1498	0.601	5.81	6 – 6.88%	14 596
15-LU	Luxemb.	25.5	507	81.0	0.626	4.74	5 – 6.79%	565
16-IT	Italy	134.8	13 461	2131	0.632	4.49	5 – 6.59%	14 535
17-Fr	France	109.9	18 266	2822	0.647	3.88	5 – 6.09%	18 104
18-BE	Belgium	103.1	3865	596	0.648	3.84	5 – 6.06%	3810
19-HR	Croatia	61.8	533	78.0	0.683	2.46	5 – 4.95%	422
GRUPPO IIB: 6 Countries (0.60% ≤ I_{25} < 0.70%)								**52 032**
20-SE	(Sweden)	31.5	3908	541	0,722	1.00	1 – 7.00%	273
GRUPPO IIC: 1 Country (0.70% ≤ I_{25} < 0.75%)								**273**
21-NL	Netherl.	45.1	8532	1066	0.800	-	-	-
22-SI	Slovenia	68.4	518	64.0	0.809	-	-	-
23-FI	Finland	77.1	2349	273	0.860	-	-	-
25-AT	Austria	78.6	4095	473	0.866	-	-	-
25-DK	(Denmark)	33.6	3277	376	0.871	-	-	-
26-EE	Estonia	20.2	337	38.2	0.882	-	-	-
27-DE	Germany	62.9	44090	4185	1.053	-	-	-
GRUPPO III: 7 Countries (0.75% ≤ I_{25})								
TOTAL				**20 Countries with I_{25} ≤ 0.75 %**				**180 400**

The last row of the table shows that the **twenty-year Plan 2026–2045 requires a total investment of €180 billion** at current prices.

According to the OECD, Europe's real GDP will grow on average by 1.8% per year between 2015 and 2030[22]. **In Table 3**, a GDP growth rate of **2.2% per year** was adopted—25% higher than the OECD figure—based on the assumption that the investments made by the EU to implement the Draghi and Letta Reports and to strengthen Defense will have a positive impact on the GDPs of the 27 countries.

The Programme—which will require a dedicated management structure to be set up in Brussels—is aimed at the 21 countries whose public R&D intensity in 2023 was **below 0.75%.** Since $0.75/(r/p)^{20} = 0.75/1.0388^{20} = 0.35\%$, only countries with I_{25} greater than 0.35% can reach the target in no more than 20 years. For this reason, in T**able 3** the values $\mathbf{I_{25+k} = 0.35\%}$ and $\mathbf{I_{25+k} = 0.75\%}$ divide the EU countries into **three Groups,** and Group II in **three Subgroups**:

- **GROUP I**: 7 countries with $\mathbf{I_{25} < 0.35\%}$ that will not be able to reach $I_{25+k} = 0.75\%$ within the 20 years of the Programme;
- **GROUP IIA**: 6 countries with $\mathbf{0.35\% \le I_{25} < 0.60\%}$ that will be able to reach $I_{25+k} = 0.75\%$ within 7 to 20 years;
- **GROUP IIB**: 6 countries with $\mathbf{0.35\% \le I_{25} < 0.74\%}$ that will be able to reach $I_{25+k} = 0.75\%$ in 5 to 6 years;
- **GROUP IIC**: 1 country with $\mathbf{I_{25} \ge 0.70\%}$ that is very close to the target and will reach it in 1 year;
- **GROUP III**: 7 countries that, with **0,75%**, **<** $\mathbf{I_{25}}$, have not to invest in the Programme.

Note that the groups would change if the rate of increase was reduced from 7% to 6%, as this would result in $\mathbf{I_{25} < 0.42\%}$, instead of $I_{25} < 0.35\%$, as the threshold for achieving 0.75% in 20 years, and Slovakia and Lithuania would move from Group IIA to Group I.

Eq. (A3) in the Appendix 1 (p. 19) – with the GDP factor **p = 1.03** – and its inverse

$$\mathbf{f} = \ln(0.75/\mathbf{I_{25}}) / \ln(\mathbf{r}/1.03) \qquad \mathbf{r} = (0.75/I_{25})^{1/\mathbf{f}} \qquad (5)$$

give one of the infinite pairs of values **(r, f)** that in **f years** (with f being a fractional number) lead from $\mathbf{I_{25}}$ to **0.75%**. The **f** values listed in column (7) of Table 3 were calculated with the value **r= 1.07** established by rule A, and with **p = 1.03** so that $f = 26.25 \ln(0.75/I_{25})$.

The numbers **n** in column (8) are integers **greater than f** and less than or equal to 20. Substituting n for f in the second Eq. (5) gives the **growth rates r** written in red in the same column.

To achieve the results listed above, it will be necessary to invest the new resources $\mathbf{R_{26-(25+n)}}$ in column (9) on p. 10, which, for each country, are the sums of the $\mathbf{DG_{25+k}}$ **increases over** $\mathbf{GBARD_{2025}}$:

$$\mathbf{R_{26-(25+n)}} = \Sigma_{k=1 \to n}\, \mathbf{DG_{25+k}} \qquad (6)$$

Each DG_{25+k} is the sum of the annual increases $\Delta G_{25+k} = \mathbf{r}\, G_{25+k-1}$ of the previous k years[23]:

$$\mathbf{R_{26-(25+n)}} = \mathbf{G_{25}}\, [\mathbf{H_n(r)} - \mathbf{n}] \quad \text{with} \quad H_n(s) = s\,(s^n - 1)/(s - 1), \quad (n = 1\text{-}20) \qquad (7)$$

as demonstrated in the Appendix 1 on page 19. The factor multiplying G_{25} increases rapidly with the number n of years, as is shown by the **red** (**green**) curve in Fig. 3, and, for n = 20 and r = 1.07, is **23.87** (**17.98**).

[22] www.oecd.org/content/dam/oecd/en/publications/reports/2012/02/strategic-transport-infrastructure-needs-to-2030_g1g13d1c/9789264114425-en.pdf?utm_source=chatgpt.com

[23] Example: the annual investments needed, with respect to the reference year 'zero', to pass – in 1 billion steps and in 5 years – from $GBARD_0$ = 10 million to $GBARD_5$ =15 million are: 1 + 2 + 3 + 4 + 5 = 15 billion.

