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# PREDICTIONS OF THE SUCCESS RATE OF EU NEW MEMBER STATES IN RECEIVING HORIZON 2020 FUNDING

# PREDVIĐANJA STOPE USPJEHA NOVIH EU ČLANICA U PROGRAMU HORIZON 2020

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*Abstract*

EU is facing increasing world competition. EU member states with high R&D intensity have been most resilient in the current economic crisis. Given that R&D intensity in the EU new member states (except for Slovenia and Estonia) lags behind the EU average (2.03 % in 2011), Horizon 2020 funding is a unique opportunity to advance the position of these states in research and innovation. The prediction shows that any significant improvement of the success of EU new member states in Horizon 2020 as compared to FP 7 is plausible only under special precautions. The first prerequisite of progress is the growth of R&D intensity towards European targets. The improvement of national science and technology infrastructure due to the structural funds allocation may also positively influence the scientific excellence. Auxiliary factors that can help in bridging the divide between new and old EU member states in terms of European funding include, for example, effective information systems, granting the preparation of Horizon 2020 projects, and higher participation of doctoral students in Horizon 2020 projects.

*Sažetak*

EU se suočava sa sve većom svjetskom konkurencijom. Članice EU s visokim stopom istraživanja i razvoja su otpornije u trenutnoj ekonomskoj krizi. S obzirom da intenzitet istraživanja i razvoja u novim EU članicama (osim Slovenije i Estonije) zaostaje za prosjekom EU (2,03% u 2011. godini), Horizon 2020 je jedinstvena prilika da se unaprijedi položaj tih država u istraživanju i inovacijama. Predviđanja pokazuju da je značajno poboljšanje uspjeha novih zemalja članica EU u Horizon 2020 u odnosu na FP 7 vjerojatna samo pod posebnim mjerama. Prvi preduvjet napretka je rast intenziteta istraživanja i razvoja prema europskim ciljevima. Poboljšanje nacionalne znanosti i infrastrukture tehnologije zbog strukturne dodjelu sredstava također može pozitivno utjecati na znanstvenu izvrsnost. Pomoćni faktori koji mogu pomoći u premošćivanju jaza između novih i starih članica EU-a u pogledu europskog financiranja uključuju, na primjer, učinkovit informacijski sustav, pomoć u pripremi Horizon 2020 projekata, veći udio doktorskih studenata u projektima Horizon 2020.

**Introduction**

European Union (EU) new member states (NMS) are lagging behind the western part of Europe in research and innovation /**1**/, /**2**/. Therefore, Horizon 2020 (H 2020) funding is a unique opportunity for them to advance their position. For achieving success in the grant competition it is necessary to understand what are the primary criteria and thresholds that must be surpassed in the evaluation process and how they depend on the essential and subsidiary factors and characteristics of the research and development environment in the respective countries. In this paper we present our analysis of the success of EU MS in 7th Framework Program (FP 7) as a starting point to our prediction for H 2020.

## 1. Basic variables of the analysis

The criteria of FP projects evaluation include: scientific and technological excellence, expected progress vs. the state of the art in the field, quality and efficiency of the consortium, management and infrastructure, impact and dissemination of results. Among these, the leading principle is excellence as a resource of new knowledge and innovation. Although the impact of excellence is especially high in European Research Council (ERC) projects, it penetrates the whole FP 7 and H 2020 programs. At the opening of H 2020 in Slovakia in January 2014, the Commissioner M. Geoghegan-Quinn said: *Excellence cannot be everywhere, but it can sproute from everywhere.* It was understood as an encouragement of the local community, because the level of scientific excellence in the country is lower that the average of EU /**3**/. Nevertheless, the islands of positive deviation exist everywhere.

In the analysis /**4**/ covering the period 2007 – 2012 it was shown that the dependence of the contributions obtained by MS from FP 7 (y [mil. €]) upon their national research and development intensity (R&DI) (x [mil. €]) can be estimated in the form of linear equation

$$y = 0.8774\, x + 30. \qquad (1)$$

with the coefficient of determination $R^2 = 0.8666$. Here R&DI is the gross domestic expenditure on research and development (GERD) as a percentage of the gross domestic product (GDP). Some of NMS are located above the estimated line (1), e.g. Hungary (HU) and Poland (PL), some are below the line, e.g. Slovakia (SK) and Czech Republic (CZ). But in general, equation (1) is a satisfactory approximation in terms of statistical significance of the estimate. Therefore, by no doubts the national R&DI is an unavoidable presupposition for the participation in the EU programs. Moreover, it is a „fuel" propelling the new infrastructure built from the EU structural funds (SF).

Finally, we will assume that the ideal contribution for the respective MS from EU programs should be proportional to the full time equivalent (FTE) of the national research community as percentage of FTE of EU.

On the basis of the above, our estimates are based on the following three explanatory variables: national scientific excellence, national R&DI and national research community FTE.

