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# An analysis of the role and engagement of universities with regard to participation in the Framework Programmes

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# An analysis of the role and engagement of universities with regard to participation in the Framework Programme

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# List of Abbreviations

ARWU: Academic Ranking of World Universities.

AT: Austria

BE: Belgium

BG: Bulgaria

CH: Switzerland

CY: Cyprus

CZ: Czech Republic

DE: Germany

DK: Denmark

DOI: Digital object identifier.

eCORDA: External Common Research Data warehouse, platform for the Framework Programme for research and technological development horizontal reporting.

EE: Estonia

EL: Greece

ERA: European Research Area.

ERC: European Research Council.

ERDF: European Regional Development Fund.

ES: Spain

ETER: European Tertiary Education Register.

EU13: Cyprus, Malta, Czech Republic, Slovenia, Slovakia, Hungary, Romania, Bulgaria, Poland, Croatia, Estonia, Latvia, Lithuania.

EU15: Austria, Portugal, Spain, France, Italy, Germany, Belgium, Netherlands, Luxembourg, Greece, Ireland, United Kingdom, Sweden, Denmark, Finland.

EUPRO: Database on FPs participations created and maintained by AIT (Austrian Institute of Technology).

Extra EU: Switzerland, Norway, Israel.

FI: Finland

FP4: Fourth Framework Programme of the European Community for research and technological development (1994-1998).

FP5: Fifth Framework Programme of the European Community for research and technological development (1999-2002).

FP6: Sixth Framework Programme of the European Community for research and technological development (2002-2006).

FP7: Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013).

FPs: Framework Programmes of the European Community for research and technological development (FP4, FP5, FP6, FP7, H2020).

FR: France

FTE: Full time equivalent.

H2020: Horizon 2020, EU Research and Innovation programme (2014-2020).

HC: Head count.

HES: Higher or Secondary Education Establishments.

HHI: Herfindahl–Hirschman Index of concentration.

HR: Croatia

HU: Hungary

IE: Ireland

IF: Impact Factor of academic journals

IL: Israel

INTERREG: European territorial cooperation programmes.

IPR: Intellectual property right.

ISCED: International Standard Classification of Education (ISCED5: Short-cycle tertiary education; ISCED 6: Bachelor's or equivalent level; ISCED 7: Master's or equivalent level; ISCED 8: Doctoral or equivalent level).

ISSN: International Standard Serial Number of publications.

IT: Italy

LT: Lithuania

LU: Luxembourg

LV: Latvia

MT: Malta

NL: Netherlands

NO: Norway

NUTS: Nomenclature of territorial units for statistics.

OTH: Other FP participants, different from HES, PRC, PUB and REC.

PL: Poland

PNAS: Proceedings of the National Academy of Sciences

PRC: Private for-profit entities (excluding HES - Higher or Secondary Education Establishments)

PT: Portugal

PUB: Public bodies (excluding Research Organisations and HES).

RDI: Research, technological development and innovation.

REC: Research Organisations.

RO: Romania

RTD: Research and technological development.

S3: Smart Specialisation Strategies 2014-2020.

SE: Sweden

SESAM: Commission database on project outputs.

SI: Slovenia

SK: Slovakia

UK: United Kingdom

UNIV project: FP projects in which at least one partner is a university.

WIPO: World Intellectual Property Organization.

WOS: Web of science

## Abstract

The "analysis of the role and engagement of universities with regard to participation in the framework programmes" was launched by the European Commission, DG RTD, to contribute to a better understanding of the motivations for university participation in the Framework Programmes for research and technological development, the resulting patterns of cooperation and their effects. The study aimed at providing evidence on universities in the context of the ex-post evaluation of FP7. The analysis highlights that university participation in European FPs and the corresponding funding is concentrated in some countries and organisations. There is stability in leadership, meaning that rankings did not change significantly over time. While motivations for participating are roughly comparable across countries and are linked mostly to the drive to improve reputation, output quality and competitiveness, the reasons behind persistent success of some players are to be found mainly in accumulated experience, efficacy of support staff and quality of people, which are also linked to wider national contexts. The quality of the projects' outputs is high on average, suggesting that the FP7 objective to promote excellence and attractiveness was, to a varying degree, achieved. More could have been done to create a cohesive and inclusive ERA and to contribute to reduce the regional variation in research and innovation performance. Free circulation of knowledge outside the well-established, long standing linkages among strong research intensive universities could have been also better facilitated in the FPs.

# Executive summary

## FUNDAMENTAL QUESTIONS AND KEY FINDINGS

***Why do some of the universities have a higher share of the total researchers that are active and successful at the European level?***

University participation in Framework Programmes for Research and Technology Development (FPs) and the related funding is concentrated in some countries and organisations. The most important reasons for the persistent success of some universities are not related to motivations, which are roughly comparable across institutes and countries, but to:

1. Accumulated experience, which has two effects: it facilitates the diffusion of best practices in preparing EU project proposals; it boosts networking capabilities. Indeed, strong self-reinforcing dynamics emerge in the network structures in the analysed FPs. Such mechanisms benefit experienced universities which perform better in EU competition. This is reflected, for example, in the stability of networks of top ranked regions and universities: there are only 3 new entries in the top 10 regions according to various indicators of network centrality in FP7 compared to FP6.

2. Quality of research and its outputs: the universities differ significantly in terms of their average scientific standing and their capacity to obtain EU funds. For example, a large share of universities, 43% of the total, received less than € 1 million each in FP7, 32% received between 1 and 10 million and 25% won over 10 million each (see: individual case studies and Annex 1; analysis of top research universities). Projects vary considerably in terms of scientific productivity. Out of 3,550 university projects with at least one publication, 39% have 2 to 5 publications; 28% has 6 to 20 publications. Approximately 10% has more than 20 publications but only 3.9% of the projects produced more than 50 articles. The interviews showed that the quality of the academic outputs, and scholars' productivity, is a particularly important driver of success of top research universities.

3. Efficacy of the support staff, which is also linked to the wider national contexts such as promotion systems affecting recruitment and careers, and openness of the labour market (see literature review and conclusions, which integrate the findings of a workshop with practitioners).

***To what extent has the participation of universities in FPs contributed to the achievements of ERA (e.g. increasing the attractiveness of Europe, contributing to open access and free circulation of knowledge)?***

It is fairly certain that the FP7 objective to promote excellence and attractiveness was, to a varying degree, achieved, considering for example:

1. The above average quality of the publications stemming from projects: 70% of the articles are published in high-quality journals and receive an above average number of citations.

2. The unique networking opportunities promoted by participation, as highlighted by Europe's 25 top research universities in the interviews.

It is questionable whether a cohesive and inclusive ERA was promoted and whether the FPs helped to reduce the wide regional variation in research and innovation performance, given the emerging concentration patterns and lesser participation of some Member States:

1. Around half of the funding received by universities (approx. € 19 billion) is concentrated in three countries (the United Kingdom, Germany and the Netherlands).

2. Most of Eastern Europe is participating less or has a limited role (e.g. EU13 received 3% of total university project funding in FP7).

3. The EU13 success rate is the lowest, on average, compared to EU15 and non-EU countries.

4. The first 20 universities account for 46.1% of the projects and 25% of the funding. Therefore, it is also debatable whether FPs facilitated free circulation of knowledge outside the well-

established, long standing linkages among strong research intensive universities (see: statistics on the participation of universities in FPs, including the social network analyses).

***How has participation of universities contributed to the development of EU research and innovation policy and the establishment of innovation management capacities within universities?***

The contribution of FP participation to the establishment of innovation management capacities is considered positive by the universities but the IPR results seem quite poor:

1. The Improvement of organisation and management of international projects by strengthening (or setting up) internal structures, dedicated to facilitating engagement in EU networks and provide knowledge commercialisation services, is a key initiative undertaken or planned by most universities. 90% of the universities covered in the case studies support FP projects through a specific structure; in 54% of the cases their research strategies include provisions to strengthen these structures.

2. Top research universities are better equipped in this respect and, according to the interviews, all the 25 organisations covered in the analysis have established a specific structure to support participation in international projects, as well as contacts and inter-personal exchanges in Brussels.

3. Nonetheless, there is a significant scope for improving the industrial exploitation of the outcomes of FP projects. The analysis of IPRs reveals that the patenting output of the funded FP7 projects is quite low, especially considering the aggregated EC financial support. In this context of fragile patenting performance, universities still play a leading role: 87.8% of IPRs refer to university projects (i.e. projects involving at least one university).

The qualitative information collected by the questionnaire and interviews suggest a positive contribution of participation to the development of EU research and innovation policy in terms of:

1. Strengthening or setting up of technology transfer and liaison offices and more opportunities for commercial exploitation of research results, for over 80% of the organisations.

2. Participation in programmes and activities promoted by national or local industry and clusters, and contribution to the development of regional innovation strategies. Approximately 60% participated in the preparation of the Smart Specialisation Strategies.

***What are the motivations for university participation in FPs?***

The case studies highlighted that the main motives for participating are:

1. Enhancement of scientific reputation and international competitiveness, which is related to the positive impact of participation on quality and quantity of scientific output. All these motives are ranked 1st by nearly 40% of the universities. In the case of top research universities, greater reputation is considered essential to facilitate access to funding for basic high-risk research, in particular through Marie Curies and ERC.

2. Financial needs are also a key driver (ranked 1st by 35% of universities covered in the case studies), though not for top research organisations (only a small number of these, less than 10%, consider financial needs important).

3. Other motivations such as the possibility to support multi-disciplinary research and training of PhD/young researchers are considered much less important.

***What are the patterns and new trends of cooperation that emerge as a result of FP participation?***

The great majority of university projects are collaborative, meaning that they involve more than one participant, although the share of collaborative projects has decreased over time: from 88% in FP4 to 58% in FP7. The main features of the cooperation trends that emerge as result of participation include:

1. In general, FP boosts intensity of collaboration, as confirmed by the analysis of co-authorship: more than 80% of university publications involve collaboration across different institutions.

2. FP participation helps to create and strengthen links between a set of central universities that are quite stable over time, as indicated by the social network analysis. Hence, the incidence of new networks appears to be quite limited. For example there are only 2 new entries in the top 10 universities, according to several measures of network centrality, in FP7 compared to FP6.

3. FPs foster transnational cooperation in EU13 where universities are involved in projects characterized by larger partnerships and above-average international reach, especially in the Cooperation programme. On the contrary, large EU15 countries, characterised by a strong national innovation system, are able to access funding without establishing wide international partnerships. For example, the share of solo projects in the EU ranges from a maximum of approximately 37% in the United Kingdom to a minimum of 4% in Slovenia.

***What are the effects of university participation in the FPs including national differences?***

The analysis reveals important effects of university participation at both the organisational and the country level:

1. Scientific quality enhancement (for more details see below "impacts on scientific and academic excellence") and related reputational gains.

2. Network formation and cooperation between universities and firms. More than 60% of the FP7 university projects involve at least one private company. Among EU countries, such share ranges between 44.5% for projects involving a United Kingdom university to 71.8% in the case of Romanian projects. The social network analysis confirms a high intensity of interactions between firms and universities in both FP7 and FP6.

3. Collaboration with firms is very important in relation to patenting. Only 22.6% of the total number of patents associated with university projects result from projects that do not involve a firm. This confirms that the large majority of projects leading to outputs with significant industrial potential are those involving private firms.

4. Industry-university cooperation activities, established thanks to the EU programmes tend to continue after the duration of the project funding in 95% of the cases.

5. Participation has a positive effect on the capacity to provide services for the commercialisation of knowledge and on spin-offs in 7 cases out of 10.

6. Nearly all universities highlight positive effects in relation to academia-industry mobility and post-degree training (see below: "emerging trends and innovation pathways").

***What are the long-term results over generations of FPs for participating universities?***

Overall, the analyses confirm what the literature suggests on long-term results in terms of:

1. Strengthening scientific productivity (see above "why some of the universities have a higher share of the total researchers that are active and successful").

2. Commercialisation of knowledge and technology transfer activities (see above "effects of university participation" and below "emerging trends and pathways to innovation").

3. Network formation, including industry-university cooperation (literature review, statistics on the participation of universities in FPs).

***What are the impacts on scientific and academic excellence?***

1. The scientific standing of the publications stemming from the analysed projects is remarkably above average, as shown by the number of citations received and the impact factor (IF) of the scientific journals in which they have been published: 69.7% of scientific publications from university projects are published in relatively high-quality journals; publications associated with projects worth more than € 5 million receive, on average, a number of citations that is well above the mean (average citations received: 3.95) and are published in

high IF journals (average journal IF over 3 years: 4.74).

2. More than 30% of the respondents, in the sample of top European universities, report positive effects of FP participation on the quality and quantity of scientific outputs.

3. Most of the top European Universities highlighted an increase in and strengthening of external collaborations (score: 4.4 on a 5-point scale), improved reputation (score: 4.1) and increased number of applications for visiting professors' and for PhD courses (score: 3.7).

***What are the emerging trends and pathways to innovation?***

The effects on knowledge commercialisation and creation of new firms are positive while the patenting output seems poor:

1. 83% of the universities covered in the case studies highlight that participation in the FP7 had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge.

2. 70% of the organisations highlight a positive effect on incubation of spin-offs.

3. On the other hand, the patenting output of the projects is quite low: 499 projects out of 19,257 with at least 1 declared patent, 1,293 total patents.

***What are the findings when looking at participation vs. non-participation?***

A survey of unsuccessful FP7 applications highlighted that:

1. Half of the applicants are dissatisfied with the feedback and 61% do not agree with the final evaluation.

2. A greater interaction with the Commission is considered essential.

3. Despite rejection, 65% of the proposals have been successfully "recycled" (or are going to be recycled in the future), confirming that there are alternative, competing schemes "on the market", often more generous or less strict in terms of requirements which seem able to reward high risk innovation. Indeed, 86% of the universities highlight one or more examples of similar funding schemes, including national, regional and European instruments (e.g. Structural Funds such as ERDF).

4. The costs of applying are an important obstacle to university participation and, as a consequence, a mere increase of available funds will not necessarily lead to greater benefits if such costs are not reduced.

## SUMMARY OF MAIN TASKS

**Study context and purpose**

The study "an analysis of the role and engagement of universities with regard to participation in the framework programmes" was launched by the European Commission – DG RTD – to acquire a better understanding of the motivations for university participation in the Framework Programmes for research and technological development, the patterns of cooperation that emerge and their effects, including differences across countries. The study is aimed at providing evidence on universities in the context of the ex post evaluation of the FP7.

**Literature review**

According to the literature, the institutional characteristics of the universities, the way funding agencies operate and the selection mechanisms adopted to allocate funds are the most relevant features to explain university participation and success rates in obtaining public funding. The literature also confirms a positive relationship between funding and scientific output at both the individual and the macro-levels of analysis. The participation in European scientific networks supported by FPs is vital for the production of knowledge and technology transfer activities. Finally, the literature shows that FPs contributed considerably to the development of cooperation between firms and universities and the creation of research networks (Task 1).

**Patterns of university participation in FPs**

1,250 universities participated in FP7 and coordinated 13,823 projects, considering the EU28 and the most active non-EU countries (Switzerland, Norway and Israel). University participation in FPs has grown significantly over time, independently of the increase in budget over the various generations of programmes. The

number of university projects increased from 8,836 in FP4 to 19,257 in FP7 and the number of projects coordinated by universities has also grown significantly from 5,113 to 13,823. Out of the total number of projects, 57.9% were coordinated by universities in FP4 and this increased to 71.8% in FP7. In this context of increasing university participation there are "winners" and "losers". The former are mostly represented by a limited number of EU15 countries which, together with Switzerland, account for the largest growth registered in resources allotted to universities. In all FPs, the three countries with the greatest number of coordinated projects account for approximately 50% of all projects (53.4% in FP4, 48.4% in FP5, 47.5% in FP6 and 49.1% in FP7) and such percentage increases to more than 60% in the top 5 countries. This significant country-level concentration, although partly mitigated by the cooperative nature of most of the analysed projects, reflects marked differences in the scientific standing and in the capacity to obtain EU funds across countries.

Participation is also highly concentrated among a relatively small set of institutions: the top 20 universities, for the number of participations, receive one fourth of the total EC funding while the top 25 institutions have submitted over 50% of the projects. A small group of universities in EU13 countries detain a high record of granted projects: 5 participants have obtained more than 100 projects and 15 participants have obtained more than 50 projects. Another aspect of concentration is that approximately one fourth of the universities received little money: less than € 250,000 during FP7.

The share of international cooperation projects, involving more than 5 countries, varies significantly across countries. For instance, in the FP7, it is lowest in the United Kingdom and Israel (respectively 37.2% and 27.2% of total projects) and highest in Eastern European countries such as Slovakia (75.3%) and Estonia (74.8%). The social network analysis highlights the presence of strong links between a set of central universities and a relatively small group of universities characterised by a high participation performance. These act as knowledge hubs which interact also with more peripheral nodes of the network (Task 2).

**Outputs of university projects**

22.4% of the university projects have at least one associated scientific publication. Even though projects vary considerably in terms of scientific productivity, the data on the distribution of publications in terms of quality of the journals and of citations received suggest a remarkable above average scientific quality of the publications: 69.7% of the nearly 40,000 articles resulting from university projects (excluding IDEAS programme) are published in relatively high-quality journals and only 2.3% are published in relatively low-quality journals. A separate analysis of 37,169 publications stemming from 2,713 IDEAS projects, between 2008 and 2013, highlighted that more than 600 publications ended up in top multidisciplinary journals (e.g. Science, Nature and PNAS). Data also reveal that publications from larger projects (> € 5 million) have on average a higher quality, as reflected by the number of citations received and the impact factor of the scientific journals.

The patenting output of the funded FP7 projects appears limited, considering the aggregated EU financial support. Only about 2.6% of the analysed university projects report at least one patent application. As can be expected, patents mostly appear when there is interaction with companies (Task 3).

**Case studies of individual universities: motivations, collaborations, innovation pathways**

75 case studies of individual institutions, covering the EU Member States and three non-EU countries (Switzerland, Norway and Israel), explore the main drivers for universities participation, and provide an analysis of industry–university collaboration as well as of selected features of the pathways to innovation. The analysis highlighted that the motivation to improve competitiveness, reputation and quality represents the most important driver for the engagement. Financial needs are another key driver (they are ranked 1st by 35% of the universities covered in the case studies) but FPs

are not the only option available to carry out high quality research, as the majority of the universities identified one or more examples of equivalent funding schemes, including national, regional and European instruments. There are "exogenous" and "endogenous" obstacles to participation. The former are mostly related to the costs of applying which are considered too high, the latter are related to internal capacities and competences (e.g. lack of time by researchers, the difficulty of dealing with administrative issues and bureaucracy). An important consequence of exogenous obstacles is that a mere increase of available funds to promote R&D will not necessarily lead to greater benefits if application costs are not curbed. 90% of the universities covered in the case studies have a dedicated support structure to aid participation. Despite the help from these structures, the limited time of researchers is still considered a big constraint. Universities are very positive in relation to the effects of participation on cooperation with other research organisations and with firms, on post-degree training as well as on academia-industry mobility. They point out that FPs boosted cooperation with other research organisations as well as industry and that cooperation activities established thanks to the EU programmes are on average medium-long term. Over 80% of the universities covered in the case studies believe that participation in the FP7 had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge and two thirds of them highlight a positive effect on incubation of spin-offs. However, only a minor share of universities seems able to provide quantitative evidence (e.g. number of spin-offs created in relation to FP projects). The assessment of the effect of participation in FPs on patenting activities is not positive but the general lack of IPR data makes it impossible to go beyond perceptions and qualitative assessments (Task 4).

**Europe's top research universities**

25 case studies were carried out on top ranking research universities in Europe, selected on the basis of: the number of participations in the different generations of FPs (with a focus on FP7 and FP6); the standing of the organization in terms of research activities; the positioning in university rankings. A geographical representation was pursued as well as a balanced coverage of generalist and technical universities. The data analysis also highlights that the sample is not as homogeneous as expected. There is a small group of outstanding universities, located in northern and central Europe that is characterized by: i) stability and high positioning in the rankings; ii) excellence and collaboration in knowledge production; iii) a networking strategy aimed at linking similar high-level performers. These universities rank at the top level in terms of number of projects and amount of EU funding. Another set of universities, mainly located in Italy, Spain and France, shows good participation results but are far from the former group. Nonetheless, these groups have some features in common: a determination to reinforce their international standing in terms of top-cited publications, fostering international networking, and enhancing participation in FPs. The positive impact on the quality and quantity of scientific outputs (ranked 1$^{st}$ by nearly 35% of the organisations), as well as the enhancement of scientific reputation and of international competitiveness (ranked 1$^{st}$ by 25% of the universities) are the most important motivations driving the participation in FPs. The positive effects on collaboration opportunities which participation is likely to generate are also very important, especially for ERC and Marie Curie programmes, which support high risk and innovative research, fostering new knowledge development. All the top research universities have a specific structure and staff dedicated to supporting participation in FPs. Most of them report that there is a strategy, generally oriented towards strengthening internationalisation of research activities but not directly focused on reinforcing involvement in FPs. The burdening effect of FPs bureaucracy is highlighted by most of the respondents, and in this respect there is a significant convergence with the other universities covered in the case studies. Participation in FPs is reported to strengthen international collaborations, internal and cross-

disciplinary collaborations, and also provide opportunities for PhD training. The main outcomes of collaboration are increasing publications in high ranked journals, prestige, reputation, career rewards and, to a much more limited extent, patents. Unlike other universities, FPs impact on industry-academic collaborations is generally low in top research organisations, this being mostly dependent on the presence of national policies supporting joint labs. The effects of participation on innovation and on technology transfer activities do not emerge clearly, or it is not easy to relate them to FPs projects (Task 5).

**Participation vs. non-participation: a survey of rejected proposals**

An analysis of "non-participation" was carried out on the basis of a survey of rejected FP7 university proposals. The survey was aimed at remedying the lack of information on this issue and the analysis allowed a first exploration of the reasons for rejection, adequacy of the selection process, path of non-successful applications, features and results of the revised projects. This restricted but at the same time fresh and unprecedented evidence makes it possible for the policy maker to draw some useful conclusions on the effectiveness of project selection. The main reasons for rejecting the proposals are related to the scientific and technological contents of the projects in approx. 77% of the cases. Approximately half of the applicants are very unsatisfied with the project evaluation due to brief and superficial feedback, considering the great deal of work which was necessary to put the bids together. According to the respondents, the selection process would benefit from some improvements such as more transparency, full reviews made available, information on the background of the reviewers, more interaction between evaluators and applicants. 61% of the applicants disagree with the final evaluation and believe that the evaluation was not useful to improve the proposal.

Approximately 35% of the projects were abandoned, following the negative assessment within FP7, while the large majority, about 65%, were re-used. In about 42% of the cases the project was submitted in full or in part to another call or self-financed. Most of the successfully re-used projects were submitted to Horizon 2020 (50%), followed by national and regional calls (35.7%). The survey highlighted that there are alternative often more generous schemes with less strict requirements but also more transparent that seem able to reward high risk innovation. Rejected proposals which are re-used are not necessarily downscaled in terms of costs but, on the contrary, their scope and size is often increased and this seems to be unrelated to the feedback received from FP7 reviewers (Task 6).

**Concluding remarks and policy implications**

This study indicates that university participation in European FPs and the corresponding funding is concentrated in some countries and organisations. Leadership is also stable, meaning that rankings have not changed significantly over the various generations of FPs.

As highlighted previously, while motives for participating are similar across countries and universities, the reasons behind the persistent success of some players are mostly related to accumulated experience, quality of support staff and of research, which are linked to the wider national contexts. Considering the quality of the projects' outcomes that emerges from the analysis of publications, it is fairly certain that the objective to promote excellence was, to a varying degree, achieved. The FPs could have done more to reduce the regional variation in research and innovation performance, given the highlighted concentration patterns. Free circulation of knowledge outside well-established, long standing linkages among strong research intensive universities could have been also better facilitated in the FPs (Task 8).

This study also suggests further research directions, such as:

- Comprehensively assessing the impact of policy on the quality of university scientific and technological outputs (beyond publications), using appropriate control samples.

- Assessing the impact of policy on specific industries and knowledge areas by mapping university granted projects by scientific/technological domains.
- Mapping best practices which explain university success (e.g. training, support services, infrastructures) and identifying measures to facilitate their up-take and the entry of new players.
- Exploring non-participation of universities further, based on the evidence that emerged from this report.
- Assessing the EU internal brain drain and measuring the direct and indirect effects on sending and receiving countries.
- Exploring alignment of EU-level and national policy supporting universities, to highlight synergies or substitution effects and whether these depend on national policy contexts.

# 1 Introduction

## 1.1 Purpose of the study

This is the Draft Final Report of the study "an analysis of the role and engagement of universities with regard to participation in the framework programmes". The study aims to identify and contribute to better understanding of the motivations for university participation in the FPs, patterns and new trends of cooperation that emerge as result of FP participation and the effects of university participation in the FPs, including differences across countries.

The report provides a comprehensive overview of universities participation in the Framework Programmes (FPs). In particular, university participation patterns are observed at different levels of breakdown in order to provide evidence on differences across countries, Specific Programmes, thematic areas and funding schemes. Moreover, an analysis of scientific outputs and a networks analysis of universities participation in FP7 is also included.

Furthermore, the report offers a comparative overview of the different FPs along the dimensions of analysis that can be significantly compared in time.

All data on projects and participants used in the report are drawn from the External Common Research Data (eCORDA) warehouse, which reports statistical information on FP6 and FP7 proposals and granted projects as of October 2014. For the quantitative analysis of participations in FP5 and FP4, and for the network analysis of FP6, the study relies on information from the EUPRO database. The data on the scientific publications come from the EC SESAM database and from other sources including Thomson Web of Science and SCImago Journal rank database.

The statistical analysis of FPs participation patterns is complemented with a rich set of qualitative data derived from 100 case studies of selected Universities across EU countries. Such case studies are meant to provide insights on the specific drivers, obstacles and effects of the participation in the EU FPS.

75 short case studies of individual institutions (Section 4 and Annex 1), covering all the EU Member States and three extra EU countries, combine quantitative secondary data (e.g. eCORDA, ETER) and quali-quantitative information collected by means of an online questionnaire. They explore the main drivers for the engagement of universities in Framework Programmes, provide an analysis of industry–university collaboration as well as of selected features of the pathways to innovation. The unit of analysis is the university and the focus is on their multiple experiences in FP7. The findings from the case studies are cross-analysed to highlight common patterns and draw conclusions on the explored issues.

25 case studies on top research universities (Section 5 and Annex 2), performing at the highest level in EU FP participation, were developed with the aim to deepen the understanding of participation features and their effects, as well as the analysis of positioning of this group of universities in the most relevant global ranking of universities. The questions addressed include: To what extent do Europe's top research universities participate in the framework programmes? What is the nature of their participation? Are they more likely to be project coordinators than non-top universities? The analysis is developed combining the evidence coming from quantitative and qualitative sources in order to provide a wide picture of what features characterize this special group of universities with respect to the others.

Finally, an analysis of "non-participation" was carried based on data on 108 rejected FP7 university proposals, collected through an online survey. The survey aimed at remedying the lack of information on rejections in eCORDA. The analysis allowed a first exploration of reasons of rejection, adequacy of the selection process, path of non-successful applications, features and results of the revised projects. This restricted but at the same time fresh and unprecedented evidence enables to draw some useful conclusions for the policy maker on the effectiveness of project selection.

In the report, the findings of the analysis are discussed in the context of the key objectives and features of the various generations of FPs, which have evolved over time. A summary of the main objectives, features and funding of the different FPs is provided in the first part of chapter 3, as a basis for contextualising the analysis of participation patterns which follows and the concluding chapter.

Even though all FPs (from FP4 to FP7) are covered in the analysis of participation patterns, more details and depth are provided on university involvement in FP7 and on related outputs, given the main purpose of the study and the actual availability of information.

## 1.2 Scope of the study and contents of the report

The study provides descriptive evidence on universities participation in FPs (FP4, FP5, FP6 and FP7) and contributes to shed light on key research questions regarding trends and patterns of universities participation under different perspectives (e.g. per specific programme, per specific thematic area, per funding scheme, per country) and the main motivations for university participation (non-participation) in FPs. Furthermore, it delivers a description of overall figures related to scientific outputs and results in terms of scientific publications and Intellectual Property Rights and evidence on the extent of Europe's top research universities participation in FPs. In this respect, the present study provides useful insights and data elaboration that can feed future analyses and policy discussion but it is important to remark that the analyses are not meant to provide an impact evaluation of EU FP policy.

It is also worth noting that the study provides a diachronic analysis of universities participation over a long time period and across different Framework Programmes. These different FPs, while being linked and coherent to a certain extent, have necessarily different structures and objectives. For this reason, the study analyses the different FPs separately. Only for some specific indicators we provide a comparative overview. The analysis of scientific outputs of the IDEAS programme (including ERC) is also presented in a separate paragraph. As the study does not apply methodologies for impact evaluation, the report provides information on projects scientific outputs (publications and IPRs) made available by the European Commission while does not include information on control samples and groups.

Even though the findings from the case studies cannot be obviously generalised, the individual cases allow to gather information on features and issues that quantitative data do not cover such as motives for participating, obstacles, strategies, features of collaborations, examples of approaches towards innovation and technology transfer, perceived effects of projects, suggestions on how to improve support instruments etc. Despite case studies are based on information and data collected mostly from rectors and research strategy offices, the views expressed should not be considered as official positions of the universities but rather they reflect the opinion and experience of respondents.

As regards the case studies of the 25 top research universities, due to the approach required by the tender, the evidences collected reflect strategies, motivations and impact as they are monitored and perceived at the central government level of the universities analysed; it means that the study does not analyse different strategies, motivations and actual impact at the "shop floor" level, or at the middle-governance level (Faculties or Departments). As a result, several aspects related to the EU FP participation may remain hidden, but the evidence collected provide very useful starting points for investigating motivations and impact of EU FP participation in high performing European universities.

The study covers all Member States and 3 Associated Countries (Switzerland, Norway and

Israel).

The rest of the report is structured as follows:

- Section 2 (Task 1) provides a detailed assessment of the extant literature on the motivations and the long-term effects of universities participation in publicly sponsored projects.

- Statistics on the participation of universities in the Framework Programmes are provided in Section 3 (Task 2 and 3). More precisely, Section 3.2 describes the methodology adopted for data cleaning and treatment. Section 3.3 to 3.6 provide detailed statistics on the different FPs including a network analysis while in Section 3.7 we offer a synthetic comparative analysis across FPs and highlight the key findings.
- Section 4 describes the main findings of a cross case analysis of 75 universities covered in the individual cases (Task 4) which are annexed to this report (Annex 1).
- Section 5 provides the results of a horizontal analysis of the 25 Top Universities which were analysed in depth (as part of Task 5). The individual cases are presented in Annex 2.
- Section 6 summarise the results of the analysis of non-participants (Task 6), based on an online survey of over hundred rejected proposals.
- Section 7 (Task 8) provides preliminary conclusions which cover all the study tasks.
- Section 8 includes a list of references.
- Finally, three annexes are attached:
  - Annex 1 – 75 case studies of individual universities (submitted as separate file);
  - Annex 2 – 25 case studies of Top European universities (submitted as separate file);
  - Annex 3 – Protocol of the interviews of Top EU universities.

# 2 Task 1 – Literature review

## 2.1 Overview

Research activity requires funding, often in large amounts. The way research carried out in universities is funded and who is the sponsor can have a major influence on the balance between excellence and utility of research activities (D'Este et al., 2013).

Even if public funding still represents the main source of financing for university research, during the past two decades the amount of government funding to sponsor academic research has gradually decreased (OECD, 2005). At the same time, there have been a number of changes that have affected public funding. Government core funds have been increasingly allocated based on performance indicators, and the allocation procedures adopted by funding agencies have been become more mission-oriented and contract-based (e.g. OECD, 2005; Skoie, 1996). These new trends in the allocation of public money have been aimed at improving the efficiency of research funds, increasing the accountability of universities and lowering institutional costs.

While many countries in Europe are in the process of rethinking the role (and funding) of research institutions and universities within their national innovation systems (Arnold et al., 2006), a growing share of the income of European universities is today generated through industrial and EU funding (Muscio et al., 2013).

Interestingly, an increasing proportion of public funding granted by European authorities has been directed at cooperative research networks rather than at individual organisations. The participation of universities in EU sponsored R&D cooperative projects has become crucial, especially in the context of increasing importance of research networks and of the internationalisation of the research. This is confirmed by recent data highlighting that the organizations that participated in EU FPs with the highest frequency are Higher and Secondary Education Institutions (HES), especially universities. In particular, HES remain the main beneficiaries of FP7, in terms of both numbers of applicants and EU funding: 2,251 HES participating in the FP7 at least once over the 2007-2013 period. The increasing participation of universities in the FPs carries important consequences both for the funding structure of universities themselves, and for the process of network formation and internationalisation of research.

## 2.2 Methodology

We provide a detailed assessment of the extant literature exploring the motivations/incentives of the participation of universities in publicly sponsored projects and the long-term effects that such participation is envisaged to have on scientific productivity, commercialization of knowledge, technology transfer activities and network formation. The assessment and synthesis of extant evidence should make this field of research more accessible to scholars, contributing to its diffusion among the scientific community.

In order to select the relevant literature to be reviewed we have adopted a three-stage exploration process. First, we have conducted an extensive search in the titles and abstracts of published, peer-reviewed articles in the main electronic reference retrieval service Scopus, using a series of keywords that cover the topics under scrutiny. The selected keywords have been the following ones: European funding, EU Framework Programmes, universities participation, scientific productivity, networks, technology transfer, sponsored projects. We have then selected all the relevant research published in academic journals along a proper time frame (from 1990 to 2014). In this phase, we have thus tracked

all the articles pertaining to the broadly defined topic on EU funding to universities, academic scientific productivity, university engagement in technology transfer activities and network formation from 1990s to the most recent years.

Second, we have performed a manual screening of the papers identified in order to validate the search terms and to filter the preliminary list according to fit and thus remove all the articles that did not fulfil the research topic.

Third, we have classified the selected papers into four major research streams that have emerged in the last decades:

(i) determinants of the participation of universities in publicly sponsored projects;
(ii) effects of public funding on the scientific productivity of universities and researchers;
(iii) effects of public funding on the commercialization of knowledge and technology transfer activities;
(iv) effects of public funding on collaborative networks formation.

Finally, we have read and analysed each selected article to create a detailed database in which we have coded the following information: (1) author name(s), (2) article title and journal of publication, (3) research question(s), (4) data used, (5) research methods, and (6) findings.

## 2.3 Evidence from the literature

The main theoretical and empirical evidence is synthetized hereafter along the four identified research streams and summarized in Table 1.

(i) Determinants of the participation of universities in publicly sponsored projects

In the last 25 years, universities have overall increased their share of participation in EU sponsored FPs (Geuna, 1996). The participation in the different FPs varies depending on whether the research system of a country relies primarily on universities or on public research centres. Ortega and Aguillo (2010), using the principal component analysis methodology, show that France, Spain and post-communist countries have research systems that rest primarily on government research centres, while universities are the principal actor performing research in United Kingdom, Switzerland, and Sweden. These patterns are influencing the distribution of the different types of participating organizations in the FPs.

The literature has identified several factors that are useful to explain the participation of universities in publicly sponsored projects. Among other factors, the institutional characteristics of the universities, the way of operating of funding agencies, and the selection mechanisms adopted to allocate funds, have been found to be relevant issues explaining university participation in publicly sponsored projects and success rates in getting the funding. Concerning the characteristics of universities, important elements determining the participation to publicly sponsored projects are the size of the university, its geographical localization, scientific research productivity, collaborative networks and scientific orientation. In particular, several scholarly papers have focused on network collaboration as the main factor determining patterns of participation in EU-FPs (Breschi and Cusmano, 2004; Autant-Bernard et al., 2007; Heller-Schuh et al., 2011; Hoekman et al.,2013). The structural properties of collaborative networks have been found to display a high level of stability, so that the same organisations occupy central positions over time (Roediger-Schluga and Barber, 2008; Paier and Scherngell, 2011) and play the role of large hubs that attract new partners to the network (Ortega and Aguillo, 2010). Moreover, universities which cooperate with industry tend to participate in larger and more long-term projects (Caloghirou et al., 2001; Scherngell and Barber, 2011). The presence of geographical, institutional, cultural and technological barriers has also been found to affect the probability that cross-region collaborations among

universities take place under EU FPs (Scherngell and Barber, 2011; Scherngell and Lata, 2013), although geographical distance effects are less important for public research collaborations (Scherngell et al., 2009; Scherngell and Barber, 2011).

Arora and Gambardella (1996) show that the past performance of researchers affects both the probability of being selected for funding and the amount of the granted budget. By disaggregating between different typologies of grants, Grimpe (2012) shows that scientist productivity (measured in terms of publication and patent stock) is a determinant only for obtaining foundation and industry grants, while it does not have any effect in relation to obtaining a FP6 or a government award. Recently, Haller and Welch (2014), reporting the results of a survey of academic scientists in a sample of US universities, highlight that both larger collaborative networks and scientists with high illusion of control and overconfidence are associated with more funding awards.

A major role is also played by the institutional reputation of the university itself, which constitutes relevant information for the funding agency in case of missing or incomplete information on specific researchers or research groups (Geuna, 1996; 1998). Studies have shown that the most reputed international universities participate more in EU FPs and especially in areas close to the knowledge frontier, such as life sciences, nanotechnology and information society (Heller- Schuh et al., 2011; Nokkala et al., 2011; Annerberg et al. 2010). Another important aspect is represented by the presence of specialized administrative units for supporting fund acquisition (Laudel, 2006).