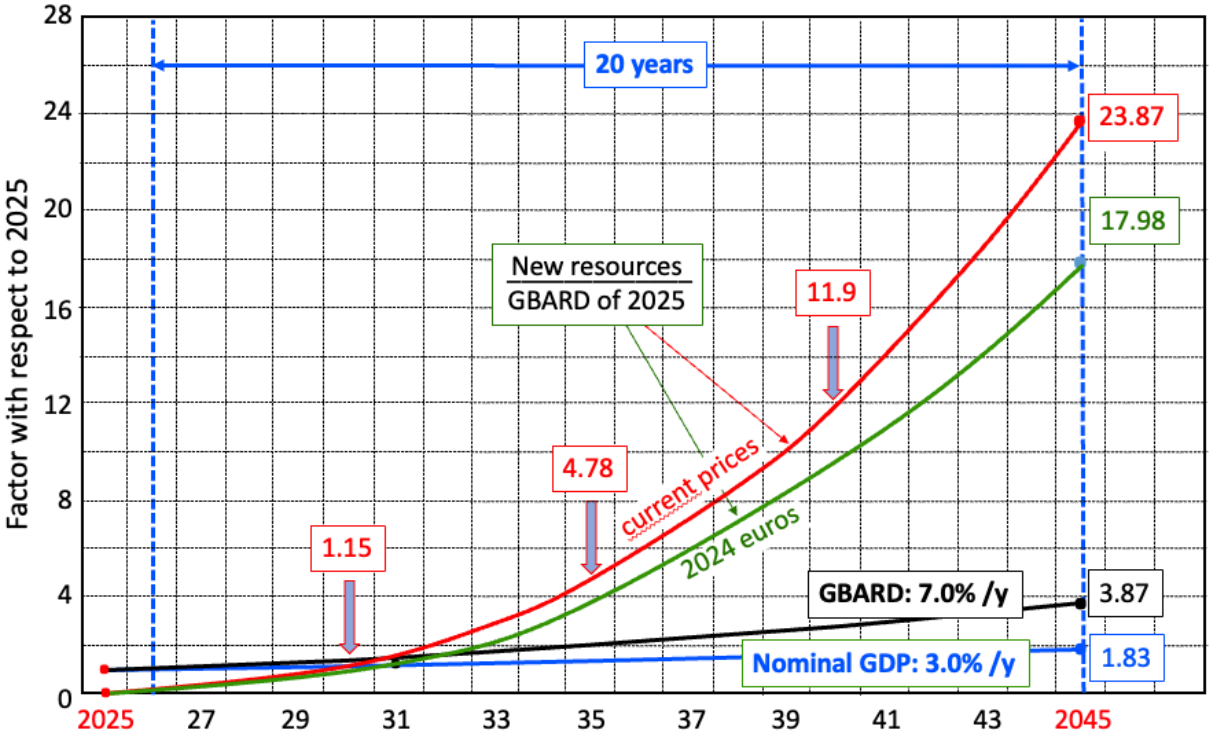

Figure 3. *Assumed trends in nominal GDP (blue curve) and GBARD (black curve). The* ***red curve*** *represents the ratio* $R_{26\text{-}(25+n)} / G_{25}$ *of Eq. (7). The* ***green curve*** *is the factor expressing the new resources in* ***2025 euro****, as discussed on pages 19-21 of Appendix 1.*

The effects of the investments, listed in column (9) of Table 3 on page 10, are shown in **Figure 4**, which illustrates how many years it takes for the countries in Group I to reach 0.75%. Three of them get close: Latvia, Portugal, and Hungary; Romania, starting from 0.152%, reaches only 0.30% (???) and stops before reaching half of the target value.

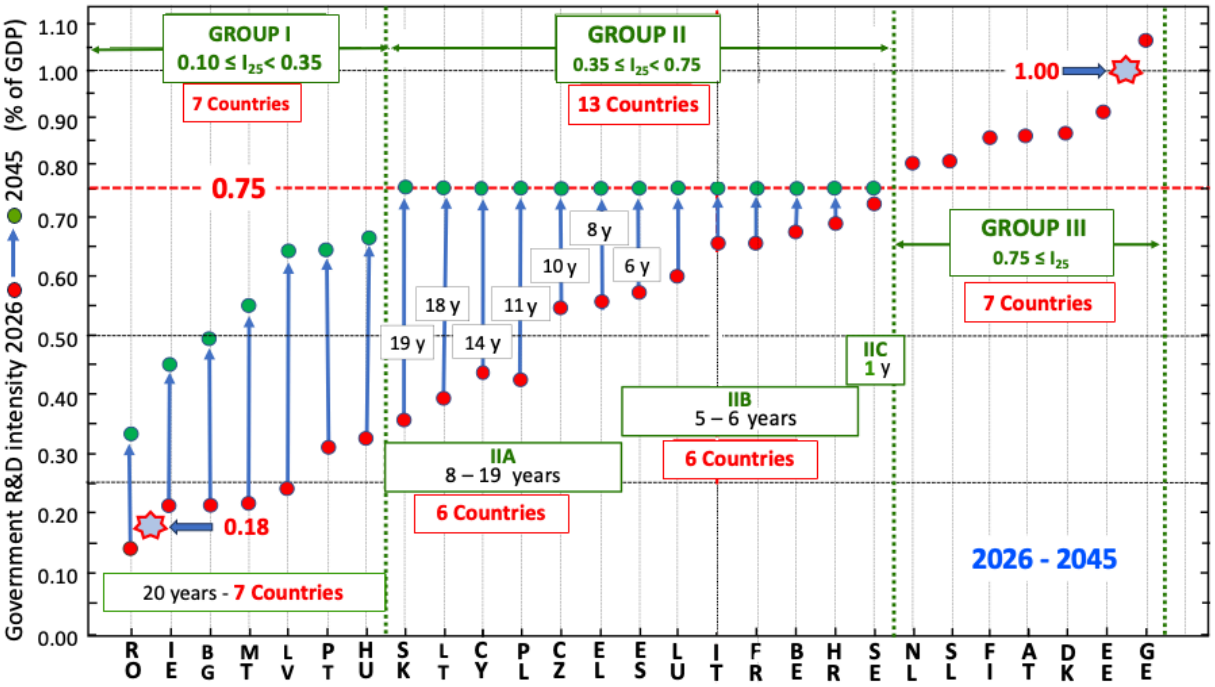

Figure 4*. The figure shows that* ***in 2025*** *the R&D intensities of the 27 countries were* ***evenly distributed between 0.18% and 1.00%*** *(Table 3, p. 7) and that 13 Countries had an intensity larger than 0,35% (Group II) and could arrive to 0,75% in 20 years.*

The model used to calculate the required resources is simplistic because

i. it uses data from 2023 for the reference year 2025,
ii. it assumes a constant **real GDP** increase of **2,2% per year**,
iii. it chooses a maximum GBARD increase of **7% per year** so that the Government R&D intensity increases by a maximum of **3.88% per year**.