## 2. Further factors influencing the success in obtaining EU research funding

In addition to the national excellence and R&DI there are also other factors which may increase the success of the respective country in the FP 7 or H 2020, such as:

a/ participation of PhD students in the projects,
d/ quality of management,
c/ efficiency of the research diplomacy,
e/ low level of bureaucracy,
f/ good language abilities,
g/ enthusiasm or scepticism of researchers depending on the political attitudes toward science,
h/ supporting grants for the preparation of European projects.

Nevertheless, we will show that these factors are only subsidiary.

## 3. The model

The ideal contribution (IdC) for the respective country from FP 7 is calculated from the total volume of funding proportionally to the FTE in the national research community. The contribution (ExC) expected according to our assumptions will be obtained as IdC multiplied by two factors:
F1 is the national excellence benchmarked to the EU average,
F2 is the national R&DI benchmarked to the EU average.
Then a simple relation holds:

$$ExC = IdC \times F1 \times F2. \quad (2)$$

ExC will be compared with the real contribution ReC obtained from /**5**/. From this comparison the plausibility of our approach will be determined.
Some alternatives are:
1. The IdC will be calculated from total R&D personnel (total FTE) minus FTE of business enterprise FTE, because mainly the researchers in public (governmental and higher education) sectors fulfil the standard requirements of the scientific excellence.
2. The square root of national R&DI will be employed because in countries with lower R&DI the cost of results (publications) is lower.
There the total amount distributed among EU MS (without associated countries) is 32491 mil. €. Regarding the full FP 7 budget, at the end of 2015 it will reach the extrapolated amount of 48376 mil. €. The extrapolation factor as a ratio of the mentioned amounts is 1.49.

## 4. National excellence in science and technology (S&T)

The data of national excellence of EU 28 in 2010 summarized in /**6**/ are applied in our calculations. The excellence is calculated as a composite indicator depending on four variables: the share of highly cited publications in all publications; number of top scientific universities and public research organisations in the country; patent applications per million population; the value of ERC grants. Details are in /**7**/. The average excellence of EU is 47.9, from old MS top ranking is Netherlands (78.9), from NMS Hungary (31.9) and the excellence of Switzerland is 97.6.

## 5. Application of the model

Calculations were done for the whole EU 28 group, however, in this paper we will show only the results for the eight NMS from Central and Eastern Europe: Bulgaria (BG), Croatia (HR), Romania (RO), Slovenia (SI) and CZ, HU, PL, SK and compare them with those obtained for Germany (DE), Spain (ES) and the Netherlands (NE). The starting data are given in Tables 1 and 2.

**Table 1. Data used for calculations of the success rate of EU MS in FP 7**

| MS | R&DI 2011 | Square root of R&DI 2011 | Excellence in S&T 2010 | FP 7 fund. 2008-2012 [mil. €] | [1]FP 7 funding 2007- 2015 [mil. €] | SF allocation 2007-13 [mil. €] |
|---|---|---|---|---|---|---|
| EU | 2.03 | 1.42 | 47.9 | 32491 | 48376 | 46400 |
| BG | 0.57 | 0.75 | 24.6 | 93 | 139 | 242 |
| HR | 0.75 | 0.87 | 12.3 | 67 | 100 | 0 |
| CZ | 1.84 | 1.36 | 29.9 | 224 | 335 | 3556 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DE | 2.84 | 1.68 | 62.8 | 6028 | 9013 | 4647 |
| ES | 1.33 | 1.15 | 36.6 | 2624 | 3923 | 5320 |
| HU | 1,21 | 1.10 | 31.9 | 242 | 353 | 1488 |
| NL | 2,04 | 1.43 | 78.9 | 2615 | 3909 | 288 |
| PL | 0.77 | 0.88 | 20.5 | 374 | 559 | 8700 |
| RO | 0.48 | 0.69 | 17.8 | 138 | 206 | 843 |
| SI | 2.47 | 1.57 | 27.5 | 146 | 218 | 859 |
| SK | 0.68 | 0.82 | 17.7 | 69 | 103 | 1215 |

[1]*FP 7 funding extrapolated to the FP 7 budget 48376 mil. €. (Associated countries are not included.) Also the allocation of SF for research, development, innovation and developing of human potential is shown.*