Geuna (1996) investigates why some universities succeed in receiving EU funding and others do not and the reasons for repeated participations, by focusing on the EU selection process. He develops a theoretical framework in which he underlines that cumulative and self-reinforcement mechanisms (e.g. centres of excellence tend to attract high quality researchers that are increasing the chances of the centre to receive external funding) are closely considered by EU institutions in addition to the quality of the proposals. The author tests the theoretical framework using a dataset of universities participating in EU-funded R&D cooperative projects under FPs 1, 2 and 3. The empirical analysis shows that the participations distribution is extremely skewed and that only few universities have achieved a high number of participations. The EU selection process seems to be based upon quality features (institutional reputation) and other cumulative and self-reinforcement mechanisms, together with other priorities set to respond to the EC policy goals (e.g. strengthening the capabilities of the peripheral regions).

Geuna (1998), using a dataset of the total population of universities in the EU countries in 1992, studies the factors that influence university participation in EU-funded R&D cooperative projects. The author finds that scientific research productivity influences both the probability of joining a EU-funded R&D cooperative project and the number of times an institution has participated in these projects, while research size has a positive influence only on the latter. In addition, institutions localized in less favoured regions and early entrants in the system tend to have advantages in repeated participation, while the lack of practice in competitive fund raising of the university system is found to have a negative influence on the propensity to take part in EU-funded R&D cooperative projects.

The analysis of the patterns of participation of universities in the EU Framework Programs and the association with their characteristics, country and geographical effects has been investigated by Lepori et al. (2015), who analyse a sample of 2,235 Higher Education Institutions participating in EU FPs. The authors find a high concentration of EU FP participation in a small group of HEIs with high reputation. Moreover, results show that the number of participations tends to increase proportionally to organizational size, and is strongly influenced by international reputation.

(ii) <u>Effects of public funding on the scientific productivity of universities and researchers</u>

A number of studies have attempted to assess the relationship between the levels of funding and the scientific productivity of academic researchers (Arora and Gambardella, 1996; Godin, 2003) using both

quantitative and qualitative approaches (Bloch et al., 2014). It is generally believed that participation in EU-funded research projects may have an important impact on the future research potential of the participants, by enhancing researcher productivity, fostering research collaborations and facilitating new research directions (see Stephan, 1996 for a general discussion on these issues and Ebadi and Schiffauerova, 2013 for a review of the literature). In a world-scale study on scientific publications at country level, Ovalle-Perandones et al. (2013) find that in 2011 almost 75% of the EU-27 articles on nanotechnology benefited from funding, but only about one-fourth were explicitly funded by the EU. Vanecek et al. (2010) analyse the impact of the FP5 and FP6 in Czech Republic. They show that publications resulting from the FP5 and FP6 projects have 42% higher mean citation rate and 77% more EU25 collaborations than the Czech standards. Moreover, the influence of FP participation on new research directions is striking because after the project start, participating teams tend to publish papers in new fields.

However, the positive effects exerted by funding on scientific productivity have been found to vary with the funding instruments and with the size of the research consortia (Arnold et al., 2005; Breschi and Malerba, 2011). Breschi and Malerba (2011) analyse a large sample of articles and patents resulting from EU FP6 funded projects. They find that the scientific productivity increases with the number of participants following a U-inverted shape, thereby indicating the existence of decreasing marginal returns to an increase in the size of research consortia. They also show that under FP6 the funding instrument Integrated Projects perform less well in terms of scientific output than both STRePs and Networks of Excellence.

From the perspective of individual researchers, there is wide evidence that research grants have a positive effect on individual productivity (Arora and Gambardella, 1996; Godin, 2003; Arora et al., 1998;), although the intensity of this impact varies depending on the stage of the career (Arora and Gambardella, 1996), on the amount of funding (Godin, 2003) and on the past research performance (Arora et al., 1998). Research grants are also found to influence the career paths of grant recipients (Bloch et al., 2014). Arora and Gambardella (1996) study the impact of the National Science Foundation (NSF) funding on the publications volumes of US economists between 1985 and 1990 and the extent to which these effects differ among researchers at different stages of their career. They find that NSF has a limited positive impact on scientific output, although the effect is more pronounced for researchers at earlier stages of their career. Godin (2003) argues that the research productivity grows with the level of funding. The author also observes that the junior researchers' productivity increases steadily as soon as they obtain research funding and over time tends to compare favourably with that of established researchers. At the same time, the productivity of researchers whose research grant applications have been rejected tends to stagnate subsequently.

Arora et al. (1998), employing a large dataset of research groups in biotechnology and bio-instrumentation fields that applied for funding between 1989–1993 by the Italian National Research Council (CNR), analyse the linkage between funding and publication performance. They find that the aggregate publication output may vary with the distribution of research grants, being elasticity of quality-adjusted publications with respect to the budget higher for a small fraction of researchers with a high quality track record of publications. Moreover, superior performance on the part of the group's leader in the past increases the probability of the research proposal being selected.

The positive relationship between funding and scientific output is also confirmed at macro-levels of analysis. Auranen and Nieminen (2010) analyse data on the competitiveness of the funding environment in eight countries and their publication output in 2000, finding that there is no straightforward relationship between these two measures. While UK, Australia and Finland appear more efficient in terms of competitive funding environment, they have not been able to increase their efficiency in publication

output, while others (Sweden and Germany) reveal a better publication performance despite the relatively low level of competition for funding.

Another aspect closely related to this stream of literature is the linkage between public funding, research collaborations and scientific productivity (see for a review on research collaborations in universities Bozeman et al., 2013). Studies in this field have found contrasting results on the impact of funded collaboration on research productivity. Cummings and Kiesler (2007) analyse the impact of collaborative research funded by the NSF on the scientific productivity of universities. They find that a larger number of universities involved in collaborative projects resulted in fewer coordination activities, which in turn led to fewer research outcomes.

Defazio et al. (2009) examine the relationships between the collaborative incentives and researcher productivity in the context of EU-funded research networks (under the Research Training Network Program (RTN) of the FP4). Employing a panel of 294 researchers in 39 EU research networks over a 15-year period, the authors find that while the impact of funding on productivity is generally positive, the overall impact of collaboration within the funded networks is weak. Collaboration during the funding period does not result in an increase of research productivity; however, in the post-funding stage, the impact of collaboration on the productivity is both positive and significant. An important conclusion from the study is that while collaborations (formed specifically for exploiting funding opportunities) are not effective at improving researcher productivity in the short term, they still contribute to promoting effective collaborations in the longer term.

(iii) Effects of public funding on the commercialization of knowledge and technology transfer activities

Over the past thirty years, knowledge transfer activities have started to be considered as a natural stage in the evolution of the modern university, in addition to the more traditional mandates of education and research. To support the commercialisation of knowledge, many universities have established specialised structures, such as technology transfer offices, science parks and incubators. Academic researchers have started to transfer academic knowledge into the industrial domain by collaborating with non-academic organisations in more formal or informal ways. In particular, prior works document that the entrepreneurial orientation of universities and the existence and efficiency of technology transfer offices positively affect the ability to jointly develop innovation outputs with companies (see Rothaermel et al., 2007 for a literature review).

However, the promotion of this new mission of universities has raised policy concerns about the changing nature of universities and their funding options. Several scholars have started to assess the potential advantages and disadvantages that such a shift can imply on the way universities create and transfer knowledge. As universities have become increasingly involved in knowledge transfer activities, a scientific debate has emerged on the potential trade-off between the original mission of universities and their new mandates.

Some observers have been convinced that such changes may lead to unintended negative consequences, especially in terms of basic research outputs and academic activities (Geuna, 2001; Florida and Cohen, 1999). An excessive emphasis on applied research raises in fact the doubt of a lack of effort in basic research sufficient to provide a satisfactory technology change in the long period (Geuna, 1999). Strehl et al. (2007) list among the negative effects of such shift the neglect of basic R&D, lower quality of research and less variety in teaching courses. Similar conclusions are drawn by Slaughter and Rhoades (1996), Vavakova (1998) and Geuna (2001).

Some other studies have claimed, in contrast, that researchers are able to balance scientific and extra-scientific interests. The convergence between academic and corporate research can imply higher flexibility and autonomy for researchers (Benner and Sandström, 2000). As a consequence, funding shifts and the new university mission should not negatively affect the academic activities of researchers

(Behrens and Gray, 2001; Van Looy et al., 2004), but both universities and businesses may benefit from collaboration (Gulbrandsen and Smeby, 2005).

The extent to which public funding contributes to the commercialization of knowledge and technology transfer activities has been recently investigated. From a macro-economic perspective, the participation in European scientific networks supported by FPs has been found to matter for the production of knowledge (Di Cagno et al., 2014). Moreover, recent literature has found some evidence in favour of a positive impact of public funding on technology or knowledge transfer activities, especially for high levels of contract funding (D'Este et al., 2003). Bozeman et al. (2013) find that federally-sponsored grants have a moderate impact in increasing work with industry. However, academic researchers with more grants and contracts have a greater propensity for industrial involvement.

Rakhmatullin and Brennan (2014) explore whether the involvement into formal networking programs (COST Action in FP7) enable participants to achieve innovation outcomes. The results suggest that some forms of industrial application are achieved by 40% of the participants, while a more limited number of participants (10%) are granted patents. Muscio et al. (2013) examine to what extent public funding affects technology transfer activities, by assessing whether public funding is a complement or substitute of private funding. The authors, in a study of Italian university departments engaged in research in the Engineering and Physical Sciences, provide evidence that government funding to universities complements funding from research contracts and consulting, contributing to increasing universities' collaboration with industry and activating knowledge transfer processes. Relying on a sample of more than 2,000 scientists in five Spanish universities, who have been awarded public funding or have been principal investigators in consultancy activities, D'Este et al. (2013) show that international competitive funding is negatively related with the amount of monetary income from consulting contracts. However, the effect of international competitive funding becomes positive when the size of funding is considered (for moderate and high levels of contract funding).

(iv) Effects of public funding on collaborative networks formation

Beginning from FP1, universities have increased their share of participation in collaborative projects, together with other universities and with public or private research centres (Geuna, 1996; Protogerou et al., 2010). Available evidence indicates that EU sponsored FPs have made an important contribution to the development of cooperation between firms and universities and the formation of research networks (Geuna, 1998; Larédo, 1998; Protogerou et al., 2010), with some exceptions (Teirlinck and Spithoven, 2012). Research networks funded by FPs are characterised by a significant degree of institutional and international diversity (Pandza et al., 2011), are facilitated by prior acquaintance, thematic and geographical proximity (Paier and Scherngell, 2011). However, the strength of the collaborative linkages may depend upon the conditions of the local economy (Azagra-Caro et al., 2013), the funding scheme that backs their formation (Protogerou et al., 2010) and the geographical distance (Paier and Scherngell, 2011; Scherngell and Barber, 2011). Protogerou et al. (2010) examine the dynamics and evolution of collaborative networks emerging in the context of EU FPs in the area of Information Society Technologies. They point out that universities and research institutes tend to have a more active and prominent role in the networks examined and that the introduction of new instruments in FP6 has considerably increased interconnectivity compared with the previous FPs. Such results are confirmed by a more recent work, in which the authors add to the previous analysis the FP7 (Protogerou et al., 2013). Scherngell and Barber (2011) compare the spatial characteristics of industrial R&D networks to those of public research R&D networks (i.e. universities and research organisations), using data on joint research projects funded by FP5. They provide evidence that geographical factors significantly affect patterns of industrial R&D collaboration, while in the public research sector effects of geography are much smaller.

Hoekman et al. (2013) study how FP funding affects subsequent co-publication activity between regions. They find that the effect of financing on co-publication activity is especially relevant for regional pairs that did not intensively co-publish before participation and when involving scientifically lagging regions.

Pandza et al. (2011) study the institutional and international diversity in emerging nanotechnology research networks funded by EU FPs. They show that nanotechnology research networks are characterized by a significant degree of collaborative diversity, thus supporting the view that European institutional arrangements are effective in their proposed aim. The study by Azagra-Caro et al. (2013) looks at the geography of research networks from another perspective, by analysing universities' participation in the EU's FP6. The authors find that universities from regions whose firms have low absorptive capacity participate more often in FP6 projects with firms outside the region. Similarly, Paier and Scherngell (2011) show that collaboration choices in EU-FPs are primarily facilitated by relational effects (prior acquaintance), thematic and geographical proximity.

Teirlinck and Spithoven (2012) analyse firm level data provided by the OECD bi-annual business R&D surveys of 2004 and 2006. Contrary to common thinking, they find that only funding by regional governments fosters the instalment of industry-science research cooperation. Instead, public funding provided by the EU FPs does not exert any impact on the instalment of industry-science cooperation, neither with universities nor with public research centers. The authors attribute this result to the fact that EU funding is targeted at firms that are already cooperating and does not favour the set-up of new cooperation. As pointed out by Hoekman and Frenken (2014), Europe remains a loosely connected group of national and regional science systems, despite efforts to integrate scientific research activities across borders. This is due to the fact that European research budgets still remain a minor funding source when compared with national and regional research budgets.

The following table summarises the main features of the most relevant literature contributions, listed according to the four research streams described above.

**Table 1 – Literature review**

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| i | Geuna, A. | Determinants of university participation in EU-funded R&D cooperative projects. 1998. Research Policy, 26, 677–687 | What are the factors that influence university participation in R&D cooperative projects supported by the EU? | Data set of universities participating in EU-funded R&D cooperative projects under FPs 1, 2 and 3. Data on number of researchers and published paper per participating institution. | Tobit model. Dependent variable: number of times a university participated in projects. Two-equation model: first equation is a probit model on the probability of the university joining an EU-funded R&D cooperative project; second equation is a truncated regression model for the number of times a university participated in these cooperative projects. | The probability of taking part in an EU-funded R&D project depends primarily on the scientific research productivity of the university. The factors that explain the number of times a university participated in a project include scientific research productivity, size, and differences among countries and scientific fields. |
| i | Geuna, A. | The participation of higher education institutions in Community Framework Programmes. 1996. Science and Public Policy 23, 287–296. | What are the mechanisms that are driving the participants' selection into the Framework Programmes? | Data set of universities participating in EU-funded R&D cooperative projects under FPs 1, 2 and 3. | Theoretical framework on the mechanisms that are driving the participants' selection into the Framework Programmes.<br>Descriptive statistics of universities participating in EU-funded R&D cooperative projects under FPs 1, 2 and 3 | The participations distribution is extremely skewed. Only few universities have achieved a high number of participations into FPs.<br>The selection process is influenced by cumulative and self-reinforcement mechanisms. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| i | Ortega, J.L, Aguillo, I.F | Describing national science and technology systems through a multivariate approach: country participation in the 6th Framework Programmes. 2010. Scientometrics, 84, 321–330 | What is the distribution of different types of participating organizations in the health thematic area of the 6th Framework Programme? | Database on the organizations participant in the projects belong to the "Life sciences, genomics and biotechnology for health" thematic area from the 6th Framework Programme of the EU. | Principal Component Analysis. | France, Spain and post-communist countries have research systems that rest primarily on government research centres, while universities are the principal actor performing research in United Kingdom, Switzerland, and Sweden. |
| i | Haller, M.K., Welch, E.W. | 2014. Entrepreneurial behavior of academic scientists: Network and cognitive determinants of commitment to grant submissions and award outcomes. 2014. Entrepreneurship Theory and Practice, 807-831 | To what extent network size and cognitive determinants are affecting award outcomes? | Survey of 1,262 academic scientists in 151 universities in the US. | Negative binomial regression. Dependent variable: number of submitted proposals that received awards | Larger collaborative networks and scientists with high illusion of control and overconfidence are associated with more awards. |
| i | Grimpe, C. | Extramural research grants and scientists' funding strategies: Beggars cannot be choosers? 2012. Research Policy, 41, 1448–1460 | Is scientific productivity a determinant for the receipt of different types of grants? | Survey among 2797 German scientists. | Multivariate probit model. Dependent variables: probability of the scientists choosing four different types of grants: the FP6, the German government, foundations, and industry. | Scientist productivity (measured in terms of publication and patent stock) is a statistically significant determinant only for obtaining foundation and industry grants, while it is not for an FP6 or government award. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| i | Lepori, B., Veglio V,, Heller-Schuh B., Scherngell T., Barber M. | Participations to European Framework Programs of Higher Education Institutions and their association with organizational characteristics. 2015. Scientometrics, forthcoming | Which HEIs characteristics, country and geographical effects affect the participation of HEIs to EU FPs? | Sample of 2,235 HEIs in 30 countries in Europe (from the European Tertiary Education Register), matched with data on participations in EU-FPs in 2011 using the EUPRO database. | Logistic regression. Dependent variable: probability of at least one participation in 2011.<br>Truncated linear regression Dependent variable: number of participations in the year 2012, | There is a high concentration of EU-FP participation in a small group of HEIs with high reputation. The number of participations tends to increase proportionally to organisational size, and is strongly influenced by international reputation. |
| ii | Auranen O., Nieminen M. | University research funding and publication performance. An international Comparison. 2010. Research Policy, 39, 822–834 | How do the funding environments of university research vary across countries?<br>Are there differences among countries in their publication performance according to the degree of competitiveness of the funding environment? | Data on 8 countries (Australia, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, and the UK) on the mechanisms of government core funding, the development of level and sources of research funding, and publication volumes from the beginning of the 2000s to the mid-2000s. | Conceptual model of input–output orientation of core funding to see the allocation mechanisms for funding. Descriptive statistics on the publication performance and efficiency of university systems in different countries. | There are significant differences in the competitiveness of funding systems, but no straightforward connection between financial incentives and the efficiency of university systems exists. |
| ii | Breschi, S., Malerba, F. | Assessing the scientific and technological output of EU Framework Programmes: evidence from the FP6 projects in the ICT field. Scientometrics, 88:239–257 | What are the determinants of the differences in scientific and technological productivity across FP6 projects? | Sample of articles and patents resulting from EU FP6 funded projects. | Negative binomial model. Dependent variables: number of scientific outputs and number of new patents | The scientific productivity increases with the number of participants following a U-inverted shape. Under FP6 the funding instrument Integrated Projects perform less well in terms of scientific output than both STRePs and Networks of Excellence. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| ii | Godin, B. | The impact of research grants on the productivity and quality of scientific research. INRS Working Paper No. 2003, Ottawa | What is the impact of NSERC funding on the scientific productivity of researchers? | Data on 15,000 researchers receiving funds from the Natural Sciences and Engineering Research Council of Canada between 1990 and 1999. Control sample of not funded researchers. Data on publication performance of researchers. | Descriptive statistics on productivity levels of researchers receiving and not receiving research grants | The research productivity grows with the level of funding. The junior researchers' productivity increases as soon as they obtain funding and over time aligns to that of established researchers. The productivity of not-funded researchers tends to stagnate. |
| ii | Arora, A., Gambardella A. | The impact of NSF support for basic research in economics. 1996. IDEAS Working papers. | What is the impact of NSF funding on the scientific productivity of US economists? Are there differential effects on researchers at different stages of their career? | Data on 1,473 applications to NSF during 1985-1990, 414 of which were awarded a research grant. Data on scientific publications. | OLS (and sample selection) regressions. Dependent variable: number of scientific publications. | NSF has a limited positive impact on average on scientific output, although the effect is more pronounced for researchers at earlier stages of their career. |
| ii | Arora, A., David, P., Gambardella, A. | Reputation and competence in publicly funded science: estimating the effects on research group productivity. 1998. Annales d'Economie et de Statistique, 49/50 | What are the determinants of the publication performance of publicly funded scientific research groups? | Data set on the universe of research groups that applied to a 1989–1993 research programme in biotechnology and bio-instrumentation, sponsored by the Italian National Research Council (CNR). Data on budget granted to each group and on the total number of publications produced. | OLS/GLS regressions. Dependent variables: amount of budget asked, budget granted. OLS and tobit estimates. Dependent variables: publication output. | The average elasticity of research output with respect to the research budget is 0.6; It approaches to 1 for a small fraction of groups led by highly prestigious principal investigators. Past research publication performance is found to have an important effect on expected levels of grant funding. |
| ii | Adams, J.D., Black, G.C., Clemmons, J.R., Stephan, P.E. | Scientific teams and institutional collaborations: evidence from U.S. universities, 1981–1999. 2005. Research Policy, 34, 259–285 | What are the patterns of research collaboration in U.S. universities? | Data on 2.4 million scientific papers written in 110 top U.S. research universities over the period 1981–1999. | OLS regressions. Dependent variables: number of authors per papers, number of papers and number of citations | Private universities and departments whose scientists have earned prestigious awards participate in larger teams, as do departments that have larger amounts of federal funding. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| ii | Bloch, C., Graversen, E.P., Skovgaard Pedersen, H. | Competitive research grants and their impact on career performance. 2014. Minerva 52, 77–96 | Do competitive research grants influence the career advancements of grant recipients? | Applications and awards from the Danish Agency for Science, Technology and Innovation to research projects in Denmark over the period 2001–2007.<br>Data on employment and academic position on all university researchers from the Danish State Employers' Authority, and register data from Statistics Denmark. | Probit model. Dependent variable: likelihood of career advancement | Individual researcher the receipt of a grant can influence both his/her scientific production and career paths. The probability for career advancement in general is about 9 percentage points higher for grant recipients. |
| ii | Cummings, J.N, & Kiesler, S. | Coordination costs and project outcomes in multi-university collaborations. 2007. Research Policy, 36(10), 1620–1634 | What is the impact of funded collaborative research on the scientific productivity of universities? | Data on 491 research collaborations funded by the US National Science Foundation (NSF) and project outcomes. Online survey to assess the coordination activities on each project. | OLS regressions. Dependent variables: project outcomes and publications | A larger number of universities involved in collaborative projects result in fewer research outcomes. Coordination costs are a<br>significant barrier to project success in multi-university collaborations |
| ii | Defazio D., Lockett A., Wright M. | Funding incentives, collaborative dynamics and scientific productivity: Evidence from the EU framework program. 2009. Research Policy 38, 293–305 | Does funding research collaboration improve researcher productivity? | Panel data of 294 researchers in 39 EU research networks in chemistry (funded under the Research Training Network Program (RTN) of the FP4). over a 15-year period. | Arellano-Bond estimator for dynamic panel data. Dependent variable: number of publication per researcher | The impact of funding on productivity is positive, while the overall impact of collaboration within the funded networks is weak. During the period of funding, collaboration does not lead to an increase in research production. In the post-funding period the impact of collaboration on productivity is positive and significant. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| ii | Vanecek J., Fatun M., Albrecht V. | Bibliometric evaluation of the FP-5 and FP-6 results in the Czech Republic. 2010. Scientometrics 83:103–114 | What is the impact of the FP5 and FP6 in the Czech Republic on publications and research directions? | Bibliometric data of the FP publications from the Web of Science (WoS) | Descriptive statistics on the number of citations and EU25 collaborations | Publications resulting from the FP5 and FP6 projects have 42% higher mean citation rate and 77% more EU25 collaborations than the Czech standards. Moreover, after the project start, participating teams tend to publish papers in new fields. |
| iii | Ovalle-Perandones, M.A., Gorraiz, J., Wieland, M., Gumpenberger, C., Olmeda-Gòmez, C. | The influence of European Framework Programmes on scientific collaboration in nanotechnology. 2013. Scientometrics, 97, 59–74 | Have European FPs shaped scientific output in the field of nanotechnology? | Data on publications and collaboration are drawn from Thomson Reuters' Journal Citation Reports, SCImago Journal & Country Rank and from Thomson Reuters' WoS | Bibliometric analysis and social network analysis | Close correlation between funding and increased output and the intensification of collaboration among Member States. In 2011 almost 75% of the EU-27 articles on nanotechnology benefited from funding, but only about one-fourth were explicitly funded by the EU. |
| iii | Rakhmatullin, R., Brennan L. | Facilitating innovation in European research area through pre-competitive EU-funded COST Actions. 2014. Journal of Innovation and Entrepreneurship, 3 (6), 1-20 | Does the involvement into formal networking programs (COST Action in FP7) enable participants to achieve innovation outcomes? | Survey data to COST actions research project participants. | Descriptive statistics on survey responses. | Some forms of industrial application are achieved by 40% of the participants, while a more limited number of participants (10%) are granted patents. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| iii | Muscio A., Quaglione D., Vallanti G. | Does government funding complement or substitute private research funding to universities? 2013. Research Policy, 42, 63– 75 | To what extent government funding affects the external funding options available to universities, in particular those related to research and consulting activities? | Dataset of 1175 university departments in Engineering and Physical Sciences in Italy between 2005–2009, from 59 public Universities. The database provides information on volume and sources of university funding, staff composition, presence university patent office. Data are matched with information on research ratings and geographical characteristics. | Tobit model with the amount of funding raised by university departments as the dependent variable. Probit model on the probability of the Department receiving any private funding. | Government funding to universities complements funding from research contracts and consulting, contributing to increasing universities' collaboration with industry and activating knowledge transfer processes. |
| iii | D'Este, P., Rentocchini, F., Grimaldi, R., Manjarrés-Henríquez, L. | The relationship between research funding and academic consulting: An empirical investigation in the Spanish context. 2013. Technological Forecasting & Social Change, 80, 1535–1545 | What is the impact of different sources of research funding on academic consulting activities? | Sample of 2603 scientists from 5 Spanish universities, who have been awarded public funding or have been principal investigators in activities contracted by external agents, over the period 1999–2004. | Linear and non-linear panel data models, which control for unobserved heterogeneity and censoring in the data. | We find that externally contracted research is positively related to the amount of monetary income from consulting contracts, but that international competitive funding has a negative effect. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| iii | Di Cagno, D., Fabrizi, A., Meliciani, V. | The impact of participation in European joint research projects on knowledge creation and economic growth. 2014. Journal of Technology Transfer, 39, 836–858 | What is the impact of the participation in European scientific networks on the stock of knowledge? | Data on scientific cooperation taken from the Research Joint Ventures (RJVs) funded by the EU. Data on GDP, R&D expenditure, population, employment and patents are taken from the database New Cronos EUROSTAT. | Negative binomial model. Dependent variable: number of patents at country level. Arellano-Bond dynamic panel-data estimations. Dependent variable: yearly per capita GDP growth. | The participation in European scientific networks supported by FPs matters for the production of knowledge, especially for countries with high levels of R&D expenditure. |
| iii | Bozeman, B., Fay, D., Slade, C.P. | Research collaboration in universities and academic entrepreneurship: the-state-of-the-art. 2013. Journal of Technology Transfer, 38, 1–67 | What is the impact of research grants and contracts on the nature and extent of faculty research and technology activities with industry? | Survey on more than 2000 academic researchers in the sciences and engineering. | Factor analysis and OLS regression. | Federally-sponsored grants have a moderate impact in increasing work with industry. Reserchers with more grants and contracts have a greater propensity for industrial involvement. |
| iv | Azagra-Caro, J.M., Pontikakis, D., Varga, A. | Delocalization patterns in university–industry interaction: Evidence from the Sixth R&D Framework Programme. 2013. European Planning Studies, 21(10), 1676–1701 | Do differences in the absorptive capacity of local firms may condition the localization of university-industry interactions under the FP6? | Dataset of universities' participation to the EU's FP6. | Tobit models. Dependent variables: number of interactions with firms of the same region, number of interactions with firms from other regions, total number of interactions. | Universities from regions whose firms have low absorptive capacity participate more often in FP6 projects with firms outside the region. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| iv | Teirlinck, P., Spithoven, A. | Fostering industry-science cooperation through public funding: differences between universities and public research centres. 2012. Journal of Technology Transfer, 37, 676–695 | What type of funding does foster the instalment of industry-science research cooperation? | Firm level data provided by the OECD bi-annual business R&D surveys of 2004 and 2006 for Belgium. | Bivariate probit models. Dependent variables: binary variables if research cooperation is done with a university or with a research centre. | Funding by regional governments fosters the instalment of industry-science research cooperation, while public funding provided by the EU framework programme does not, neither with universities nor with public research centres. |
| iv | Pandza, K., Wilkins, T.A., Alfoldi, E.A. | Collaborative diversity in a nanotechnology innovation system: Evidence from the EU Framework Programme. 2011. Technovation 31, 476–489 | Is collaborative diversity affecting nanotechnology research networks under the FPs? | Dataset compiled by the EC's Unit G4 Nanoscience and Nanotechnology on 108 collaborative projects funded in FP6 under the Thematic Area 3. Database listing all partners, institutional affiliation and features. | Scatter plot and descriptive statistics on both international diversity and institutional diversity of collaborations on nanotechnology projects, by types of policy instruments. | Nanotechnology research networks funded by EU FPs are characterized by a significant degree of collaborative diversity. |
| iv | Protogerou, A., Caloghirou, Y., Siokas, E. | Policy-driven collaborative research networks in Europe. 2010. Economics of Innovation and New Technology, 19 (4), 349–372 | Which are the dynamics and evolution of collaborative networks emerging in the context of EU FPs in the area of Information Society Technologies? | STEP to RJVs database including detailed information on all collaborative cross-national research projects funded by the European Commission in FP1–FP6, derived from CORDIS | Network analysis. | Universities and research institutes tend to have a more active and prominent role in the networks examined. The introduction of new instruments in FP6 has considerably increased interconnectivity compared with the previous FPs |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| iv | Protogerou, A., Caloghirou, Y., Siokas, E. | Twenty-five years of science-industry collaboration: the emergence and evolution of policy-driven research networks across Europe. 2013. Journal of Technology Transfer, 38, 873–895 | Which are the dynamics and evolution of collaborative networks emerging in the context of the seven EU FPs ? | STEP to RJVs database including detailed information on all collaborative cross-national research projects funded by the European Commission in FP1–FP7, derived from CORDIS | Network analysis. | Considerable growth in terms of participating entities and participations across FPs, resulting in large networks. The participation intensity of industrial actors has decreased, while that of universities and research centres has increased. |
| iv | Hoekman J, Scherngell T, Frenken3 K, Tijssen R. | Acquisition of European research funds and its effect on international scientific collaboration | Are existing scientific collaborations between EU subnational regions conducive for acquiring FP funding? Does FP funding, in turn, stimulates subsequent co-publication activity between pairs of EU regions? | Dataset of research articles indexed by the Web of Science database and FP joint projects participations extracted from the EUPRO database | Poisson regression Dependent variable: number of joint projects participated by pair of regions | Previous co-publication activity only has a minor effect on being funded. The effect of funding on co-publication activity is especially significant for regional pairs that did not intensively co-publish before participation. |
| iv | Paier, M., Scherngell, T. | Determinants of collaboration in European R&D networks: Empirical evidence from a discrete choice model. 2011. Industry and Innovation, 18 (1), 89-104 | What are the determinants of inter-organizational R&D collaborations funded within the European FPs? | Data on EU-FP projects from the EUPRO database and from a representative survey of participants. | Ordered logit model. Dependent variable: observed collaborations between two organizations (0 no collaboration, 1 loose collaboration, 2 intensive collaboration) | Collaboration choices in EU-FPs are facilitated by prior acquaintance, thematic and geographical proximity. The impact of geographical effects increases for more intensive collaboration. |

| Stream | Authors | Article | Research Question | Data | Research method | Findings |
|---|---|---|---|---|---|---|
| iv | Scherngell, T., Barber M.J. | Distinct spatial characteristics of industrial and public research collaborations: evidence from the FP5 | Are spatial characteristics of industrial R&D and public research R&D networks different? | Data on joint research projects funded by the FP5 | Network analysis and negative binomial spatial interaction models. | Geographical factors significantly affect patterns of industrial R&D collaboration, while in the public research sector effects of geography are much smaller. |

*Source: authors' elaboration*

# 3 Task 2 and 3 – Statistics on the participation of Universities in EU Framework Programmes

## 3.1 Introduction

In this section, we identify and discuss university participation patterns across different FPs and over time, looking at differences across countries, Specific Programmes, thematic areas and funding schemes. We provide statistics on the composition of projects in terms of partnerships and network size, amount of funding and success rate. In addition, we perform network analyses, in order to shed some light on the networking activities of European universities. We also analyse scientific outputs, by aggregating data on publications and IPRs at university level and providing summary statistics by country, funding schemes and Specific Programmes.

Throughout the report, we make use of country codes to denote specific countries as reported in Table 2.

**Table 2 – Country codes**

| Code | Country | Code | Country |
|---|---|---|---|
| **AT** | Austria | **IL** | Israel |
| **BE** | Belgium | **IT** | Italy |
| **BG** | Bulgaria | **LT** | Lithuania |
| **CH** | Switzerland | **LU** | Luxembourg |
| **CY** | Cyprus | **LV** | Latvia |
| **CZ** | Czech Republic | **MT** | Malta |
| **DE** | Germany | **NL** | Netherlands |
| **DK** | Denmark | **NO** | Norway |
| **EE** | Estonia | **PL** | Poland |
| **EL** | Greece | **PT** | Portugal |
| **ES** | Spain | **RO** | Romania |
| **FI** | Finland | **SE** | Sweden |
| **FR** | France | **SI** | Slovenia |
| **HR** | Croatia | **SK** | Slovakia |
| **HU** | Hungary | **UK** | United Kingdom |
| **IE** | Ireland | | |

In the analysis, we provide a breakdown of university participation in terms of Specific Programmes for FP4-FP5 and FP6, FP7. It is therefore useful to briefly illustrate which are the main areas of research that the single Specific Programmes cover and which are the thematic areas they are divided into.

FP7 Specific Programmes

Overriding aim[1]: to contribute to the Union becoming the world's leading research area. This requires the Framework Programme to be strongly focused on promoting and investing in world-class state-of-the-art research, based primarily upon the principle of excellence in research. Budget 2007-2013: EUR 50,521 million.

The objectives of FP7 have been grouped into four Specific Programmes: COOPERATION, IDEAS, PEOPLE, CAPACITIES, Euratom.

[1] Decision No. 1982/2006/ec of the European Parliament and of the Council of 18 December 2006.

-COOPERATION provides project funding for collaborative transnational research. The programme is organised through several themes, which include:

- Health;
- Information and Communication Technologies;
- Nanosciences;
- Nanotechnologies;
- Materials and new Production Technologies;
- Transport (including Aeronautics);
- Food, Agriculture, and Biotechnology;
- Environment (including Climate Change);
- Energy;
- Socio-economic Sciences and Humanities;
- Security;
- Space;
- General Activities

-IDEAS provides project funding for individuals and their teams engaged in frontier research. This Specific Programme is implemented by the European Research Council (ERC).

-PEOPLE funds actions to improve the training, career development and mobility of researchers between sectors and countries worldwide. It is implemented through the Marie Curie Actions and Specific Actions to Support ERA policies.

-CAPACITIES funds actions that are designed to improve Europe's research infrastructure and the research capacity of SMEs and other smaller programmes, including:

- Research for the Benefit of SMEs;
- Research Infrastructures;
- Science in Society;
- Research Potential;
- Activities of International Cooperation;
- Regions of Knowledge;
- Coherent Development of Research Policies;
- Joint Technology Initiatives.

-Euratom: funds actions that are designed to support technological development, international cooperation, dissemination of technical information and training activities in the field of nuclear research. It conceives two programmes: Fusion energy research and Nuclear fission and radiation protection.

FP6 Specific Programmes

Main aim[2]: to have a structuring effect on research and technological development in Europe, including the Member States, associated candidate countries and other associated countries and make a significant contribution to the establishment of the European Research Area and to innovation; to further the objective set out in Article 163(1) of the Treaty, of strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level, while promoting all the research activities deemed necessary by virtue of other Chapters of this Treaty. Budget 2002-2006: EUR 16,270 million.

[2] Decision No. 1513/2002/ec of the European Parliament and of the Council of 27 June 2002.

The objectives of FP6 have been grouped into three Specific Programmes: Integrating and Strengthening the ERA[3], Structuring the ERA, Euratom.

- "Integrating and Strengthening the ERA" aims at supporting the development of the ERA, thereby involving industry as well as the knowledge infrastructure, and at stimulating the coherent development of research and innovation policy in Europe by supporting programme coordination and joint actions conducted at national and regional level as well as among European organisations. Activities take one of the following forms:

- Support for the co-ordination of activities;
- Coherent development of research and innovation policies;
- Life Science, Genomics and biotechnology for health;
- Information Society technologies;
- Nanotechnologies and nanosciences, knowledge-based multifunctional materials, and new production processes and devices;
- Aeronautics and space;
- Food safety and health risks;
- Sustainable development and global change and ecosystems;
- Citizens and governance in the European knowledge-based society;
- Policy support and anticipating scientific and technological needs;
- Horizontal research activities involving SMEs;
- International co-operation;
- JRC non-nuclear activities.

- "Structuring the ERA" aims at remedying weaknesses in European research and innovation. The programme is implemented through the following thematic areas:

- Research and innovation;
- Human resources and mobility (Marie Curie Actions);
- Research infrastructures;
- Science and society

-"Euratom" contributes to the creation of the ERA in the field of nuclear energy by improving integration and co-ordination of nuclear research in Europe. It includes the following thematic areas:

- Controlled thermonuclear fusion;
- Management of radioactive waste;
- Radiation protection.

FP5 Specific Programmes

Overall objective[4]: to maintain and enhance, in the context of a genuine 'European research area', the research potential of European laboratories, universities and companies and their ability to produce knowledge of the highest level and high-quality technologies; and to help ensure that European research

[3] The Specific Programme "Integrating and Strengthening the ERA" includes two blocks of activities: "Focusing and integrating European Research" and "Strengthening the foundations of ERA".