However, applying these hypotheses results in four interesting pieces of information[24],

- **€180 billion** (at current prices) are required to complete the Programme.
- For the **7 countries in Group I** (Bulgaria, Latvia, Malta, Ireland, Portugal, Romania, and Hungary), the 0.75% target is **not achievable** within the 20-year horizon of the Programme — assuming a maximum annual increase in public R&D intensity of 3.88% — but significant progress will be made: for example, Romania will increase from 0.152% to 1.038820 × 0.14 = **0.325%**, while Latvia, Portugal, and Hungary will reach 0.65% (see **Fig. 4**, p. 12).
- For the **6 countries in Group IIA** (Czechia, Cyprus, Greece, Lithuania, Poland, and Slovakia), reaching the 0.75% target with annual increases of 3.88% **will require between 8 years (Greece) and 19 years (Slovakia).**
- For the **6 countries in Group IIB** (Belgium, Croatia, France, Italy, Luxembourg, and Spain), the annual increases in GBARD needed to reach 0.75% in 5 years range between **5.0% and 6.9%** and are more manageable than the 7.0% required for the countries of Group I.
- **Sweden**, the only country in Group IIC, is already very close to the target, which it can reach in 1 year.

3 European Union subsidies

The disparity among countries — illustrated in **Figure 2a** (p. 8) and **Figure 4** (p. 12) — is the result of the European Union's sustained lack of interest, over the past two decades, in ensuring balanced funding of public research across Member States, despite many declarations to the contrary, beginning with the Lisbon Strategy of 2000.

The more than twenty-year history of this issue leads to the conclusion that motions and recommendations are not sufficient: this disparity will not diminish **without targeted and lasting European interventions.** To this end **a twenty-year plan of financial** support is proposed, quantified according to **Rule B**:

B. Countries that in 2025 have a research intensity $I_{(25)} < 0.75\%$, and that in year k increase their GBARD by DG_{25+k} relative to 2025, will receive from the EU — in the following year — a grant S_{25+k} equal to 50% of that increase:

$$S_{25+k} = 0{,}50\ DG_{25+k}. \qquad (1 \leq k \leq 20) \qquad (8)$$

[24] **In this Report, euro amounts expressed in millions—typically sums of annual values—are either followed by the label "current prices" or left unspecified. Amounts adjusted for inflation, on the other hand, are explicitly indicated as "euro 2025."**

EU grants at current prices, divided by $GBARD_{2025}$, are listed in Column (4) of **Table 4**, which requires a preliminary remark: 50% of each year's additional investment will be reimbursed by the EU in the following year. However, if in any given year the actual investments fall short of those projected in **Table 3**, the corresponding grant will be reduced proportionally.

To calculate the **resources needed**—both at **current prices** (Column 9, Table 3) and in **2025 euros**—for each country (each having its own value of *r*, shown in Column 8, Table 3 on page 10, it is useful to introduce two proportional quantities, **U** and **V**:

$$\mathbf{U} = \mathbf{R}_{26\text{-}(25+n)} / G_{25} \text{ (euro correnti)}; \quad \mathbf{V} = \mathbf{T}_{26\text{-}(25+n)} / G_{25}. \text{ (euro 2025).} \qquad (9)$$

The product **Q = 0.50 V** of Column (6) expresses how many times the **total EU subsidies** (in 2025 euros) exceed the GBARD G_{25} invested by each country in the year 2025.

Table 4*. Quantities U, V, Q and R&D intensity at the beginning and at the end of the twenty-year Programme.*

	(1)	(2) GBARD 2025 G_{25} (bn)	(3) Duration n (years) – rate of GBARD (r-1)	(4) U = $R_{26-(25+n)}/G_{25}$ (current prices)	(5) V= $T_{26-(25+n)}/G_{25}$ Eq. A14 (€ 2025)	(6) Q = 0.50 V (€ 2025)	(7) InitialR &D intens. I_{25} (%)	(8) Final R&D Intens. I_{25+n} (%)
Group I	1-RO	493	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.152	**0.325**
	2-IE	1051	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.206	**0.441**
	3-BG	213	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.225	**0.481**
	4-MT	52,5	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.252	**0.539**
	5-LV	118	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.299	**0.640**
	6-PT	802	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.299	**0.640**
	7-HU	616	20 – 7.00%	**23.87**	**17.98**	**8.99**	0.311	**0.665**
II A	8-SK	453	19 – 6.93%	**20.68**	**15.82**	**7.91**	0.368	**0.750**
	9-LT	278	18 – 6.86%	**17.85**	**13.83**	**6.92**	0.387	**0.750**
	10-CY	138.3	14 – 6.96%	**10.04**	**8.251**	**4.13**	0.442	**0.750**
	11-PL	3817	11 – 6.67%	**5.547**	**4.753**	**2.38**	0.510	**0.750**
	12-CZ	1626	10 – 7.00%	**4.784**	**4.153**	**2.08**	0.512	**0.750**
	13-EL	1281	8 – 6.62%	**2.790**	**2.492**	**1.25**	0.569	**0.750**
II B	14-ES	8997	6 – 6.88%	**1.622**	**1.488**	**0.744**	0.601	**0.750**
	15-LU	507	5 – 6.79%	**1.114**	**1.032**	**0.516**	0.626	**0.750**
	16-IT	13 461	5 – 6.59%	**1.080**	**1.005**	**0.503**	0.632	**0.750**
	17-Fr	18 266	5 – 6.09%	**0.991**	**0.923**	**0.462**	0.647	**0.750**
	18-BE	3865	5 – 6.06%	**0.986**	**0.918**	**0.459**	0.648	**0.750**
	19-HR	533	6 – 6.88%	**0.792**	**0.739**	**0.370**	0.683	**0.750**
I C	20-SE	3908	1 – 7.00%	**0.0699**	**0.0690**	**0.035**	0.722	**0.750**
		60 476	**Total in mn**	**90 200**				

The total amount of the reimbursements is €90 billion—half of the €180 billion appearing in the bottom line of Table 3, as expected[25].

Which countries are the best funded by the twenty-year Plan?

