A TWO-SPEED EUROPE IN THE AREA OF RESEARCH

Andrejs GESKE, Dina BĒRZIŅA
University of Latvia
Raina blvd.19, Riga, LV-1586, Latvia

ABSTRACT

The world is moving fast and European Union invests significantly into moving towards smart, sustainable and inclusive economy. One of the driving forces for Europe's advancement is a strong commitment towards the development of knowledge and innovation based economy, supported by relevant European policy initiatives; in particular, research and innovation Framework programmes. The current one, Horizon 2020, promotes excellence in research. Analysing the participation of Member states' groups (EU-15 and EU-13) to the European Union research Framework programmes and corresponding impact, unequal influence is observed – the dominance of EU-15 country group is obvious. Given the current heterogeneous status of EU-15 and EU-13 countries, such approach increases the disparities between the country groups in terms of involvement into the research projects.
Since the Sixth Framework Programme Higher educational institutions (HEI) constitute majority of the Framework programme participants collecting more than 30% of the funding thus determining the scientific progress in Europe. For several Framework programmes in a row the leading higher educational institutions are University of Cambridge and University of Oxford. However, size makes sense – among the top-50 HEI only few universities form Denmark and Sweden can be found, but none from Baltic countries.

Keywords: Framework Programme, Horizon 2020, research and technological development (RTD), EU Member States (EU-13, EU-15).

1. INTRODUCTION

The Framework programme (FP) is the most visible instrument of European Union (EU) research policy – the European dimension, the collaborative requirement and the scope of its strategic objectives are essential characteristics of it. Framework programme is a mechanism for consolidating research and innovation activities in Europe that could be implemented through cooperation at the same time generating added-value in each participating country.

EU Member states, which joined the Community in 2004, 2007 and 2013, participate to the EU Framework programmes since FP5 on equal basis with other EU Member states: at first as associated candidate countries, later as full EU members. These countries now are indicated by abbreviation EU-13 (earlier referred as candidate countries – CC): Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia – joined EU in 2004; Bulgaria, Romania – 2007; Croatia – 2013. Worth mentioning – for the participation to the Framework programme, the associated country is charged yearly participant fee calculated on basis of the country's GDP. The European Commission (EC) offers discount to all the EU candidate countries.

The goal of this study is to assess the impact of European Framework programmes on research and development in EU countries and Norway.
The authors of this study seek to determine and analyse trends of EU-13 participation to the FP5, FP6, FP7 and the first years of Horizon 2020 on basis of the data available in the European Union Open Data Portal [11], CORDIS – Community Research and Development Information Service [6], Archive of FP Programme Evaluation and Monitoring Documents [4], Eurostat [12], and ETER – European Tertiary Education Register [10].
The novelty of the approach presented is a systematic analysis of the EU-13 Member states' participation throughout the Framework programmes from FP5 to H2020 and assessment of the trends for participation of individual Higher educational institutions from Baltic-Nordic countries (EU: Estonia, Latvia, Lithuania, Denmark, Finland, Sweden and Norway – associated to EU) to the Framework programmes. Regularities were searched using the Spearman's rank correlation coefficient.

2. EUROPEAN UNION AND ITS BUDGET

EU Member states differ: there are large and developed economies (France, Germany, Italy, Spain), large and economically less developed (Poland, Romania), small and economically developed (Belgium, Luxembourg, the Netherlands), small and economically less developed (Baltic countries, Croatia, Slovakia) among them. Each of these countries has joined the EU for raising of their living standards by performing together. Although the goal is the same, the activities for meeting the goal vary: this is determined by political choice of the national governments as well as by national capabilities.
The 28 EU countries traditionally could be divided into two groups – the EU-15 and EU-13 Member states. The first group or the 'old Member states' are comprised from countries which established the European Union and the ones which joined before 2004. The second group or 'new Member states' accounts for those which joined since 2004. EU-15 group are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, United Kingdom. For the EU-13 group stands Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia. By comparing EU-13 to EU-15 Member states one can see a considerable diversity: EU-13 countries make up only 26% of the total EU territory; the population of EU-13 group constitute 21% of the EU total, but GDP in these countries is only 8% of the total. Accordingly, the inhabitants in the EU-13 have lower GDP per capita – the average value for EU-15 group is € 30,000, while for EU-13 constitute somewhat above € 10,000 [9].
Each of the countries contribute to the common EU budget and in return receive payments through various funds and programmes. The contribution is determined by the country's economy – the wealthier countries are charged more, the poorer ones – less.