[4] Decision No. 182/1999/EC of the European Parliament and of the Council of 22 December 1998 concerning the Fifth Framework Programme of the European Community for research, technological development and demonstration activities (1998 to 2002)

serves the Union's economic and social objectives: increasing industrial competitiveness and the quality of life for European citizens. Budget 1999-2002: EUR 14,960 million.

FP5 has the following components:

- Thematic programmes implementing research, technological development and demonstration activities across four themes; "Thematic Programmes" includes:
  - User-friendly information society (FP5-IST)
  - Quality of life and management of living resources (FP5-LIFE QUALITY)
  - Competitive and sustainable growth (FP5-GROWTH)
  - Energy, environment and sustainable development (FP5-EESD)
- Horizontal programmes across three wider oriented topics, including
  - Confirming the international role of Community research (FP5-INCO 2)
  - Improving human research potential and the socio-economic knowledge base (FP5-HUMAN POTENTIAL)
  - Promotion of innovation and encouragement of participation of small and medium-sized enterprises (SMEs) (FP5-INNOVATION-SME)
- the Euratom, comprising a focused Thematic programme implementing research and training activities in the nuclear sector
- direct RTD actions to be implemented by the European Commission's Joint Research Centre (JRC) which comprise research, scientific and technical support of an institutional nature.

FP4 Specific Programmes

Main objective[5]: to implement research and technological development (RTD) programmes and demonstration programmes by promoting cooperation with and between enterprises, research centres and universities; to promote cooperation in the field of Community RTD and demonstration with third countries and international organizations; to disseminate and optimize the results of Community RTD and demonstration activities; and to stimulate the training and mobility of researchers in the Community. Budget 1994-1998: EUR 11,879 million.

FP4 comprises the following activities:

- Activity 1: Research, technological development and demonstration programmes
- Activity 2: Cooperation with third countries and international organisations
- Activity 3: Dissemination and exploitation of results
- Activity 4: Training and mobility of researchers.

Note that Activity 1 also comprised Research & Training in the nuclear sector which are prior to the EURATOM Programme. In terms of comparability with FP5-FP7, the activities are therefore aggregated as follows:

- Thematic Programmes, comprising 15 focused programmes in seven thematic areas implementing research, technological development and demonstration activities in:
  - Information and communications technologies (FP4-ACTS, FP4-ESPRIT 4, FP4-ESSI 2, FP4-TELEMATICS 2C)

[5] Decision No. 1110/94/EC of the European Parliament and of the Council of 26 April 1994 concerning the Fourth Framework of the European Community activities in the field of research and technological development and demonstration.

- Life sciences and technologies (FP4-BIOTECH 2, FP4-BIOMED 2, FP4-FAIR)
- Industrial technologies (FP4-BRITE/EURAM 3, FP4-SMT)
- Transport (FP4-TRANSPORT)
- Environment (FP4-ENV 2C, FP4-MAST 3)
- Energy (FP4-NNE-JOULE C, FP4-NNE-THERMIE C)
- Targeted Socio-Economic Research (FP4-TSER)

- Horizontal Programmes comprising activities to stimulate third country cooperation, dissemination of results and training and mobility of researchers.
  - Cooperation with third countries and international organizations (FP4-INCO)
  - Stimulation of the training and mobility of researchers (FP4-TMR)
  - Dissemination and Exploitation of Results (FP4-INNOVATION)
- Preceding EURATOM activities as research & training in the nuclear sector (FUSION 12C, NFS 2).

As it is illustrated in the methodology section, we have used information provided in the eCORDA database for FP6 and FP7 and, for the earlier FPs (FP4 and FP5), we have extracted data from the EUPRO database (created and maintained by AIT).

## 3.2 Methodology

### 3.2.1 Data sources and selection criteria

The eCORDA database provides information on FP6 and FP7 participation patterns. Instead, we rely on the EUPRO database to analyse the participation patterns in FP4 and FP5.

Concerning FP6 and FP7, we have focused on the EU28 (plus Switzerland, Norway and Israel) and performed a cleaning of the eCORDA database (FP6 and FP7) in order to identify universities among all the participants. In fact, in the eCORDA database, universities are included in the generic HES category and may also lack a label (N/A type in the database). The definition of universities adopted is based on the analysis of the degrees awarded by the institutions. Such degrees must be at least ISCED 5 according to the International Standard Classification of Education, corresponding to tertiary (or higher) education.

We selected the universities to be included in the database as follows:

- we selected from the eCORDA database all participants' names labelled as HES or N/A (undefined type);
- we further filtered the eCORDA database according to the geographical location of partners in order to restrict the country coverage. The final coverage is EU28 plus Switzerland, Norway and Israel;
- we applied algorithms to institutions' names using multiple languages to consolidate names of participant and to identify universities;
- we manually checked the unclear cases of institutions relying on the European Tertiary Education Register (ETER)[6] and other web-based available sources (e.g. web-pages of the institutions and the European University Association register).

In order to check the robustness of the algorithm we applied it to participants that were not labelled as HES or N/A, and we obtained a consistent verification of its reliability. We identified a relatively small number of cases of institutions somehow related to universities: most of them are associations of universities and hospitals linked to universities with very limited tertiary education level activities. In the present approach we opted for not including organizations not labelled as HES or N/A in the analysis. Furthermore, we made a sampling of those HES labelled participants selected through the algorithm to check whether they were indeed universities according to our definition. Results proved the robustness of the algorithm.

The examination of the databases, in particular FP7 proposals and FP6, revealed the presence of a large number of inconsistencies in the names of participants (e.g. the same university reported with different spelling and different coding). We made an effort to solve this issue through the use of automatic procedures for the consolidation of names and further manual checking. All the statistics in which we treat project level data are in no way affected by the presence of potential residual inconsistencies in university names due to the fact that we aggregated data at country, Specific Programme, thematic area or funding scheme levels.

We applied a semantic approach to discriminate if a participant or an applicant is a university or not. We further checked manually (for FP7 granted projects only) whether the participants that were not classified as universities by the semantic approach were not tertiary education institutions. We applied the same methodology also on the FP6 database.

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[6] ETER (http://ec.europa.eu/education/tools/education-register_en.htm) is promoted by the Directorate General for Education and Culture of the European Commission, in cooperation with the Directorate General for Research and Innovation and EUROSTAT. The Register builds on the results and experience of the EUMIDA study.

The final database on FP7 counts 19,257 projects in which at least one partner is a university granted to a total of 1,274 universities. Regarding the remaining FPs, the sample of projects in which at least one partner is a university is made of 7,281 projects in FP6, 9,991 in FP5 and 8,947 in FP4.

These numbers constitute the basis upon which statistics on the participation of universities in the different FPs are performed.

Structure of indicators

In the following sections, we discuss university participation patterns across different FPs and over time, looking at differences across countries, Specific Programmes, thematic areas and funding schemes. In the analysis we consider the following indicators: the number of granted projects with at least one university as participant, the number of projects in which universities are partners or coordinators, the concentration levels in terms of number of projects in which at least one partner is a university and the allocation of EU financial contribution. Moreover, we also study the composition of consortia by providing statistics on number of partnerships and network size.

To identify new trends of cooperation that emerge as a result of participation in FPs we employ a network perspective using information on the collaborative links among the FP7 grant holders. The analysis is used to identify not only the number of established partnerships but also to map the countries and geographic regions as well as the type of institutional partnerships that have been created. Finally, we also analyse the position of universities within the network of relationships in order to identify the knowledge hubs and peripheral institutions. Table 3 provides a detailed description of the indicators used and the corresponding level of breakdown.

**Table 3 – Areas, indicators/parameters and level of breakdown**

| Areas | Indicators / parameters | Level of breakdown |
|---|---|---|
| **Overall figures of university participation** | Number of granted projects in which at least one partner is a university | per specific programme;<br>per specific thematic area;<br>per funding scheme;<br>per country;<br>per range of EC funding size;<br>per time period |
| | Number of universities participating as partner | per specific programme;<br>per specific thematic area;<br>per range of EC funding size;<br>per country |
| | Number of universities participating as coordinator | per country |
| | Concentration levels in terms of number of projects in which at least one partner is a university | per range of EC funding size;<br>per country;<br>per time period |
| | Success rate: ratios of retained to eligible proposals | per specific programme;<br>per specific thematic area;<br>per funding scheme;<br>per country |
| | EC financial contribution | per specific programme;<br>per funding scheme;<br>per country |
| **Description of participation patterns** | Composition of consortia: number of partnerships and network size | per specific programme;<br>per country |
| **Network analysis** | Mapping the links among countries, geographic regions and the type of institutional partnership<br>analysis of the position of universities within the whole FP network of relationships<br>Classification of participants in terms of:<br>prominence or prestige in the network,<br>role as brokers, gatekeepers or as peripheral institutions, | per specific programme;<br>per specific thematic area;<br>per funding scheme;<br>per country |

### 3.2.2 Methodology for analysing projects output

In this report we analyse the outputs (in terms of publications and IPRs) associated with FP7 UNIV projects, taking into account the EC financial contribution, the number of partners in the projects, the Specific Programmes and the Funding Schemes. The information and data needed to carry out the

analysis of the scientific outputs come from multiple sources. To organise the dataset including information on projects' outputs we have used information on sampled projects' scientific outputs (publications and IPRs) made available by the European Commission and included in the SESAM database. We then collected information from proprietary databases that are accessible from our institutions. As far as bibliometric information is concerned, we relied on the proprietary databases SCImago and Web of Science (WOS). The inclusion of this information in the dataset allows going beyond the mere (although informative) quantitative analysis of scientific achievements volumes and better qualifying the scientific outputs issued within a specific research project.

In the following paragraphs, we highlight the procedure that we adopted to treat the data on scientific publications and IPRs.

#### 3.2.2.1 Scientific Publications

We conducted the analysis of scientific publications on two levels:

First, counted the publications per project and grouped publications in order to produce aggregated data at university level. This analysis was just based on the processing of the raw data provided by the Commission.

Second, we performed a matching of each publication with bibliometric data in order to derive indicators of quality and scientific standing. The matching was based on the following steps:

I) Extraction from each record of the ISSN (we checked the data and this information appears to be nearly always available). Matching of the ISSN with data extracted from the databases SCImago in order to derive the characteristics of the Journal in which the article has appeared. Such characteristics are impact factor and ranking within the field. The use of these journal's specific variables will allow the identification of high-impact scientific results and computation of the average quality of publications associated with a specific project.

II) Extraction from each record of the DOI (Digital Object Identifier). The DOI is present for the majority of publications that have been provided by the Commission, although in some cases it is not correctly specified. We used the correct DOI for downloading through the database Web of Science (WOS) the full bibliometric records of the related publication. Given the large number of publications, we used automated online procedures to download information on each article. In particular, we downloaded data on total citations received by the article as of March 2015. We have computed a time and sector weighted distribution of the citations received by all the analysed articles in order to identify the highly-cited articles, i.e. the subset of article falling in the top 5% of the distribution of citations.

Note that the above methodological approach has been adopted only for the publications reported in the SESAM database. The data made available by the EC on publications related to IDEAS projects do not allow the application of the methodology for the automatic matching with external bibliometric databases. However, we made an effort to identify a subset of high-impact publications from IDEAS projects. For this purpose we made a manual screening of the 37,000 publications related to IDEAS projects involving at least a UNIV beneficiary in order to identify those that have appeared in the top 5 journals by scientific field. More details on the procedure are provided in the following section 3.3.6.

#### 3.2.2.2 Intellectual Property Rights

The data made available by the Commission on the IPRs (patents, trademarks, designs, utility models) unfortunately does not allow a matching with patent databases. This is due to the fact that an in-depth

analysis of the data provided revealed that patent numbers and patent codes reported by grant recipients are not usable to retrieve original patent documents through standard patent databases. Even the use of other information such as the reported "title" of the IPR proved ineffective for the identification of the original patent document (even using advanced search tools as those provided by commercial IP databases like Thomson Innovation). Hence, the nature of the available data prevents us from adding further IP specific data. For this reason, we used the data provided by the Commission just by counting the number of IPRs associated with a specific project, distinguishing among the different typologies of rights (patents, trademarks, designs, utility models).

We performed a preliminary check on the coherence of the IPR classification (patents, trademarks, registered designs, utility models) and the associated text description. When it has been possible to clearly identify an inconsistency between the recorded and the actual IPR type (e.g. the IPR "WO2007110462" recorded as a Trademark while being a WIPO patent), we updated with the correct information. We found 57 cases of this type; in all the other cases, including those with no clear IPR description, we relied on the recorded classification.

### 3.2.3 Network analysis

We used network analysis techniques to identify the position of institutions in the network of relationships in order to analyse new trends of cooperation. In our network analytical approach, the eCORDA database was referred to characterize the positioning of universities in the whole FP network. In this approach, the organisations represent the network nodes which are inter-linked via joint FP projects.

We identified and characterised universities according to different Social Network Analysis (SNA) concepts, such as their prominence or prestige in the network, or the role they exert as brokers or gatekeepers, for instance in networks with industry or university participation, or for cross border cooperation. The fundamental concept that was used for the actor specific analyses is the concept of centrality (see Wasserman and Faust, 1994; Heller- Schuh et al. 2011 for further details and examples). The results of the network analyses have been illustrated in the form of different network visualisations. Such visualisations provide strong ad-hoc insight into the role of different nodes in the network.

## 3.3 Analysis of participation in FP7

In this section we provide a detailed analysis of the participation of universities to the FP7. In the following paragraphs we move from aggregated statistics to specific breakdowns that aim at highlighting specific patterns at country level or funding-instrument level.

The analysis of the data reveals that the sample of FP7 projects in which at least one partner is a university (from now on "UNIV projects") is made of 19,257 projects. Such projects have been granted to a total of 1,274 universities. The number of projects in the dataset account for 76.3% of the whole amount of FP7 projects. The university participants account for 5.0% of FP7 participants[7].

The following Table illustrates the aggregated FP7 financial contribution of the EC for UNIV projects. The data refer to the EC funding only and not to the total cost of the related projects. The Table also reports the total amount of EC funding received by all the universities in the sample.

**Table 4 – EC funding in FP7 for UNIV projects and universities**

| LEVEL OF ANALYSIS | Total EC Funding (€ million) |
|---|---|
| Projects involving at least one university (UNIV projects) | 38,871.8 |
| Universities (Aggregate) | 18,923.6 |

*Source: authors' calculation based on eCORDA*

The average EC funding for UNIV projects has been about € 2.02 million, while universities have received on average € 14.85 million, corresponding to an average of € 0.98 million per project. UNIV projects account for 86.5% of the total EC funding in FP7. The amount received by universities accounts for 48.7% of the total EC funding. More details on the financial contribution at project and participants levels are provided in the following section 3.3.5.

The following Table describes a breakdown by macro geographical area of the participant universities, the average EC funding and the number of participations. Participations are defined as the number of occurrences of each university in the database of all retained projects. EU15 countries account for 72.5% of the universities that have obtained at least one EC grant and 83.8% of the participations in FP7. Overall, EU15 countries have received 85.2% of the EC total financial contribution in FP7. The three extra EU countries analysed (Israel, Norway and Switzerland) show a significantly higher incidence of EC funding compared to the incidence of participants, while the opposite applies to EU13 countries.

**Table 5 – Number of participants, participations and EC funding in FP7 by macro geographical area**

| EU Area | Participants | | Participations | | EC funding | |
|---|---|---|---|---|---|---|
| **EU15** | 924 | 72.5% | 38,728 | 83.8% | 16,130.3 | 85.2% |
| **EU13** | 285 | 22.4% | 3,495 | 7.6% | 706.7 | 3.7% |
| **EUXT** | 65 | 5.1% | 3,984 | 8.6% | 2,086.5 | 11.0% |

*Source: authors' calculation based on eCORDA*

[7] This percentage is computed considering only participants located in the EU28 countries plus Switzerland, Israel and Norway.

### 3.3.1 Overall participation and geographical breakdown

Statistics on the incidence of UNIV projects over the total number of projects in FP7 (both in terms of numbers and amount of funding) indicate that, on average, universities are involved in larger projects. In the following paragraphs, a detailed breakdown of such aggregate figures is provided in order to identify specific patterns of university participation in FP7. Figures are disaggregated by country, programme and funding scheme. It has to be noted that the following statistics are performed on two levels of analysis: at project and university level.

Table 6 reports the count of UNIV projects by country. It has to be remarked that a project can involve as partners more universities which are potentially located in different countries. Therefore, the third column (% on total number of projects) adds up to more than 100%. The Table shows that UK is the country with the highest percentage of UNIV projects on the total number of projects (41.5%), followed by DE (23.8%), IT (15.2%) and NL (14.9%).

13,823 UNIV projects out of 19,257 were coordinated by a university. Note that, due to the presence of projects including one or more universities as partners but a coordinator that is not a university, the total of the last column (% of university as coordinator on country projects) does not sum to 100%. In our sample, around 72% of the UNIV projects also have a university as a coordinator. Countries with a low level of participation of universities as coordinators (<=15%) are: LT, SI, SK, RO, CZ, EE. Countries with a high level of participation of universities as coordinators (>=30%) are: AT, BE, DK, DE, ES, FR, NL, IE, CH. Countries with a very high level of participation of universities as coordinators (>50%) are: UK and IL.

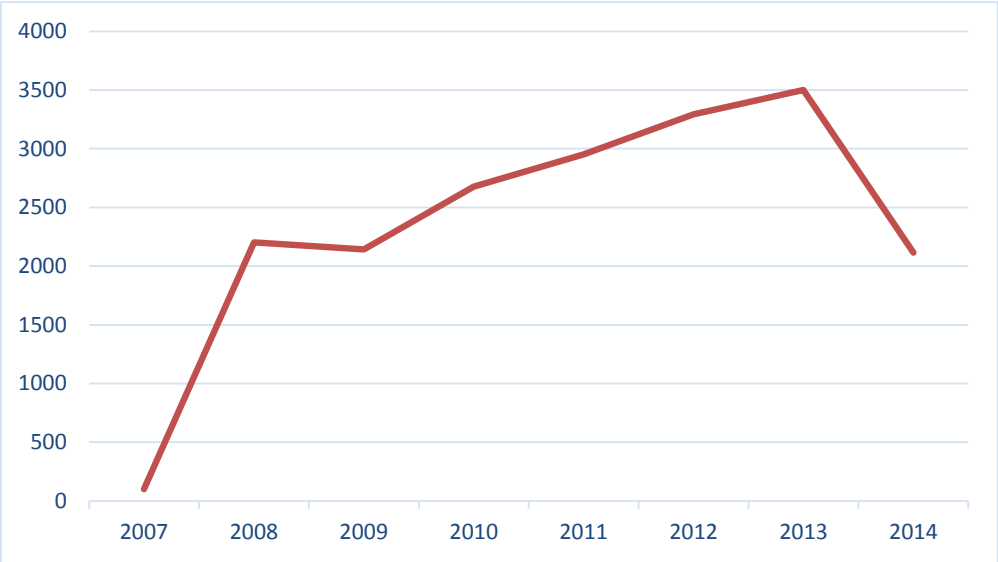
**Table 6 – Number of UNIV projects by country in FP7**

| Country | UNIV Projects | % on total number of projects | University as coordinator | % of university as coordinator on total number of projects | % of university as coordinator on country projects |
|---|---|---|---|---|---|
| **AT** | 1,179 | 6.1% | 354 | 2.6% | 30.0% |
| **BE** | 1,493 | 7.8% | 460 | 3.3% | 30.8% |
| **BG** | 163 | 0.8% | 25 | 0.2% | 15.3% |
| **CH** | 1,982 | 10.3% | 779 | 5.6% | 39.3% |
| **CY** | 166 | 0.9% | 45 | 0.3% | 27.1% |
| **CZ** | 460 | 2.4% | 53 | 0.4% | 11.5% |
| **DE** | 4,580 | 23.8% | 1,440 | 10.4% | 31.4% |
| **DK** | 1,245 | 6.5% | 389 | 2.8% | 31.2% |
| **EE** | 174 | 0.9% | 21 | 0.2% | 12.1% |
| **EL** | 1,006 | 5.2% | 257 | 1.9% | 25.5% |
| **ES** | 2,281 | 11.8% | 740 | 5.4% | 32.4% |
| **FI** | 798 | 4.1% | 214 | 1.5% | 26.8% |
| **FR** | 1,751 | 9.1% | 573 | 4.1% | 32.7% |
| **HR** | 116 | 0.6% | 20 | 0.1% | 17.2% |
| **HU** | 415 | 2.2% | 79 | 0.6% | 19.0% |
| **IE** | 987 | 5.1% | 374 | 2.7% | 37.9% |
| **IL** | 1,139 | 5.9% | 716 | 5.2% | 62.9% |
| **IT** | 2,933 | 15.2% | 877 | 6.3% | 29.9% |
| **LT** | 152 | 0.8% | 11 | 0.1% | 7.2% |
| **LU** | 38 | 0.2% | 10 | 0.1% | 26.3% |
| **LV** | 90 | 0.5% | 19 | 0.1% | 21.1% |
| **MT** | 49 | 0.3% | 9 | 0.1% | 18.4% |
| **NL** | 2,878 | 14.9% | 1,117 | 8.1% | 38.8% |
| **NO** | 527 | 2.7% | 152 | 1.1% | 28.8% |
| **PL** | 741 | 3.8% | 140 | 1.0% | 18.9% |
| **PT** | 569 | 3.0% | 108 | 0.8% | 19.0% |
| **RO** | 248 | 1.3% | 22 | 0.2% | 8.9% |
| **SE** | 2,011 | 10.4% | 556 | 4.0% | 27.6% |
| **SI** | 217 | 1.1% | 16 | 0.1% | 7.4% |
| **SK** | 150 | 0.8% | 13 | 0.1% | 8.7% |
| **UK** | 7,986 | 41.5% | 4,234 | 30.6% | 53.0% |
| **TOT** | **19,257** | **100.0%** | **13,823** | **100.0%** | **71.8%** |

*Source: authors' calculation based on eCORDA*

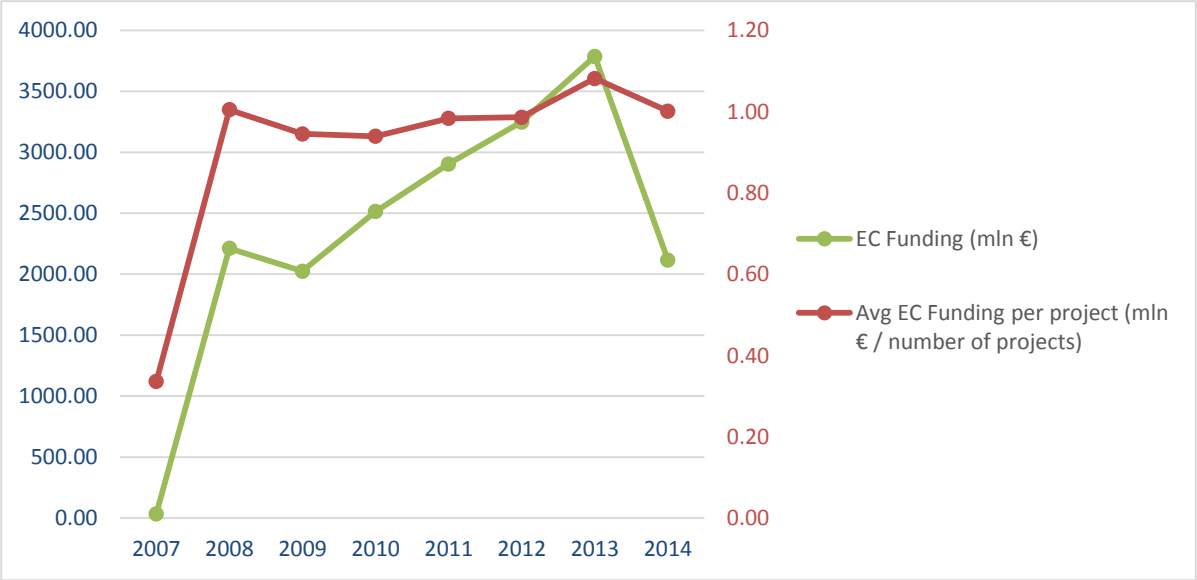
Figure 1 illustrates the trend of UNIV projects across the considered years (2007-2014). The displayed years are those corresponding to the starting dates of the projects. As it is evident from the graph, the number of UNIV projects increased more or less steadily until 2013 and then experienced a drop in 2014. This drop is potentially due to the fact that the FP7 was near the end and fewer calls had been launched. The following Figure on the average EC funding per project by year and the trend in aggregated EC funding by year confirm this intuition.

**Figure 1 – Trend of UNIV projects in FP7**




*Source: authors' calculation based on eCORDA*

**Figure 2 – Trend of EC funding in € million (left axis) and average of EC funding per project as the ratio of EC funding on the number of projects (right axis)**




*Source: authors' calculation based on eCORDA*

The following Table illustrates the number and percentages of UNIV projects by country and selected time intervals (2007-2009; 2010-2011; 2012-2014). Some EU13 countries were early birds: in the time frame 2007-2009 BG has the highest percentage of UNIV projects (44.8%), followed by SI (36.9%), RO (36.3%) and LT (34.9%). On the contrary, several EU15 countries show a slow start: for instance IE, LU, UK have low percentages of UNIV projects in 2007-2009 compared to the last period (2012-2014). In the time frame 2012-2014 MT has the highest percentage of UNIV projects (57.1%), followed by LU (52.6%), UK (46.9%) and IE (45.9%).

**Table 7 – Number of UNIV projects by country and time intervals in FP7**

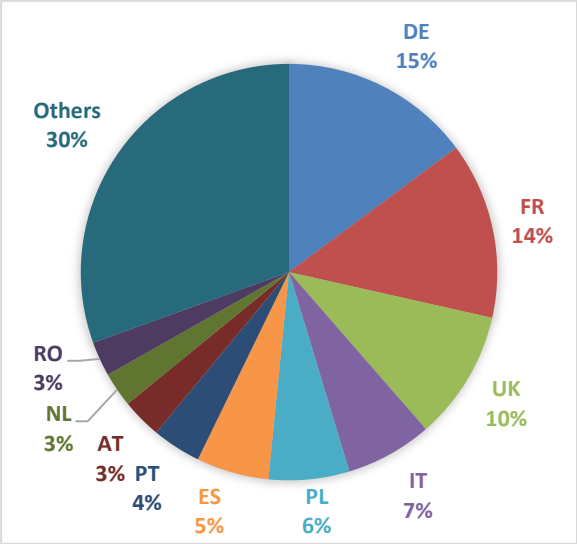
| Country | Projects | 2007-2009 | 2010-2011 | 2012-2014 |
|---|---|---|---|---|
| **AT** | 1,179 | 27.6% | 30.7% | 41.7% |
| **BE** | 1,493 | 28.3% | 30.6% | 41.1% |
| **BG** | 163 | 44.8% | 23.9% | 31.3% |
| **CH** | 1,982 | 26.8% | 31.6% | 41.7% |
| **CY** | 166 | 30.5% | 29.3% | 40.2% |
| **CZ** | 460 | 33.0% | 27.7% | 39.3% |
| **DE** | 4,580 | 27.0% | 30.4% | 42.6% |
| **DK** | 1,245 | 27.1% | 28.8% | 44.1% |
| **EE** | 174 | 29.9% | 29.9% | 40.2% |
| **EL** | 1,006 | 31.1% | 31.6% | 37.2% |
| **ES** | 2,281 | 24.8% | 30.7% | 44.5% |
| **FI** | 798 | 30.8% | 28.5% | 40.7% |
| **FR** | 1,751 | 27.6% | 29.9% | 42.5% |
| **HR** | 116 | 31.9% | 25.9% | 42.2% |
| **HU** | 415 | 33.2% | 32.0% | 34.9% |
| **IE** | 987 | 21.5% | 32.7% | 45.9% |
| **IL** | 1,139 | 25.3% | 30.5% | 44.2% |
| **IT** | 2,933 | 27.7% | 32.2% | 40.1% |
| **LT** | 152 | 34.9% | 27.0% | 38.2% |
| **LU** | 38 | 13.2% | 34.2% | 52.6% |
| **LV** | 90 | 33.3% | 24.4% | 42.2% |
| **MT** | 49 | 24.5% | 18.4% | 57.1% |
| **NL** | 2,878 | 25.6% | 29.3% | 45.1% |
| **NO** | 527 | 24.9% | 30.6% | 44.5% |
| **PL** | 741 | 33.3% | 30.9% | 35.8% |
| **PT** | 569 | 27.8% | 28.8% | 43.4% |
| **RO** | 248 | 36.3% | 30.2% | 33.5% |
| **SE** | 2,011 | 29.0% | 29.8% | 41.2% |
| **SI** | 217 | 36.9% | 29.0% | 34.1% |
| **SK** | 150 | 32.7% | 32.7% | 34.7% |
| **UK** | 7,986 | 24.2% | 28.9% | 46.9% |

*Source: authors' calculation based on eCORDA*

Table 8 and the pie chart illustrate the number and percentage of universities which were awarded a UNIV project in FP7, by country of origin. DE shows the highest percentage of universities which were granted a UNIV project (15%), followed by FR (14%), UK (10%) and IT (7%).

**Table 8 – Number of universities awarded a UNIV project and participations, by country in FP7. Pie chart of the top 10 countries in terms of universities awarded a UNIV project**

| Country | Number of universities | % | Participations | % |
|---|---|---|---|---|
| AT | 39 | 3.1% | 1,274 | 2.8% |
| BE | 26 | 2.0% | 1,638 | 3.5% |
| BG | 27 | 2.1% | 201 | 0.4% |
| CH | 24 | 1.9% | 2,179 | 4.7% |
| CY | 11 | 0.9% | 179 | 0.4% |
| CZ | 23 | 1.8% | 484 | 1.0% |
| DE | 188 | 14.8% | 6,055 | 13.1% |
| DK | 13 | 1.0% | 1,355 | 2.9% |
| EE | 7 | 0.5% | 174 | 0.4% |
| EL | 33 | 2.6% | 1,093 | 2.4% |
| ES | 71 | 5.6% | 2,563 | 5.5% |
| FI | 21 | 1.6% | 918 | 2.0% |
| FR | 175 | 13.7% | 2,051 | 4.4% |
| HR | 29 | 2.3% | 121 | 0.3% |
| HU | 22 | 1.7% | 502 | 1.1% |
| IE | 23 | 1.8% | 1,051 | 2.3% |
| IL | 17 | 1.3% | 1,230 | 2.7% |
| IT | 85 | 6.7% | 3,662 | 7.9% |
| LT | 13 | 1.0% | 178 | 0.4% |
| LU | 1 | 0.1% | 38 | 0.1% |
| LV | 12 | 0.9% | 130 | 0.3% |
| MT | 1 | 0.1% | 49 | 0.1% |
| NL | 35 | 2.7% | 3,492 | 7.6% |
| NO | 24 | 1.9% | 575 | 1.2% |
| PL | 79 | 6.2% | 844 | 1.8% |
| PT | 48 | 3.8% | 652 | 1.4% |
| RO | 34 | 2.7% | 263 | 0.6% |
| SE | 31 | 2.4% | 2,314 | 5.0% |
| SI | 10 | 0.8% | 217 | 0.5% |
| SK | 17 | 1.3% | 153 | 0.3% |
| UK | 135 | 10.6% | 10,572 | 22.9% |
| TOT | 1274 | 100.0 | 46,207 | 100.0% |




*Source: authors' calculation based on eCORDA*

Table 9 reports the concentration levels in terms of project counts (top 4, 5, 10 and 20 universities) and the Herfindahl–Hirschman Index (HHI)[8] by country. The project concentration is considerably high both across and within countries. The first 10 universities in terms of number of projects represent the 28.9% of the entire sample of UNIV projects. If the first 20 universities are considered, the percentage rises to 46.1%. Looking at country levels, it emerges a certain variance in the concentration levels. For example, if we consider UK, it emerges that the first top 4 universities in UK in terms of the total number of projects represent the 31.6% of the UK sample of UNIV projects. Instead, the first top 4 universities in DE, IT and FR, represent respectively the 21.2%, 29.0%, 22.6% of the DE, IT, FR samples of UNIV projects. The Table clearly reflects the size and the structure of higher education institutions in the different countries, as it is evident from the cases of MT and LU. In these countries, only one university is associated with all the projects granted to the country (this is the reason why the HHI takes value 1 in these countries).

**Table 9 – Concentration levels in FP7: project counts**

| Country | TOP4 | TOP5 | TOP10 | TOP20 | HHI |
|---|---|---|---|---|---|
| **AT** | 52.1% | 59.9% | 82.5% | 96.7% | 0.09 |
| **BE** | 72.8% | 80.1% | 97.3% | 99.6% | 0.17 |
| **BG** | 62.6% | 66.9% | 79.8% | 96.9% | 0.11 |
| **CH** | 74.0% | 79.2% | 92.7% | 99.6% | 0.15 |
| **CY** | 88.0% | 94.0% | 98.8% | 100.0% | 0.38 |
| **CZ** | 67.8% | 74.3% | 87.0% | 99.1% | 0.13 |
| **DE** | 21.2% | 25.8% | 41.9% | 61.1% | 0.02 |
| **DK** | 90.1% | 95.5% | 99.8% | 100.0% | 0.23 |
| **EE** | 98.3% | 98.3% | 100.0% | 100.0% | 0.41 |
| **EL** | 63.5% | 68.2% | 85.6% | 96.7% | 0.10 |
| **ES** | 32.1% | 38.0% | 57.1% | 78.0% | 0.04 |
| **FI** | 66.2% | 66.2% | 97.2% | 99.2% | 0.14 |
| **FR** | 22.6% | 26.6% | 42.3% | 59.7% | 0.02 |
| **HR** | 43.1% | 43.1% | 71.6% | 81.9% | 0.07 |
| **HU** | 61.2% | 69.2% | 94.9% | 99.3% | 0.11 |
| **IE** | 73.5% | 81.3% | 96.6% | 99.5% | 0.15 |
| **IL** | 75.4% | 85.9% | 99.5% | 100.0% | 0.15 |
| **IT** | 29.0% | 34.7% | 53.5% | 73.3% | 0.03 |
| **LT** | 77.6% | 83.6% | 98.0% | 100.0% | 0.18 |
| **LU** | 100.0% | 100.0% | 100.0% | 100.0% | 1.00 |
| **LV** | 82.2% | 85.6% | 97.8% | 100.0% | 0.19 |
| **MT** | 100.0% | 100.0% | 100.0% | 100.0% | 1.00 |
| **NL** | 39.8% | 48.0% | 69.0% | 99.4% | 0.06 |
| **NO** | 77.8% | 84.1% | 94.5% | 99.1% | 0.17 |
| **PL** | 38.2% | 44.3% | 59.0% | 75.8% | 0.04 |
| **PT** | 54.3% | 62.7% | 78.7% | 91.4% | 0.09 |
| **RO** | 53.2% | 58.1% | 75.4% | 93.5% | 0.08 |
| **SE** | 58.0% | 68.4% | 92.0% | 98.7% | 0.10 |
| **SI** | 94.5% | 96.8% | 100.0% | 100.0% | 0.56 |
| **SK** | 64.0% | 72.0% | 92.0% | 100.0% | 0.12 |
| **UK** | 31.6% | 35.9% | 51.9% | 70.9% | 0.03 |

[8] The Herfindahl–Hirschman Index is a statistical measure of concentration. In Table 9 the HHI accounts for the number of universities in a country, as well as concentration, by incorporating the relative size (i.e. the share of projects) of all universities in a country. It is calculated by squaring the share of projects of all universities in a country and then summing the squares. The HHI can range from 0 to 1.0: a higher value of the index indicates that a country's UNIV projects are concentrated in a relative low number of universities.

*Source: authors' calculation based on eCORDA*

Table 10 reports the concentration levels in terms of EC funding (top 4, 5, 10 and 20 universities) and the HHI[9] by country. It is interesting to remark that the top ten universities get the 16.2% of the total FP7 EC funding granted to the universities of our sample. Instead, the top 20 universities receive one fourth of the total EC funding. At country level, the Table shows for example that the first top 4 universities in UK in terms of received EC funding represent the 31.4% of the UK sample. Instead, the first top 4 universities in terms of received EC funding in DE, IT and FR, represent respectively the 18.5%, 25.9%, 24.1% of the DE, IT, FR samples. Again, MT and LU have only one university, which gets all the EC funding assigned to the country.