Taking 50% of the new resources from Column (9) of Table 3 (page 10), the reimbursements in current prices to the countries in Groups I and II amount to €79.9 billion and €100.5 billion, respectively. These figures suggest that countries already more advanced in public research investment tend to benefit more, particularly those receiving the largest contributions: Ireland (€12.5 billion, current prices), Poland (€10.6 billion), Portugal (€9.6 billion), France (€9.1 billion), Hungary (€7.4 billion), Spain (€7.3 billion), and Italy (€7.3 billion).

However, **focusing on absolute figures can be misleading**, as EU subsidies are proportional to G25, the GBARD in the reference year, and countries with a lower G25 inevitably receive fewer subsidies.

Moreover, different countries have programmes of different durations, and for a fair comparison, inflation must be considered. For this reason, Figure 5 presents the Q ratios—from Column (6) of Table 4—which measure **how many times the reimbursements**, expressed in 2025 euros, **exceed each country's 2025 GBARD**.

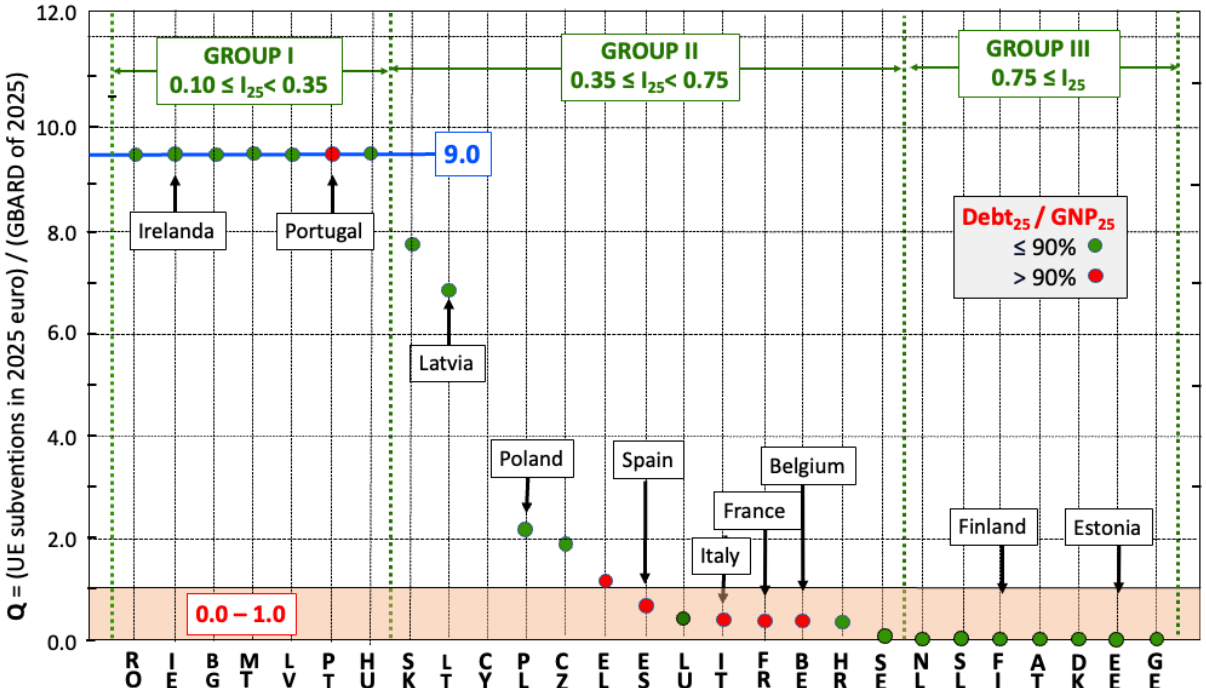

Figure 5. *The Q ratio between total EU contributions and GBARD—both referred to 2025 values—is the parameter that best captures the fairness of the twenty-year Programme.*

The figure clearly shows that the main beneficiaries of the Programme are the **countries in Group I**, which over twenty years receive, in 2025 euros, reimbursements amounting to **nine times their public research investment** of that same year.

Latvia and Poland receive, respectively, seven times and two and half times what they invested in 2025.

[25] The formulas for *U* and *V* are provided in the Appendix (page 19), and their numerical values—shown in Columns (4) and (5) of Table 4—are taken from Table A1 (page 20).

The larger and more indebted countries (Belgium, France, Italy[26], and Spain) show values close to Q = 0.5—that is, over 5–6 years, they receive reimbursements equal to about half of what they invested in public research in 2025.

4. Overview

Figure 6 was produced using the numerical values of EU reimbursements (in 2025 euros) — year by year — as listed in Tables A2 and A3 (pages 22–25).

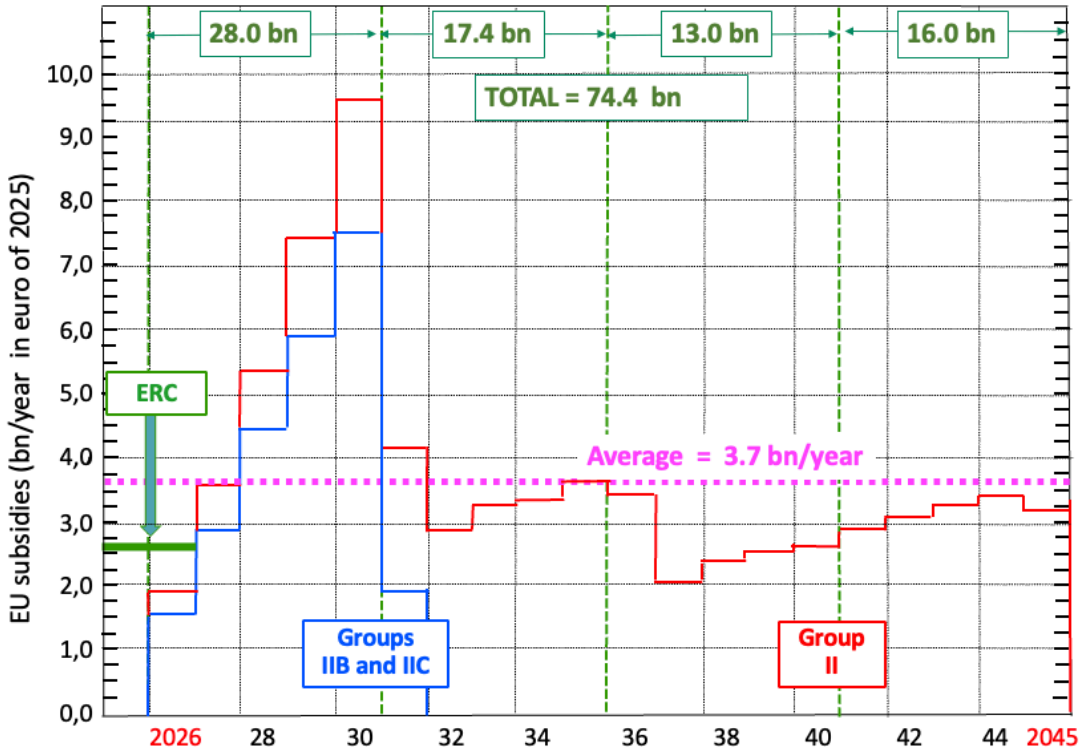

Figura 6. *The annual trend of EU investments, expressed in 2025 euros, is compared with the yearly budget of the European Research Council (green segment***).**

The figure shows that across the four five-year periods, the €74.4 billion (in 2025 euros) are distributed as follows: **28.0 – 17.4 – 13.0 – 16.0** billion.