**Table 2. Data (2011) used for calculations of the success rate of EU MS in FP 7**

| Country | FTE [%] | FTE bus. enterpr. [%] | FTE (thousands) | FTE public (thousands) | [1]Population [mil.] |
|---|---|---|---|---|---|
| EU | 0.7 | 0.3 | 1615.4 | 923.4 | 488 |
| BG | 0.4 | 0.1 | 11.9 | 8.9 | 7.9 |
| HR | 0.5 | 0.1 | 6.8 | 5.4 | 4.4 |
| CZ | 0.6 | 0.3 | 30.7 | 15.4 | 10.3 |
| ES | 0.7 | 0.3 | 130.2 | 74.4 | 41.9 |
| DE | 0.9 | 0.5 | 338.3 | 150.3 | 82.6 |
| HU | 0.6 | 0.3 | 23.0 | 11.5 | 10.1 |
| NL | 0.6 | 0,3 | 53.6 | 26.8 | 16.5 |
| PL | 0.4 | 0.1 | 64.1 | 54.5 | 38.2 |
| RO | 0.2 | 0.0 | 16.1 | 16.1 | 21.5 |
| SI | 0.9 | 0.5 | 8.8 | 3.9 | 1.9 |
| SK | 0.7 | 0.1 | 15.3 | 13.1 | 5.4 |

[1]*Population of the respective country is not used in calculations*

We perform three different calculations:
No. 1:
IdC values are calculated proportionally to the total FTE. ExC are obtained using Eq. (2).
No. 2:
IdC values are calculated proportionally to the FTE of public sector. ExC are obtained using Eq. (2).
No. 3:
IdC values are calculated proportionally to the total FTE. ExC are obtained using Eq. (2), where F2 must be substituted by a modified factor F3 reflecting the square root values of R&DI (3rd column in Table 1).
While only the results of the calculation No. 2 will be given here (Table 3). All calculations are compared in Table 4.

**Table 3. Calculation No. 2. FP 7 ideal (IdC), expected (ExC) and real (ReC) contributions**

| MS | IdC proportional to public sector FTE [mil.€] | F1 | F2 | ExC [mil.€] | ReC 2007-2015 [mil.€] |
|---|---|---|---|---|---|
| EU | 48 376 | 1.00 | 1.00 | 48 006 | 48 376 |
| BG | 466 | 0.51 | 0.28 | 67 | 139 |
| HR | 283 | 0.26 | 0.37 | 27 | 100 |
| CZ | 807 | 0.62 | 0.91 | 455 | 335 |
| DE | 7 874 | 1.31 | 1.40 | 14 441 | 9 013 |
| ES | 3 898 | 0.76 | 0.65 | 1 925 | 3 923 |
| HU | 602 | 0.67 | 0.60 | 242 | 353 |
| NL | 1 404 | 1.65 | 1.00 | 2 316 | 3 909 |
| PL | 2 855 | 0.43 | 0.38 | 467 | 559 |
| RO | 843 | 0.37 | 0.24 | 75 | 206 |
| SI | 204 | 0.57 | 1.22 | 142 | 218 |
| SK | 686 | 0.37 | 0.33 | 84 | 103 |

**Table 4. Comparison of calculations No. 1, 2 and 3**

| No. | Σ ExC [mil. €] | σ [mil. €] |
|---|---|---|
| 1 | 55702 | 2005 |

| | | |
|---|---|---|
| 2 | 48006 | 1341 |
| 3 | 51054 | 1454 |

*2nd column: the sum Σ ExC, 3rd column: σ (mean quadratic deviation) calculated as the square root of the Σ(ReC – ExC)²/ 28.*

**Conclusions**

From Table 4 it follows that the calculation No. 2 gives the best correspondence between the sum of expected contributions (48 006 mil. €) and the extrapolated FP 7 budget (48 376 mil. €.) The mean quadratic deviation is only 1 341 mil. €. Also two other treatments give satisfactory results, which confirm our assumption that excellence and R&DI are the decisive factors of the success of the respective country in the EU funding competition. Nevertheless, from the calculations it follows that referring to the acquisition of European money the EU 28 MS could be divided into four groups showing certain similarities. They depend on their economic power and derived national support of research:

1. EU funding of the most developed countries – Denmark, Finland, France, Germany, Luxembourg and Sweden is lower than expected from our model. Obviously they have rich research supporting national agencies and in effect they are losers indirectly supporting other states.
2. The previous conclusion is not valid for three well developed countries – Austria, Belgium and the Netherlands. In the case of Benelux countries we may speculate with the historical affinity to the European values.
3. Western countries suffering more from economic crisis with consequences also for the research, like Italy, Greece, Portugal, Spain and Ireland win more European money than our model predict.
4. Similar is the situation in developing NMS – Bulgaria, Croatia, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia and Slovakia. Here only Czech Republic with well supported S&T is an exception.

In summary, we may conclude that the criticism of the research communities because of lower absolute contributions obtained from EU programs, which often found and sound in some NMS, is not correct. In the European grant competition they do their best, but they are critically limited by both insufficient national R&DI and the lower excellence, which are the consequences of long-lasting devastation of the research environment by national policies. The distribution of funds in H 2020 in favour of NMS could be only changed if the national research excellence and R&DI will improve. At present it is hoped that the new infrastructure built mostly due to European SF (Table 1) will provide a partial remedy. Nevertheless, we estimate that provided the appropriate national R&DI, the period needed for the improvement of national excellence indicators will last about five to seven years.

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*Notes*

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