3. EU FRAMEWORK PROGRAMMES FOR RESEARCH AND DEVELOPMENT

Entering the EU research community for candidate countries coincides with significant change in the Framework programme constituency – the EC started to emphasise role of the research institutions in promoting innovation and European scientific competitiveness, and explicitly welcoming formation of the European research community.

Fifth framework programme of the European Community for research, technological development and demonstration activities (1998 – 2002)

During FP5 EU-15 countries were involved in the implementation of about 16 thousand projects while EU-13 managed to do less than 3 thousand; the participation of candidate countries (at that time EU-12) in FP5 was lower than expected – all together they were involved in 16% of all FP5 projects and coordinated 5% of them (in comparison: EU-15 were involved in 93% of all the projects and coordinated 83% of them; Norway made 9% of projects and coordinated 2%) [11].

In 2001, the Commission implemented several measures to support the integration of candidate countries into the EU RTD activities: several targeted calls for proposals were launched for CCs intended at training of the research staff from these countries for participation to EU Framework programmes; no exceptions or advantages in the rules for participation were introduced. In 2001 Framework monitoring panel chaired by Professor M. Horvat recommended to emphasise contribution to enlargement with European added value criteria [1]. This was implemented as bonus points in evaluation of the proposals involving participants from CCs; however, suggestion worked till candidate countries became Member states and no privileges in form of bonus points for geographical coverage were further applied.

In 2002 the External Monitoring Panel chaired by Wilhelm Krull expressed concerns that the participants from CCs are still facing huge barriers to enter FP5 projects [2]. The success rates for participation in FP5 varied from country to country and from programme to programme: e.g. smaller countries like Estonia, Latvia, and Slovenia demonstrated considerable success but the bigger ones were lacking back. One of hurdles for full successful participation of the researchers from CCs was obsolete technical equipment of research facilities (infrastructure) [2].

Despite the problems indicated, the survey clearly demonstrated that the opportunity to participate in the Framework programme on an equal basis with EU partners is highly appreciated in the CCs. The main positive findings included:

- good general knowledge of the FP5;
- high interest of research institutes to participate in the research projects;
- established links to EU research community.

Sixth Framework Programme for Research and Technological Development (2003 – 2006)

The FP6 came with introduction of new instruments which tightened the competition for FP6 grants as only acquainted and experienced participants were included into the consortia – no coordinator from EU-15 wanted to take a risk of inviting un-known participants from EU-13. By the end of FP6 it proved that the new instruments (Integrated projects – IP and Networks of Excellence – NoE) were not as successful as initially hoped. The frequency of EU-13 participation in these projects was satisfactory: involvement in 70% of all the projects of respective type, but the absolute number of participations proved a tenfold dominance of partnership from EU-15 versus EU-13 [15].

FP6 commenced systematised coordination of EU and Member states' RTD policies. Initiatives like the ERA-nets and European Technology Platforms (ETPs) provided stakeholders with an opportunity to identify and approach the challenges jointly. Participation of EU-13 countries in the ERA-nets is almost equal to EU-15: involvements respectively in 65% and 72% of all ERA-net projects; however, ETPs were formed as 'clubs from wealthy organisations', projects had to be significantly co-financed by participants themselves and no wide involvement of EU-13 partners was possible.