The red bars illustrate the year-by-year evolution of EU contributions. The blue bars refer to Group I countries and, as expected, show a peak at the end of the five-year phase. Because of this peak, in 2030 spending (in 2025 euros) is more than double the average annual expenditure over the twenty years, which stands at **€3.7 billion**—as marked by the magenta dashed line.

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[26] For Italy the ratio is Q = 0.50, which is eighteen times lower than that of the Group I countries. In the five-year period 2026–2030, the GBARD sequence is: 14.347 – 15.292 – 16.300 – 17.374 – 18.519 billion euros and the annual increases – relative to 2025 – are 0.887 – 1.832 – 2.840 – 3.914 – 5.059 billion euros. It is worth noting that these annual increases are very similar to the proposal published on the front page of *Corriere della Sera* on 1 October 2020, when – in order to reach 0.75% of GDP in five years – 14 scientists (including the authors of this report) called on the Government to increase GBARD in the sequence 1.00 – 2.00 – 3.00 – 4.00 – 5.00 billion euros.

It is instructive to compare the magenta line with the green segment, which represents the **entire annual grant budget of the European Research Council (ERC)** awarded solely based on scientific excellence: **€2.5 billion per year**. According to the 2026–2045 Programme, the EU would therefore invest each year one and a half times what it currently invests in Europe's best researchers through the ERC. **This is a more than reasonable amount**, as it would place **all researchers in all EU countries** on equal footing, correcting the disparities among the 27 Member States—a disparity that is unacceptable because, as discussed on page 9, it implies that more than half of European countries:

- **lack the means and research infrastructures** to contribute over the long term to Europe's economic development;
- **are unable to train their young researchers** to compete on equal terms for ERC grants awarded solely on the basis of scientific merit;
- **cannot offer their research groups even the minimum conditions** to conduct high-quality basic science or to apply competitively for European funding.

This is not only an injustice—it is a waste.

A further argument in favour of adopting the twenty-year Programme can also be made: the **€3.7 billion per year** required between 2026 and 2045 represent only a minor adjustment within the broader investment horizon of **€750–800 billion annually** that, according to the Draghi Report, **Europe must commit each year** to improve productivity, support the green transition, and safeguard sovereignty.

* * *

Three Concluding Remarks

First, the **twenty-year Programme is ambitious** because – as shown in Fig. 4 on page 12 – after 5 to 20 years, the R&D intensity of the 21 EU countries currently below 0.75% will reach:

- **0.75% for 13 countries** (Group II): Belgium, Czechia, Cyprus, Croatia, Estonia, France, Italy, Luxembourg, Poland, Slovakia, Slovenia, Spain, and Sweden;
- **around 0.70% for 3 countries** in Group I: Lithuania, Portugal, and Hungary;
- **between 0.40% and 0.50% for 4 countries** in Group I: Bulgaria, Latvia, Malta, and Ireland;
- **0.33% for Romania**, which in 2025 starts from an intensity of just 0.15%.

Second, the **twenty-year Programme is fair** because, under rule B (p. 13), it funds all countries in Groups I and II while **giving preference** – as shown in Fig. 5 on page 15 – to the **Group I countrie**s, which are the furthest from the 0.75% target. The more advanced countries receive, in proportion to their 2025 investment in public research, **eighteen times less** than the countries in Group I.

Third, **the financial commitment required from the EU is reaso**nable. As shown in Fig. 6 (page 16), across the four five-year periods, the EU would need to invest **€28.0 billion, €17.4 billion, €13.0 billion, and €16.0 billio**n respectively – for a total **of €74.4 billion** (all in 2025 euros). Over the 2025–2044 period, the average annual investment – **€3.7 billio**n in 2025 euros – corresponds to **one and a half times** the amount allocated in 2022 (also in 2025 euros) to the

European Research Council[27] grants, which support European researchers, especially young ones, solely based on scientific excellence, regardless of nationality. It is, in fact, more than reasonable to invest **an equal amount** in strengthening the public research systems of the Union, thereby creating the necessary conditions for researchers from **all EU countries** – including those **returning from the US** through European and national programmes now being developed – to have access to the means and infrastructure required to **contribute to Europe's long-term development**. This would also allow them to compete on equal footing in excellence-based EU programmes without needing to emigrate again.

To conclude, it should be emphasized that the investments made **over the twenty years of the Programme will only be effective for Europe's long-term economic development if, in parallel, each country promotes specific national programmes focused on the themes outlined on page 7.** The body in Brussels tasked with coordinating the Programme will also need to support the funded countries in adopting best practices and in removing the many obstacles that currently hinder the transfer of knowledge from basic research to industry.

Acknowledgments

We are very grateful to Rossana Camilloni and Giovanni Stefani for their insightful critical feedback, thorough proofreading, careful checking of calculations, and suggestions for corrections and improvements, and to Alessandro De Angelis for his critical reading of the report, his contribution to the drafting of the Appeal published in *Corriere della Sera* on April 12 and for his continued efforts to promote and disseminate it.