**Table 10 – Concentration levels in FP7: EC funding**

| Country | TOP 4 | TOP 5 | TOP10 | TOP20 | HHI |
|---|---|---|---|---|---|
| **AT** | 51.5% | 61.1% | 84.4% | 98.1% | 0.09 |
| **BE** | 70.7% | 78.8% | 97.8% | 99.9% | 0.19 |
| **BG** | 67.6% | 72.8% | 86.5% | 98.4% | 0.16 |
| **CH** | 75.5% | 81.4% | 94.0% | 99.8% | 0.17 |
| **CY** | 95.2% | 96.9% | 100.0% | 100.0% | 0.45 |
| **CZ** | 74.4% | 80.8% | 93.8% | 99.9% | 0.15 |
| **DE** | 18.5% | 22.0% | 36.6% | 55.4% | 0.02 |
| **DK** | 91.3% | 96.5% | 99.9% | 100.0% | 0.25 |
| **EE** | 99.5% | 99.8% | 100.0% | 100.0% | 0.41 |
| **EL** | 63.9% | 71.2% | 86.8% | 97.7% | 0.12 |
| **ES** | 33.5% | 39.0% | 57.6% | 78.9% | 0.05 |
| **FI** | 72.0% | 80.1% | 98.4% | 100.0% | 0.19 |
| **FR** | 24.1% | 27.9% | 44.3% | 62.9% | 0.03 |
| **HR** | 61.2% | 69.8% | 88.0% | 97.8% | 0.12 |
| **HU** | 67.8% | 75.9% | 97.3% | 100.0% | 0.15 |
| **IE** | 72.9% | 80.9% | 97.7% | 99.9% | 0.15 |
| **IL** | 84.4% | 90.4% | 99.8% | 100.0% | 0.20 |
| **IT** | 25.9% | 30.3% | 48.9% | 71.7% | 0.03 |
| **LT** | 82.7% | 87.5% | 98.7% | 100.0% | 0.26 |
| **LU** | 100.0% | 100.0% | 100.0% | 100.0% | 1.00 |
| **LV** | 88.3% | 93.1% | 99.8% | 100.0% | 0.29 |
| **MT** | 100.0% | 100.0% | 100.0% | 100.0% | 1.00 |
| **NL** | 36.9% | 43.9% | 73.0% | 99.7% | 0.07 |
| **NO** | 85.2% | 89.1% | 97.7% | 99.9% | 0.23 |
| **PL** | 40.7% | 47.2% | 65.9% | 84.1% | 0.06 |
| **PT** | 56.1% | 64.5% | 78.8% | 92.3% | 0.10 |
| **RO** | 56.6% | 64.2% | 80.5% | 94.8% | 0.11 |
| **SE** | 60.0% | 71.8% | 94.1% | 99.5% | 0.12 |
| **SI** | 96.0% | 97.7% | 100.0% | 100.0% | 0.50 |
| **SK** | 60.8% | 73.6% | 95.9% | 100.0% | 0.13 |
| **UK** | 31.4% | 36.0% | 51.5% | 70.8% | 0.04 |

*Source: authors' calculation based on eCORDA*

Table 11 reports the concentration levels in terms of EC funding (top 5 universities) and the HHI by country and time frame. The results show that in large countries concentration levels have remained

[9] In Table 10 the HHI is calculated by squaring the share of EC funding of all universities in a country and then summing the squares.

quite stable over time: for example, UK, DE and IT reveal slightly higher concentration levels in the time frame 2011-2014 than in the time frame 2007-2010. On the opposite, late entrants and small countries reveal a decrease in the concentration levels in the time frame 2011-2014 as compared to the time frame 2007-2010: for example, LT, PL, RO, SI and SK show a decrease in terms of both the TOP5 and the HHI. This result signals that in these countries EC funding is distributed over a higher number of universities in the second time frame.

**Table 11 – Concentration levels of funding in two time frames in FP7 (2007-2010; 2011-2014)**

| Country | 2007-10 TOP5 | 2007-10 HHI | 2011-14 TOP5 | 2011-14 HHI |
|---|---|---|---|---|
| **AT** | 64.4% | 0.10 | 58.9% | 0.10 |
| **BE** | 81.0% | 0.20 | 78.0% | 0.19 |
| **BG** | 78.5% | 0.14 | 75.0% | 0.21 |
| **CH** | 82.7% | 0.18 | 81.5% | 0.17 |
| **CY** | 98.5% | 0.43 | 97.9% | 0.49 |
| **CZ** | 79.3% | 0.15 | 83.0% | 0.17 |
| **DE** | 21.4% | 0.02 | 22.6% | 0.02 |
| **DK** | 97.0% | 0.24 | 96.3% | 0.25 |
| **EE** | 99.8% | 0.50 | 100.0% | 0.36 |
| **EL** | 69.2% | 0.12 | 72.6% | 0.12 |
| **ES** | 42.5% | 0.05 | 37.5% | 0.04 |
| **FI** | 80.1% | 0.19 | 80.4% | 0.19 |
| **FR** | 31.1% | 0.03 | 28.4% | 0.03 |
| **HR** | 63.3% | 0.12 | 75.2% | 0.14 |
| **HU** | 79.2% | 0.17 | 79.4% | 0.18 |
| **IE** | 78.5% | 0.15 | 82.2% | 0.15 |
| **IL** | 89.4% | 0.20 | 91.0% | 0.21 |
| **IT** | 30.9% | 0.03 | 31.2% | 0.04 |
| **LT** | 94.0% | 0.32 | 85.1% | 0.26 |
| **LU** | 100.0% | 1.00 | 100.0% | 1.00 |
| **LV** | 97.5% | 0.26 | 92.8% | 0.33 |
| **MT** | 100.0% | 1.00 | 100.0% | 1.00 |
| **NL** | 43.2% | 0.06 | 45.0% | 0.07 |
| **NO** | 91.2% | 0.21 | 89.3% | 0.25 |
| **PL** | 56.7% | 0.08 | 43.6% | 0.06 |
| **PT** | 69.7% | 0.12 | 61.5% | 0.09 |
| **RO** | 70.4% | 0.16 | 62.5% | 0.09 |
| **SE** | 70.7% | 0.12 | 72.6% | 0.12 |
| **SI** | 98.6% | 0.63 | 96.9% | 0.43 |
| **SK** | 83.8% | 0.17 | 71.5% | 0.12 |
| **UK** | 35.9% | 0.04 | 36.1% | 0.04 |

*Source: authors' calculation based on eCORDA*

Table 12 provides a comparison of HHI based on projects and EC funding values in order to highlight in which of the two typologies the level of concentration is highest. The index of the last column is the ratio between the HHI at project level and the HHI at EC funding level. An index greater than 1 means that the considered country is more concentrated on projects rather than on funding, namely that universities located in that country are hubs of projects rather than of funding (which is more distributed over the other participants). Only SI (with a ratio of 1.2) is most concentrated in terms of projects rather than funding followed by EE, MT and LU (with a ratio equal to 1). In the case of MT and LU this is due to the fact that these countries have only one university, which gets all the projects and EC funding assigned to the country. Instead, countries that are most concentrated in terms of funding rather than projects are HU, BG, LV and HR (ratio below 0.70).

**Table 12 – Comparison of HHI based on project and EC funding values in FP7**

| Country | HHI (Project basis) | HHI (EC Funding basis) | Ratio Project/EC Funding |
|---|---|---|---|
| **AT** | 0.09 | 0.09 | 0.93 |
| **BE** | 0.17 | 0.19 | 0.90 |
| **BG** | 0.11 | 0.16 | 0.69 |
| **CH** | 0.15 | 0.17 | 0.89 |
| **CY** | 0.38 | 0.45 | 0.85 |
| **CZ** | 0.13 | 0.15 | 0.87 |
| **DE** | 0.02 | 0.02 | 0.94 |
| **DK** | 0.23 | 0.25 | 0.93 |
| **EE** | 0.41 | 0.41 | 1.00 |
| **EL** | 0.10 | 0.12 | 0.88 |
| **ES** | 0.04 | 0.05 | 0.87 |
| **FI** | 0.14 | 0.19 | 0.76 |
| **FR** | 0.02 | 0.03 | 0.80 |
| **HR** | 0.07 | 0.12 | 0.62 |
| **HU** | 0.11 | 0.15 | 0.69 |
| **IE** | 0.15 | 0.15 | 0.96 |
| **IL** | 0.15 | 0.20 | 0.76 |
| **IT** | 0.03 | 0.03 | 0.93 |
| **LT** | 0.18 | 0.26 | 0.70 |
| **LU** | 1.00 | 1.00 | 1.00 |
| **LV** | 0.19 | 0.29 | 0.68 |
| **MT** | 1.00 | 1.00 | 1.00 |
| **NL** | 0.06 | 0.07 | 0.95 |
| **NO** | 0.17 | 0.23 | 0.74 |
| **PL** | 0.04 | 0.06 | 0.74 |
| **PT** | 0.09 | 0.10 | 0.90 |
| **RO** | 0.08 | 0.11 | 0.74 |
| **SE** | 0.10 | 0.12 | 0.85 |
| **SI** | 0.56 | 0.50 | 1.12 |
| **SK** | 0.12 | 0.13 | 0.97 |
| **UK** | 0.03 | 0.04 | 0.78 |

*Source: authors' calculation based on eCORDA*

### 3.3.2 Participation by Specific Programme

Table 13 reports the count of UNIV projects by Specific Programme. 40.1% of UNIV projects, out of 19,257, relate to the Specific Programme PEOPLE, followed by 34.8% assigned to COOPERATION, while 17.8% refer to the Specific Programme IDEAS. Very low percentages of UNIV projects are associated with the Specific Programmes CAPACITIES (6.8%) and Euratom (0.6%). Note that due to the fact that universities can participate in more than one project, belonging to different Specific Programmes, the last column (% on total) adds up to more than 100%. The Table also shows that 87.4% of the participating universities are associated with COOPERATION, the 68.1% with PEOPLE and the 55.3% with CAPACITIES. Only 417 universities, out of 1,274 participating in the FP7, have been granted at least one project related to the IDEAS program that includes the ERC.

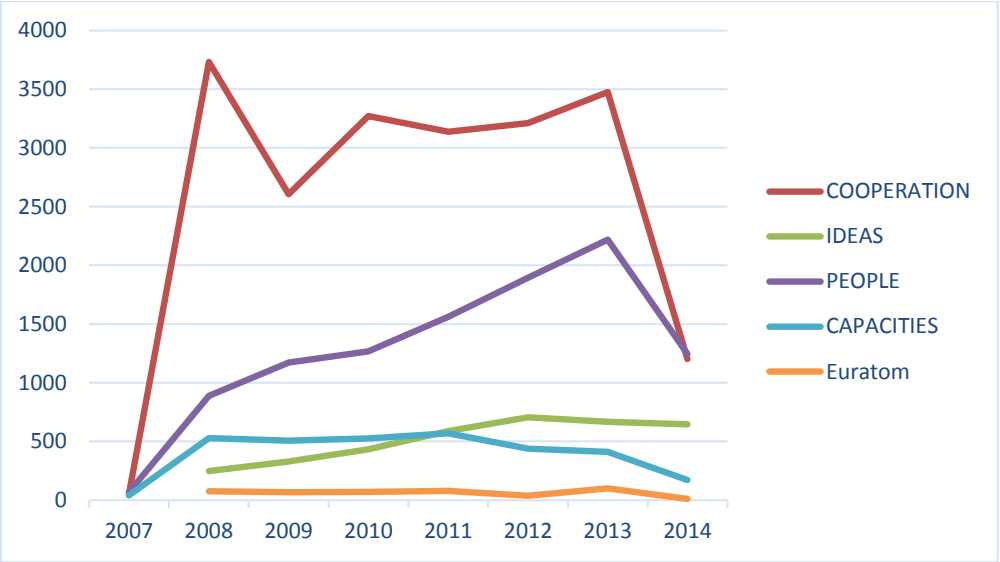
Figure 3 illustrates the trend across the years of the number of UNIV projects by Specific Programme.

**Table 13 – Number of UNIV projects and universities as participants by Specific Programme in FP7**

| Specific Programme | Number of UNIV projects | % on total number of projects | Number of university participants | Percent age on total | Particip ations | % on total |
|---|---|---|---|---|---|---|
| **COOPERATION** | 6692 | 34.8% | 1113 | 87.4% | 25899 | 56.0% |
| **IDEAS** | 3428 | 17.8% | 417 | 32.7% | 3912 | 8.5% |
| **PEOPLE** | 7721 | 40.1% | 868 | 68.1% | 12030 | 26.0% |
| **CAPACITIES** | 1300 | 6.8% | 705 | 55.3% | 3810 | 8.2% |
| **Euratom** | 116 | 0.6% | 169 | 13.3% | 556 | 1.2% |
| **TOTAL** | **19257** | **100.0%** | **1,274** | | **46207** | **100.0%** |

*Source: authors' calculation based on eCORDA*

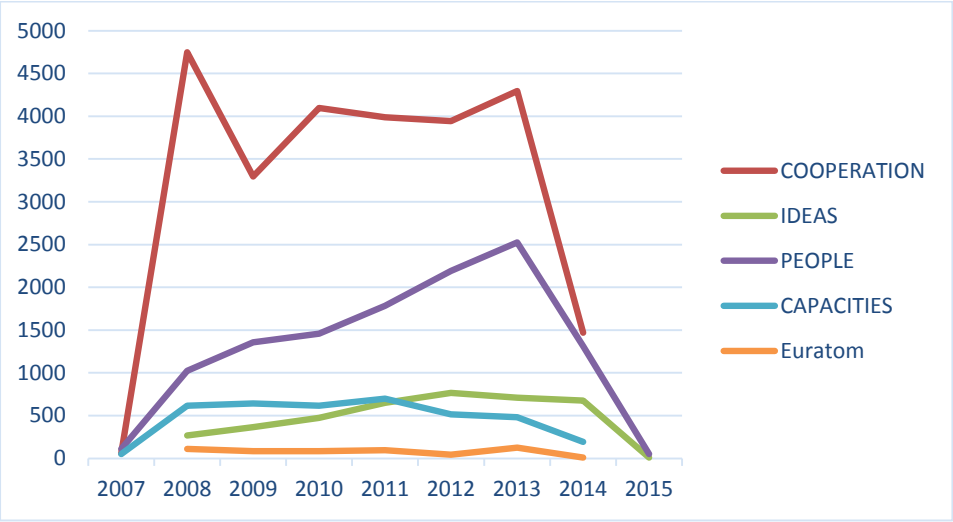
**Figure 3 – Trend of the number of UNIV projects by Specific Programme in FP7**




*Source: authors' calculation based on eCORDA*

Figure 4 describes the trend across the years of the number of universities participants by Specific Programme, revealing a similar performance to the one illustrated before in terms of number of UNIV projects.

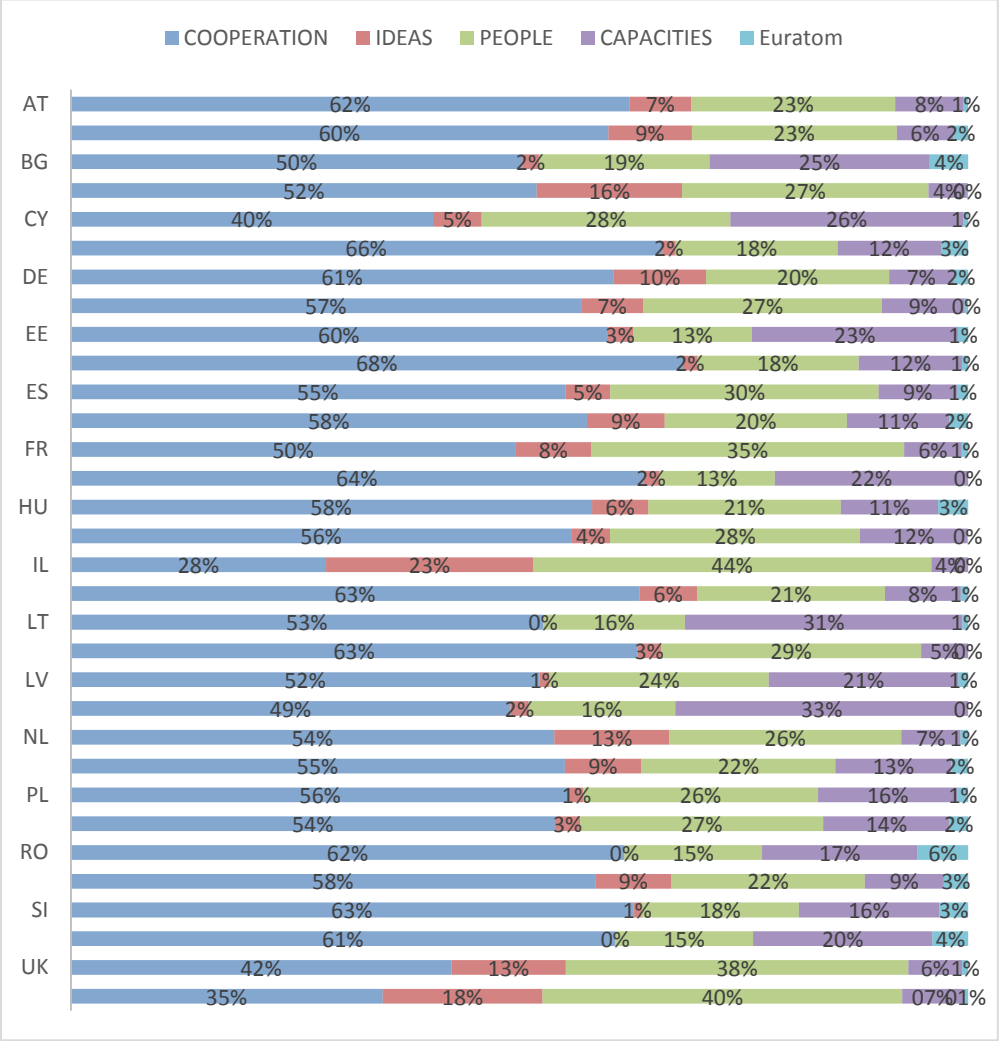
**Figure 4 – Trend of the number of university participants by Specific Programme in FP7**




*Source: authors' calculation based on eCORDA*

Figure 5 illustrates the composition of the portfolio of UNIV projects across the different Specific Programmes by country. The largest incidence of UNIV projects associated with COOPERATION occurs in the following countries: EL (68%), CZ (66%), HR (64%), while the lowest value is recorded for IL (28%), which instead registers the highest incidence of projects in PEOPLE (44%) and IDEAS (23%). The Specific Programme CAPACITIES includes the largest incidence of UNIV projects for MT (33%), LT (31%), CY (26%) and BG (25%). The weight of the UNIV projects associated with Euratom in the single countries' project portfolio is limited across all the countries.

**Figure 5 – Portfolio composition of UNIV projects across Specific Programmes by country in FP7**




*Source: authors' calculation based on eCORDA*

Table 14 illustrates the participation of universities in the different Specific Programmes by country. In line with previous evidence on the portfolio composition of UNIV projects across the different schemes, it emerges that universities mostly participate in COOPERATION, with the exception of HU (reporting similar incidence for COOPERATION and CAPACITIES), IL and LV (privileging PEOPLE), LU and MT (showing the same percentage incidence across all the schemes).

**Table 14 – Participation of universities in the different Specific Programmes by country in FP7**

| Country | Participants | COOPERATION | IDEAS | PEOPLE | CAPACITIES | Euratom |
|---|---|---|---|---|---|---|
| **AT** | 39 | 85% | 33% | 62% | 51% | 10% |
| **BE** | 26 | 88% | 42% | 58% | 58% | 23% |
| **BG** | 27 | 74% | 7% | 56% | 44% | 11% |
| **CH** | 24 | 100% | 58% | 83% | 58% | 13% |
| **CY** | 11 | 82% | 18% | 55% | 82% | 9% |
| **CZ** | 23 | 91% | 17% | 65% | 61% | 13% |
| **DE** | 188 | 90% | 40% | 58% | 48% | 12% |
| **DK** | 13 | 92% | 54% | 69% | 62% | 8% |
| **EE** | 7 | 100% | 43% | 57% | 43% | 14% |
| **EL** | 33 | 88% | 24% | 70% | 70% | 15% |
| **ES** | 71 | 92% | 39% | 85% | 66% | 21% |
| **FI** | 21 | 95% | 38% | 67% | 71% | 29% |
| **FR** | 175 | 85% | 29% | 61% | 38% | 6% |
| **HR** | 29 | 86% | 7% | 38% | 48% | 0% |
| **HU** | 22 | 73% | 32% | 86% | 73% | 9% |
| **IE** | 23 | 83% | 39% | 70% | 65% | 4% |
| **IL** | 17 | 76% | 53% | 94% | 47% | 0% |
| **IT** | 85 | 95% | 46% | 84% | 66% | 16% |
| **LT** | 13 | 77% | 0% | 62% | 69% | 8% |
| **LU** | 1 | 100% | 100% | 100% | 100% | 0% |
| **LV** | 12 | 58% | 8% | 92% | 42% | 8% |
| **MT** | 1 | 100% | 100% | 100% | 100% | 0% |
| **NL** | 35 | 83% | 57% | 60% | 71% | 34% |
| **NO** | 24 | 83% | 21% | 67% | 58% | 13% |
| **PL** | 79 | 80% | 6% | 72% | 42% | 8% |
| **PT** | 48 | 83% | 27% | 67% | 38% | 6% |
| **RO** | 34 | 85% | 0% | 59% | 56% | 15% |
| **SE** | 31 | 100% | 35% | 71% | 77% | 29% |
| **SI** | 10 | 80% | 10% | 50% | 50% | 10% |
| **SK** | 17 | 82% | 0% | 53% | 65% | 18% |
| **UK** | 135 | 93% | 50% | 83% | 70% | 20% |

*Source: authors' calculation based on eCORDA*

Table 15 describes the amount of EC funding by Specific Programme devoted to UNIV projects. The total amount of EC funding devoted to UNIV projects in the COOPERATION and Euratom Specific Programmes is mostly concentrated in the interval € 2.5-5 million, while for IDEAS and CAPACITIES in the interval € 1-2.5 million and for PEOPLE in the interval € 250,000 -1 million.

**Table 15 – EC funding by Specific Programme: amount and distribution of UNIV projects in FP7 (€ million)**

| Programme | EC Funding | <=0.25 | 0.25 - 1.0 | 1.0 - 2.5 | 2.5 - 5.0 | >5.0 |
|---|---|---|---|---|---|---|
| **COOPERATION** | 25917.17 | 1.6% | 10.9% | 23.5% | 41.3% | 22.7% |
| **IDEAS** | 5813.16 | 4.3% | 8.8% | 84.2% | 2.3% | 0.6% |
| **PEOPLE** | 3911.33 | 74.3% | 14.8% | 3.2% | 7.3% | 0.3% |
| **CAPACITIES** | 2893.05 | 1.2% | 27.8% | 47.9% | 15.0% | 8.1% |
| **Euratom** | 337.13 | 1.7% | 27.6% | 19.0% | 31.0% | 20.7% |

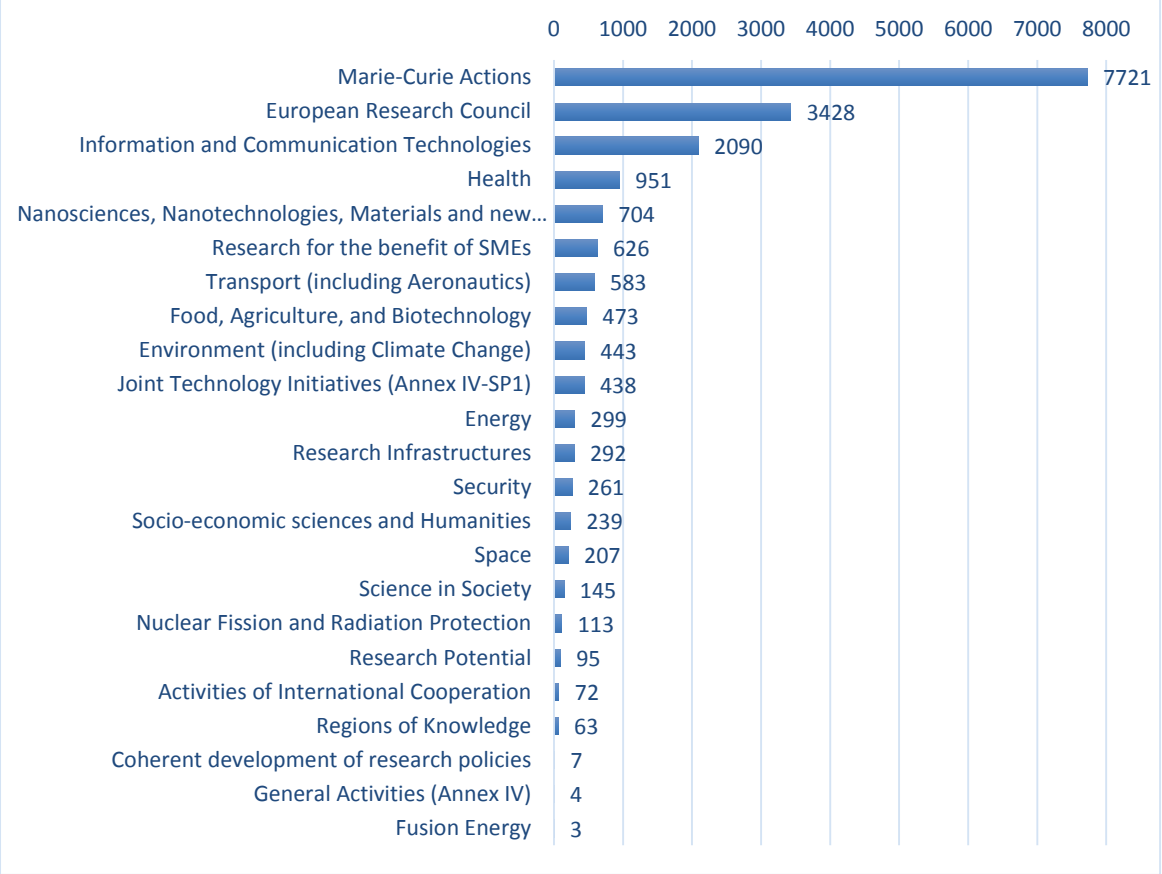
*Source: authors' calculation based on eCORDA*

Figure 6 and Figure 7 illustrate the number of UNIV projects and the number of universities with at least one granted project by Thematic Areas. The greatest number of UNIV projects is associated with Marie-Curie Actions, ERC and Information and Communication Technologies thematic areas. In terms of the

number of universities with at least one granted project in the Thematic Area, Figure 7 shows that 868 universities were awarded a project belonging to Marie-Curie Actions, followed by Information and Communication Technologies (671) and Health (491). Note that:

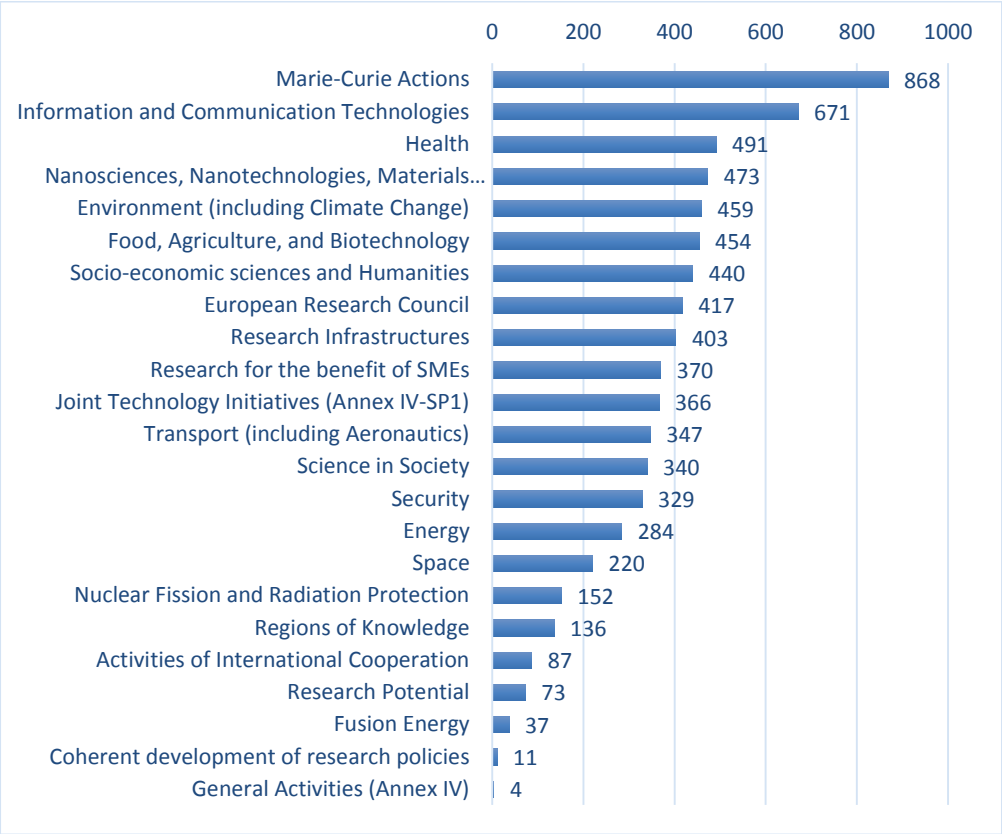
- COOPERATION includes: Health, Information and Communication Technologies, Nanosciences, Nanotechnologies, Materials and new Production Technologies, Transport (including Aeronautics), Food, Agriculture, and Biotechnology, Environment (including Climate Change), Energy, Socio-economic Sciences and Humanities, Security, Space, General Activities;
- IDEAS includes European Research Council (ERC);
- PEOPLE includes Marie-Curie Actions;
- CAPACITIES includes Research for the Benefit of SMEs, Research Infrastructures, Science in Society, Research Potential, Activities of International Cooperation, Regions of Knowledge, Coherent Development of Research Policies, Joint Technology Initiatives. Euratom includes: Nuclear Fission and Radiation Protection.

**Figure 6 – Number of UNIV projects by Thematic Areas in FP7**




*Source: authors' calculation based on eCORDA*

**Figure 7 – Number of universities with at least one granted project in each Thematic Area in FP7**




*Source: authors' calculation based on eCORDA*

Given the importance of IDEAS in the FP7, in the following Table we provide a breakdown of all retained projects granted under this Specific Programme. In particular, we have computed the following indicators: number of projects with at least one participant located in a specific country (column 2); number of projects coordinated by a participant located in a specific country (column 3); number of participations (column 5); total EC funding received by participants located in a specific country (column 6); average EC funding received by participants located in a specific country (column 7). The joint observation of all these indicators clearly shows that the IDEAS projects are, on average, highly geographically concentrated. Indeed, 51.5% of projects are coordinated by a participant from three countries (NL, UK and DE). Moreover, 52.6% of the total EC funding is allocated to NL, UK and DE. Extra EU countries (NO, CH, IL) have a significant weight in terms of number of projects, participations and EC funding. 18.1% of projects are coordinated by a participant from extra EU countries (NO, CH, IL), with a leading role played by IL. The total EC funding received by participants located in IL and CH totals more than € 900 million. CH is the third top country in terms of total EC funding, after DE and NL. Interestingly, in terms of number of projects coordinated by a participant some differences emerge between the overall figures in FP7 and the ones of the Specific Programme IDEAS. Some countries have significantly higher percentages of projects coordinated in the Specific Programme IDEAS with respect to the FP7: CH (9.1% versus 5.6%), DE (12.6% versus 104%), IL (7.7% versus 5.2%) and NL (10.4% versus 8.1%). Other countries report, on the contrary, lower percentage incidences for the Specific Programme IDEAS compared to the FP7: IT (4.9% versus 6.3%), ES (3% versus 5.4%), FR (3.6% versus 4.1%).

**Table 16 – Universities participation in the IDEAS Specific Programme by country**

| Country | Projects | Coordinator | Percentage | Participations | EC Funding Sum (€ million) | EC Funding Average (€ million) |
|---|---|---|---|---|---|---|
| **AT** | 81 | 76 | 2.3% | 81 | 119.07 | 1.47 |
| **BE** | 139 | 131 | 3.9% | 142 | 199.39 | 1.40 |
| **BG** | 3 | 2 | 0.1% | 3 | 2.07 | 0.69 |
| **CH** | 321 | 302 | 9.1% | 330 | 533.75 | 1.62 |
| **CY** | 9 | 9 | 0.3% | 9 | 11.65 | 1.29 |
| **CZ** | 7 | 5 | 0.1% | 7 | 8.60 | 1.23 |
| **DE** | 471 | 421 | 12.6% | 516 | 734.78 | 1.42 |
| **DK** | 86 | 78 | 2.3% | 89 | 136.41 | 1.53 |
| **EE** | 5 | 3 | 0.1% | 5 | 4.51 | 0.90 |
| **EL** | 16 | 16 | 0.5% | 16 | 22.38 | 1.40 |
| **ES** | 114 | 100 | 3.0% | 119 | 150.53 | 1.26 |
| **FI** | 69 | 63 | 1.9% | 71 | 108.83 | 1.53 |
| **FR** | 147 | 119 | 3.6% | 153 | 210.40 | 1.38 |
| **HR** | 2 | 2 | 0.1% | 2 | 3.25 | 1.63 |
| **HU** | 26 | 24 | 0.7% | 27 | 36.27 | 1.34 |
| **IE** | 42 | 38 | 1.1% | 45 | 52.24 | 1.16 |
| **IL** | 263 | 256 | 7.7% | 269 | 400.90 | 1.49 |
| **IT** | 188 | 165 | 4.9% | 211 | 233.96 | 1.11 |
| **LU** | 1 | 1 | 0.0% | 1 | 1.01 | 1.01 |
| **LV** | 1 | 1 | 0.0% | 1 | 1.36 | 1.36 |
| **MT** | 1 | 0 | 0.0% | 1 | 0.33 | 0.33 |
| **NL** | 369 | 346 | 10.4% | 415 | 597.47 | 1.44 |
| **NO** | 45 | 42 | 1.3% | 45 | 82.33 | 1.83 |
| **PL** | 11 | 9 | 0.3% | 13 | 11.71 | 0.90 |
| **PT** | 16 | 14 | 0.4% | 17 | 21.99 | 1.29 |
| **SE** | 171 | 161 | 4.8% | 179 | 278.83 | 1.56 |
| **SI** | 2 | 1 | 0.0% | 2 | 0.64 | 0.32 |
| **UK** | 1,016 | 951 | 28.5% | 1,143 | 1,596.53 | 1.40 |

*Source: authors' calculation based on eCORDA*

In the following Table we have examined the number of IDEAS projects granted to the top 5, top10 and top25 university participants. The Table shows that the top five and top ten universities have been granted, respectively, the 15% and 24% of the projects funded under IDEAS.

**Table 17 – Number of IDEAS projects granted to top participants**

| | TOP 5 | % on total IDEAS programme | TOP 10 | % on total IDEAS programme | TOP 25 | % on total IDEAS programme |
|---|---|---|---|---|---|---|
| **Participations** | 586 | 14.9% | 929 | 23.7% | 1,506 | 38.5% |
| **Funding** | 912 | 16.3% | 1,434 | 25.8% | 2,325 | 41.8% |
| **Represented Countries** | UK<br>CH | | UK<br>CH<br>IL<br>BE | | UK<br>CH<br>IL<br>BE<br>DE<br>NL<br>DK<br>SE | |

*Source: authors' calculation based on eCORDA*

### 3.3.3 Participation by funding scheme

Table 18 describes the number of UNIV projects by funding scheme. Nearly 70% of UNIV projects, out of 19,257, relate to the Marie Curie Actions and CP funding schemes. 17.0% of UNIV projects are instead financed with the ERC funding scheme. The column "% on all FP7 projects" refers to the share of UNIV projects on the total of FP7 projects financed with the specific instrument. Regarding the Network of Excellence, all the 57 FP7 financed projects are UNIV projects. Concerning the CP funding scheme, the 92.5% of the financed projects are those in which at least a university is a participant. On average, more than 60% of the funded projects in the different funding schemes are UNIV projects. The specialization index provides a picture of how much UNIV projects deviate from the average in the usage of the different funding schemes.

**Table 18 – Number of UNIV projects by funding scheme in FP7**

| Funding scheme | Description | ALL FP7 projects | % on total | UNIV projects | % on total UNIV projects | % on ALL FP7 projects funded by the scheme | Specialization index |
|---|---|---|---|---|---|---|---|
| **171** | Article 171 of the Treaty | 736 | 2.9% | 438 | 2.3% | 59.5% | 0.78 |
| **BSG** | Research for the benefit of specific groups | 968 | 3.8% | 614 | 3.2% | 63.4% | 0.83 |
| **CP** | Collaborative project, including combination of CP & CSA | 6,216 | 24.6% | 5747 | 29.8% | 92.5% | 1.21 |
| **CSA** | Coordination and Support Action | 2,570 | 10.2% | 1,611 | 8.4% | 62.7% | 0.82 |
| **ERC** | Support for frontier research (ERC) | 4,341 | 17.2% | 3,281 | 17.0% | 75.6% | 0.99 |
| **MC** | Support for training and career development of researchers (Marie Curie) | 10,350 | 41.0% | 7,509 | 39.0% | 72.6% | 0.95 |
| **NOE** | Network of Excellence | 57 | 0.2% | 57 | 0.3% | 100.0% | - |
| **Total** | | **25,238** | **100.0%** | **19,257** | **100.0%** | **76.3%** | **-** |

*Source: authors' calculation based on eCORDA*

Table 19 describes the distribution of UNIV projects by country and funding scheme. The largest incidence of UNIV projects associated with CP funding scheme occurs in the following EU13 countries MT (63.3%), SI (59.9%), EE (59.2%), CZ (58.9%) and RO (58.5%), while the lowest values are recorded for UK (38.3%) and IL (28.1%); the latter registers the highest incidence of projects funded by MC funding scheme (43.4%) and ERC (21.9%). In addition to IL, the MC funding scheme makes up for the largest share of UNIV projects in the UK (38.1%) and in FR (34.3%). The weight of the UNIV projects funded by NOE, 171 and BSG in the single countries' project portfolio is limited across all the countries.