At the beginning of FP6 expert group led by Dr. Erkki Ormala concluded that Europe must strive for better integration of the 'new Member states' into the Framework programmes as inclusion them in all EU policies and instruments is a prerequisite for effective deployment of human and economic potential of these countries in building a more competitive and cohesive Europe, enjoying sustained development [14]. By the end of FP6 it became obvious that relative participation of EU-13 has decreased but no in-depth analysis on failures of this country group already in the second framework programme in a row was conducted. The general numbers provided by EC testify that FP6 success rates are lower than in FP5: 18% successful FP6 proposals versus 26% under FP5; 19% successful FP6 applicants versus 24% in FP5 [15].

Expert group for assessment of the FP6 implementation led by Prof. Ernst Th. Rietschel indicated that the accession of 10 'new Member states' during FP6 also meant that in 2004 the Framework programme had to absorb many new participants from new EU countries. Retour in FP (ratio of % FP participation to % contribution to EU GDP) vs. increasing Country's GERD level indicated that 'more poor' EU countries (e.g. Poland, Slovakia, Lithuania, Czech Republic, Latvia, as well as some from EU-15: Spain, Greece, Portugal) were financing the wealthiest ones as well as all the 3rd countries participating without contribution to the FP6 [13].

Nevertheless, the expert group concluded that EU-12 will further assimilate into Framework programmes over the time as others did before (like Austria, Finland, Sweden which joined in 1995).

Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 – 2013)

The goal of the next framework programme was contributing to European Union becoming the world's leading research area – the FP7 was strongly focused on promoting and investing in world-class state-of-the-art research, based primarily upon the principle of excellence in research. The word 'excellence' is strongly correlating with word 'well-known' and was a new challenge for the EU-13 countries. Also, in comparison to FP6, FP7 was the first Framework programme where there were no bonuses for participation of the EU-13 country representatives.

Implementation of the FP7 coincided with the 2008 financial crisis followed by a global economic recession; therefore, EC promoted investments in research and innovation as the best way to ensure Europe's competitiveness at a global scale. A comprehensive action plan for a coordinated response to the economic crisis called European Economic Recovery Plan was launched. In terms of funding it meant that part of financing foreseen to 'regular research projects' was diverted to financing three major partnerships between public and privates for the sectors most disruptively hit by the crisis: automobile sector – 'European green cars'; construction sector – 'Energy-efficient

buildings'; manufacturing – 'Factories of the future' [3]. This appeared to be a support for important European industry not widespread among the EU-13.

The most comprehensive analysis of participation to the Framework programmes is presented by expert group led by Louise O. Fresco. The expert group indicated that high degree of concentration of EU funding among the participating organisations can lead to both positive as well as negative effects on actors within the system: 'One the one hand, it can lead to increased global competitiveness and economies of scale and foster the emergence of centres of excellence. On the other hand, it can lead to unintended effects, such as the dominance of status over content, risks of elitist compartmentalisation or barriers against newcomers and actors from network peripheries' [5]. EU-13 countries gained mainly from the FP7 programme activity foreseen to enhance the research potential of convergence regions and made up with 4% of the total FP7 funding. On contrary – EU associated states accumulated 9% of funding (Norway – 1.7%, it is more than any singular EU-13 country) and EU-15 – 85%. Researchers from the EU- 13 have relatively small participations in FP7 projects. Considering the total FP7 funding for research and innovation projects the annual FP7 contribution per inhabitant was € 14 on average across the EU- 15, but only € 3 for EU-13 [5].

Summary

Summarising the involvement of EU-13 countries into the Framework programmes on research, technology and innovation development one can observe a two-speed Europe in the area of RTD. The Ex- Post evaluation of the FP7 indicates that top- 100 organisations were able to almost double their annual EC funding contribution from FP6 to FP7 [5]. There are no participants from EU-13 countries among the top-100 organisations; two can be found among top-200: Tarty University (Estonia) ranks 176 and Jozef Stefan institute (Slovenia) ranks 178 [11]. In other words, it means – no space for newcomers from EU-13 (with exception for Small and medium sized enterprises – SME).