[27] See pag. 21 of di https://opag.europa.eu/en/publication-detail/-/publication/3a11d526-ceab-11ed-a05c-01aa75ed71a1

APPENDIX 1

New resources to be invested by the EU, expressed — year by year — in current euros and in 2025 euros

A1. New resources over twenty years in current euros

Using the symbol **f** to denote the (fractional) number of years that are needed to go – with a GBARD grow rate equal to (r-1) – from $\mathbf{I_{25}} = G_{25}/PIL_{25}$ (initial government R&D intensity) to $\mathbf{I_{25+f}} = G_{25+f} / PIL_{25+f} = \mathbf{0.75\%}$, with a **3% annual increase** in nominal GDP (**p = 1.03**), one can write

$$r^f G_{25} / (p^f PIL_{25}) = (r/p)^f I_{25} = 0.75\%, \qquad (A1)$$

from which one derives

$$\mathbf{r} = (0.75/\mathbf{I_{25}})^{1/f}, \qquad (\mathbf{I_{25}} \text{ in \%; } p = 1.03) \qquad (A2)$$

and also

$$\mathbf{f} = \ln(0.75/\mathbf{I_{25}}) / \ln(\mathbf{r}/1.03). \qquad (\mathbf{I_{25}} \text{ in \%; } p = 1.03) \qquad (A3)$$

Having fixed the intensity I_{25}, Eqs. (A2) and (A3) give the infinite number of pairs f - (r -1) leading to 0.75%. In the specific case r = 1.07 and p = 1.03, Eq. (A3) becomes

$$\mathbf{f} = 26.25 \ln(0.75/\mathbf{I_{25}}) \qquad (r = 1.07; p = 1.03) \qquad (A4)$$

* * *

To calculate the **new resources** $\mathbf{R_{26-(25+j)}}$ during the n years of each country's Programme, it is useful to consider the case n = 5 and calculate the sum $\Sigma_{k=1\to n}\, DG_{25+k}$ of the increases $DG_{25+k} = (G_{25+k} - G_{25})$ **with respect to 2025**, with k ranging from 1 to 5:

$$\mathbf{R_{26-(25+n)}} = \Sigma_{k=1\to n}\, \mathbf{DG_{25+k}} = G_{25}(r^1 - 1) + G_{25}(r^2 - 1) + G_{25}(r^3 - 1) + G_{25}(r^4 - 1) + G_{25}(r^5 - 1) =$$

$$= \mathbf{G_{25}}\,[\,\mathbf{r}\,(\mathbf{r^n} - 1)/(\mathbf{r} - 1) - \mathbf{n}\,]. \qquad (n = 1, 20; \text{ in the example: } n = 5) \qquad (A5)$$

where the sum of a geometric progression $\sum_{k=1}^{n} x^k = x\,(x^n - 1) / (x - 1)$ was used.

It is useful for the following to define the function

$$\mathbf{H_n(s)} = s\,(s^n - 1)/(s - 1) \qquad \text{so that} \qquad \mathbf{R_{26-(25+n)}} = \mathbf{G_{25}}\,[\mathbf{H_n}(r) - \mathbf{n}]. \qquad (A6)$$

To obtain the subsidies paid in n years by the EU (the following year), one must multiply Eq. (A6) by the **factor 0.5** of rule B (p. 13):

$$\mathbf{S_{26-(25+n)}} = \mathbf{0.50}\ \mathbf{R_{25-(25+n)}} = \mathbf{0.50}\ \mathbf{G_{25}}\,[\mathbf{H_n}(r) - \mathbf{n}]. \qquad (n = 1, 20) \qquad (A7)$$

For r = 1.07, n = 20 this equation becomes

$$\mathbf{S_{26-45}} = 23.87/2\ \mathbf{G_{25}} = \mathbf{11{,}94}\ \mathbf{G_{25}} \qquad (r = 1.07; n = 20) \qquad (A8)$$

To obtain the subsidies in the time interval **from m to n years**, it is sufficient to calculate the difference

$$\mathbf{S_{(25+m)-(25+n)}} = \mathbf{S_{26-(25+n)}} - \mathbf{S_{26-(25+m)}}. \qquad (n > m;\ m, n = 1, 20) \qquad (A9)$$

A2. Annual allocation of new resources in 2025 euros

In the above formulae the yearly amounts have been summed so that the results are at 'current prices'. To calculate the **new resources $T_{26-(25+n)}$ in '2025 euros'**, each term of Eq. (A5) has to be divided by the inflation factor g (in the model: g = 1.02):

$$\mathbf{T_{26-(25+n)}} = G_{25}\,(r^1 - 1)/g^1 + G_{25}\,(r^2 - 1)/g^2 + G_{25}\,(r^3 - 1)/g^3 + G_{25}\,(r^4 - 1)/g^4 + G_{25}\,(r^5 - 1)/g^5 + \ldots =$$

$$= G_{25}\,\{\,[(\tfrac{r}{g})^1 - (\tfrac{1}{g})^1] + [(\tfrac{r}{g})^2 - (\tfrac{1}{g})^2] + [(\tfrac{r}{g})^3 - (\tfrac{1}{g})^3] + [(\tfrac{r}{g})^4 - (\tfrac{1}{g})^4]\;\; [(\tfrac{r}{g})^5 - (\tfrac{1}{g})^5] + \ldots.\}$$

$$\mathbf{T_{26-(25+n)}} = G_{25}\;[\mathbf{H_n}(\tfrac{r}{g}) - \mathbf{H_n}(\tfrac{1}{g})]. \qquad \text{(A10)}$$

In writing Eq. (A10), the function $H_n(s)$ defined by formula (A6) was used.

It should be noted that – with 1/g = (1 - x) and x tending to 0 – the function $H_n(1/g)$ tends to n so that for g = 1, **Eq. (A10) becomes Eq. (A6)**.

To compute – for each value of r – the new resources in current prices and in 2025 euros it is useful to introduce the quantities U and **V**

$$\mathbf{U} = R_{26-(25+n)} / G_{25}; \qquad \mathbf{V} = T_{26-(25+n)} / G_{25}; \qquad \mathbf{P = V / U} \qquad \text{(A12)}$$

which are given by the formulae

$$\mathbf{U} = R_{26-(25+n)} / G_{25} = [\mathbf{H_n(r)} - \mathbf{j}] \qquad \text{(A13)}$$

$$\mathbf{V} = T_{26-(25+n)} / G_{25} = [\mathbf{H_n}(\tfrac{r}{g}) - \mathbf{H_n}(\tfrac{1}{g})] \qquad \text{(A14)}$$

with the function $H_n(s)$ defined in Eq. (A6).

In columns (5)-(8) of Table A2, the values of the four quantities U, V, P = V/U and Q =0.35xV with g =1.02 are collected for all countries in Groups I and II.