**Table 19 – Number of UNIV projects by country and funding scheme in FP7**

| Country | UNIV projects | 171 | BSG | CP | CSA | ERC | MC | NOE |
|---|---|---|---|---|---|---|---|---|
| **AT** | 1,179 | 3.1% | 2.2% | 55.6% | 9.3% | 6.5% | 22.3% | 1.0% |
| **BE** | 1,493 | 1.3% | 2.1% | 54.5% | 9.8% | 8.8% | 22.2% | 1.1% |
| **BG** | 163 | 0.0% | 3.1% | 43.6% | 38.7% | 1.8% | 11.0% | 1.8% |
| **CH** | 1,982 | 1.9% | 0.9% | 47.0% | 6.5% | 15.4% | 27.1% | 1.2% |
| **CY** | 166 | 0.0% | 3.0% | 49.4% | 15.7% | 4.8% | 25.3% | 1.8% |
| **CZ** | 460 | 6.3% | 2.0% | 58.9% | 14.1% | 1.5% | 17.0% | 0.2% |
| **DE** | 4,580 | 2.6% | 2.1% | 56.0% | 8.2% | 10.0% | 20.2% | 0.9% |
| **DK** | 1,245 | 3.1% | 2.2% | 51.1% | 9.6% | 6.7% | 26.4% | 1.0% |
| **EE** | 174 | 1.1% | 4.0% | 59.2% | 20.1% | 2.9% | 12.6% | 0.0% |
| **EL** | 1,006 | 3.9% | 4.3% | 58.3% | 13.7% | 1.6% | 16.9% | 1.3% |
| **ES** | 2,281 | 2.1% | 3.2% | 50.2% | 9.6% | 4.8% | 29.3% | 0.8% |
| **FI** | 798 | 3.4% | 1.9% | 55.8% | 10.3% | 8.4% | 19.4% | 0.9% |
| **FR** | 1,751 | 3.5% | 1.3% | 43.7% | 7.8% | 8.3% | 34.3% | 1.1% |
| **HR** | 116 | 2.6% | 5.2% | 51.7% | 25.9% | 1.7% | 12.1% | 0.9% |
| **HU** | 415 | 3.1% | 2.9% | 51.3% | 15.7% | 6.3% | 20.0% | 0.7% |
| **IE** | 987 | 2.1% | 4.9% | 49.0% | 11.8% | 3.6% | 27.6% | 1.0% |
| **IL** | 1,139 | 0.5% | 0.5% | 28.1% | 5.0% | 21.9% | 43.4% | 0.5% |
| **IT** | 2,933 | 4.5% | 3.7% | 55.9% | 9.0% | 6.2% | 19.8% | 1.0% |
| **LT** | 152 | 0.0% | 10.5% | 48.0% | 28.9% | 0.0% | 12.5% | 0.0% |
| **LU** | 38 | 5.3% | 0.0% | 50.0% | 18.4% | 2.6% | 23.7% | 0.0% |
| **LV** | 90 | 4.4% | 1.1% | 52.2% | 24.4% | 1.1% | 16.7% | 0.0% |
| **MT** | 49 | 4.1% | 2.0% | 63.3% | 16.3% | 2.0% | 12.2% | 0.0% |
| **NL** | 2,878 | 2.7% | 1.1% | 49.3% | 8.5% | 11.6% | 25.7% | 1.1% |
| **NO** | 527 | 1.7% | 2.3% | 55.2% | 9.3% | 8.5% | 21.6% | 1.3% |
| **PL** | 741 | 3.8% | 3.5% | 50.9% | 15.9% | 1.5% | 22.7% | 1.8% |
| **PT** | 569 | 2.6% | 4.2% | 51.3% | 12.5% | 2.8% | 25.8% | 0.7% |
| **RO** | 248 | 1.6% | 2.8% | 58.5% | 23.0% | 0.0% | 13.3% | 0.8% |
| **SE** | 2,011 | 2.9% | 2.1% | 54.5% | 9.4% | 8.2% | 21.4% | 1.5% |
| **SI** | 217 | 0.5% | 3.7% | 59.9% | 21.7% | 0.9% | 12.9% | 0.5% |
| **SK** | 150 | 4.7% | 2.0% | 45.3% | 32.7% | 0.0% | 15.3% | 0.0% |
| **UK** | 7,986 | 1.7% | 2.2% | 38.3% | 6.9% | 12.3% | 38.1% | 0.6% |
| **TOTAL** | **19,257** | **2.3%** | **3.2%** | **29.8%** | **8.4%** | **17.0%** | **39.0%** | **0.3%** |

*Source: authors' calculation based on eCORDA*

### 3.3.4 Composition of projects

Table 20 concerns the internationalisation potential of UNIV projects by country. The Table provides the average number of countries involved in UNIV projects by country (second column). The most internationally oriented countries are small and belonging to EU13: MT (12.0), LV (9.8), EE (9.6), BG (9.5), LT (9.4), SK (9.3); the least internationally oriented countries are the mainly extra EU or from EU15: IL (3.6), UK (4.6), CH (5.3), FR (5.4), DE (5.9) and NL (5.9). The Table also provides the distribution of projects by number of countries involved.

**Table 20 – Internationalisation: average number of countries involved in each UNIV project and distribution of projects by number of countries involved in FP7**

| Country | Mean | 1 country | 2 to 5 countries | 6 to 10 countries | more than 10 countries |
|---|---|---|---|---|---|
| **AT** | 6.8 | 18.5% | 24.1% | 38.8% | 18.6% |
| **BE** | 6.5 | 19.1% | 23.4% | 42.5% | 15.0% |
| **BG** | 9.5 | 14.7% | 18.4% | 32.5% | 34.4% |
| **CH** | 5.3 | 32.3% | 21.1% | 35.8% | 10.8% |
| **CY** | 8.4 | 23.5% | 13.3% | 36.7% | 26.5% |
| **CZ** | 8.0 | 10.4% | 21.5% | 44.6% | 23.5% |
| **DE** | 5.9 | 18.1% | 30.0% | 40.7% | 11.1% |
| **DK** | 7.0 | 21.0% | 20.6% | 37.1% | 21.2% |
| **EE** | 9.6 | 8.0% | 17.2% | 37.4% | 37.4% |
| **EL** | 7.2 | 13.3% | 24.7% | 41.6% | 20.5% |
| **ES** | 6.0 | 22.5% | 27.0% | 36.5% | 14.0% |
| **FI** | 7.1 | 16.5% | 23.9% | 39.0% | 20.6% |
| **FR** | 5.4 | 26.1% | 27.4% | 36.1% | 10.5% |
| **HR** | 8.2 | 15.5% | 15.5% | 40.5% | 28.4% |
| **HU** | 7.6 | 17.6% | 15.4% | 43.4% | 23.6% |
| **IE** | 6.4 | 18.9% | 29.7% | 35.2% | 16.2% |
| **IL** | 3.6 | 59.9% | 12.9% | 20.3% | 6.9% |
| **IT** | 6.2 | 15.4% | 31.0% | 41.7% | 11.9% |
| **LT** | 9.4 | 9.2% | 19.7% | 39.5% | 31.6% |
| **LU** | 7.3 | 15.8% | 18.4% | 50.0% | 15.8% |
| **LV** | 9.8 | 16.7% | 17.8% | 31.1% | 34.4% |
| **MT** | 12.0 | 14.3% | 12.2% | 22.4% | 51.0% |
| **NL** | 5.9 | 26.1% | 22.2% | 39.3% | 12.5% |
| **NO** | 7.3 | 16.9% | 21.1% | 39.3% | 22.8% |
| **PL** | 7.2 | 13.5% | 25.1% | 40.9% | 20.5% |
| **PT** | 7.5 | 12.0% | 25.5% | 40.8% | 21.8% |
| **RO** | 8.6 | 7.7% | 21.4% | 38.7% | 32.3% |
| **SE** | 6.5 | 18.3% | 23.5% | 41.9% | 16.3% |
| **SI** | 8.8 | 8.3% | 18.0% | 41.9% | 31.8% |
| **SK** | 9.3 | 7.3% | 17.3% | 39.3% | 36.0% |
| **UK** | 4.6 | 39.2% | 23.6% | 29.3% | 7.9% |

*Source: authors' calculation based on eCORDA*

Since the IDEAS Specific Programme is less focused on setting up large international collaboration partnerships, in the following Table we present the data on the average number of countries excluding all the projects related to the IDEAS Specific Programme. As expected we observe a reduction in the incidence of single country projects, especially for those countries like the UK that have a high number of participation in the IDEAS Specific Programme.

**Table 21 – Internationalisation: average number of countries involved in each UNIV project and distribution of projects by number of countries involved in FP7. Data exclude IDEAS projects**

| Country | Mean | 1 | 1 to 5 | 5 to 10 | more than 10 |
|---|---|---|---|---|---|
| **AT** | 7.2 | 13.6% | 24.8% | 41.7% | 19.9% |
| **BE** | 7.0 | 12.0% | 24.7% | 46.8% | 16.5% |
| **BG** | 9.6 | 14.4% | 18.1% | 32.5% | 35.0% |
| **CH** | 6.1 | 21.7% | 22.8% | 42.7% | 12.9% |
| **CY** | 8.9 | 19.1% | 14.0% | 38.9% | 28.0% |
| **CZ** | 8.1 | 9.7% | 21.2% | 45.3% | 23.8% |
| **DE** | 6.5 | 10.3% | 31.9% | 45.4% | 12.4% |
| **DK** | 7.4 | 16.1% | 21.2% | 39.9% | 22.8% |
| **EE** | 9.8 | 6.5% | 16.6% | 38.5% | 38.5% |
| **EL** | 7.3 | 12.1% | 24.8% | 42.2% | 20.8% |
| **ES** | 6.3 | 19.2% | 27.7% | 38.4% | 14.7% |
| **FI** | 7.7 | 9.5% | 25.4% | 42.7% | 22.5% |
| **FR** | 5.8 | 21.3% | 27.9% | 39.4% | 11.4% |
| **HR** | 8.4 | 14.0% | 15.8% | 41.2% | 28.9% |
| **HU** | 8.0 | 13.1% | 15.7% | 46.0% | 25.2% |
| **IE** | 6.6 | 16.6% | 29.7% | 36.7% | 16.9% |
| **IL** | 4.3 | 50.0% | 14.6% | 26.4% | 9.0% |
| **IT** | 6.5 | 10.7% | 32.0% | 44.6% | 12.7% |
| **LT** | 9.4 | 9.2% | 19.7% | 39.5% | 31.6% |
| **LU** | 7.4 | 16.2% | 16.2% | 51.4% | 16.2% |
| **LV** | 9.9 | 15.7% | 18.0% | 31.5% | 34.8% |
| **MT** | 12.2 | 14.6% | 10.4% | 22.9% | 52.1% |
| **NL** | 6.5 | 16.7% | 23.9% | 45.0% | 14.3% |
| **NO** | 7.9 | 10.8% | 21.4% | 42.9% | 24.9% |
| **PL** | 7.3 | 13.2% | 24.5% | 41.5% | 20.8% |
| **PT** | 7.6 | 9.8% | 25.9% | 42.0% | 22.4% |
| **RO** | 8.6 | 7.7% | 21.4% | 38.7% | 32.3% |
| **SE** | 7.1 | 11.6% | 24.8% | 45.8% | 17.8% |
| **SI** | 8.8 | 7.9% | 17.7% | 42.3% | 32.1% |
| **SK** | 9.3 | 7.3% | 17.3% | 39.3% | 36.0% |
| **UK** | 5.1 | 32.5% | 24.9% | 33.5% | 9.1% |

*Source: authors' calculation based on eCORDA*

Table 22 describes the size of networks for UNIV projects by country. It reports the distribution of projects by number of partners involved. Approximately 42.1% of UNIV projects, out of 19,257, relate to solo projects (projects involving only one participant) and 58% are collaborative. About 20.8% are UNIV projects involving from 6 to 10 partners, while the other ranges (2 to 5 partners, 11 to 15, and >15) are, on average, less represented. This means that, when collaborating, participant universities are mainly involved in consortia of 6 to 10 partners. IL, UK and CH show the lowest levels of partnerships as revealed by their high share of solo projects (equal to 58.3%, 37.4% and 31.7% respectively). Small EU13 countries such as MT, SK, RO, SI and LV are characterised by the highest levels of partnerships as shown by their high share of projects involving more than fifteen partners. In line with previous results, it

appears that universities located in smaller countries with a weaker research system participate to UNIV projects involving a high number of partners.

**Table 22 – Network size by country in FP7**

| Country | UNIV Projects | Participants | Solo projects | 2 to 5 partners | 6 to 10 | 11 to 15 | >15 |
|---|---|---|---|---|---|---|---|
| **AT** | 1,179 | 39 | 17.5% | 8.1% | 28.2% | 20.5% | 25.7% |
| **BE** | 1,493 | 26 | 18.1% | 8.6% | 30.4% | 20.6% | 22.2% |
| **BG** | 163 | 27 | 10.4% | 5.5% | 27.6% | 22.7% | 33.7% |
| **CH** | 1,982 | 24 | 31.7% | 8.4% | 25.8% | 16.7% | 17.4% |
| **CY** | 166 | 11 | 21.1% | 4.2% | 27.1% | 18.7% | 28.9% |
| **CZ** | 460 | 23 | 9.3% | 7.0% | 26.1% | 25.9% | 31.7% |
| **DE** | 4,580 | 188 | 16.5% | 10.9% | 32.0% | 20.7% | 19.9% |
| **DK** | 1,245 | 13 | 20.7% | 7.5% | 25.0% | 19.5% | 27.3% |
| **EE** | 174 | 7 | 8.0% | 9.8% | 25.3% | 23.0% | 33.9% |
| **EL** | 1,006 | 33 | 11.7% | 9.7% | 27.7% | 23.8% | 27.0% |
| **ES** | 2,281 | 71 | 20.9% | 10.0% | 29.7% | 18.4% | 21.0% |
| **FI** | 798 | 21 | 15.3% | 9.3% | 26.8% | 19.4% | 29.2% |
| **FR** | 1,751 | 175 | 23.3% | 13.4% | 25.6% | 17.9% | 19.9% |
| **HR** | 116 | 29 | 14.7% | 5.2% | 26.7% | 21.6% | 31.9% |
| **HU** | 415 | 22 | 15.7% | 6.7% | 23.1% | 24.3% | 30.1% |
| **IE** | 987 | 23 | 18.4% | 10.8% | 31.1% | 18.4% | 21.2% |
| **IL** | 1,139 | 17 | 58.3% | 6.4% | 14.9% | 11.2% | 9.1% |
| **IT** | 2,933 | 85 | 12.6% | 13.1% | 30.2% | 22.2% | 21.9% |
| **LT** | 152 | 13 | 5.9% | 8.6% | 32.9% | 20.4% | 32.2% |
| **LU** | 38 | 1 | 15.8% | 10.5% | 23.7% | 21.1% | 28.9% |
| **LV** | 90 | 12 | 8.9% | 13.3% | 22.2% | 18.9% | 36.7% |
| **MT** | 49 | 1 | 10.2% | 6.1% | 18.4% | 14.3% | 51.0% |
| **NL** | 2,878 | 35 | 23.9% | 9.2% | 28.2% | 18.3% | 20.4% |
| **NO** | 527 | 24 | 16.9% | 6.6% | 26.2% | 20.3% | 30.0% |
| **PL** | 741 | 79 | 10.9% | 12.3% | 28.3% | 23.8% | 24.7% |
| **PT** | 569 | 48 | 10.4% | 11.6% | 28.5% | 20.4% | 29.2% |
| **RO** | 248 | 34 | 5.6% | 8.1% | 25.8% | 21.8% | 38.7% |
| **SE** | 2,011 | 31 | 17.2% | 9.4% | 28.0% | 20.5% | 24.8% |
| **SI** | 217 | 10 | 3.7% | 10.1% | 27.2% | 23.0% | 35.9% |
| **SK** | 150 | 17 | 7.3% | 6.0% | 23.3% | 24.7% | 38.7% |
| **UK** | 7,986 | 135 | 37.2% | 11.1% | 23.7% | 14.5% | 13.4% |

*Source: authors' calculation based on eCORDA*

As we have already done for the previous Tables, in the following Table we present the data on the network size by excluding all the projects related to the IDEAS Specific Programme. IL, UK and CH show the lowest levels of partnerships as revealed by their high share of solo projects (equal to 37%, 27% and 18% respectively). Also in this case, small EU13 countries such as MT, SK, RO, SI and LV are characterised by the highest levels of partnerships as shown by their high share of projects involving more than fifteen partners.

**Table 23 – Network size by country in FP7; Data exclude IDEAS projects**

| Countries | Solo projects | 2 to 5 partners | 6 to 10 | 11 to 15 | >15 |
|---|---|---|---|---|---|
| **AT** | 11.8% | 7.0% | 28.2% | 20.5% | 25.7% |
| **BE** | 10.1% | 7.4% | 30.3% | 20.6% | 22.2% |
| **BG** | 9.8% | 4.9% | 27.0% | 22.7% | 33.7% |
| **CH** | 18.0% | 6.0% | 25.7% | 16.7% | 17.4% |
| **CY** | 15.7% | 4.2% | 27.1% | 18.7% | 28.9% |
| **CZ** | 8.5% | 6.3% | 26.1% | 25.9% | 31.7% |
| **DE** | 9.0% | 8.3% | 31.9% | 20.7% | 19.9% |
| **DK** | 14.9% | 6.3% | 25.0% | 19.5% | 27.3% |

| | | | | | |
|---|---|---|---|---|---|
| **EE** | 6.3% | 8.6% | 25.3% | 23.0% | 33.9% |
| **EL** | 10.3% | 9.5% | 27.7% | 23.8% | 27.0% |
| **ES** | 17.0% | 8.9% | 29.7% | 18.4% | 21.0% |
| **FI** | 7.8% | 8.1% | 26.8% | 19.4% | 29.2% |
| **FR** | 17.6% | 10.8% | 25.5% | 17.9% | 19.9% |
| **HR** | 12.9% | 5.2% | 26.7% | 21.6% | 31.9% |
| **HU** | 10.6% | 5.8% | 22.9% | 24.3% | 30.1% |
| **IE** | 15.5% | 9.6% | 31.0% | 18.4% | 21.2% |
| **IL** | 37.3% | 4.3% | 14.9% | 11.2% | 9.1% |
| **IT** | 8.5% | 10.9% | 30.2% | 22.2% | 21.9% |
| **LT** | 5.9% | 8.6% | 32.9% | 20.4% | 32.2% |
| **LU** | 15.8% | 7.9% | 23.7% | 21.1% | 28.9% |
| **LV** | 7.8% | 13.3% | 22.2% | 18.9% | 36.7% |
| **MT** | 10.2% | 6.1% | 16.3% | 14.3% | 51.0% |
| **NL** | 14.0% | 6.3% | 28.2% | 18.3% | 20.4% |
| **NO** | 9.9% | 5.1% | 26.2% | 20.3% | 30.0% |
| **PL** | 10.4% | 11.5% | 28.2% | 23.8% | 24.7% |
| **PT** | 8.1% | 11.1% | 28.5% | 20.4% | 29.2% |
| **RO** | 5.6% | 8.1% | 25.8% | 21.8% | 38.7% |
| **SE** | 10.0% | 8.2% | 27.9% | 20.5% | 24.8% |
| **SI** | 3.2% | 9.7% | 27.2% | 23.0% | 35.9% |
| **SK** | 7.3% | 6.0% | 23.3% | 24.7% | 38.7% |
| **UK** | 27.6% | 8.1% | 23.6% | 14.5% | 13.4% |

*Source: authors' calculation based on eCORDA*

Table 24 describes the types of partnerships characterizing UNIV projects by country. Organisations participating in FP7 are classified as follows:

- Higher education (HES);
- Research organisations (excluding education) (REC);
- Public body (excluding research and education) (PUB);
- Private for profit (excluding education and including the following sub-group: small or medium enterprises [SMEs]) (PRC); and
- Others (OTH).

On average, universities establish partnership mainly with other universities, REC and PRC. However, some countries such as MT, BG, SI, RO, EE, SK and LU show high percentage of collaboration with PUB, compared to other nations. On the opposite side, IL presents the lowest percentage of collaboration with PUB. It seems that in smaller countries with smaller research and innovation systems universities tend to cooperate more with public bodies than in other countries. It must be noted that data on partnerships reported in Table 24 are influenced by the size of networks for UNIV projects shown in Table 22. This explains why countries like UK and IL, characterized by high shares of solo projects, reveal low percentage of participation with other universities.

**Table 24 – Data on partnerships by country in FP7**

| Country | Projects | Participants | Other universities | HES non university | REC | PRC | PUB | OTH |
|---|---|---|---|---|---|---|---|---|
| **AT** | 1,179 | 39 | 75.4% | 6.2% | 69.4% | 65.3% | 19.3% | 17.1% |
| **BE** | 1,493 | 26 | 76.3% | 6.2% | 68.6% | 60.5% | 17.3% | 15.6% |
| **BG** | 163 | 27 | 76.7% | 8.0% | 74.2% | 58.9% | 38.7% | 29.4% |
| **CH** | 1,982 | 24 | 64.7% | 4.3% | 56.2% | 51.9% | 11.8% | 8.4% |
| **CY** | 166 | 11 | 72.9% | 12.0% | 68.1% | 57.8% | 25.3% | 22.9% |
| **CZ** | 460 | 23 | 85.7% | 6.1% | 80.0% | 70.2% | 20.9% | 20.0% |
| **DE** | 4,580 | 188 | 76.9% | 5.0% | 68.4% | 63.4% | 14.6% | 12.7% |
| **DK** | 1,245 | 13 | 73.7% | 6.5% | 66.2% | 58.6% | 18.8% | 16.0% |
| **EE** | 174 | 7 | 89.1% | 14.9% | 73.6% | 55.2% | 29.3% | 23.6% |
| **EL** | 1,006 | 33 | 79.3% | 6.6% | 75.0% | 70.5% | 18.0% | 17.7% |
| **ES** | 2,281 | 71 | 71.3% | 4.8% | 66.3% | 58.9% | 16.7% | 15.1% |
| **FI** | 798 | 21 | 78.2% | 6.5% | 68.7% | 62.2% | 19.4% | 15.7% |
| **FR** | 1,751 | 175 | 72.0% | 4.2% | 60.8% | 54.0% | 12.7% | 11.8% |
| **HR** | 116 | 29 | 82.8% | 6.9% | 75.9% | 68.1% | 22.4% | 19.8% |
| **HU** | 415 | 22 | 80.2% | 8.2% | 69.9% | 58.6% | 21.9% | 17.1% |
| **IE** | 987 | 23 | 73.9% | 5.1% | 63.2% | 65.8% | 17.8% | 17.5% |
| **IL** | 1,139 | 17 | 39.5% | 3.3% | 33.0% | 28.4% | 5.7% | 5.7% |
| **IT** | 2,933 | 85 | 79.2% | 5.4% | 70.9% | 64.9% | 16.5% | 14.4% |
| **LT** | 152 | 13 | 82.2% | 9.9% | 79.6% | 64.5% | 25.7% | 25.0% |
| **LU** | 38 | 1 | 71.1% | 13.2% | 63.2% | 65.8% | 28.9% | 28.9% |
| **LV** | 90 | 12 | 85.6% | 10.0% | 73.3% | 52.2% | 23.3% | 17.8% |
| **MT** | 49 | 1 | 77.6% | 18.4% | 83.7% | 69.4% | 49.0% | 28.6% |
| **NL** | 2,878 | 35 | 72.4% | 5.1% | 61.1% | 53.8% | 15.1% | 12.4% |
| **NO** | 527 | 24 | 79.7% | 5.9% | 67.6% | 59.0% | 23.7% | 17.5% |
| **PL** | 741 | 79 | 81.2% | 7.4% | 72.5% | 59.9% | 17.8% | 15.5% |
| **PT** | 569 | 48 | 84.0% | 4.9% | 72.8% | 62.7% | 19.7% | 20.0% |
| **RO** | 248 | 34 | 88.7% | 10.5% | 76.2% | 71.8% | 29.8% | 24.2% |
| **SE** | 2,011 | 31 | 77.0% | 4.3% | 68.7% | 62.2% | 17.1% | 14.0% |
| **SI** | 217 | 10 | 86.6% | 10.6% | 83.9% | 68.2% | 30.0% | 25.8% |
| **SK** | 150 | 17 | 88.0% | 10.0% | 76.7% | 66.7% | 29.3% | 26.7% |
| **UK** | 7,986 | 135 | 56.5% | 3.5% | 49.1% | 44.5% | 11.6% | 10.0% |

*Source: authors' calculation based on eCORDA*

Table 25 describes the types of partnerships characterizing UNIV projects by Specific Programme. Due to the different nature of the Specific Programmes, universities reveal high percentage of collaboration in the COOPERATION and Euratom programmes where partnerships with REC and PRC are more frequent than the other types of partnerships. Lower percentages of collaboration are associated with the Specific Programmes IDEAS and PEOPLE. In these programmes partnerships with other universities are more diffused than the other types of partnerships.

**Table 25 – Partnerships by Specific Programme in FP7 (percentage on total projects)**

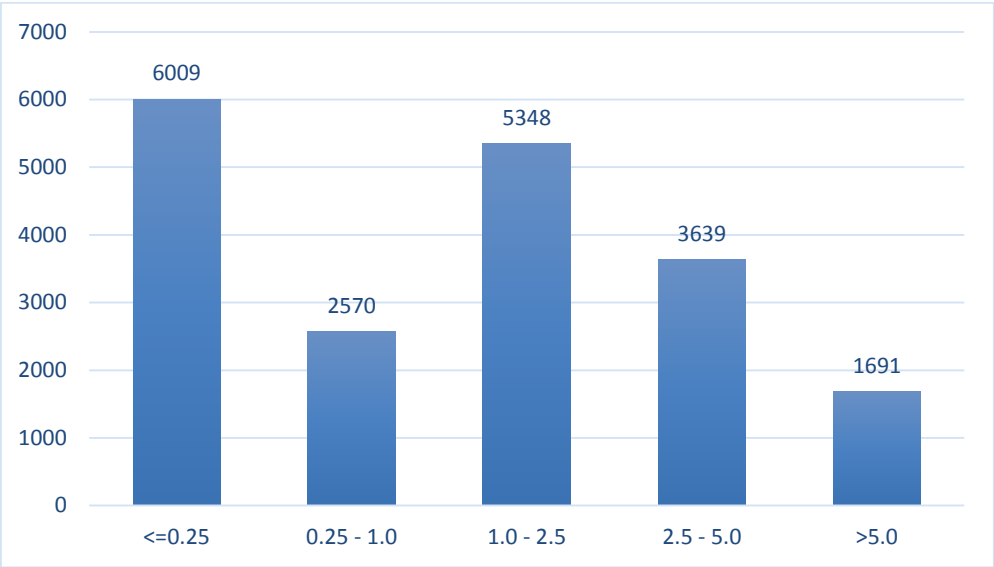
| Programme | Projects | Other universities | HES non university | REC | PRC | PUB | OTH |
|---|---|---|---|---|---|---|---|
| **COOPERATION** | 6692 | 80.6% | 5.2% | 85.6% | 82.3% | 20.2% | 17.5% |
| **IDEAS** | 3428 | 11.7% | 0.2% | 6.5% | 0.5% | 0.2% | 0.0% |
| **PEOPLE** | 7721 | 17.9% | 0.6% | 12.1% | 11.2% | 1.6% | 1.5% |
| **CAPACITIES** | 1300 | 53.4% | 6.3% | 75.5% | 74.3% | 23.2% | 27.9% |
| **Euratom** | 116 | 85.3% | 1.7% | 95.7% | 79.3% | 31.0% | 17.2% |

*Source: authors' calculation based on eCORDA*

### 3.3.5 EU funding and success rate

This section presents statistics concerning EU funding and success rate. Statistics are provided at both the project (UNIV projects) and the participant (universities) levels of analysis. To give a comprehensive picture, indicators are provided at different levels of breakdowns, e.g. per range of EC funding size, per country, Specific Programme and EC funding instrument. It is worth noting that statistics regards the EU financial contribution to granted UNIV projects and not the corresponding project costs. The average EC funding per UNIV project is approximately € 2.02 million. Yet, as Figure 8 clearly shows, the distribution of UNIV projects by EC funding size is skewed: a high number of UNIV projects has been granted € 250,000 or less (6,009 out of 19,257 UNIV projects, representing more than 30%) while a minority of UNIV projects have been granted more than € 5 million (1,691, representing nearly 9%).

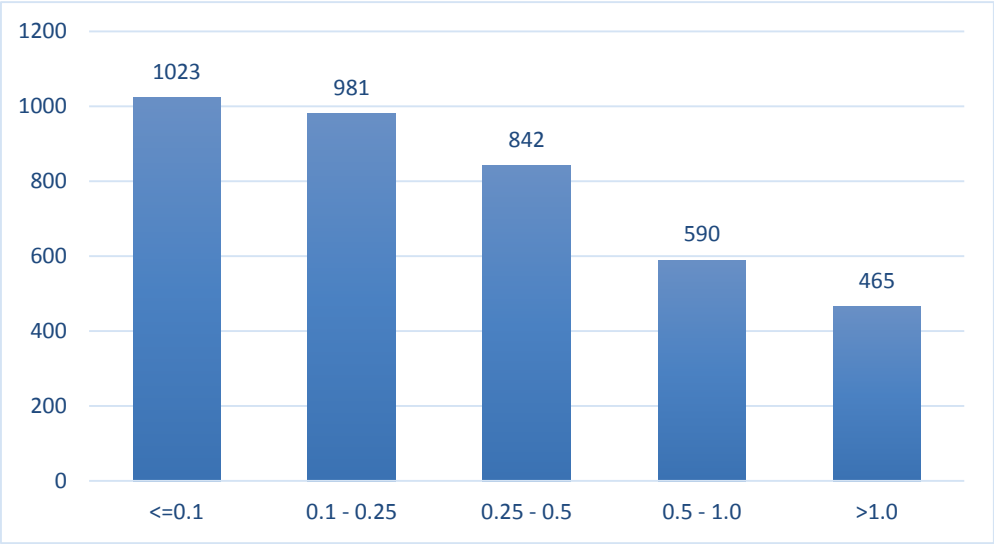
**Figure 8 – Distribution of UNIV projects by EC funding size in FP7 (€ million)**




*Source: authors' calculation based on eCORDA*

Figure 9 illustrates the distribution of universities by range of EC funding. The figure shows that 80% of universities has been granted at least one project with a EC funding (for the university) of up to € 100,000 while 36% of universities has been granted at least one project with a EC funding (for the university) of more than € 1 million. It is worth noting that an organization receiving different amount of EC funding in different projects can be included in more than one range of EC funding. For example, a university receiving € 100,000 in one project and € 1 million in another project is counted twice. This explains why the total number of organizations reported in Figure 9 (3,901) is higher than the total number of universities participating in FP7 (1,274).

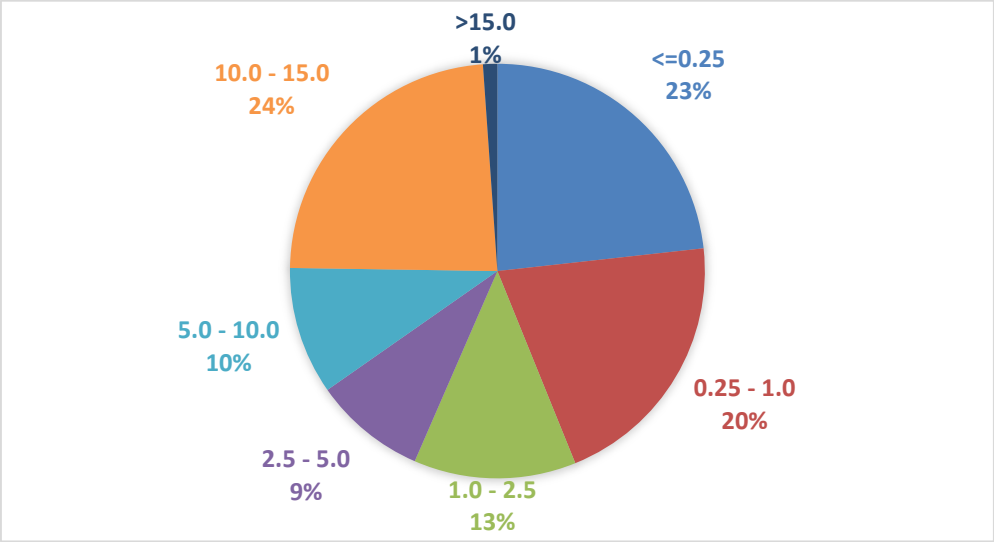
**Figure 9 – Distribution of participants per range of EC funding in FP7 (€ million)**




*Source: authors' calculation based on eCORDA*

Figure 10 illustrates the share of EC funding received in aggregate by each university. 43% of universities has received a total amount of EU funding lower than € 1 million: 23% has been granted € 250,000 or less; 20% are included in the range € 250,000 -1 million. Only 1% of universities has been granted a total amount of EU funding greater than € 15 million while 24% are included in the range € 10-15 million. The remaining 32% of universities are associated to the three medium size ranges: 13% are in the € 1-2.5 million range; 9% in the € 2.5-5 million range; 10% in the € 5-10 million range.

**Figure 10 – EC funding received in aggregate by each university in FP7 (€ million)**




*Source: authors' calculation based on eCORDA*

Table 26 shows the amount of EC funding by country of participants. The fourth column reports the total EC funding received by universities while the last column reports the average EC funding per participant.

The countries revealing the highest total amount of EC funding received by universities are UK, DE, NL, CH, IT and SE while the countries revealing the lowest values are small and late entrants countries like MT, LU, LV, LT and SK.

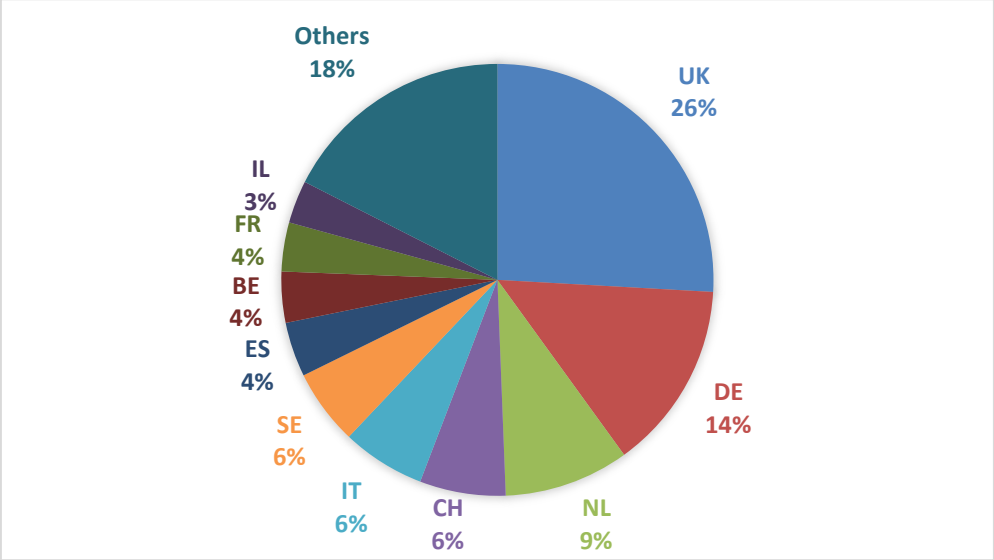
**Table 26 – Amount of EC funding by country of participants in FP7**

| Country | Projects | Participants | Total EC funding received by universities (€ million) |
|---|---|---|---|
| **AT** | 1,179 | 39 | 499.6 |
| **BE** | 1,493 | 26 | 721.9 |
| **BG** | 163 | 27 | 30.2 |
| **CH** | 1,982 | 24 | 1,217.8 |
| **CY** | 166 | 11 | 47.4 |
| **CZ** | 460 | 23 | 116.3 |
| **DE** | 4,580 | 188 | 2,674.0 |
| **DK** | 1,245 | 13 | 605.3 |
| **EE** | 174 | 7 | 39.1 |
| **EL** | 1,006 | 33 | 318.5 |
| **ES** | 2,281 | 71 | 773.8 |
| **FI** | 798 | 21 | 370.3 |
| **FR** | 1,751 | 175 | 693.6 |
| **HR** | 116 | 29 | 38.8 |
| **HU** | 415 | 22 | 100.4 |
| **IE** | 987 | 23 | 394.3 |
| **IL** | 1,139 | 17 | 605.6 |
| **IT** | 2,933 | 85 | 1,182.0 |
| **LT** | 152 | 13 | 22.6 |
| **LU** | 38 | 1 | 12.8 |
| **LV** | 90 | 12 | 19.0 |
| **MT** | 49 | 1 | 6.0 |
| **NL** | 2,878 | 35 | 1,771.9 |
| **NO** | 527 | 24 | 263.1 |
| **PL** | 741 | 79 | 182.5 |
| **PT** | 569 | 48 | 143.6 |
| **RO** | 248 | 34 | 38.8 |
| **SE** | 2,011 | 31 | 1,069.4 |
| **SI** | 217 | 10 | 39.8 |
| **SK** | 150 | 17 | 26.0 |
| **UK** | 7,986 | 135 | 4,899.4 |
| **Total** | **19,257** | **1,274** | **18,923.6** |

*Source: authors' calculation based on eCORDA*

Figure 11 illustrates the share of EC funding for the top 10 recipient countries. Around half of the EC funding in UNIV projects is concentrated in three countries: UK (26%), DE (14%) and NL (9%). The other countries included in the top 10 EU funding recipients are CH, IT, SE, ES, BE, FR and IL.