Observing participation exclusively for research projects across the Framework programmes one can find not pleasing trend (see Tab. 1): during FP6 there were 11% EU-13 participants for research projects accumulating 3% of the total FP7 funding; in FP7 – participation declined to 4% of research projects and 2% of funding; the observed trend continues in Horizon 2020 – during the first years participants from EU-13 constitute 4% of research projects and 2% of funding.

Table 1. Distribution of Research projects and Individual grants over FP6 – H2020 [created by authors]

Program-me	Country group	Participation in Research projects / total projects	Research project funding / total project funding	Individual grants / total projects	Individual grant funding / total project funding
FP6	EU-15	49%	65%	10%	13%
	EU-13	11%	3%	1%	1%
FP7	EU-15	25%	51%	19%	25%
	EU-13	4%	2%	2%	1%
H2020	EU-15	41%	41%	20%	27%
	EU-13	4%	2%	1%	1%

The same is true also for individual research grants provided by Marie Skłodowska-Curie actions and European Research Council – EU-13 participation is constant – 1-2% of projects and just 1% of funding. It should be recognised that EU-15 participation to the research projects also drops due to increased involvement of Associated countries Norway, Switzerland, Israel and smaller ones (here should be mentioned that the previously largest AC participant Switzerland is only partially eligible for receiving of EC funding under Horizon 2020).

Another indicator analysing country participation to the Framework programmes would be number of participations per researcher (FTE – full time equivalent). As seen from the graph (see Fig. 1) – the gap between EU-15 and EU-13 participation enlarges over the Framework programmes.

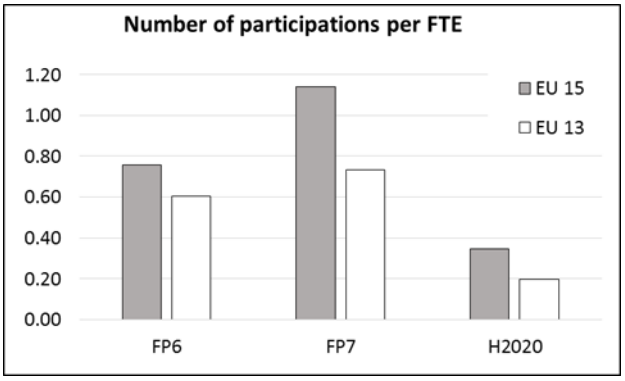

Figure 1. Relationships between FTE and involvement in FP6 – Horizon 2020 [created by authors]

4. HORIZON 2020 – THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION (2014–2020)

The current Framework programme, Horizon 2020, is the core part of Europe 2020, Innovation Union and European Research Area (ERA) as it is:

- strengthening the EU's global position in research, innovation and technology;
- responding to the economic crisis to invest in future jobs and growth;
- addressing people's concerns about their livelihoods, safety and environment.

Europe is slow in turning RTD results into marketable products or successful businesses to boost an industry that leads international markets through a potential disruptive business based on innovation with a strong market orientation.

Like Economic recovery plan consumed part FP7 budget, a part of the first three years' funding foreseen for research in Horizon 2020 was transferred to another economy boosting plan - Investment Plan for Europe, which foresees a smart mobilisation of public and private sources of finance of at least € 315 billion over the period of 2015-2017. However, after two years of implementation, the winners are EU-15 countries accumulating 93% of currently contracted funding [18].

It is too early for analysing of the Horizon 2020 impacts; however, some results and detected trends are discussed further in the paper.

In two first years (2014-2015) EU-15 countries had 83% of the participations in the signed grants, while EU-13 only 8%, Norway – 1%; similarly, the majority of the EU funding went to participations from EU-15 (89%), while EU-13 received only 4%, Norway – 2%, i.e. Norway alone has made about 40% of EU-13 total funding. In EU-13 countries (excluding Cyprus) there are more newcomers: looking at unique participations one can observe that range of FP participants is saturated in EU-15 countries (the same is true for Norway) – each organisation participates on average in 3 projects, while in EU-13 there are about 2 projects per organisation (see Fig. 2).