Table A1 *- Values of parameters U, V, and R for an inflation factor g = 1.02 (1/g = 0.9804).*

	(1)	(2) GBARD 2025 G_{25} (mn)	(3) New resources $R_{26-(25+n)}$ (mn)	(4) Years **n** and rate **(r-1)** from Table 3	(5) **U = $R_{26-(25+n)}$ /G_{25}** (curr. prices)	(6) **V= $T_{26(25+n}$ /G_{25}** Eq. A14 (€ 25)	(7) **P = V/U**	(8) **Q = 0.50 V**	(9) **R = $PR_{26(25+n)}$: 180 400**
	GROUP. I	**3346**	**79 856**	20-7.00%	**23865**	**17.987**	0.753	**8.990**	**0-3333**
GROUP II A	Slovakia	453	9370	19-6.93%	20.68	15.82	0.765	7.095	0.0397
	Lithuania	278	4961	18-6.86%	17.85	13.83	0.775	6.922	0.0213
	Cyprus	138,3	1389	14-6.96%	10.04	8.51	0.822	4.125	0.0063
	(Poland)	3817	21164	11-6.67%	5.547	4.53	0.857	2.234	0.1005
	(Czechia)	1626	7778	10-7.00%	4.784	4.53	0.868	2.076	0.0374
	Greece	1281	3574	8-6.62%	2.790	2.492	0.893	1.245	0.0177
			48 236						**0.2229**

	(1)	(2) GBARD 2025 G_{25} (bn)	(3) New resources $R_{26-(25+n)}$ (bn)	(4) Years **n** and rate **(r-1)** from Table 3	(5) **U =** $R_{26-(25+n)}/G_{25}$ (curr. prices)	(6) **V=** $T_{26(25+n}/G_{25}$ Eq. A14 (€ 25)	(7) **P = V/U**	(8) **Q = 0.50 V**	(9) **R =** $PR_{26(25+n)}$ **/180 400**
GRUPPO II B	Spain	8997	14596	6-6.88%	1.622	1.488	0.917	0.7437	0.0744
	Luxemb.	507	565	5-6.79%	1.114	1.032	0.933	0.5183	0.0029
	Italy	13461	14535	5-6.59%	1.080	1.005	0.931	0.5017	0.0750
	France	18266	18104	5-6.09%	0.991	0.923	0.931	0.4606	0.0934
	Belgium	3865	3810	5-6.06%	0.986	0.918	0.931	0.4581	0.0197
	Croatia	533	422	5-4.95%	0.792	0.739	0.933	0.3687	0.0022
			52 032						**0.2676**
II C	(Sweden)	3908	**273**	1-7.00%	0.0699	0.0690	0.987	0.0340	**0.0015**
		TOTALE	**180.4 bn**			**Inflation factor weighted with the weights P = V/U**			**0.8253**

The last row of the table shows that the **weighted average** of the ratios P = V/U

$$\mathbf{R} = \sum_{k=1}^{n} \left(\frac{R\ 26-(25+k)}{180\ 400\ mn}\right)\left(\frac{V}{U}\right),$$

is 82.5%. This means that the €0.50 × 180.4 billion = €90.2 billion (in current prices), reimbursed by the Union over the 20 years of the Plan, correspond to €0.825 × 90.2 **= €74.4 billion (in 2025 euros).** Consequently, the average annual expenditure over the 20 years, expressed in 2025 euros, amounts to **€74.4 / 20 = €3.7 billion per year**. This is shown graphically in Fig. 6 on page 16.

* * *

The ratio Q of column (8), obtained by multiplying Eq. (A14) by 0.59, measures how much the EU subsidies (expressed in 2025 euros) are greater than G25:

$$\mathbf{Q = (subsidies\ in\ 2025\ euros)\ /\ G_{25} = 0.50\ V}. \qquad \text{(A15)}$$

The values of Q in column (8) are graphed in **Fig. 5** on p. 15.

It is important to highlight that, moving from the countries in Group I to the three Group II B countries (**France, Italy, and Spain**) that receive the largest subsidies, **the value of Q drops from 9.0 to around 0.5**—an eighteen-fold decrease. This factor offers a *quantitative measure* of how strongly the twenty-year Programme favours countries that are lagging furthest behind in terms of public research funding.

A3. Annual distribution of new resources in 2025 euros

To calculate the annual allocation of **new resources—expressed in 2025 euros**—we return to the first of Eqs. (A10), in which the factors $1/g^k$ (with g = 1.02) account for inflation:

$$\mathbf{T_{25-(25+n)}} = G_{25}\,(r^1 - 1)/g^1 + G_{25}\,(r^2 - 1)/g^2 + G_{25}\,(r^3 - 1)/g^3 + G_{25}\,(r^4 - 1)/g^4 + G_{25}\,(r^5 - 1)/g^5 + \ldots..$$

The new resources (in 2025 euros) are simply the terms of this progression. Thus, for the k-th year:

$$\text{(new resources needed in the k-th year – 2025 euros)} = G_{25}\ [(\frac{r}{g})^k - (\frac{1}{g})^k]. \qquad \text{(A16)}$$

This is the formula used to compute the values listed in Table A2, which is divided into three sections.

Table A2. *The new resources required in year k, expressed in* ***2025 euros****, are calculated using Eq. (A16) (with g = 1.02 and p = 1.03). The values of* ***(r/g – 1)*** *are shown in red in Column (2) and those of* $\mathbf{(1/g)^k}$ *are also in red in the top Row, Column (4)-(23) for the years k = 1-20.*

(1) Country	**(2)** **Year – percent.** with inflation **n-(r/g-1)**	**(3)** $\mathbf{G_{25}}$ (mn) $\mathbf{1/g^k}$	**(4)** **Year k =1** (mn) 0.980	**(5)** **Year 2** (mn) **0.**961	**(6)** **Year 3** (mn) 0.942	**(7)** **Year 4** (mn) 0.924	**(8)** **Year 5** (mn) 0.906	**(9)** **Year 6** (mn) 0.888	**(10)** **Year k =7** (mn) 0.871
Group I	20-4.90%	3346	**230**	**466**	**709**	**961**	**1220**	**1487**	**1764**
Slovakia	19-4.83%	453	30.8	62.4	95.0	126	163	199	236
Lithuania	18-4.76%	278	18.7	37.9	57.7	78	99	121	143
Cyprus	14-4.86%	138.3	9.43	19.1	29.1	39.4	50.1	61.0	72.4
(Poland)	11-4.58%	3817	250	506	769	1040	1317	1604	1899
(Czechia)	10-4.90%	1626	112	226	345	467	593	723	857
Greece	8-4.53%	1281	83.1	168	256	346	438	534	632
Group IIA			**504**	**1019**	**1552**	**2096**	**2660**	**3242**	**3839**
Spain	6-4.78%	8997	606	1230	1872	2533	3214	3917	-
Luxemb.	5-4.70%	507	33.8	68.4	104	141	179	-	-
Italy	5-4.50%	13461	870	1761	2677	3617	4583	-	-
France	5-4.01%	18266	1090	2203	3341	4503	5691	-	-
Belgium	5-3.98%	3865	239	464	703	948	1197	-	-
Croatia	5-2.89%	533	25.9	51.9	78.3	105	132	-	-
(Sweden)	1-4.90%	3908	268					-	-
Groups IIB + IIC			**3133**	**5778**	**8775**	**11 847**	**14 996**	**3917**	**-**
Totals in mn		**8640**	**3867**	**7263**	**11036**	**14 904**	**18 876**	8646	**5603**
			1st five-year period: 55 946 mn						