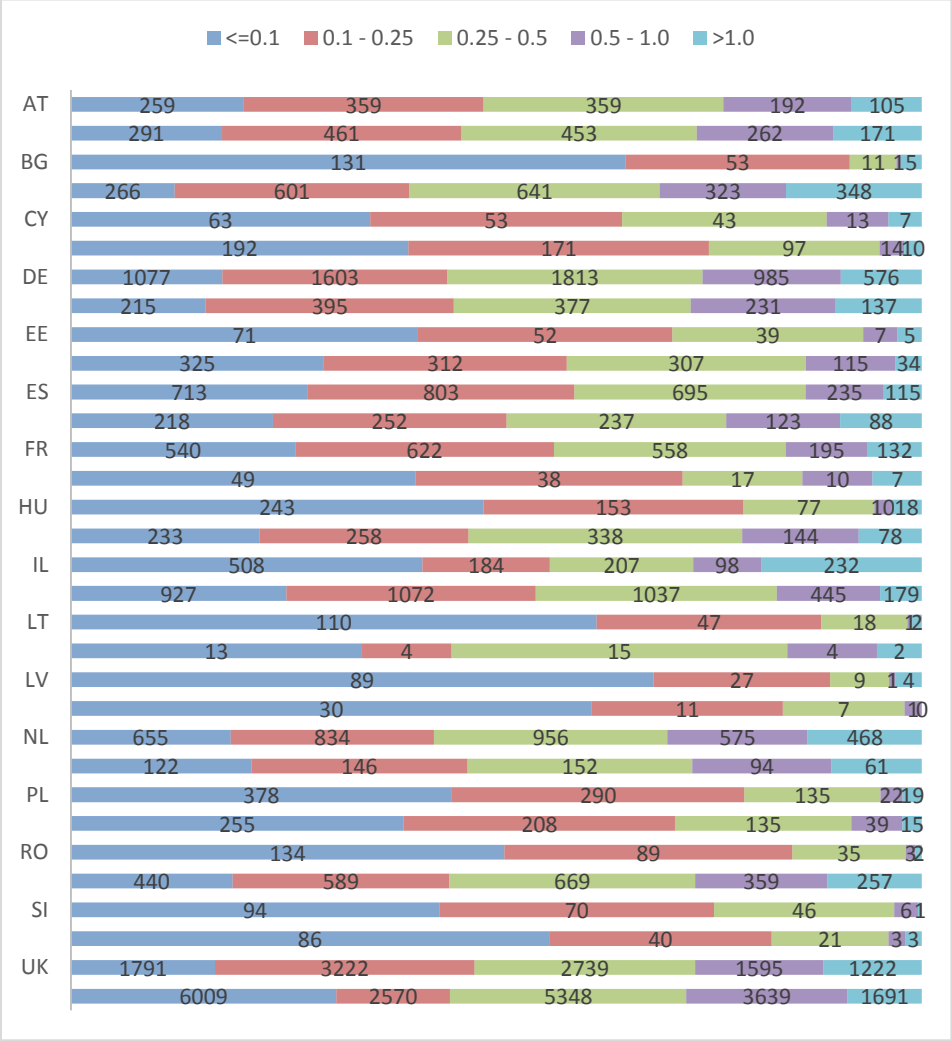
**Figure 11 – Top 10 countries in terms of share of funding received in FP7**




*Source: authors' calculation based on eCORDA*

Figure 12 illustrates the number of projects for different ranges of EC funding by country. BG, LV, LT, SK and RO are characterized by a high share of UNIV projects that have been granted € 100,000 or less. On the opposite side, CH, IL and NL are characterized by a high share of UNIV projects that has been granted more than € 1 million.

**Figure 12 – Number of UNIV projects per range of received EC funding by country in FP7 (€ million)**




*Source: authors' calculation based on eCORDA*

Table 27 shows the breakdown of EC funding by country of participants and Specific Programme. The total amount of EC funding devoted to universities is mostly concentrated in the COOPERATION Programme followed by IDEAS, PEOPLE, CAPACITIES and Euratom, respectively. It is worth noting that the total amount of EU funding awarded to the COOPERATION Programme is higher than the sum of the EU funding awarded to the other Programmes. Among the countries characterised by the highest total amount of EC funding received by universities, UK, DE and NL are the main beneficiaries in all the Specific Programmes; CH is relatively more able to attract EC funding in IDEAS, PEOPLE and COOPERATION and less in CAPACITIES and Euratom; IT and SE received a relatively significant amount of funding across all the Programmes and the same emerges on lower level for ES and BE.

**Table 27 – Breakdown of EC funding by country of participants and Specific Programme in FP7 (€ million)**

| Country | COOPERATION | IDEAS | PEOPLE | CAPACITIES | Euratom |
|---|---|---|---|---|---|
| **AT** | 297.1 | 119.1 | 71.4 | 11.4 | 0.5 |
| **BE** | 395.7 | 199.4 | 105.1 | 17.2 | 4.5 |
| **BG** | 11.2 | 2.1 | 3.0 | 13.3 | 0.6 |
| **CH** | 496.7 | 533.8 | 168.6 | 18.4 | 0.3 |
| **CY** | 19.1 | 11.7 | 8.8 | 7.8 | 0.0 |
| **CZ** | 76.7 | 8.6 | 13.0 | 15.7 | 2.2 |
| **DE** | 1,522.4 | 734.8 | 299.1 | 90.8 | 26.9 |
| **DK** | 320.5 | 136.4 | 120.4 | 27.5 | 0.5 |
| **EE** | 21.8 | 4.5 | 3.4 | 9.3 | 0.2 |
| **EL** | 215.7 | 22.4 | 35.6 | 44.2 | 0.6 |
| **ES** | 434.9 | 150.5 | 148.5 | 36.1 | 3.9 |
| **FI** | 199.8 | 108.8 | 41.0 | 18.6 | 2.1 |
| **FR** | 315.6 | 210.4 | 144.1 | 21.5 | 2.0 |
| **HR** | 14.0 | 3.3 | 2.8 | 18.8 | - |
| **HU** | 44.3 | 36.3 | 14.1 | 5.1 | 0.6 |
| **IE** | 245.6 | 52.2 | 77.4 | 18.8 | 0.3 |
| **IL** | 131.6 | 400.9 | 66.6 | 6.6 | - |
| **IT** | 756.3 | 234.0 | 144.7 | 41.1 | 5.9 |
| **LT** | 10.7 | - | 2.9 | 9.0 | 0.0 |
| **LU** | 9.7 | 1.0 | 1.9 | 0.1 | - |
| **LV** | 7.4 | 1.4 | 2.3 | 7.9 | 0.1 |
| **MT** | 3.9 | 0.3 | 0.7 | 1.0 | - |
| **NL** | 884.2 | 597.5 | 234.4 | 50.2 | 5.7 |
| **NO** | 124.0 | 82.3 | 42.0 | 14.8 | - |
| **PL** | 90.2 | 11.7 | 28.1 | 52.0 | 0.6 |
| **PT** | 84.6 | 22.0 | 24.6 | 11.9 | 0.6 |
| **RO** | 24.6 | - | 5.4 | 8.0 | 0.8 |
| **SE** | 611.8 | 278.8 | 124.9 | 40.7 | 13.2 |
| **SI** | 25.2 | 0.6 | 7.1 | 6.6 | 0.3 |
| **SK** | 14.5 | - | 3.9 | 7.3 | 0.2 |
| **UK** | 2,192.4 | 1,596.5 | 954.8 | 141.9 | 13.7 |
| **TOTAL** | **9,602.1** | **5,561.2** | **2,900.4** | **773.6** | **86.2** |

*Source: authors' calculation based on eCORDA*

Table 28 describes the breakdown of EC funding devoted to UNIV projects by instrument. The majority of UNIV projects have been financed through the MC or the CP instrument: approximately 39% have been financed through the MC instrument for a total amount of EC funding equal to € 3,885million; 30% through the CP instrument for a total of € 24,773 million. UNIV projects have been financed through the NOE, 171 and BSG to a lesser extent.

The average EC funding for the UNIV projects is higher for the CP and ERC instruments than for the other instruments while NOE reveals the lowest value.

The share of EC financial contribution devoted to UNIV projects is 88.7% of the whole amount of FP7 EC funding. The CP instrument reveals the highest share of EC funding devoted to UNIV projects compared to the whole amount of EC funding (94.7%) and is followed by 171 (86.0%), MC (82.0%) and ERC (75.7%).

**Table 28 – Breakdown of EC funding by instrument in FP7 at project level**

| Instruments | Description | UNIV Projects | Percentage | Total EC Funding received by UNIV Project (€ million) | Mean EC Funding (€ million) | ALL EC Funding (€ million) | % UNIV / ALL |
|---|---|---|---|---|---|---|---|
| **171** | Article 171 of the Treaty | 438 | 2.3% | 1690.67 | 3.9 | 1966.4 | 86.0% |
| **BSG** | Research for the benefit of specific groups | 614 | 3.2% | 777.37 | 1.8 | 1199.7 | 64.8% |
| **CP** | Collaborative project, Combination of CP & CSA | 5747 | 29.8% | 24773.26 | 56.6 | 26166.2 | 94.7% |
| **CSA** | Coordination and support action | 1611 | 8.4% | 1640.18 | 3.7 | 2887.7 | 56.8% |
| **ERC** | Support for frontier research (ERC) | 3281 | 17.0% | 5790.53 | 13.2 | 7645.2 | 75.7% |
| **MC** | Support for training and career development of researchers (Marie Curie) | 7509 | 39.0% | 3885.09 | 8.9 | 4737.4 | 82.0% |
| **NOE** | Network of Excellence | 57 | 0.3% | 314.74 | 0.7 | 314.7 | 100.0 % |
| | **Total** | **19257** | **100.0 %** | **38871.8** | **88.7** | **44917.3** | **86.5 %** |

*Source: authors' calculation based on eCORDA*

The call for proposals in FP7 attracted 158,562 applications for funding of which 153,842 (97%) were eligible[10]. In the following Table we report the success rate computed according to different possible methods (respectively, referring to number of eligible proposals that have been retained, ratio of the number of participations in retained projects to number of participations in eligible proposals, ratio of the financial contribution of retained proposals to the financial requested contribution of eligible proposals). For the two latter methods we also provide a geographic breakdown based on the location of the universities. EU15 countries show a higher success rate than EU13 although the highest is associated to the extra EU countries in the sample: Israel, Norway and Switzerland.

**Table 29 – Success rate in FP7 for UNIV projects and geographical breakdown**

| method | Sample | FP7 eligible | FP7 retained | retained / eligible |
|---|---|---|---|---|
| **Projects** | UNIV projects | 114119 | 20013 | 17.5% |
| **Participations** | UNIV projects | 232994 | 44447 | 19.1% |
| | eu15 | 194979 | 37338 | 19.1% |
| | eu13 | 20566 | 3289 | 16.0% |
| | Extra EU | 17449 | 3820 | 21.9% |
| **EC funding** | UNIV funding | 122087.97 | 20453.00 | 16.8% |
| | eu15 | 104388.34 | 17510.98 | 16.8% |
| | eu13 | 7152.07 | 813.15 | 11.4% |
| | Extra EU | 10547.57 | 2128.87 | 20.2% |

*Source: authors' calculation based on eCORDA*

[10] Eligible applications are submitted proposals that fulfil the formal eligibility criteria set by the respective calls for proposals.

We also computed success rates (using the project-based approach) by the size of the project network, ranging from 1 (solo projects) to over 15 partners. Solo projects reveal a success rate below the average (16%). We also found that the success rate increase with the number of partners involved in a project: UNIV projects involving from 2 to 5 partners are associated to a success rate of 16.2% while for UNIV projects with more than 15 participants the success rate equals 32.1%.

Table 30 describes the breakdown of success rates by Specific Programme. IDEAS reveals the lowest success (9.5%) followed by COOPERATION that however reveals a success rate (19.5%). On the other hand, the highest success rate is associated to the Euratom Programme. In this programme 45.5% proposal are retained. The success rate for CAPACITIES and PEOPLE is 20.6% AND 22.1%, respectively.

**Table 30 – Success rate by Specific Programme in FP7 according to the project-based approach**

| | COOPERATION | IDEAS | PEOPLE | CAPACITIES | Euratom |
|---|---|---|---|---|---|
| **Granted** | 7,690 | 3,129 | 8,016 | 1,076 | 102 |
| **Proposals** | 39,507 | 32,960 | 36,215 | 5,213 | 224 |
| **Success rate** | **19.5%** | **9.5%** | **22.1%** | **20.6%** | **45.5%** |

*Source: authors' calculation based on eCORDA*

Table 31 describes the success rates by country for UNIV projects. In the second column we report the success rate in terms of projects. In this case, in order to avoid multiple counting, UNIV projects are assigned to the country of the coordinator. As project coordinators can be institutions other than universities, the success rates reported in Table 31 do not represent the overall success rate of projects involving at least one university by country. In column three, we report the success rate in terms of funding. In this case for each project we have allocated the share of financing to the respective participant country. The data show that Israel reveals the highest success rate (24.7%) followed by CH (22.8%). Some of the smallest and/or least developed scientific systems register the lowest values: RO (4.3%), SI (4.4%) and SK (7.2%). Compared to its participation level in terms of number of UNIV projects and EU financial contribution, Italy shows a low success rate (9.6%). In terms of EU funding (column three), Switzerland shows the highest success rate (23.8%) followed by the Netherlands (22.5%).

It is worth noting that the variance in success rates across countries might be due to differences in countries specialization as regards the different Specific Programmes. Indeed, the success rate shows a high variance across Specific Programmes in FP7.

**Table 31 – Success rate for UNIV projects by country in FP7**

| Country | Success rate in terms of projects Project allocated to countries on the base of coordinator | Success rate in terms of EC funding Funding allocated to countries based on the share of each participant |
|---|---|---|
| **AT** | 17.7% | 19.1% |
| **BE** | 16.0% | 17.6% |
| **BG** | 13.2% | 10.0% |
| **CH** | 22.8% | 23.8% |
| **CY** | 10.2% | 8.9% |
| **CZ** | 9.3% | 12.4% |
| **DE** | 16.9% | 19.5% |
| **DK** | 16.1% | 20.0% |
| **EE** | 11.1% | 16.5% |
| **EL** | 12.1% | 10.7% |
| **ES** | 11.8% | 11.3% |
| **FI** | 10.1% | 10.3% |
| **FR** | 14.3% | 16.5% |
| **HR** | 9.5% | 16.4% |
| **HU** | 12.8% | 13.8% |
| **IE** | 19.3% | 14.7% |
| **IL** | 24.7% | 17.5% |
| **IT** | 9.6% | 12.7% |
| **LT** | 8.7% | 8.6% |
| **LU** | 17.2% | 10.0% |
| **LV** | 13.4% | 8.2% |
| **MT** | 20.5% | 21.0% |
| **NL** | 19.0% | 22.5% |
| **NO** | 12.7% | 16.4% |
| **PL** | 10.6% | 10.5% |
| **PT** | 8.6% | 8.1% |
| **RO** | 4.3% | 6.1% |
| **SE** | 13.1% | 17.5% |
| **SI** | 4.4% | 14.8% |
| **SK** | 7.2% | 8.9% |
| **UK** | 19.4% | 18.0% |
| **TOTAL** | 15.9% | 16.8% |

*Source: authors' calculation based on eCORDA*

### 3.3.6 Analysis of project outputs

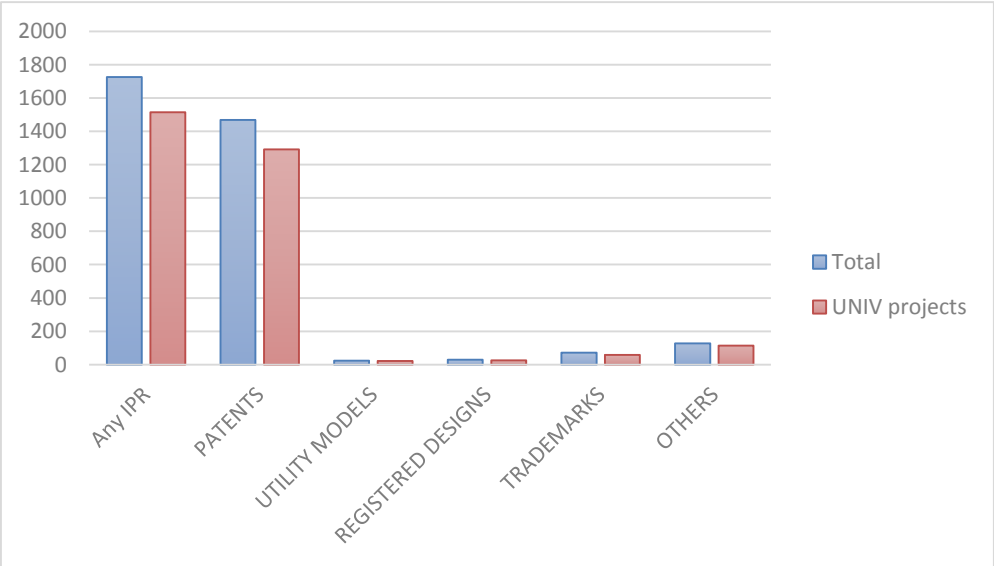
In this section we analyse scientific outputs (in terms of publications and IPRs) associated with FP7 UNIV projects, taking into account the EC financial contribution, the number of partners in the projects, the Specific Programmes and the Funding Schemes.

The information and data needed to carry out the analysis of the scientific outputs come from multiple sources. To organise the dataset including information on projects' outputs we have used information on sampled projects' scientific outputs (publications and IPRs) made available by the European Commission and included in the SESAM database. We then collected information from proprietary databases that are accessible from our institutions. As far as bibliometric information is concerned, we relied on the proprietary databases SCImago and Web of Science (WOS) using the approach described below. The inclusion of this information in the dataset allows going beyond the mere (although informative) quantitative analysis of scientific achievements volumes and better qualifying the scientific outputs issued within a specific research project.

#### 3.3.6.1 Analysis of Intellectual Property Rights

In this section we report basic statistics on the number of IPRs associated with all projects and UNIV projects funded within the FP7. We disaggregate data by type of IPR (patents, trademarks, designs, utility models, others) and by different Specific Programmes, Funding Schemes, size of the EC financial contribution and type of partners. Figure 13 shows that a total of 1,726 IPRs are associated with projects under the FP7, of which 1,470 are patents, 25 are utility models, 30 are registered designs and 73 are trademarks. 1,516 IPRs or 87.8%, of a total of 1,726, refer to UNIV projects. Regarding patents, 88.0% is associated with UNIV projects. In general, the patenting output of the funded projects appears to be quite low given the aggregated financial support in FP7. This evidence might be partly due to an underestimation of the actual number of patents stemming from the projects for two reasons: first, beneficiaries might have not reported patent applications[11]; second, at the moment of the analysis not all FP7 projects are closed.

**Figure 13 – Number of IPRs associated with all projects and UNIV projects funded within the FP7**




*Source: authors' calculation based on eCORDA and SESAM*

[11] Note that we could not find any patent related to projects under the IDEAS programme. This is likely due to incomplete reporting by beneficiaries.

Table 32 reports the count of projects (total projects and UNIV projects) with at least one IPR. A total of 572 UNIV projects have at least one IPR. 499 UNIV projects have at least one patent, 15 have at least a utility model, 18 have at least a registered design and 36 have at least a trademark. These numbers suggest that only about 2.6% of the analysed UNIV projects report at least one patent application. If we exclude projects under the IDEAS program for which data is not available, such percentage is equal to 3.15%.

**Table 32 – Count of projects (total projects and UNIV projects) with at least one IPR.**

| Count of projects with IPR | TOT IPR | PATENTS | UTILITY MODELS | REGISTERED DESIGNS | TRADEMARKS | OTHERS |
|---|---|---|---|---|---|---|
| **Total projects** | 688 | 599 | 18 | 20 | 47 | 62 |
| **UNIV projects** | 572 | 499 | 15 | 18 | 36 | 53 |

*Source: authors' calculation based on eCORDA and SESAM*

Table 33 reports the distribution of UNIV projects by number of patents. The majority of UNIV projects (50.3%) has one patent, 41.1% has from 2 to 5 patents, 8.6% has more than 5 patents.

**Table 33 – Distribution of UNIV projects by number of patents**

| Number of patents per UNIV project | Number of UNIV projects | Percentage |
|---|---|---|
| **1 patent** | 251 | 50.3% |
| **from 2 to 5 patents** | 205 | 41.1% |
| **more than 5 patents** | 43 | 8.6% |
| **Total** | **499** | **100.0%** |

*Source: authors' calculation based on eCORDA and SESAM*

Table 34 shows the count of UNIV projects with patents and the number of patents by Specific Programme. COOPERATION is the Specific Programme with the highest number of projects with patents (328) and the highest number of patents (842), followed by PEOPLE (105 projects with patents and 183 patents). The SESAM database, on projects output, does not report IPRs related to IDEAS. Euratom is the Specific Programme with the lowest number of projects with patents (6).

**Table 34 – Number of UNIV projects with at least one patent and number of patents by Specific Programme**

| Programme | All UNIV Projects | UNIV projects with patents | Percentage | Number of patents |
|---|---|---|---|---|
| **COOPERATION** | 6,692 | 328 | 4.9% | 842 |
| **IDEAS** | 3,428 | 0 | 0.0% | 0 |
| **PEOPLE** | 7,721 | 105 | 1.4% | 183 |
| **CAPACITIES** | 1,300 | 60 | 4.6% | 255 |
| **Euratom** | 116 | 6 | 5.2% | 13 |
| **Total** | **19,257** | **499** | **2.6%** | **1,293** |

*Source: authors' calculation based on eCORDA and SESAM*

Table 35 shows the count of UNIV projects with patents and the number of patents by Funding Scheme. CP (Collaborative project) is the Funding Scheme with the highest number of projects with patents (335) and the highest number of patents (883), followed by MC (105 projects with patents and 183 patents). ERC and NOE are related to the IDEAS Programme and data IPRS are not available.

**Table 35 – Number of UNIV projects with at least one patent and number of patents by Funding Scheme**

| Funding Scheme | All UNIV Projects | UNIV projects with patents | Percentage | Number of patents |
|---|---|---|---|---|
| **171** | 438 | 5 | 1.1% | 8 |
| **BSG** | 614 | 47 | 7.7% | 101 |
| **CP** | 5,747 | 335 | 5.8% | 883 |
| **ERC** | 1,611 | 0 | 0.0% | 0 |
| **CSA** | 3,281 | 7 | 0.2% | 118 |
| **MC** | 7,509 | 105 | 1.4% | 183 |
| **NOE** | 57 | 0 | 0.0% | 0 |
| **Total** | **19,257** | **499** | **2.6%** | **1,293** |

*Source: authors' calculation based on eCORDA and SESAM*

Table 36 shows the count of UNIV projects with patents and the number of patents by size of the EC financial contribution. 207 UNIV projects (for a total of 521 patents) received between € 2.5 and 5 million, followed by 103 UNIV projects (for a total of 404 patents) receiving more than € 5 million. In terms of percentage incidence, 6.1% of UNIV projects, out of 1,691 funded with more than € 5 million, have patents; 5.7% of the projects receiving between € 2.5 and 5 million, out of 3,639, have patents. Very few projects that received funding from the EC in the range € 0.25-1 million have patents (0.9%). Low percentage incidences of UNIV projects with patents are found for projects that received less than € 0.25 million and between € 1 and 2.5 million (1.1% and 1.8% respectively).

**Table 36 – Number of UNIV projects with at least one patent and number of patents by size of the EC financial contribution**

| EC range (€ million) | All UNIV Projects | UNIV projects with patents | Percentage | Number of patents |
|---|---|---|---|---|
| **<=0.25** | 6009 | 69 | 1.1% | 83 |
| **0.25 - 1.0** | 2570 | 22 | 0.9% | 50 |
| **1.0 - 2.5** | 5348 | 98 | 1.8% | 235 |
| **2.5 - 5.0** | 3639 | 207 | 5.7% | 521 |
| **>5.0** | 1691 | 103 | 6.1% | 404 |
| **Total** | **19257** | **499** | **2.6%** | **1293** |

*Source: authors' calculation based on eCORDA and SESAM*

We have also analysed the relationship between patenting outputs of UNIV projects and the composition of the network. The highest number of projects with patents results from interactions with PRCs. 5.3% of UNIV projects out of 7,452 projects with at least one PRC partner, have patents (for a total 1,001 patents and 393 projects). Moreover, only 22.6% of the total number of patents associated with UNIV projects is the result of UNIV projects that do not involve a PRC. Lower percentages of the total number of patents associated with UNIV projects are the result of UNIV projects involving OTH and PUB as partners. This might be due to the fact that these projects involved more basic and upstream research activities.

#### 3.3.6.2 Analysis of scientific publications

In this section we show the results of the statistical analysis of publications associated with UNIV projects funded within the FP7. We disaggregate data by different Specific Programmes, size of the EC financial contribution, number and type of partners.

In addition to basic counts of publications, in our analysis we also provide details on the quality of publications and related scientific journals using standard bibliometric approaches. In order to do this we have matched the data extracted from eCORDA with data from the proprietary databases SCImago and Web of Science (WOS).

At the journal level, we matched the publications declared by participants using the related ISSN code to the repository SCImago. For 39,493 publications (86.5%), out of a total of 45,632 declared publications, we could find a unique match[12]. For each matched publication we downloaded data on the impact factor of the journal in the publication year and the ranking of the journal in its scientific field according to the SCImago Journal Rank indicator (SJR)[13].

At the single article level, we matched the publications declared by participants using the related Digital Object Identifier (DOI), when made available in a correct form by the participants, and searching the WOS database. We could find a unique match for 21,690 publications (47.5%), out of the total 45,632 declared publications[14]. For each matched publication we downloaded data on the total number of citations received as of March 2015, number co-authors, number of different institutions involved in the article (proxied by the different affiliations reported by co-authors). The analysis of citation patterns allowed us to identify a subset of high-impact publications (top 5% in terms of forward citations received).

Finally we selected the sub-set of publications deriving from UNIV projects: the following table summarizes the matching process and highlights the relevant samples of analysis.

**Table 37 – Summary of publications samples**

| Sample | All projects | UNIV projects |
|---|---|---|
| **EC SESAM database** | 45,632 | 39,729 |
| **matched with SCImago through ISSN** | 39,493 | 34,349 |
| **matched with WOS through DOI** | 21,690 | 19,109 |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

[12] Unmatched publications are due to different factors including publications without an ISSN or reporting non-existent ISSN.

[13] The SJR is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from. It is a variant of the eigenvector centrality measure used in network theory. Such measures establish the importance of a node in a network based on the principle that connections to high-scoring nodes contribute more to the score of the node. The SJR indicator, which is inspired by the PageRank algorithm, was developed for extremely large and heterogeneous journal citation networks. It is a size-independent indicator and it ranks journals by their 'average prestige per article' and can be used for journal comparisons in science evaluation processes.

[14] Unmatched publications are due to different factors including: publications reporting no DOI or a mispecified DOI; publications that have appeared in books, chapters or scientific journals not covered in the WOS database.

Before moving to the presentation and discussion of the evidence on publications it is important to clarify some relevant methodological issues.

- The extraction of data from the SESAM database provided by the Commission does not include data from projects related to the IDEAS programme. The IDEAS programme involves funding instruments such as ERC and NOE that are designed to target high level fundamental and applied research. We will comment statistics in light of this limitation.
- Scientific publications are just one among different forms of disclosure of the innovative knowledge generated by the project. Here, we focus the analysis on scientific publications, rather than publications at large, because of their higher accountability and because of their higher scientific impact.
- The data that we use are related to the sub-set of scientific publications stemming from projects that have appeared on a journal before the closure of the project. Given the time requirements of editorial processes, we might underestimate the actual number of publications linked to a specific project.
- The analysis cannot account for those publications that despite deriving from the analysed projects have not been reported by the beneficiaries.
- Different scientific fields show different structural propensity to publish. There is significant heterogeneity across fields in the modes of scientific knowledge production in terms of propensity to collaborate, average team size, cost of research and infrastructures. For this reason we have split projects according to their size and network composition. We are aware that a comprehensive analysis of the quality of scientific publications would require the application of econometric models that control simultaneously for all the above mentioned factors. However, such data treatment is beyond the scope of this report.

Table 38 reports the number of all FP7 projects and UNIV projects with at least one publication, as well as the total number of publications and mean number of publications per project. Note that this initial statistics are based on any type of publication, before the introduction of the filtering on ISSN and DOI that we have carried out to restrict the analysis on publication with associated bibliometric data. 3,550 UNIV projects (18.4%), out of a total of 19,257, have at least one associated publication, such percentage rises to 22.4% when we exclude IDEAS projects. As expected, of the 4,614 projects funded under FP7 that report at least one publication, the largest majority (76.9%) are UNIV projects and of the 45,632 total publications associated with FP7 projects, 87.1% refer to UNIV projects.

**Table 38 – Number of all FP7 projects and UNIV projects with publications**

| Level | Projects | | Projects with at least 1 publication | Publications |
|---|---|---|---|---|
| **All projects** | 25,238 | | 4,614 | 45,632 |
| **UNIV projects** | 19,257 | | 3,550 | 39,729 |
| **% of UNIV on all projects** | 76.3% | | 76.9% | 87.1% |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Table 39 illustrates the percentile distribution of the number of publications per project. The 4,614 FP7 projects with at least one publication have a mean of 9.89 publications, while the 3,550 UNIV projects with at least one publication have a mean of 11.19 publications. Table 40 illustrates the distribution of FP7 and UNIV projects per number of publications. 39.0% of UNIV projects with at least one publication, out of a total of 3,550 projects, produced from 2 to 5 publications, 28.2% has from 6 to 20 publications

and 20.3% has one publication. Only 3.9% of UNIV projects with publications has more than 50 associated publications. The overall evidence from the analysis of publications across projects highlights the presence of a significantly skewed distribution with a median of just 4 publications and a 90th centile of 25 publications.

**Table 39 – Percentile distribution of the number of publications per project**

| Level | Min | Max | Mean | Std. Dev. | Percentile | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | **10th** | **25th** | **50th** | **75th** | **90th** |
| **UNIV projects** | 1 | 509 | 11.19 | 26.15 | 1 | 2 | 4 | 10 | 25 |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

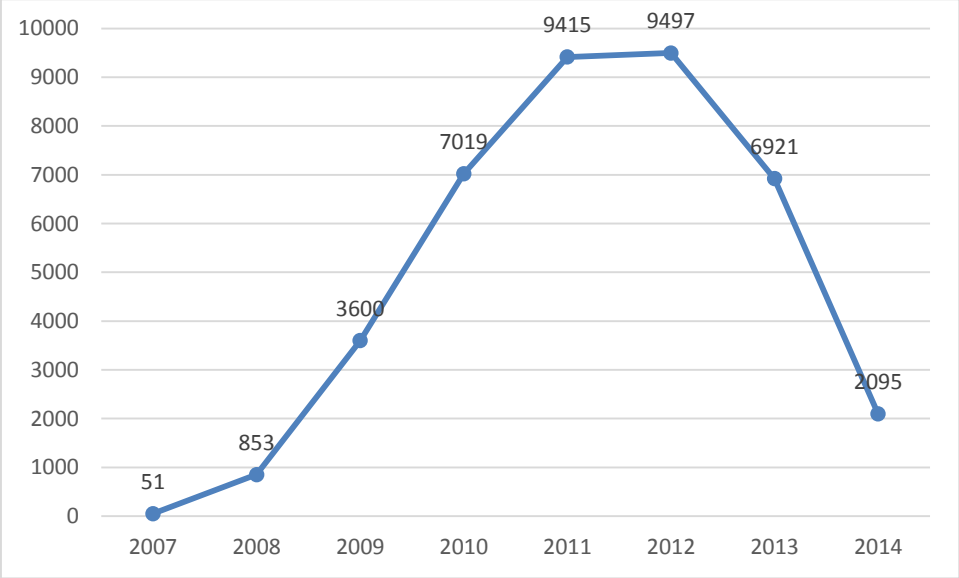
**Table 40 – Distribution of FP7 and UNIV projects per number of publications**

| Publications per project | UNIV projects | % on Total |
|---|---|---|
| **1** | 720 | 20.3% |
| **from 2 to 5** | 1,384 | 39.0% |
| **from 6 to 20** | 1,001 | 28.2% |
| **from 21 to 50** | 306 | 8.6% |
| **more than 50** | 139 | 3.9% |
| **Total** | **3,550** | **100.0%** |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Figure 14 illustrates the time trend in terms of number of publications associated with UNIV projects. As it is evident from the graph, there is an upward trend in terms of number of publications that reaches a peak in 2012 (9,497 publications). Note that the decreasing trend after 2012 is due to the combined effect of a reduction in the number of projects and most importantly to a censoring factor (i.e., there is a larger number of ongoing projects whose outcomes have not yet been recorded in SESAM at the moment of this analysis). For this reasons, the graph is compatible with an underlying constant scientific productivity over the analysed years. Note that 428 publications (1.1%) report missing publication year.

**Figure 14 – Number of UNIV publications across the years**




*Source: authors' calculation based on eCORDA, SCImago and WOS*

Table 41 reports the number of publications in UNIV projects by subject macro-category. It shows that 49.4% of publications refer to Life Sciences and Biomedicine, 28.3% to Physical Sciences and 20.0% to the Technology field. Social Sciences and Arts and Humanities account for less than 3%. These results are compatible with the different structural propensity to publish in the different fields of research.

**Table 41 – Number of publications in UNIV projects by subject macro-category**

| Macro-category | Publications | Percentage | Cumulate |
|---|---|---|---|
| **Life Sciences & Biomedicine** | 15,344 | 49.4% | 49.4% |
| **Physical Sciences** | 8,801 | 28.3% | 77.8% |
| **Technology** | 6,201 | 20.0% | 97.7% |
| **Social Sciences** | 656 | 2.1% | 99.9% |
| **Arts & Humanities** | 46 | 0.1% | 100.0% |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Table 42 reports the number of publications associated with UNIV projects by specific subject micro-categories. Note that subject areas are available for 78.3% of the records. More than 2,500 publications refer to the Chemistry area, followed by Physics (2,385 publications), Biochemistry & Molecular Biology (2,044) and Science & Technology (1,931).

**Table 42 – Top 25 categories by number of publications in UNIV projects**

| Category | Publications | % |
|---|---|---|
| **CHEMISTRY** | 2549 | 8.2% |
| **PHYSICS** | 2385 | 7.7% |
| **BIOCHEMISTRY & MOLECULAR BIOLOGY** | 2044 | 6.6% |
| **SCIENCE & TECHNOLOGY - OTHER TOPICS** | 1931 | 6.2% |
| **MATERIALS SCIENCE** | 1507 | 4.8% |
| **ENVIRONMENTAL SCIENCES & ECOLOGY** | 1235 | 4.0% |
| **ENGINEERING** | 1183 | 3.8% |
| **MICROBIOLOGY** | 848 | 2.7% |
| **CELL BIOLOGY** | 799 | 2.6% |
| **GENETICS & HEREDITY** | 790 | 2.5% |
| **METEOROLOGY & ATMOSPHERIC SCIENCES** | 725 | 2.3% |
| **NEUROSCIENCES & NEUROLOGY** | 723 | 2.3% |
| **PHARMACOLOGY & PHARMACY** | 712 | 2.3% |
| **BIOTECHNOLOGY & APPLIED MICROBIOLOGY** | 704 | 2.3% |
| **ASTRONOMY & ASTROPHYSICS** | 651 | 2.1% |
| **GEOLOGY** | 566 | 1.8% |
| **IMMUNOLOGY** | 512 | 1.6% |
| **INFECTIOUS DISEASES** | 404 | 1.3% |
| **AGRICULTURE** | 357 | 1.1% |
| **PLANT SCIENCES** | 355 | 1.1% |
| **ONCOLOGY** | 342 | 1.1% |
| **RESEARCH & EXPERIMENTAL MEDICINE** | 329 | 1.1% |
| **CARDIOVASCULAR SYSTEM & CARDIOLOGY** | 312 | 1.0% |
| **FOOD SCIENCE & TECHNOLOGY** | 311 | 1.0% |
| **ENDOCRINOLOGY & METABOLISM** | 305 | 1.0% |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Table 43 shows the distribution of publications in terms of journal ranking quartiles based on SCImago. Note that we have no information for 5,380 publications (13.5%). It emerges that the publications for which we could retrieve the ranking are distributed as follows: 69.7% are published on relatively high-quality journals (first quartile, Q1) and only 2.3% are published in relatively low-quality journals (Q4). We will use this general distribution as a reference to evaluate the quality distribution of publications across specific sub-sample.

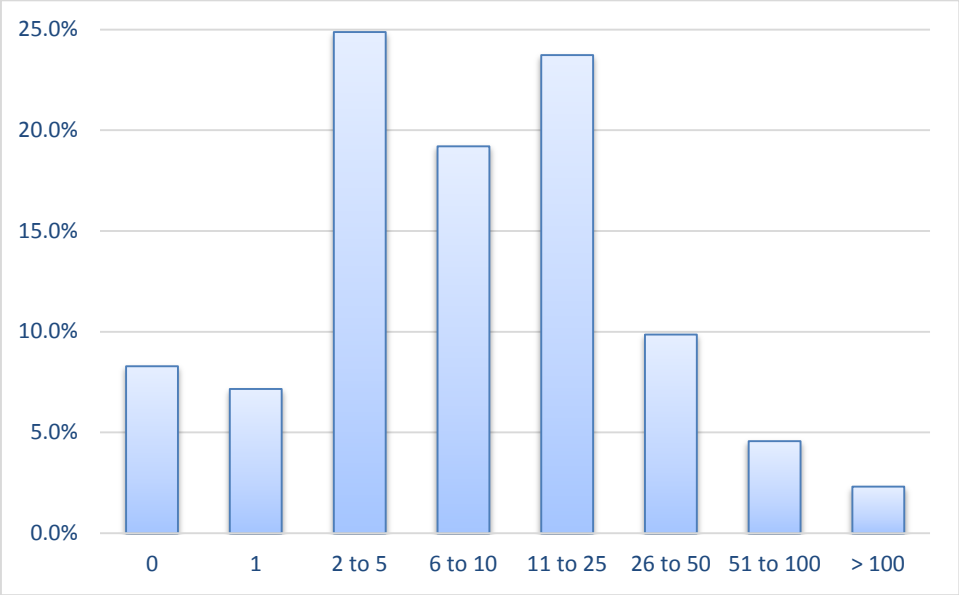
**Table 43 – Distribution of publications in terms of journal ranking quartiles**

| Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|
| 69.7% | 19.9% | 8.1% | 2.3% |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Figure 15 illustrates the distribution of forward citations. Nearly 25% of publications have received from 11 to 25 citations; more than 16% of publications have received more than 26 citations; only less than 10% of examined publications are uncited.