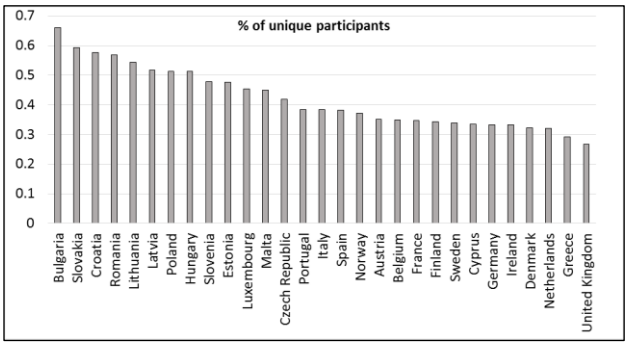

Figure 2. Percentage of unique participants in Horizon 2020 [created by authors]

A specificity which should be considered when analysing the total number of coordinated projects is the Presidency of the Council of the EU. In 2014-2016 Presidencies were held by Greece, Italy (2014), Latvia, Luxembourg (2015), Netherlands, Slovakia (2016). If for bigger countries like Greece, Italy, Netherlands number of organised presidency events would not significantly influence the total number of coordinators coming from particular country, then from smaller countries it is essential: e.g. 30% of Horizon 2020 project coordinators in Latvia are organisers of the Presidency Events.

Regarding the funding obtained by Member states in Horizon 2020 one should notice the high correlation with FP7 – 0.98. This means that Europe has developed a system that will not change or changes very slowly. As a characterising parameter we have chosen percentage of EU-28 obtained funding (Framework programme financing is granted on basis of excellence – only part is retained by EU-28, part goes to AC which pay contributions for their participation to FPs, part goes to 3rd countries eligible for receiving financing from FP). Retained FP funding for larger EU Member states is a subject to change only for a few percentage points; e.g., Germany has increase from 18% to 20% in terms of EU-28 retained funding. United Kingdom experiences a decrease from 17% to 15.5%; as well as France – from 13% to 11% and Italy – from 9% to 8%. Performance for the Netherlands is constant – 8% of FP funding. Significant changes are observed in some of the countries: the major reduction is for Bulgaria from 0.24% to 0.14% (and Switzerland partly not eligible for funding). The largest winners are: Luxembourg – has an increase from 0.15% to 0.27%, Malta – from 0.05% to 0.09%, Estonia – from 0.23% to 0.36% and Slovakia – from 0.19% to 0.28%. The performance of Latvia remains unchanged, while Norway has boosted, Lithuania – dropped.

Also macro economical parameters could be related with amount of retained Horizon 2020 funding. When attributing Framework programme funding with country's population one can observe about twenty-fold difference – the lowest funding below € 5 per inhabitant is for Romania, Bulgaria and Poland; funding of € 5 to € 10 is aligned with Lithuania, Croatia, Slovakia, Hungary, Czech Republic, and Latvia. All the mentioned 9 countries are from EU-13 group: the population of these countries constitute 20% of EU total, but GDP is 7.7% of EU total, however, the accumulated funding from Horizon 2020 is only 3.5% of the available. The highest funding (above € 60 per inhabitant) is aligned with Belgium, Luxembourg, Denmark, Netherlands and EU Associated country Iceland. The performance of EU-13 and EU-15 countries varies (see Tab. 2).

Table 2. Comparison of EU-13 and EU-15 countries [created by authors]

	EU13	EU15
Area	26%	74%
Population	21%	79%
GDP, €	7.7%	92%
Researchers	13%	87%
RTD expenditures, €	4.3%	96%
FP7, €	4.7%	95%
Participants H2020, retained	9.2%	91%
H2020, €	4.8%	95%

The retained funding per inhabitant strongly correlates with GDP per capita (Spearman's Rank Correlation Coefficient $r=0.83$, $p<0.01$), the number of researchers per 1,000 inhabitants ($r=0.73$, $p<0.01$), the expenditure for RTD per capita ($r=0.78$, $p<0.01$), the expenditure of EU funds in RTD per capita ($r=0.69$, $p<0.01$). It is also notably correlating with the percentage of county's contribution to RTD ($r=0.57$, $p<0.01$) and percentage of EU fund investments into RTD ($r=0.70$, $p<0.01$). All the mentioned values are highly correlating ($r=0.44$–0.94) (see Tab. 3).