(1) Country	(2) Year – percent. with inflation n-(r/g-1)	(3) G_{25} (mn) $1/g^k$	(11) Year 8 (mn) 0.854	(12) Year 9 (mn) 0.837	(13) Year 10 (mn) 0.820	(14) Year 11 (mn) 0.804	(15) Year 12 (mn) 0.789	(16) Year 13 (mn) 0.773	(17) Year k =14 (mn) 0.758
Group I	20-4.90%	3346	**2050**	**2346**	**2654**	**2972**	**3302**	**3645**	**4001**
Slovakia	19-4.83%	453	274	314	354	397	441	486	533
Lithuania	18-4.76%	278	166	190	214	240	267	294	322
Cyprus	14-4.86%	138,3	84.1	96.3	109	122	135	149	164
(Poland)	11-4.58%	3817	2204	2518	2842	3176	-	-	-
(Czechia)	10-4.90%	1626	996	1140	1290	-	-	-	-
Greece	8-4.53%	1281	733	-	-	-	-	-	-
Group IIA			**4457**	**4258**	**4809**	**3935**	**843**	**929**	**1019**
Spain	6-4.78%	8997	-	-	-	-	-	-	-
Luxemb.	5-4.70%	507	-	-	-	-	-	-	-
Italy	5-4.50%	13461	-	-	-	-	-	-	-
France	5-4.01%	18266	-	-	-	-	-	-	-
Belgium	5-3.98%	3865	-	-	-	-	-	-	-
Croatia	5-2.89%	533	-	-	-	-	-	-	-
(Sweden)	1-4.90%	3908	-	-	-	-	-	-	-
Groups IIB + IIC			**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Totals in mn		**6507**	**6604**	**7463**	**6907**	**4145**	**4574**	**5020**
2nd five-year period: 34 823 mn						**3rd five-year period: 25 951 mn**			

(1) Country	(2) Year – percent. with inflation n-(r/g-1)	(3) G_{25} (mn) $1/g^k$	(18) Year 15 (mn) 0.743	(19) Year 16 (mn) 0.728	(20) Year 17 (mn) 0.714	(21) Year 18 (mn) 0.700	(22) Year 19 (mn) 0.686	(23) Year 20 (mn) 0.673	(30) TOTAL
Group I	20-4.90%	3346	**4371**	**4756**	**5156**	**5573**	**6007**	**6458**	**60 128**
Slovakia	19-4.83%	453	583	634	687	742	799	-	7156
Lithuania	18-4.76%	278	351	383	414	447	-	-	3838
Cyprus	14-4.86%	138.3	-	-	-	-	-	-	1140
(Poland)	11-4.58%	3817	-	-	-	-	-	-	18 125
(Czechia)	10-4.90%	1626	-	-	-	-	-	-	6749
Greece	8-4.53%	1281	-	-	-	-	-	-	3190
Group IIA			**934**	**1017**	**1101**	**1189**	**799**	**-**	**40 198**
Spain	6-4.78%	8997	-	-	-	-	-	-	13 372
Luxemb.	5-4.70%	507	-	-	-	-	-	-	526
Italy	5-4.50%	13461	-	-	-	-	-	-	13 508
France	5-4.01%	18266	-	-	-	-	-	-	16 828
Belgium	5-3.98%	3865	-	-	-	-	-	-	3551
Croatia	5-2.89%	533	-	-	-	-	-	-	393
(Sweden)	1-4.90%	3908	-	-	-	-	-	-	268
Group IIB + IIC			**-**	**-**	**-**	**-**	**-**	**-**	**48 446**
	Totals in mn		**5305**	**5773**	**6257**	**6562**	**6806**	**6458**	**148 722**
				4th five-year period: 31 856 mn					

The last rows of the three sections of the table indicate that the resources needed—expressed in 2025 euros—for the four five-year periods amount to: **56.0 + 34.8 + 26.0 + 31.9 = 148.7** billion euros. These correspond to a total of 50% reimbursements from the EU over twenty years amounting to **74.4 billion euros**, which—as already stated—corresponds to an average of **3.7 billion euros per year.**

For clarity, Table A3 lists—year by year—the new resources required to implement the twenty-year Plan (in blue), along with the EU grants (in red), which are obtained by dividing the new resources by two.

Table A3. *The new resources needed—listed year by year in* ***millions of 2025 euros****)—appear (in blue) in the first and third rows. When multiplied by 0.50, they yield the corresponding EU grants (in red). The five-year totals of the EU contributions are shown in the penultimate row.*

Year	1	2	3	4	5	6	7	8	9	10
Resources	**3867**	**7263**	**11036**	**14 904**	**18 876**	**8646**	**5603**	**6507**	**6604**	**7463**
Subsidies	**1934**	**3631**	**5518**	**7452**	**9438**	**4323**	**2801**	**3254**	**3302**	**3731**
Anno	11	12	13	14	15	16	17	18	19	20
Resources	**6907**	**4145**	**4574**	**5020**	**5305**	**5773**	**6257**	**6562**	**6806**	**6458**
Subsidies	**3454**	**2072**	**2287**	**2510**	**2652**	**2886**	**3129**	**3281**	**3403**	**3229**

1st five-years period	2nd five-years period	3rd five-years period	4th five-years period
Subs. – 28,0 Mrd	**Subs,– 17,4 Mrd**	**Subs. – 13,0 Mrd**	**Subs. – 16,0 Mrd**

UE subsidies on 20 years: 74,4 mn (euro2025) (*)

(*) To maintain the achieved R&D intensity, each country—after the n years indicated in column (2) —must increase its GBARD at its own expense by 3% per year, to keep pace with the growth of nominal GDP.

Using the red figures in the last rows of the second line of Table A4, the **histogram in Figure 6** was constructed. Its content is discussed on page 16.