**Figure 15 – Distribution of forward citations**

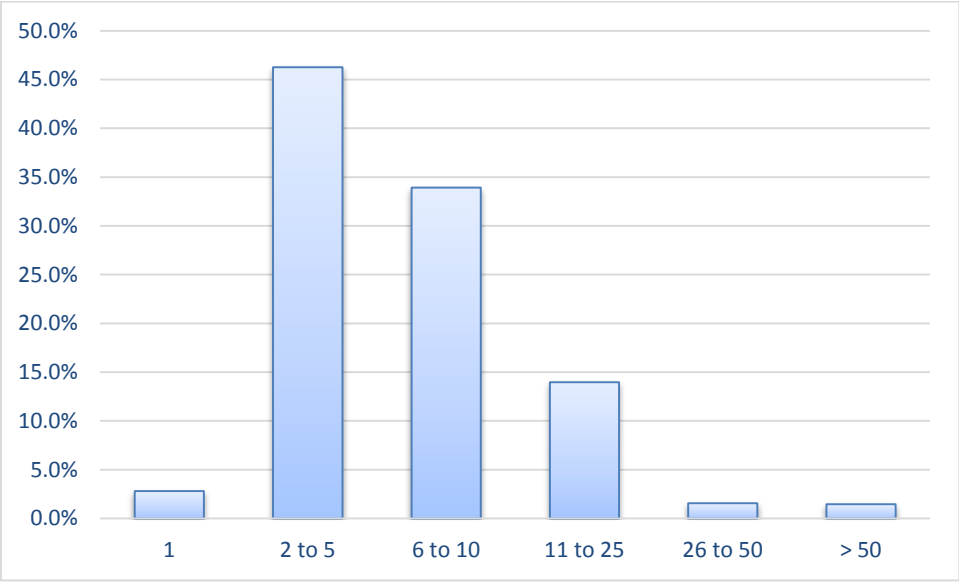



*Source: authors' calculation based on eCORDA, SCImago and WOS*

The joint observation of the data on the distribution of publications in terms of quality of the journals and of citations received suggest the presence of a remarkable above average scientific standing of the publications stemming from the analysed projects.

Figure 16 shows the distribution of UNIV publications by number of authors. About 46% of analysed publications have from 2 to 5 authors, around one third of publications have between 6 and 10 authors. Finally there are about 3% of publications with very large co-authorships.

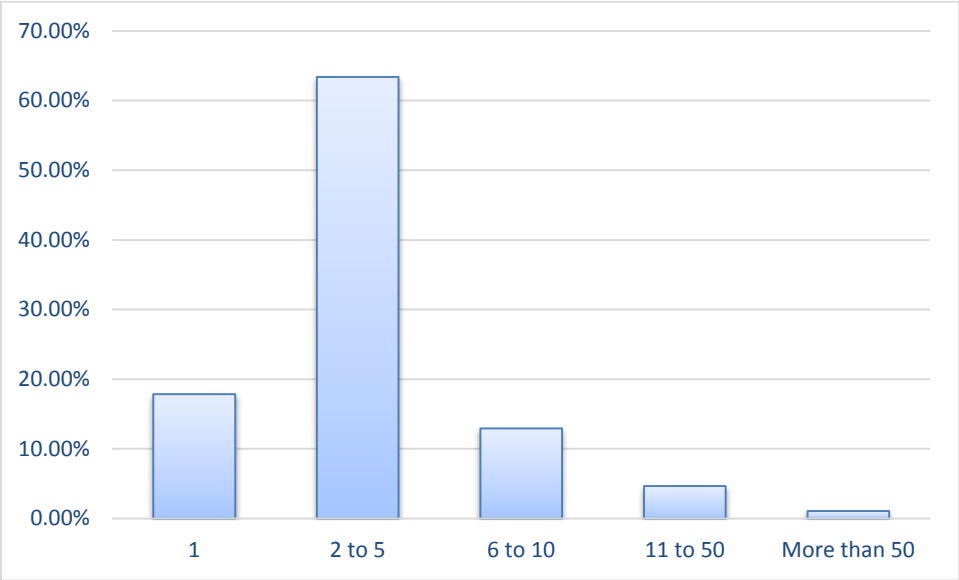
**Figure 16 – Distribution of UNIV publications by number of authors**




*Source: authors' calculation based on eCORDA, SCImago and WOS*

Figure 17 illustrates the distribution of UNIV publications by number of authors' affiliations[15]. More than 80% of UNIV publications involve collaboration across different institutions. In most of the cases such collaboration involved 2 to 5 organizations. Nonetheless we observe a non-negligible incidence of papers co-authored by researchers affiliated to more than 10 organizations. On average the analysis of co-authorships confirm the presence of significant inter organizational research collaborations in the context of FP projects.

**Figure 17 – Distribution of UNIV publications by number of authors' affiliations**




*Source: authors' calculation based on eCORDA, SCImago and WOS*

Table 44 reports the descriptive statistics on UNIV publications by Specific Programme by breaking down the overall publication initially retrieved in the SESAM database into those with valid DOI and ISSN. Only for the two latter subgroups we can compute bibliometric indicators of scientific quality.

**Table 44 – Publications by Specific Programme**

| Programme | SESAM Publ. | Publ. with DOI | Publ. with ISSN |
|---|---|---|---|
| **COOPERATION** | 25,649 | 12,718 | 16,193 |
| **PEOPLE** | 9,127 | 4,665 | 5,184 |
| **CAPACITIES** | 4,314 | 1,412 | 2,339 |
| **Euratom** | 639 | 314 | 213 |
| **Total** | **39,729** | **19,109** | **23,929** |

*Source: authors' calculation based on eCORDA, SESAM, SCImago and WOS*

[15] Note that 410 records report missing values on affiliations.

In particular in Table 45 we focus the analysis on the subset of publications for which we could retrieve bibliometric data. Hence, we refer here to the subset of publication with a valid DOI and published in a scientific journal covered by the database WOS. On average, UNIV publications receive 2.78 citations, have 8.97 authors per publication and the reported authors have 3.67 affiliations. Moreover, 69.7% of UNIV publications are published in Q1 journals and report an average journal impact factor on three years of 4.22.

Concerning the Specific Programmes, it emerges that the highest number of publications with bibliometric data is associated with COOPERATION (12,718 publications). Euratom is also the Specific Programme with the highest average number of publications per project (5.51), followed by COOPERATION (3.83) and CAPACITIES (3.32). On average, publications associated with UNIV projects under COOPERATION receive 2.89 citations, have 7.03 authors and authors have 3.80 affiliations. Publications associated with UNIV projects under PEOPLE receive on average 2.81 citations, have 10.54 authors and authors have 3.60 affiliations. Publications associated with UNIV projects under CAPACITIES receive on average 1.94 citations, have 7.39 authors and authors have 3.69 affiliations. Publications associated with UNIV projects under COOPERATION and PEOPLE receive on average citations that are above the whole sample mean. In terms of quality of publications, the Table shows that COOPERATION presents not only the highest volume of publications, but also the highest incidence of high quality publications: 71.8% are published in top journals and 5.9% are highly cited. Note that in the SESAM database the publications stemming from IDEAS programme are not recorded.

Table 46 describes the top three subjects by number of publications in the different Specific Programmes. Note that in this case we are using all publications with a valid ISSN and not only the publications with bibliometric data from WOS. Under the Specific Programme COOPERATION the top three subjects of publication are Biochemistry & Molecular Biology (6.1%), Chemistry (5.9%) and Science and Technology (4.9%). Under PEOPLE, the top three subjects of publication are instead Physics (11.4%), Chemistry (8.9%) and Science and Technology (6.1%). Physics is also the top subject for publications associated with UNIV projects under CAPACITIES (8.3%), followed by Chemistry (4.1%) and Meteorology & Atmospheric Sciences (4.0%). In Euratom, the first subject category is represented by Nuclear Science and Technology (20.5%), followed by Physics (13.9%) and Material Sciences (13.1%).

**Table 45 – Bibliometrics on UNIV publications by Specific Programme**

| Programme | Publ. with DOI | Avg. Citations received | Avg. authors | Avg. affiliations | Highly cited publ. | | Journal relevance: | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Publ. in top 5% | % on DOI publ. | Publ. in Q1 journals | % on publ. | Avg. journal IF on 3 years |
| **COOPERATION** | 12,718 | 2.89 | 7.03 | 3.80 | 754 | 5.9% | 16,193 | 71.8% | 3.87 |
| **PEOPLE** | 4,665 | 2.81 | 10.54 | 3.60 | 193 | 4.1% | 5,184 | 70.4% | 4.70 |
| **CAPACITIES** | 1,412 | 1.94 | 7.39 | 3.69 | 35 | 2.5% | 2,339 | 60.9% | 2.80 |
| **Euratom** | 314 | 1.34 | 5.77 | 2.59 | 3 | 1.0% | 213 | 35.9% | 2.19 |
| **Total** | **19,109** | **2.78** | **8.97** | **3.67** | **985** | **5.2%** | **23,929** | **69.7%** | **4.22** |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

**Table 46 – Top three subjects by number of publications in the different Specific Programmes**

| Programme | Total pub | Top 3 subjects by number of publications | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Subject 1 | Publ. | % | Subject 2 | Publ. | % | Subject 3 | Publ. | % |
| **COOPERATION** | 25,649 | BIOCHEMISTRY & MOLECULAR BIOLOGY | 1571 | 6.1% | CHEMISTRY | 1504 | 5.9% | SCIENCE & TECHNOLOGY - OTHER TOPICS | 1251 | 4.9% |
| **PEOPLE** | 9,127 | PHYSICS | 1041 | 11.4% | CHEMISTRY | 814 | 8.9% | SCIENCE & TECHNOLOGY - OTHER TOPICS | 561 | 6.1% |
| **CAPACITIES** | 4,314 | PHYSICS | 359 | 8.3% | CHEMISTRY | 177 | 4.1% | METEOROLOGY & ATMOSPHERIC SCIENCES | 172 | 4.0% |
| **Euratom** | 639 | NUCLEAR SCIENCE & TECHNOLOGY | 131 | 20.5% | PHYSICS | 89 | 13.9% | MATERIALS SCIENCE | 84 | 13.1% |

*Source: authors' calculation based on eCORDA. SESAM, SCImago and WOS*

Table 47 reports the descriptive statistics on UNIV publications by EC funding range (number of publications, average citations received, average number of authors, authors' affiliations and publication quality). Publications associated with UNIV projects getting more than € 5 million receive, on average, a number of citations that are well above the mean (3.95) and have a higher number of authors and authors' affiliations than the average (8.69 and 4.64 respectively). In terms of quality of publications, the Table shows that publications associated with projects funded with more than € 5 million belong for the most to Q1 journals (73.2%) and are associated with high IF journals (4.74). Overall, the evidence highlights that publications resulting from large UNIV projects are more cited, appear on higher quality journals and involve more authors than smaller UNIV projects. Table 48 illustrates the descriptive statistics on UNIV publications by number of partners. Larger projects with more than 15 partners produce publications which are on average more cited (3.17), have a higher number of authors (8.19) and are published for the most in Q1 journals (71.4%).

**Table 47 – Bibliometrics on UNIV publications by EC funding range (€ million)**

| EC Funding range (€ million) | Publ. with DOI | Avg. Citations received | Avg. authors | Avg. affiliations | Highly cited publ. | | Journal relevance: | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Publ. in top 5% | %. on DOI publ. | Publ. in Q1 journals | % on publ. | Avg. journal IF on 3 years |
| **<=0.25** | 4,088 | 2.83 | 10.84 | 3.58 | 177 | 4.3% | 4,723 | 71.2% | 4.67 |
| **0.25 - 1.0** | 1,161 | 2.04 | 6.20 | 3.76 | 23 | 2.0% | 1,152 | 56.0% | 3.48 |
| **1.0 - 2.5** | 1,320 | 2.04 | 6.25 | 3.22 | 44 | 3.3% | 1,923 | 59.6% | 2.88 |
| **2.5 - 5.0** | 5,721 | 2.75 | 6.85 | 3.64 | 263 | 4.6% | 7,904 | 70.6% | 4.03 |
| **>5.0** | 6,819 | 3.95 | 8.69 | 4.64 | 478 | 7.0% | 8,227 | 73.2% | 4.74 |
| **Total** | **19,109** | **2.78** | **8.97** | **3.67** | **985** | **5.2%** | **23,929** | **69.7%** | **4.22** |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

**Table 48 – Bibliometrics on UNIV publications by number of partners**

| Nr. of partners | Publ. with DOI | Avg. Citations received | Avg. authors | Avg. affiliations | Highly cited publ. | | Journal relevance: | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Publ. in top 5% | % on DOI publ. | Publ. in Q1 journals | % on publ. | Avg. journal IF on 3 years |
| **1** | 4,234 | 2.86 | 10.93 | 3.69 | 200 | 4.7% | 4,843 | 70.1% | 4.71 |
| **2 to 5** | 986 | 2.16 | 5.96 | 3.29 | 20 | 2.0% | 1,179 | 67.1% | 3.89 |
| **6 to 10** | 3,477 | 2.88 | 6.68 | 3.46 | 184 | 5.3% | 5,124 | 69.7% | 3.79 |
| **11 to 15** | 3,620 | 2.27 | 6.17 | 3.32 | 178 | 4.9% | 4,656 | 67.1% | 3.42 |
| **>15** | 6,792 | 3.17 | 8.19 | 4.47 | 403 | 5.9% | 8,127 | 71.4% | 3.74 |
| **Total** | **19,109** | **2.78** | **8.97** | **3.67** | **985** | **5.2%** | **23,929** | **69.7%** | **4.22** |

*Source: authors' calculation based on eCORDA, SCImago and WOS*

Publications related to IDEAS projects

The data on publications related to IDEAS projects have been provided by the EC. The information available for each publication does not allow the application of the methodology for the automatic matching with external bibliometric databases. For this reason in what follows we mainly provide aggregated statistics for the publications related to IDEAS projects. To further extend the analysis however we made an effort to identify a subset of high-impact publications from IDEAS projects. We thus made a manual screening of the publications related to IDEAS projects involving at least a UNIV beneficiary in order to identify those that have appeared in the top 5 journals by scientific field. Such sub-sample of journals has been identified using the SCImago journal rank indicators by field. This criteria for the selection of journals is meant to provides an indication of the presence of publications in leading journals such as Science, Nature, Cell, Proceedings of the National Academy of Science. For clarity we report below the list of analysed journals by scientific field.

By filtering only those publications related to IDEAS projects started between 2008 and 2013, we obtained a sample of 37,169. The following table illustrate the distribution in time of the publications by start year of the corresponding project and by year of publication.

**Table 49 – Distribution of IDEAS related publications by project start date and publication year**

| Year | Number of projects | No. of publications by start date of the projects | No. of publications by year of publication |
|---|---|---|---|
| **2008** | 237 | 5916 | 168 |
| **2009** | 301 | 8449 | 1208 |
| **2010** | 405 | 4949 | 2286 |
| **2011** | 546 | 9381 | 4175 |
| **2012** | 625 | 6474 | 8056 |
| **2013** | 599 | 2000 | 12284 |
| **2014** | | | 8992 |
| **TOTAL** | **2713** | **37169** | **37169** |

*Source: authors' calculation based on eCORDA and SCImago*

UNIV projects present a significant variance in terms of productivity. This is partly due to the specificities of the different scientific fields. However, it is worth noting the presence of a non-negligible fraction of projects (12.6%) with a very high number of declared publications (more than 30 publications).

**Table 50 – Number of projects by publication range for the IDEAS programme**

| Range in the number of publications | Number of UNIV Projects | % |
|---|---|---|
| **0** | 678 | 25.0% |
| **01-05** | 518 | 19.1% |
| **06-10** | 420 | 15.5% |
| **11-15** | 287 | 10.6% |
| **16-20** | 206 | 7.6% |
| **21-25** | 139 | 5.1% |
| **26-30** | 124 | 4.6% |
| **More than 30** | 341 | 12.6% |
| TOTAL | **2713** | **100%** |

*Source: authors' calculation based on eCORDA and SCImago*

We have investigated to what extent the variations in the number of publications are correlated with the size of the projects. Data seem to suggest a higher average number of publications for larger projects. However, the increase in the number of publications per funding size is not particularly sharp. Indeed, the average number of IDEAS related publications per project increases from 12.8 for projects receiving less than € 1 million to 17.6 for projects receiving more than € 2.5 million. Also, projects receiving more than € 2.5 million show a high variance in the number of IDEAS related publications.

**Table 51 – Distribution of projects and IDEAS related publications by EC funding size**

| funded_cost | project_count | percentage | publication_upd_count | Percentage | publication_average | publication_min | publication_max | publication_stdev |
|---|---|---|---|---|---|---|---|---|
| **<1.0M** | 272 | 10% | 3478 | 9.4% | 12.787 | 0.000 | 89.000 | 16.073 |
| **1.0M-1.5M** | 1135 | 41.8% | 11587 | 31.2% | 10.209 | 0.000 | 113.000 | 14.161 |
| **1.5M-2.0M** | 539 | 19.9% | 7740 | 20.8% | 14.360 | 0.000 | 172.000 | 20.002 |
| **2.0M-2.5M** | 633 | 23.3% | 12009 | 32.3% | 18.972 | 0.000 | 246.000 | 27.433 |
| **More than 2.5 M** | 134 | 4.9% | 2355 | 6.3% | 17.575 | 0.000 | 209.000 | 30.217 |
| TOTAL | **2713** | **100%** | **37169** | **100%** | **13.700** | **0.000** | **246.000** | **20.535** |

*Source: authors' calculation based on eCORDA and SCImago*

The largest part of IDEAS projects has just one recipient, but still there are about 19% of projects with more than one partner. However, the following table indicates the absence of significant differences among these two types of projects in terms of scientific productivity.

**Table 52 – Distribution of projects and IDEAS related publications by number of participants**

| Partners | project_count | percentage | Number of publications | Percentage | publication_average | publication_min | publication_max | publication_stdev |
|---|---|---|---|---|---|---|---|---|
| **1** | 2211 | 81.5% | 29988 | 80.7% | 13.563 | 0.000 | 246.000 | 20.620 |
| **More than 1** | 502 | 18.5% | 7181 | 19.3% | 14.305 | 0.000 | 172.000 | 20.165 |
| **TOTAL** | **2713** | **100%** | **37169** | **100%** | **13.700** | **0.000** | **246.000** | **20.535** |

*Source: authors' calculation based on eCORDA and SCImago*

In the following table we show the number of publications that have appeared in the top 5 journals in selected scientific fields. The journal rank has been computed using the SCImago journal rank indicator with reference to the data between 2000 and 2012. The data reveal the presence of a significant number of publications in leading international journals. This result is consistent with the objective of the IDEAS programme to support academic excellence. We observe the presence of significant contribution of the IDEAS programme to the advancement of scientific knowledge across different areas of natural science and engineering. Note that we are not analysing the whole set of publications and we are not providing evidence on productivity issues.

**Table 53 – Distribution of IDEAS related publications in top journals by selected scientific field**

| Sector | Number of publication | Top 5 journals per Sector |
|---|---|---|
| **MULTIDISCIPLINARY** | 762 | NATURE |
| | | SCIENCE |
| | | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES |
| | | INTERNATIONAL JOURNAL OF CHAOS IN APPLIED SCIENCES AND ENGINEERING |
| | | PROCEEDINGS OF THE JAPAN ACADEMY SERIES B: PHYSICAL AND BIOLOGICAL SCIENCES |
| **AGRICULTURAL AND BIOLOGICAL SCIENCES** | 43 | ANNUAL REVIEW OF PLANT BIOLOGY |
| | | TRENDS IN ECOLOGY AND EVOLUTION |
| | | PLANT CELL |
| | | ANNUAL REVIEW OF PATHOLOGY: MECHANISMS OF DISEASE |
| | | ECOLOGY LETTERS |
| **BIOCHEMISTRY, GENETICS AND MOLECULAR BIOLOGY** | 144 | ANNUAL REVIEW OF BIOCHEMISTRY |
| | | CELL |
| | | NATURE REVIEWS MOLECULAR CELL BIOLOGY |
| | | PHYSIOLOGICAL REVIEWS |
| | | NATURE GENETICS |
| **CHEMICAL ENGINEERING** | 166 | ANNUAL REVIEW OF BIOPHYSICS |
| | | NATURE NANOTECHNOLOGY |

| | | |
|---|---|---|
| | | NANO LETTERS |
| | | NATURE BIOTECHNOLOGY |
| | | CATALYSIS REVIEWS - SCIENCE AND ENGINEERING |
| **CHEMISTRY** | 135 | CHEMICAL REVIEWS |
| | | NATURE MATERIALS |
| | | ACCOUNTS OF CHEMICAL RESEARCH |
| | | CHEMICAL SOCIETY REVIEWS |
| | | PROGRESS IN POLYMER SCIENCE |
| **ECONOMICS, ECONOMETRICS AND FINANCE** | 38 | QUARTERLY JOURNAL OF ECONOMICS |
| | | ECONOMETRICA |
| | | JOURNAL OF FINANCE |
| | | JOURNAL OF POLITICAL ECONOMY |
| | | JOURNAL OF ECONOMIC LITERATURE |
| **ENGINEERING** | 234 | NATURE MATERIALS |
| | | NATURE NANOTECHNOLOGY |
| | | NANO LETTERS |
| | | NATURE BIOTECHNOLOGY |
| | | MATERIALS SCIENCE AND ENGINEERING: R: REPORTS |
| **IMMUNOLOGY AND MICROBIOLOGY** | 48 | IMMUNITY |
| | | NATURE IMMUNOLOGY |
| | | JOURNAL OF EXPERIMENTAL MEDICINE |
| | | NATURE REVIEWS IMMUNOLOGY |
| | | MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS |
| **MATERIALS SCIENCE** | 163 | NATURE MATERIALS |
| | | PROGRESS IN MATERIALS SCIENCE |
| | | NATURE NANOTECHNOLOGY |
| | | PROGRESS IN POLYMER SCIENCE |
| | | NATURE PHOTONICS |
| **MATHEMATICS** | 42 | JOURNAL OF THE AMERICAN MATHEMATICAL SOCIETY |
| | | ANNALS OF MATHEMATICS |
| | | INVENTIONES MATHEMATICAE |
| | | ACTA MATHEMATICA |
| | | ADVANCES IN THEORETICAL AND MATHEMATICAL PHYSICS |
| **NEUROSCIENCE** | 135 | NEURON |
| | | NATURE REVIEWS NEUROSCIENCE |
| | | NATURE NEUROSCIENCE |
| | | EMBO JOURNAL |
| | | TRENDS IN NEUROSCIENCES |
| **PHYSICS AND ASTRONOMY** | 140 | REVIEWS OF MODERN PHYSICS |
| | | ADVANCES IN PHYSICS |
| | | NATURE MATERIALS |
| | | NATURE PHYSICS |
| | | SURFACE SCIENCE REPORTS |

### 3.3.7 Network Analysis

In this section we report results from the network analysis to highlight new trends of cooperation in FP7. This analysis allows to provide evidence on the position of universities in the network of relationships, the types of institutional partnerships and the network of collaborations involving universities at both the country and the region level of analysis.

The information and data used to carry out the network analysis come from eCORDA. In order to use this information we first treat data in order to clean regional assignments within the eCORDA database. The main issue was mainly related to the disambiguation of NUTS revisions.

In order to define the network under consideration the main identifier is the university flag provided in the eCORDA database. All FP7 projects with university participation provide the basis for the definition of the networks:

- Organisation based network, with nodes representing organisations and the number of joint projects edges
- Country based network, with countries representing nodes and the number of joint projects organisations located in these countries edges
- Region based network, with countries representing nodes and the number of joint projects organisations located in these countries edges

The network indicators for analysing the positioning of universities are described in what follows:

- Position of an actor within the network determines the possibility to successfully participate in information flows
- Direct relations are as relevant as indirect second- and third-degree relations
- Different centrality measures accounting for local and global connectedness
- Degree centrality: many direct links/partner, high collaboration experience and direct access to diverse information (local reach)
- Eigenvector centrality: connection to well-connected actors provides actors with more influence (network power)
- Closeness centrality: shortest paths to all other network actors, efficient reach/spread of information within the network (global reach)
- Betweenness centrality: positioned on shortest paths between actors, key position for controlling the information flow within the network (gate keeper)

The analysis of universities positioning in the network of relationships provides some key results. The analysis reveals generally a high correlation between the four centrality measures under consideration. The Technical University of Denmark has the highest number of partners (degree), and also shows a high centrality for all other centrality dimensions

<u>Methodology</u>

In our analytical approach to analyse the structure of the FP UNIV project network, we employ a Social Network Analysis (SNA) perspective. SNA has come into fairly wide use for the analysis of social systems in the recent past, also in the context of R&D interactions (see, e.g. Heller-Schuh et al. 2011, Barber et al. 2011, Scherngell 2013, Barber and Scherngell 2013), offering a wide range of powerful analytical tools disclosing the structure of large social systems.

The notion of a social network and the procedures of social network analysis have attracted considerable interest and curiosity from the social science community in recent years. Central to network analysis are identifying, measuring, and testing hypotheses about the structural forms and substantive contents of relations among actors. This distinctive structural-relational emphasis sets social network analysis apart from individualistic, variable-centric traditions in the social sciences. The main underlying assumption in this context is that structural relations are often more important for understanding observed behaviours and resulting structures than are attributes of the actors (see, e.g., Scherngell 2013).

The network of FP project collaborations can formally be described as a graph consisting of nodes (vertices) and edges (links). A familiar representation is obtained by letting $V$ be a set of nodes representing organisations participating in the FP, and $E$ be a set of edges where elements of $E$ are unordered pairs of distinct nodes $v_i$, $v_j$ representing a link in the form of a joint FP project participation between a pair $\{v_i, v_j\}$. The two sets together are called a simple graph $G_1=(V, E)$ where all pairs $\{v_i, v_j\} \in E$ are distinct and $\{v_i, v_i\} \notin E$ for $i \neq j = 1, \ldots, n;$ the number of edges incident on a vertex $i=1, \ldots, n$ is called the *degree* $k_i$; a *path* is defined as a specific sequence of nodes and vertices in the network, giving rise to the important notion of *shortest paths* or *geodetic distance d*. Note that $G_1$ represents an unweighted graph by definition. The weighted form is given by $G_2=(V, E, W)$ where $W=\{w_1, w_2, \ldots, w_n\}$ represent weights denoting the magnitude of joint projects between two organisations. In the current analysis, we draw on both types of graphs, using the weighted form mainly for visualisations. Further note that both $G_1$ and $G_2$ represent undirected graphs.

Given this network definition, we are able to apply SNA indicators to describe the role of specific nodes; in our case we are interested in the roles of universities. In this analysis we focus on four different types of centrality measures (see, for instance, Heller-Schuh et al. 2011) that are calculated for each university, as well as for each region by aggregating individual interactions to the regional level. The reasoning behind using different kinds of centrality is to disclose distinct roles of nodes, in our case countries, in the network.

Given our graph theoretical network definition, the topology of the graph $G_1$ is encoded in the $n \times n$ adjacency matrix **X** with elements

$$\mathbf{X}(i, j) = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nn} \end{pmatrix} \qquad (1)$$

where $x_{ij}$ denotes the project collaborations between two organisations. Our first measure, *Degree centrality* is defined as

$$C_D(i) = x_{i.} = \sum_{j=1}^{n} x_{ij} \qquad (2)$$

normalised by ($n$-1), so that it may be simply interpreted as the degree of prestige a node has due its simple number of connections to other nodes.

*Second*, *Eigenvector centrality* accords each vertex a centrality that depends both on the number and the quality of its connections by examining all vertices in parallel and assigning centrality weights that correspond to the average centrality of all neighbours. In this respect, Eigenvector centrality tells us whether a university is linked to other highly inter-linked universities or more to peripheral ones. It is formally given by

$$C_E(i) = \frac{1}{\lambda} \sum_{j=1}^{n} x_{ij} k_j \qquad (3)$$

where $\lambda$ is the largest eigenvalue of **X**. A high Eigenvector centrality of a node indicates that this node is connected with other nodes that also show many connections, rather than to peripheral nodes.

Third, *betweenness centrality* of a vertex can be defined as the fraction of geodesic paths between any pair of vertices on which this vertex lies. It is measured by the frequency of one actor positioned on the shortest path between other groups of actors arranged in. Those actors, who are located on the shortest paths between many actors, therefore hold a key position for controlling the flow of information within the network, and integrating peripheral nodes (gatekeeper or knowledge hub function). It is defined by

$$C_B(i) = \sum_{\substack{j=1 \\ j<k}}^{n} \left[ d_{jk}(i) / d_{jk} \right] \qquad (4)$$

where $d_{jk}(i)$ represents the shortest path between organisations *j* and *k* going through university *i*.

*Fourth*, *closeness centrality* of a vertex is the total of geodesic distances this vertex has to all other vertices. Therefore it can be described as efficient reach/spread of information within the network, or the global reach a vertex has. It is given by

$$C_C(i) = \left[ \sum_{j=1}^{n} d_{ij} \right]^{-1}. \qquad (5)$$

Network visualisations are done by means of information-theoretic techniques in combination with GI techniques. For the university network visualisation, we determine the position for the nodes (countries) using a standard approach from spring model ideas according to the normalized Laplacian, so that universities that show a relatively higher collaboration intensity are positioned nearer to each other. The node size corresponds to the weighted degree centrality of a university. For the region and country networks, we place the nodes according to their geographical location, with the node size corresponding to the number of projects a region/country has.

Results

As shown in the following table, KU Leuven and TU Delft come on second and third rank for degree centrality, respectively, while just on rank 7 and 10 for Eigenvector centrality, i.e. they are less connected to other central partners; however, both have a strong role in connecting peripheral partners and partners located further away in the network, as shown by the high betweenness centrality (rank 1 and 3)

The University of Oxford and the University of Cambridge seem to be the opposite case than KU Leuven, coming on rank 2 and rank 1 for Eigenvector centrality, respectively, while even not appearing under the top 10 for betweenness centrality, i.e. both universities are more focused connecting to other central players than on integrating peripheral ones.

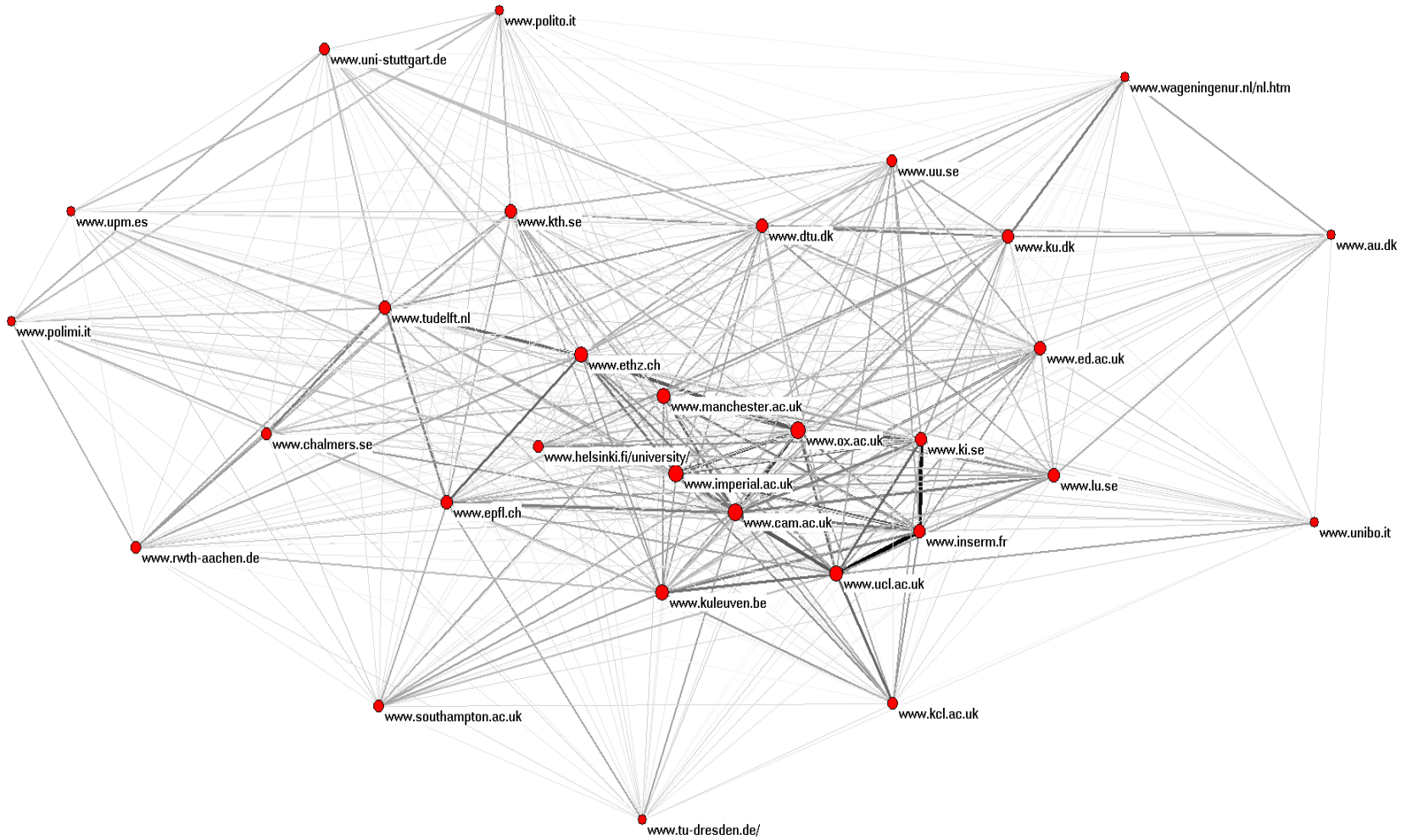
**Table 54 – Overview of top ranked universities in FP7 centrality degree.**

| Univ. | Degree | Univ. | Eigen-vector | Univ. | Between-ness | Univ. | Close-ness |
|---|---|---|---|---|---|---|---|
| www.dtu.dk | 0.0955 | www.cam.ac.uk | 0.128687 | www.kuleuven.be | 0.018065 | www.dtu.dk | 0.513087 |
| www.kuleuven.be | 0.093381 | www.ox.ac.uk | 0.126532 | www.dtu.dk | 0.017988 | www.kuleuven.be | 0.510476 |
| www.tudelft.nl | 0.080219 | www.ethz.ch | 0.125548 | www.tudelft.nl | 0.013404 | www.tudelft.nl | 0.507084 |
| www.imperial.ac.uk | 0.077413 | www.dtu.dk | 0.122414 | www.imperial.ac.uk | 0.010850 | www.imperial.ac.uk | 0.505279 |
| www.manchester.ac.uk | 0.073707 | www.imperial.ac.uk | 0.120929 | www.manchester.ac.uk | 0.010150 | www.manchester.ac.uk | 0.504193 |
| www.ethz.ch | 0.073014 | www.manchester.ac.uk | 0.113072 | www.ethz.ch | 0.010126 | www.ethz.ch | 0.503183 |
| www.cam.ac.uk | 0.072079 | www.kuleuven.be | 0.110657 | www.unibo.it | 0.009620 | www.cam.ac.uk | 0.502995 |
| www.ox.ac.uk | 0.071283 | www.ucl.ac.uk | 0.109182 | www.ucl.ac.uk | 0.009562 | www.ox.ac.uk | 0.502301 |
| www.ucl.ac.uk | 0.068685 | www.epfl.ch | 0.102404 | www.epfl.ch | 0.009555 | www.unibo.it | 0.502035 |
| www.epfl.ch | 0.065810 | www.tudelft.nl | 0.098362 | www.rwth-aachen.de | 0.009486 | www.ucl.ac.uk | 0.500980 |

The above table remarks the stability of networks of top ranked universities: there are only 2 new entries in the top 10 universities, according to various centrality measures, in FP7 compared to FP6 (see paragraph 3.4.6).