Table 3. Correlations of Horizon 2020 retained funding with national indexes [created by authors]

Factor	Spearman's Rank Corr. Coefficient
FP7 accumulated funding per capita	0.90
GDP per capita	0.83
Expenditures for RTD per capita	0.78
Expenditure of EU funds in RTD per capita	0.69
Expenditures for RTD, % GDP	0.57
Expenditures for RTD, % EU funds	0.70

The correlation could be observed between performance in Horizon 2020 programme and other programmes. For example, the OECD Programme for International Student Assessment (PISA) of 15-year-old students world-wide [21]: correlation with the OECD PISA 2015 performance in science is 0.54 ($p<0.01$) (see Fig. 3). Actually it means – there is no one decisive factor responsible for success in Horizon 2020 performance and retained funding.

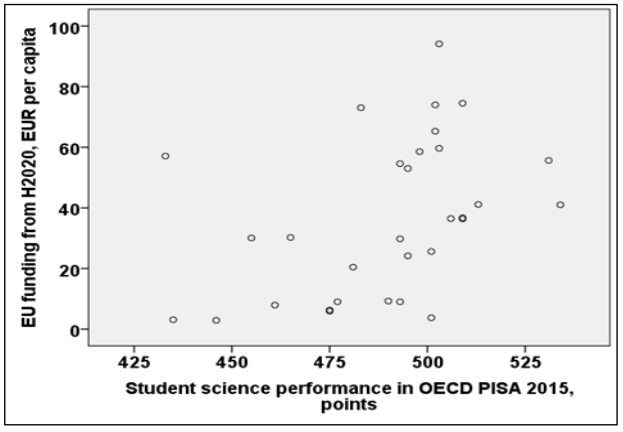

Figure 3. Correlation of retained Horizon 2020 funding and students mean science performance in PISA 2015 [created by authors]

5. ANALYSIS OF PARTICIPATION AMONG HIGHER EDUCATION INSTITUTIONS

Higher educational institutions (HEI) are the biggest beneficiaries in terms of both numbers of applicants and requested EU funding for retained proposals in the last Framework programmes since FP6. Therefore, the further discussion is devoted to the analysis of HEI participation (see Fig. 4). Drop in numbers for years of 2007 and 20014 is explained with change of programmes when less calls for proposals are opened for the last year and rather few contracts are signed on the first year of the new programme.

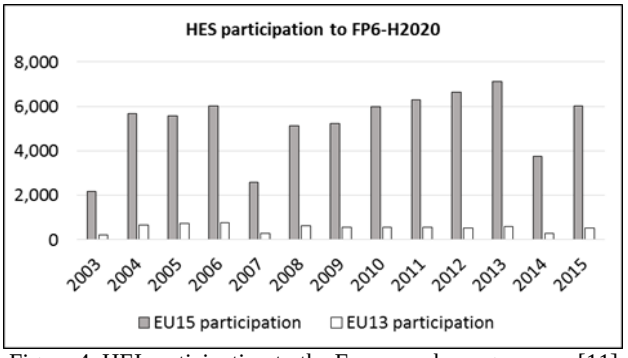

Figure 4. HEI participation to the Framework programmes [11]

Among the top-10 universities in Horizon 2020 five are from UK: University of Cambridge, University of Oxford, University College of London, Imperial College of Science, Technology and Medicine, University of Edinburgh.

In course of further analysis we have created an example consisting of Nordic counties (Denmark, Finland, Sweden and Associated, Norway) and Baltic countries (Estonia, Latvia, Lithuania). There is information available on 278 HEIs of this region on ETER Data base [10]. Only a part of them (221) are active in research. The others (57) in majority are colleges not providing university education. There is a number of such kind HEIs in Latvia and Estonia, but none in Finland and Norway. Only part of the institutions active in research have participated and succeeded in Horizon 2020 (see Tab. 4) – in total there are 80 HEIs holders of Horizon 2020 grants.

Table 4. HEI characteristics and performance in Horizon 2020 for Nordic-Baltic countries, December 2016 [11]

Country	Number of HEIs active in Research	Number of HEIs with H2020 projects	Number of H 2020 projects	Number of H 2020 project coordinators	H 2020 grants, M €
SE	39	23	581	149	312.8
DK	18	9	485	213	246.7
FI	42	19	275	88	139.6
NO	49	12	171	54	102.5
EE	7	4	73	21	26.6
LV	27	7	31	5	6.6
LT	39	6	39	4	5.9

The most active and successful are: University of Copenhagen with 184 Horizon 2020 projects, Technical University of Denmark – 115 projects. On contrary – there are 14 HEIs implementing only one Horizon 2020 project. On average – there are twice as many HEIs in Nordic countries as in Baltic countries; fourfold more those which participate to the Horizon 2020 programme being involved in 11 times more projects and accumulating total funding 21 fold as much as Baltic countries. It indicates that concentrating of higher education and science in fewer numbers of HEIs is essential for achieving of higher results (see Fig. 4).

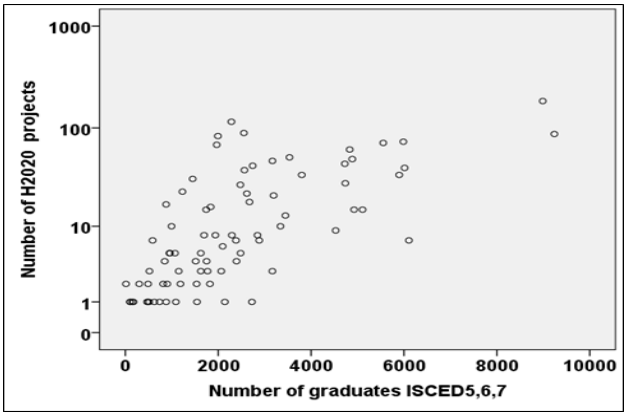

Figure 4: Correlation of number of Horizon 2020 projects and number of HEI graduates [created by authors]

The most successful from Baltic countries is Estonia, which has already accomplished considerable reorganisation in higher education and research management including the reduction of number of HEIs [22]. The participation indicators demonstrate that Estonia alone (being the smallest of the Baltic counties) performs twice as effective as Latvia and Lithuania together.

6. CONCLUSIONS AND DISCUSSION

Our study convincingly demonstrates that greater investments of EU-15 Member states into country's research and development in comparison to EU-13 Member states ensures faster growth for EU-15 countries and widens the gap between EU-15 and EU-13 Member states' performance in the EU Framework programmes. Also, our study deduces that changes in higher education systems are indispensable by bringing together studies with research activities. Performance of Estonia and Slovenia (both EU-13) is a prof for this concept.

There is a number of studies performed by authors both from EU-13 and EU-15 countries on Framework programme performance analysis. Some findings of other authors regarding the low share of retained funding for EU-13 Member states in EU Framework programmes [7], [8], [16], [17], [19], [20], [22]:

- majority of the research grants in Framework programmes are allocated with natural sciences, but these sciences need more expensive infrastructure and materials for research activities;
- there is a considerable brain-drain from EU-13 countries which is determined by better working conditions outside;
- in many countries research and innovation is not top-priority;
- becoming a Horizon 2020 project coordinator requires international recognition determined by the prestigious of the research organisation which is considerably higher in EU-15 counties; presentation of researchers' excellence for project participants frequently is replaced by general description of an organisation;
- research activities in industrial enterprises are weak or not developed at all; therefore, allocation of private funding for research activities is limited;
- lack of experience in response to the calls for proposals; lack of resources (both human and financial) for proposal preparation;
- there is higher probability to get into project consortia for organisations repeatedly than for newcomers;
- lack of administrative capacity for project management.

7. ACKNOWLEDGMENT

The article is written in the framework of a project that has received funding from Norway Grants Programme 2009–2014 in accordance with the project "EU policies impact to the transformations of the higher education and research system in Norway and Latvia" agreement No NFI/R/2014/006.

8. REFERENCES

[1] 2001 Annual monitoring report on the RTD activities conducted under the EC and Euratom research framework programmes, **European Commission**, Office for Official Publications of the European Communities, 2003.

[2] 2002 Synthesis monitoring report on the activities conducted under the European research area and the EC / Euratom research framework programmes, **European Commission**, 2003, https://ec.europa.eu/research/evaluations/pdf/archive/archive_of_reports/2002_report/fp5_external_monitoring_report_2002.pdf [electronic source]

[3] A European Economic Recovery Plan, COM (2008) 800 final, **Official Journal of the European Union**, 26.11.2008.

[4] Archive of FP Programme Evaluation and Monitoring Documents, **European Commission**, https://ec.europa.eu/research/evaluations/index_en.cfm?pg=archive [electronic source].

[5] Commitment and Coherence. Ex-Post Evaluation of the 7th EU Framework Programme, **European Commission**, Publications Office of the European Union, 2015.

[6] CORDIS – Community Research and Development Information Service, **European Commission**, cordis.europa.eu/projects/home_en.html [electronic source].

[7] J.F. Dhainaut, V. Diebolt, B. Pouletty-Lefèbvre, et al. (2015). What strategy should France implement for H2020? **Therapie.** Jan-Feb;70(1):95-109.

[8] S. G. Enger, F. Castellacci, Who gets Horizon 2020 research grants? Propensity to apply and probability to succeed in two- step analysis, **TIK working papers on innovation studies No. 20160225**, 2016, University of Oslo, www.sv.uio.no/tik/InnoWP/tik_working_paper_20160225.pdf [electronic source]

[9] **EU budget at a glance**, www.europarl.europa.eu/news/en/news-room/20141202IFG82334/eu-budget-explained-expenditure-and-contribution-by-member-state [electronic source].

[10] **European Tertiary Education Register**, https://www.eter-project.com [electronic source]

[11] European Union Open Data Portal, **European Commission**, https://data.europa.eu/euodp/en [electronic source].

[12] Eurostat, **European Commission**, ec.europa.eu/eurostat/data/database [electronic source].

[13] Evaluation of the Sixth Framework Programmes for Research and Technological Development 2002-2006, **European Commission**, Publications Office of the European Union, 2009.

[14] Five-Year Assessment of the European Union Research Framework Programmes 1999-2003, **European Commission**, Office for Official Publications of the European Communities, 2005.

[15] FP6 Final Review: Subscription, Implementation, Participation, **European Commission**, Office for Official Publications of the European Communities, 2008.

[16] F. L. Furtunescu, EU opportunities for research in the health field. What should be done to improve the Romanian participation? **Acta Medica Transilvanica**, Vol. 2, no 2, 2012, pp. 121-123.

[17] A. Geuna, Determinants of university participation in EU-funded R&D cooperative projects, **Research Policy,** Vol. 26, 1998, pp. 667-687.

[18] Investment Plan for Europe, **European Commission**, https://ec.europa.eu/priorities/publications/country-factsheets-investment-plan-state-play_en [electronic source].

[19] S. Luby, M. Lubiova, Predictions of the success rate of EU new member states in receiving Horizon 2020 funding, **Informatalogia**, Vol. 49, Iss. 1/2, 2016, pp. 41-46.

[20] P.C. Mitran, G. Monah, Education and research – promoting factors for the culture of innovation, **Economics, Management, and Financial Markets,** 11(1), 2016, pp. 100–108.

[21] OECD, **PISA 2015 Results (Volume I): Excellence and Equity in Education**, 2016, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264266490-en

[22] D. Rambaka, **Policy reform and research performance in countries in transition: a comparative case study of Latvia and Estonia**, Doctoral thesis, University of Manchester, 2011.