The following figure shows the network visualisation of the core university network identified by using the top 30 universities regarding weighted degree. The network visualisation places nodes with a high degree centrality in the centre, while at the same time positioning nodes with intensive connections close to each other. The visualisation points to a very densely connected core and supports conclusions from the centrality analysis. Key results on the university network show strong collaboration links between some central players, many of them located in the UK, and important "gatekeeper" universities (e.g., KU Leuven, TU Delft). The core university network seem not to follow a particular geographical logic, i.e. country clusters or explicit clusters of neighbouring countries are not observable (with the exception of the core UK cluster)

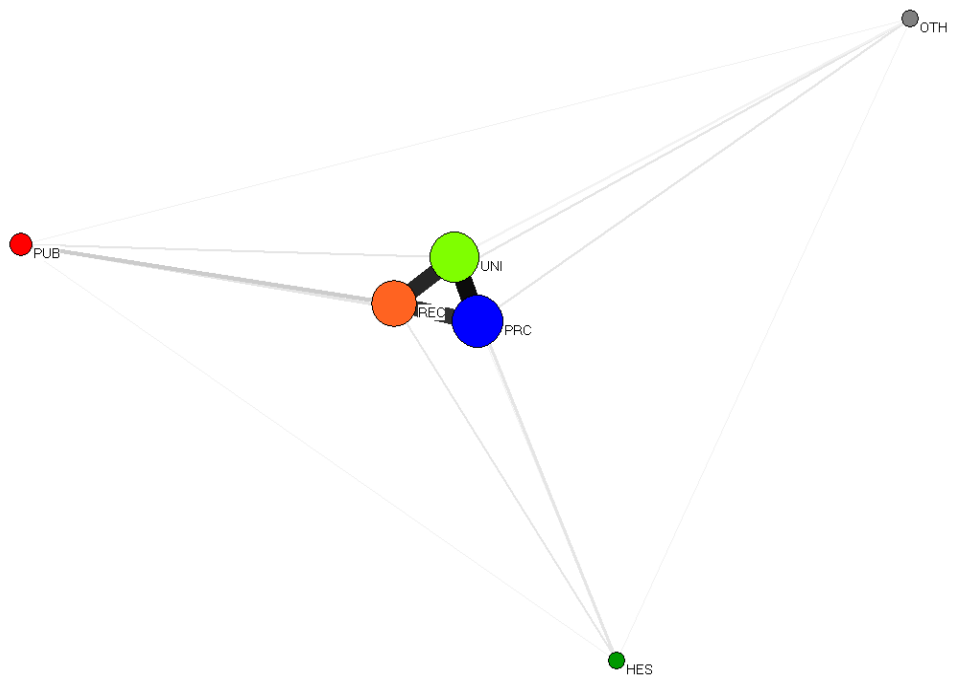
**Figure 18 – Network visualisation by using the top 30 universities by weighted degree**




*Source: authors' calculation based on eCORDA*

The Figure 19 shows the visualisation of the institutional partnerships in FP7. The network visualisation of the institutional partnerships demonstrates the main institution types that participate in FP7. The three main components are firms (PRC), universities (UNI) and research organisations (REC). The interaction intensity between the three main components is of similar magnitude. Concerning the less intensive participating institution types, the public body (PUB) shows a significantly lower collaboration intensity with universities than with research organisations.

**Figure 19 – Visualisation of the institutional partnerships in FP7**




*Source: authors' calculation based on eCORDA*

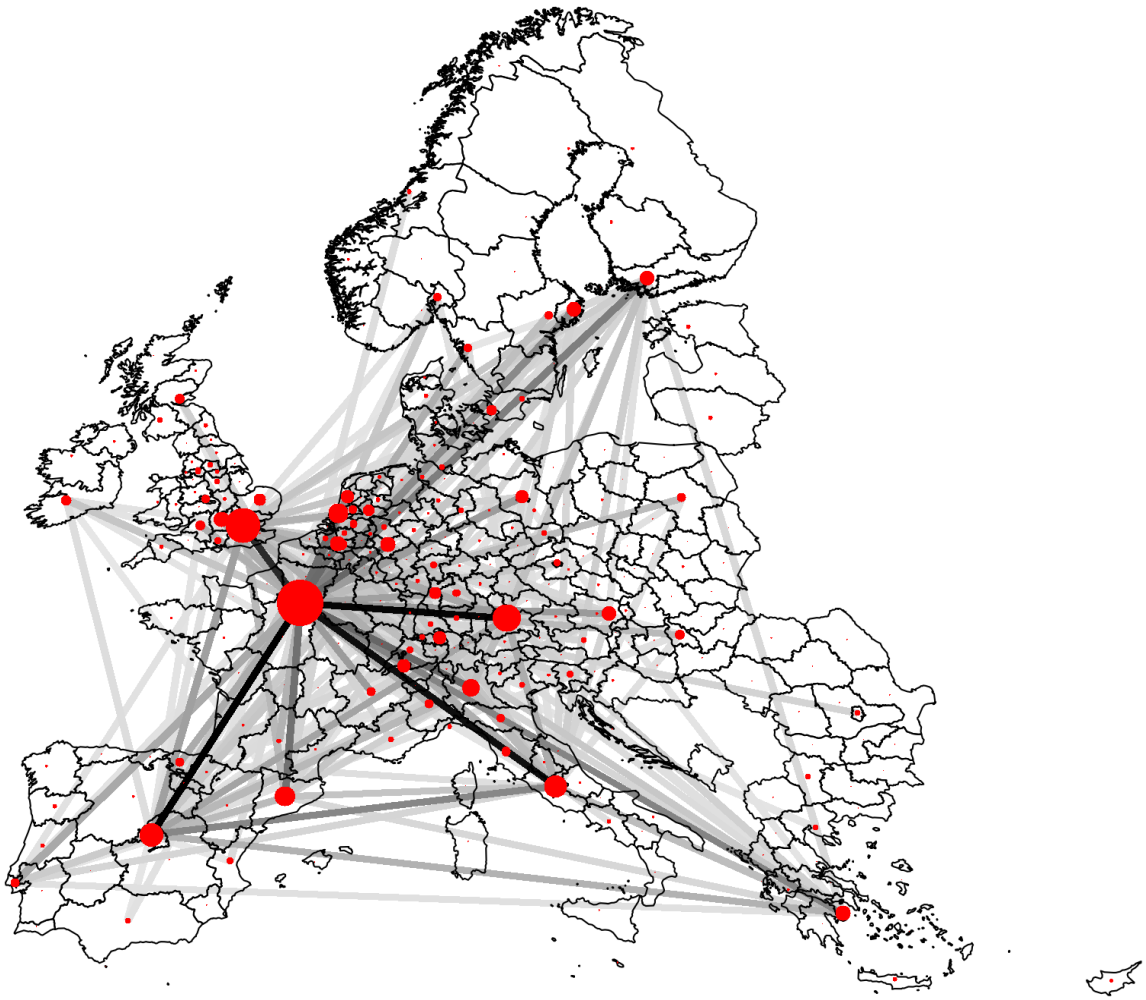
In the Figure 20 we provide the visualisation of the country network. The visualization highlights some key results. The UK constitutes the most central country in the FP7 UNI network, showing the highest number of participations and the highest number of collaborations. The highest number of joint projects is observed for the large European countries UK, Germany and France. Southern European and Benelux countries are more intensively connected than Northern European countries. The collaboration within Southern European countries is much more intensive than between Scandinavian ones. Poland shows the highest inter-linking of the Eastern European countries.

**Figure 20 – Visualisation of the country network**

*Notes: FP7 projects with UNI participations. Nodes: Countries with size corresponding to the number of projects. Edges: Number of joint FP UNI projects, with darkness corresponding to intensity (the darker, the higher the number of join FP UNI projects between two countries)*
*Source: authors' calculation based on eCORDA*

In the next figure we move to the visualisation of the region-level network. The results at the regional level of analysis provide additional and much finer insights than on the country level. Ile-de-France constitutes the central region, pointing to a very centralised system in France. UK, though focused to a significant extent on the London region, is less centralised than France, while Germany is the geographically most diversified country. Most intensive collaborations can be observed between the regions of Ile-de-France and Oberbayern (Germany), and Ile-de-France and Rome. Inter-linking of Eastern and Southern European regions is mainly refined to capital regions.

**Figure 21 – Visualisation of the region-level network**



Notes: FP7 projects with UNI participations. Nodes: NUTS-2 regions with size corresponding to the number of projects. Edges: Number of joint FP UNI projects, with darkness corresponding to intensity (the darker, the higher the number of join FP UNI projects between two regions).
*Source: authors' calculation based on eCORDA*

The Table 55 presents the region positioning analysis on top ranked regions in FP7. A stronger correlation between the four centrality measures under consideration than for the analysis at the university level while at an aggregated level, the usage of different centrality measures becomes less meaningful. Ile-de-France (FR10) has the highest centrality in all centrality measures pointing to a strong geographical concentration in France and a rather centralised research system (note that France as a whole has not the highest intensity of university participation). Spanish regions Madrid (ES30) and Barcelona (ES51) have a very high centrality; point to a particular motivation of Spanish universities to acquire extramural research funds, but geographically concentrated in Madrid and Barcelona. Oberbayern (DE21) is the most central German region in the FP7 UNI project network, London (UKI2) in the UK (showing a higher centrality than the regions East Anglia and Oxfordshire, including the University of Cambridge and the University of Oxford respectively).

This table also shows the stability of networks of top ranked regions: there are only 3 new entries in the top 10 regions according to various indicators of network centrality in FP7 compared to FP6 (see paragraph 3.4.6).

**Table 55 – Region positioning analysis on top ranked regions in FP7**

| Region | Degree | Region | Eigenvector | Region | Betweenness | Region | Closeness |
|---|---|---|---|---|---|---|---|
| FR10 | 0.98 | FR10 | 0.47 | FR10 | 0.0122 | FR10 | 19.42 |
| ES30 | 0.95 | ES30 | 0.26 | ES51 | 0.0099 | ES30 | 19.30 |
| ITI4 | 0.95 | DE21 | 0.25 | BE10 | 0.0092 | DE21 | 19.30 |
| UKI1 | 0.94 | ITI4 | 0.24 | UKI1 | 0.0075 | ITI4 | 19.29 |
| EL30 | 0.94 | UKI1 | 0.24 | ES30 | 0.0072 | UKI1 | 19.27 |
| BE10 | 0.93 | NL33 | 0.18 | EL30 | 0.0069 | DEA2 | 19.22 |
| DE21 | 0.93 | ITC4 | 0.18 | ITI4 | 0.0063 | ITC4 | 19.21 |
| ES51 | 0.93 | ES51 | 0.17 | PT17 | 0.0062 | ES51 | 19.21 |
| NL33 | 0.93 | BE10 | 0.17 | NL33 | 0.0061 | BE10 | 19.21 |
| FI1C | 0.92 | FI1C | 0.15 | DE21 | 0.0060 | NL33 | 19.20 |

*Source: authors' calculation based on eCORDA*

## 3.4 Analysis of participation in FP6

The analysis of the data reveals that the sample of FP6 UNIV projects is made of 7,281 projects. The number of projects in the dataset account for 72.4% of the whole amount of FP6 projects. Figures on the number of universities that participated in the FP6 cannot be defined with sufficient accuracy due to the presence of significant data issues associated to the duplications of identification codes and to misspelled organization names.

The Table 56 illustrates the aggregated FP6 financial contribution of the EC for UNIV projects. The data refer to the EC funding only and not to the total cost of the related projects. The Table also reports the total amount of EC funding received by all the universities in the sample.

**Table 56 – EC funding in FP6 (total amount and average amount per project) for UNIV projects and universities**

| LEVEL OF ANALYSIS | Total EC Funding (€ million) |
|---|---|
| **Projects involving at least one university (UNIV projects)** | 15,002.2 |
| **Universities (Aggregate)** | 5,928.1 |

*Source: authors' calculation based on eCORDA*

The average EC funding for UNIV projects has been about € 2.06 million. The overall figures indicate that UNIV projects account for 90% of the total EC funding in FP6. The amount received by universities accounts for 35.6% of the total EC funding. More details on the financial contribution at project and participants levels are provided in the following section 3.3.5.

### 3.4.1 Overall participation and geographical breakdown

In the following paragraphs, a detailed breakdown of aggregate figures on the incidence of UNIV projects over the total number of projects in FP6 (both in terms of numbers and amount of funding) is provided in order to identify specific patterns of university participation in FP6. Figures are disaggregated by country, programme and funding scheme.

Table 57 reports the count of UNIV projects by country. It has to be remarked that a project can involve as partners more universities which are potentially located in different countries. Therefore, the third column (% on total number of projects) adds up to more than 100%.

Table 57 shows that UK is the country with the highest percentage of UNIV projects on the total number of projects (44.9%), followed by DE (30.3%), IT (20.8%) and NL (17.5%).

4,311 UNIV projects, out of 7,281, were coordinated by a university. Note that, due to the presence of projects including one or more universities as partners but a coordinator that is not a university, the total of the last column (% of university as coordinator on country projects) does not sum to 100%. In our sample, around 59.2% of the UNIV projects also have a university as a coordinator. Countries with a low level of participation of universities as coordinators (<=15%) are: LT, LV, MT, PL,PT, SI, SK, RO, HU, HR, CZ, EE, BG. Countries with a medium-high level of participation of universities as coordinators (>=20%) are: CY, DE, ES, FR, IE, IL, IT, LU, NL. UK is the country with the highest level of participation of universities as coordinators (37.3%).

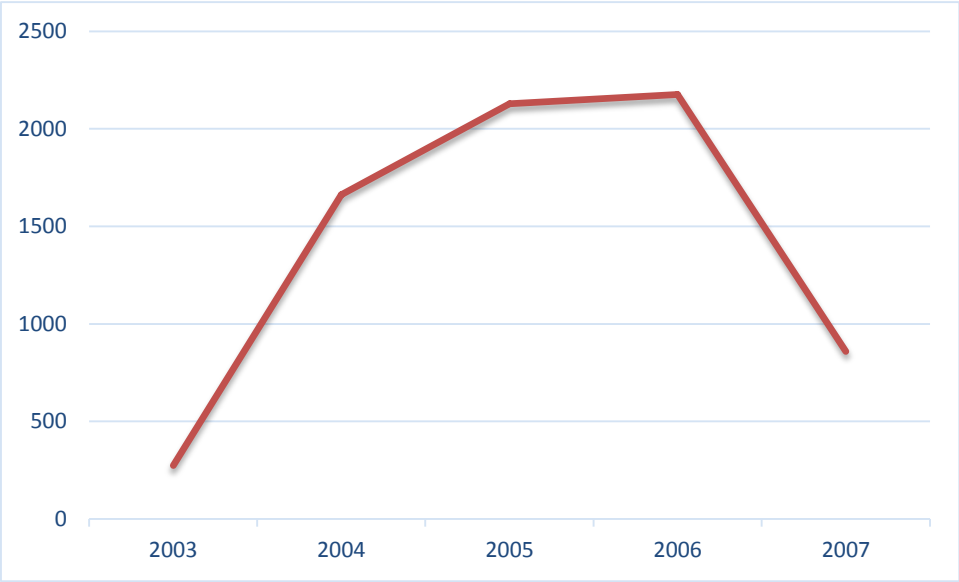
**Table 57 – Number of UNIV projects by country in FP6**

| Country | Number | % on total number of projects | university as coordinator | % of university as coordinator on total number of projects | % of university as coordinator on country projects |
|---|---|---|---|---|---|
| **AT** | 616 | 8.5% | 120 | 2.8% | 19.5% |
| **BE** | 827 | 11.4% | 152 | 3.5% | 18.4% |
| **BG** | 108 | 1.5% | 9 | 0.2% | 8.3% |
| **CH** | 809 | 11.1% | 133 | 3.1% | 16.4% |
| **CY** | 73 | 1.0% | 17 | 0.4% | 23.3% |
| **CZ** | 299 | 4.1% | 13 | 0.3% | 4.3% |
| **DE** | 2,205 | 30.3% | 485 | 11.3% | 22.0% |
| **DK** | 584 | 8.0% | 114 | 2.6% | 19.5% |
| **EE** | 113 | 1.6% | 10 | 0.2% | 8.8% |
| **EL** | 626 | 8.6% | 102 | 2.4% | 16.3% |
| **ES** | 1,139 | 15.6% | 232 | 5.4% | 20.4% |
| **FI** | 472 | 6.5% | 76 | 1.8% | 16.1% |
| **FR** | 1,106 | 15.2% | 274 | 6.4% | 24.8% |
| **HR** | 57 | 0.8% | 4 | 0.1% | 7.0% |
| **HU** | 374 | 5.1% | 42 | 1.0% | 11.2% |
| **IE** | 441 | 6.1% | 130 | 3.0% | 29.5% |
| **IL** | 288 | 4.0% | 68 | 1.6% | 23.6% |
| **IT** | 1,518 | 20.8% | 341 | 7.9% | 22.5% |
| **LT** | 102 | 1.4% | 6 | 0.1% | 5.9% |
| **LU** | 5 | 0.1% | 1 | 0.0% | 20.0% |
| **LV** | 76 | 1.0% | 4 | 0.1% | 5.3% |
| **MT** | 40 | 0.5% | 4 | 0.1% | 10.0% |
| **NL** | 1,274 | 17.5% | 321 | 7.4% | 25.2% |
| **NO** | 282 | 3.9% | 51 | 1.2% | 18.1% |
| **PL** | 609 | 8.4% | 91 | 2.1% | 14.9% |
| **PT** | 311 | 4.3% | 37 | 0.9% | 11.9% |
| **RO** | 142 | 2.0% | 13 | 0.3% | 9.2% |
| **SE** | 1,144 | 15.7% | 226 | 5.2% | 19.8% |
| **SI** | 160 | 2.2% | 10 | 0.2% | 6.3% |
| **SK** | 128 | 1.8% | 5 | 0.1% | 3.9% |
| **UK** | 3,272 | 44.9% | 1,220 | 28.3% | 37.3% |
| **TOT** | **7,281** | | **4,311** | **100.0%** | **59.2%** |

*Source: authors' calculation based on eCORDA*

Figure 22 illustrates the trend of UNIV projects across the considered years (2003-2007). The displayed years corresponds to the starting dates of the projects. As it is evident from the graph, the number of UNIV projects experiences an upward trend up to the year 2006, followed by a drop in the number of UNIV projects which started in 2007. As for FP7, this drop is possibly due to the fact that the FP6 was nearing the end and fewer calls had been launched.

**Figure 22 – Trend of UNIV projects in FP6**




*Source: authors' calculation based on eCORDA*

The **Error! Reference source not found.** illustrates the number and percentages of UNIV projects by country and selected time intervals (2003-2005; 2006-2007). It emerges that in the time frame 2003-2005 LV has the highest percentage of UNIV projects (69.3%), followed by LT (66%) and IE (64%). In the time frame 2006-2007 LU has the highest percentage of UNIV projects (80%), followed by HR (51.8%) and CY (47.2%). Interestingly, there is a significant increase in the percentages of UNIV projects between the two considered periods for LU (from 20% to 80%), while the majority of other countries see a considerable drop in 2006-2007 (see for example BG that reports 60.4% in 2003-2005 and 39.6% in 2006-2007).

**Table 58 - Number of UNIV projects by country and time intervals in FP6**

| Country | Projects | 2003-2005 | 2006-2007 | Participations |
|---|---|---|---|---|
| **AT** | 616 | 58.9% | 41.1% | 694 |
| **BE** | 827 | 59.9% | 40.1% | 973 |
| **BG** | 108 | 60.4% | 39.6% | 117 |
| **CH** | 809 | 57.4% | 42.6% | 956 |
| **CY** | 73 | 52.8% | 47.2% | 74 |
| **CZ** | 299 | 57.9% | 42.1% | 315 |
| **DE** | 2,205 | 60.2% | 39.8% | 3248 |
| **DK** | 584 | 61.0% | 39.0% | 675 |
| **EE** | 113 | 63.4% | 36.6% | 114 |
| **EL** | 626 | 58.6% | 41.4% | 723 |
| **ES** | 1,139 | 61.1% | 38.9% | 1394 |
| **FI** | 472 | 60.9% | 39.1% | 540 |
| **FR** | 1,106 | 62.2% | 37.8% | 1458 |
| **HR** | 57 | 48.2% | 51.8% | 60 |
| **HU** | 374 | 59.1% | 40.9% | 407 |
| **IE** | 441 | 64.0% | 36.0% | 469 |
| **IL** | 288 | 56.1% | 43.9% | 325 |
| **IT** | 1,518 | 61.1% | 38.9% | 2010 |
| **LT** | 102 | 66.0% | 34.0% | 105 |
| **LU** | 5 | 20.0% | 80.0% | 5 |
| **LV** | 76 | 69.3% | 30.7% | 77 |
| **MT** | 40 | 59.0% | 41.0% | 40 |
| **NL** | 1,274 | 56.6% | 43.4% | 1543 |
| **NO** | 282 | 55.7% | 44.3% | 302 |
| **PL** | 609 | 62.1% | 37.9% | 685 |
| **PT** | 311 | 62.7% | 37.3% | 343 |
| **RO** | 142 | 56.1% | 43.9% | 151 |
| **SE** | 1,144 | 63.3% | 36.7% | 1411 |
| **SI** | 160 | 58.0% | 42.0% | 163 |
| **SK** | 128 | 62.4% | 37.6% | 131 |
| **UK** | 3,272 | 57.5% | 42.5% | 4849 |

Source: authors' calculation based on eCORDA

### 3.4.2 Participation by Specific Programme

Table 59 reports the count of UNIV projects by Specific Programme. 54.1% of UNIV projects out of 7,281 have been assigned to the Programme "Integrating and Strengthening the ERA", followed by 45.1% assigned to "Structuring the ERA", while very low percentages of UNIV projects are associated with the Programme Euratom (0.8%).

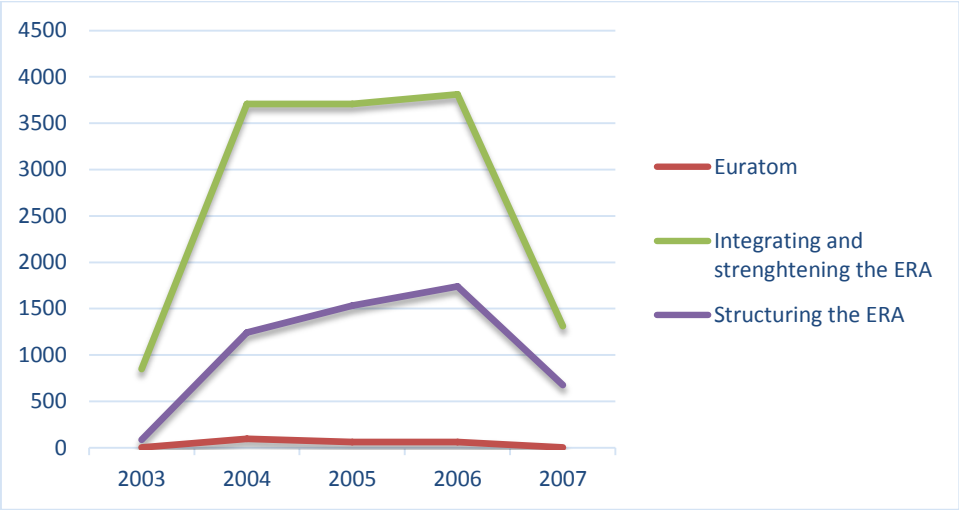
Figure 23 illustrates the trend across the years of the number of UNIV projects by Specific Programme. While Euratom reveals a rather constant trend over time, "Structuring the ERA" sees an upward tendency along the years, with a drop in the year 2007 as previously showed. The number of UNIV projects associated with "Integrating and Strengthening the ERA" keeps around more than 3,700 in the years 2004-2006, with a peak in 2006 (3,812).

**Table 59 – Number of UNIV projects by Specific Programme in FP6**

| Programme | Number of UNIV projects | % on total number of projects | Participations | % on total participations |
|---|---|---|---|---|
| **Integrating and Strengthening the ERA** | 3,940 | 54.1% | 17,958 | 73.7% |
| **Structuring the ERA** | 3,282 | 45.1% | 6,110 | 25.09% |
| **Euratom** | 59 | 0.8% | 289 | 1.19% |
| **TOTAL** | **7,281** | **100.0%** | **24,357** | **100.00%** |

*Source: authors' calculation based on eCORDA*

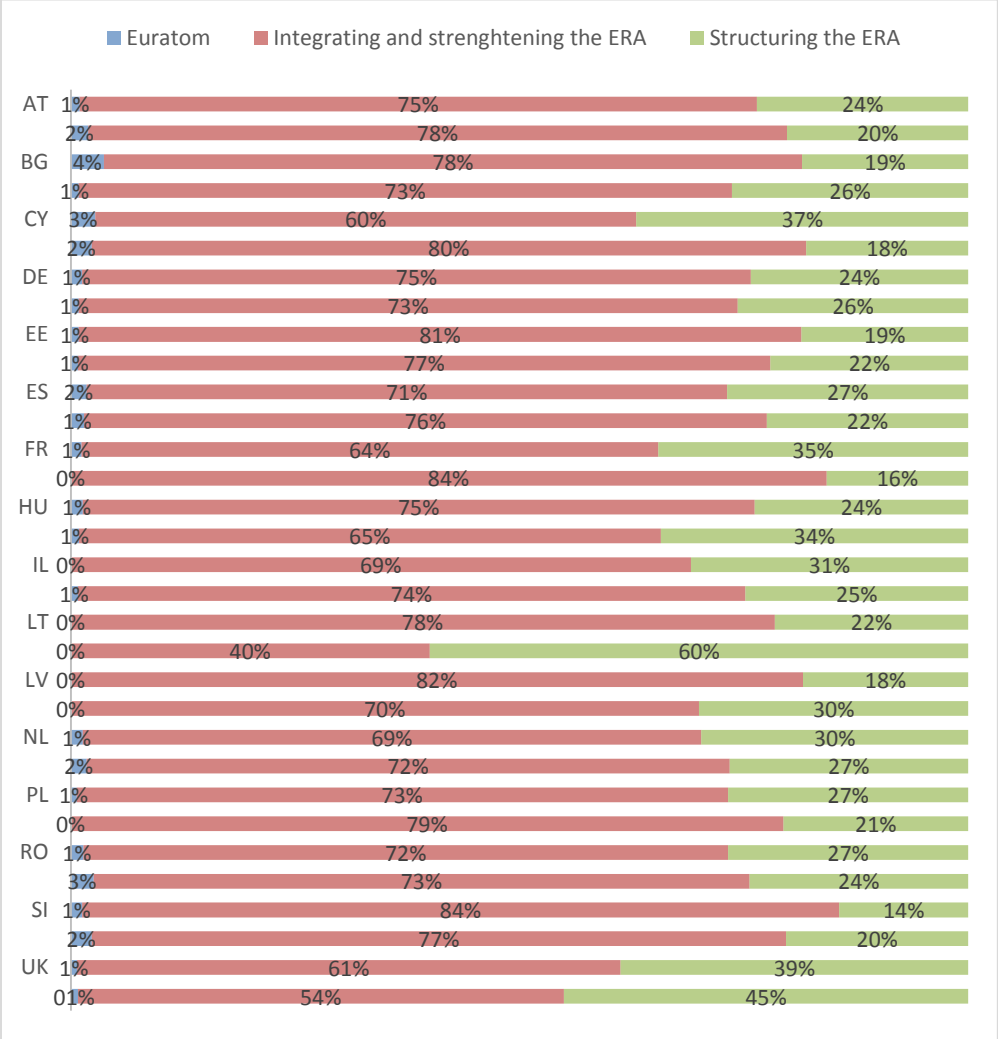
**Figure 23 – Trend of the number of UNIV projects by Specific Programme in FP6**




*Source: authors' calculation based on eCORDA*

Figure 24 illustrates the composition of the portfolio of UNIV projects across the different Specific Programmes by country. The largest incidence of UNIV projects associated with "Integrating and Strengthening the ERA" occurs in the following countries: HR (84%), SI (84%), LV (82%), EE (81%), CZ (80%), while the lowest value is recorded for LU(40%), which instead registers the highest incidence of projects in "Structuring the ERA" (60%). The Specific Programme "Structuring the ERA" includes the largest incidence of UNIV projects for LU (60%), UK(39%), CY(37%), FR(35%). The weight of the UNIV projects associated with Euratom in the single countries' project portfolio is limited across all the countries.

**Figure 24 – Portfolio composition of UNIV projects across Specific Programmes by country in FP6**




*Source: authors' calculation based on eCORDA*

Table 60 describes the amount of EC funding by Specific Programme devoted to UNIV projects. The total amount of EC funding devoted to UNIV projects in the Specific Programmes Euratom and "Integrating and strengthening the ERA" is mostly concentrated in the interval € 1-2.5 million, while for "Structuring the ERA" in the interval <= € 0.25 million.

**Table 60 – EC funding by Specific Programme: amount and distribution of UNIV projects in FP6 (€ million)**

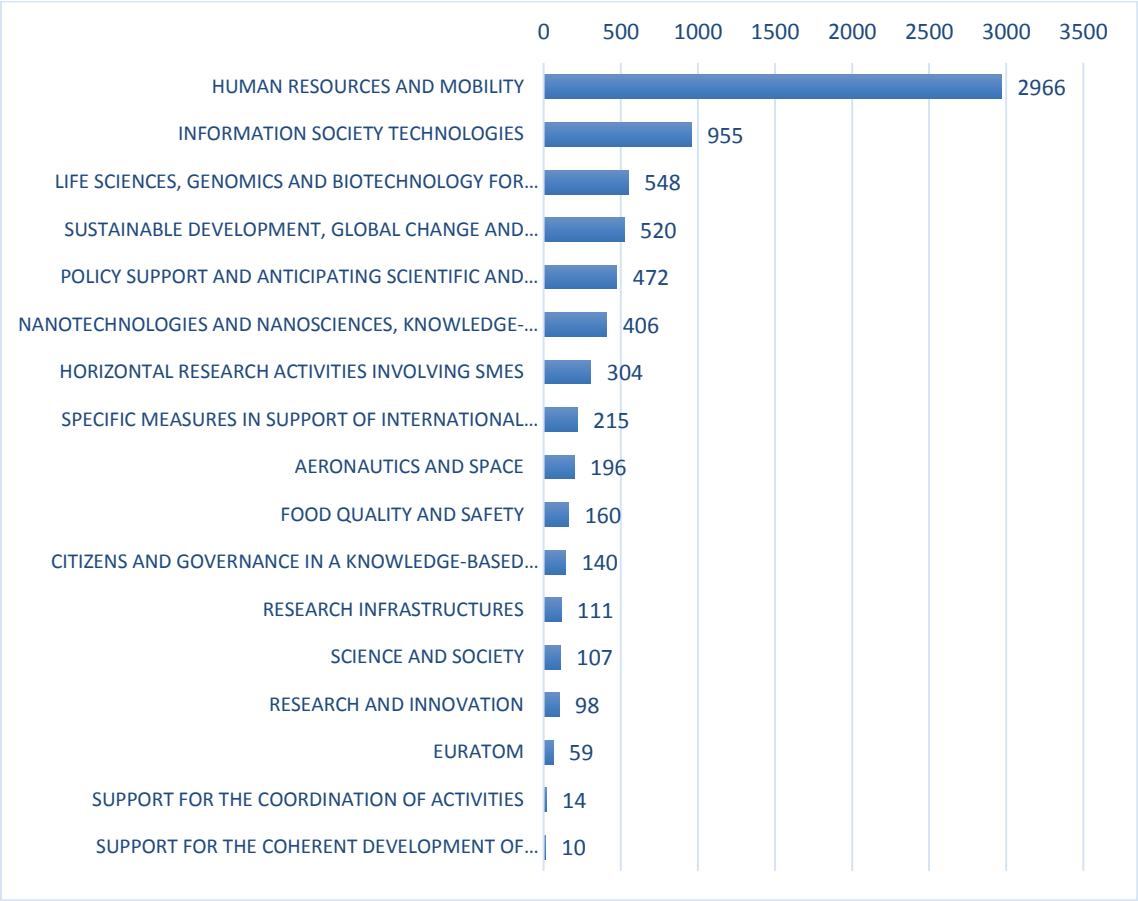
| Programme | EC Funding | <=0.25 | 0.25 - 1.0 | 1.0 - 2.5 | 2.5 - 5.0 | >5.0 |
|---|---|---|---|---|---|---|
| **Euratom** | 166.8 | 15.3% | 22.0% | 32.2% | 10.2% | 20.3% |
| **Integrating and strengthening the ERA** | 12,646.7 | 3.9% | 21.8% | 41.0% | 15.2% | 18.2% |
| **Structuring the ERA** | 2,188.7 | 65.6% | 17.8% | 10.5% | 4.9% | 1.2% |

*Source: authors' calculation based on eCORDA*

Figure 25 illustrates the number of UNIV projects by Thematic Areas. The greatest number of UNIV projects is associated with the following thematic areas: Human Resources and Mobility (2,966) and Information Society Technologies (955). Note that:

- "Integrating and strengthening the ERA" includes: Life Science, Genomics and biotechnology for health; Information Society technologies; Nanotechnologies and nanosciences, knowledge-based multifunctional materials, and new production processes and devices; Aeronautics and space; Food safety and health risks; Sustainable development and global change and ecosystems; Citizens and governance in the European knowledge-based society; Support for the co-ordination of activities; Support for the coherent development of research and innovation policies; Policy support and anticipating scientific and technological needs; Horizontal research activities involving SMEs; International co-operation; JRC non-nuclear activities.
- "Structuring the ERA" includes: Research and innovation; Human resources and mobility (Marie Curie Actions); Research infrastructures; Science and Society.

**Figure 25 – Number of UNIV projects by Thematic Areas in FP6**




*Source: authors' calculation based on eCORDA*

### 3.4.3 Participation by funding scheme

Table 61 describes the number of UNIV projects by funding scheme. Note that a considerable number of UNIV projects in FP6 has missing information on the associated funding scheme (59.9%). For this reason the table provides breakdown of only 4486 projects. Hence, the reliability of related statistics is very limited as it is not known the reason for the missing data.

**Table 61 – Number of UNIV projects by funding scheme in FP6 (Note: 4363 projects, 60% of the sample, report no data on funding scheme)**

| Funding scheme | Description | ALL FP6 projects | % on total | UNIV projects | % on total UNIV projects | % on ALL FP6 projects funded by the scheme |
|---|---|---|---|---|---|---|
| **EIF** | Intra-European Fellowships | 1767 | 39,4% | 1170 | 40,1% | 66,2% |
| **ERG** | European reintegration grants | 390 | 8,7% | 213 | 7,3% | 54,6% |
| **EST** | Early Stage Training | 229 | 5,1% | 172 | 5,9% | 75,1% |
| **IRG** | International reintegration grants | 426 | 9,5% | 209 | 7,2% | 49,1% |
| **LCF** | Large Conferences | 26 | 0,6% | 13 | 0,4% | 50,0% |
| **MC_F** | Marie Curie / International Fellowships | 1206 | 26,9% | 811 | 27,8% | 67,2% |
| **SCF** | Series of Events | 103 | 2,3% | 73 | 2,5% | 70,9% |
| **TOK** | Transfer of Knowledge | 339 | 7,6% | 257 | 8,8% | 75,8% |
| **TOTAL** | | 4486 | 100,0% | 2918 | 100,0% | 65,0% |

*Source: authors' calculation based on eCORDA*

### 3.4.4 Composition of projects

Table 62 - INTERNATIONALISATION: NUMBER OF COUNTRIES INVOLVED IN EACH PROJECT IN FP6 shows the "degree of international orientation" of FP6 UNIV projects by country. On average, UNIV projects in FP6 have involved 5.1 countries. Similarly to FP7, FP6 UNIV projects tend to be more internationally oriented than the average of FP6 projects (4.4).

The second column provides the average number of countries involved in UNIV projects by country. Small research and innovation systems (e.g. MT, EE, BG, LV, SK) confirm to be the most internationally oriented countries in FP6. The less internationally oriented countries are the following: UK, LU, FR, DE, IT and NL. The Table also provides the distribution across ranges of number of partners. It appears that the most internationally oriented countries show a high percentage of UNIV projects involving more than ten countries (e.g. MT and BG) while less internationally oriented countries are mainly associated to UNIV projects involving only one country (e.g. UK and LU).

**Table 62 - INTERNATIONALISATION: NUMBER OF COUNTRIES INVOLVED IN EACH PROJECT IN FP6**

| Country | Mean | 1: country | 2 to 5 countries involved | 6 to 10 | more than 10 |
|---|---|---|---|---|---|
| **AT** | 8.5 | 7.9% | 22.4% | 41.8% | 27.3% |
| **BE** | 9.0 | 7.0% | 20.6% | 40.4% | 31.7% |
| **BG** | 11.8 | 5.4% | 13.4% | 29.5% | 48.2% |
| **CH** | 8.2 | 10.2% | 19.9% | 41.6% | 28.1% |
| **CY** | 10.1 | 19.5% | 14.3% | 28.6% | 32.5% |
| **CZ** | 9.8 | 2.7% | 19.3% | 40.2% | 37.2% |
| **DE** | 7.6 | 8.1% | 26.6% | 44.4% | 20.8% |
| **DK** | 9.1 | 9.7% | 18.0% | 38.9% | 32.7% |
| **EE** | 11.6 | 2.6% | 16.5% | 35.7% | 43.5% |
| **EL** | 9.3 | 8.8% | 17.8% | 38.1% | 35.0% |
| **ES** | 8.2 | 11.2% | 20.3% | 41.2% | 27.1% |
| **FI** | 9.0 | 7.4% | 18.6% | 40.7% | 32.9% |
| **FR** | 7.3 | 15.7% | 24.6% | 37.1% | 22.5% |
| **HR** | 10.6 | 5.3% | 15.8% | 38.6% | 40.4% |
| **HU** | 9.3 | 8.5% | 16.5% | 40.4% | 34.0% |
| **IE** | 8.1 | 17.0% | 19.7% | 35.3% | 27.8% |
| **IL** | 8.1 | 14.5% | 20.8% | 36.7% | 27.7% |
| **IT** | 7.6 | 11.2% | 25.4% | 41.9% | 21.4% |
| **LT** | 10.3 | 3.8% | 15.1% | 40.6% | 36.8% |
| **LU** | 6.4 | 16.7% | 0.0% | 66.7% | 0.0% |
| **LV** | 11.1 | 2.5% | 12.7% | 38.0% | 43.0% |
| **MT** | 13.1 | 2.3% | 20.5% | 20.5% | 47.7% |
| **NL** | 7.8 | 12.1% | 21.9% | 42.2% | 23.7% |
| **NO** | 9.7 | 9.5% | 17.0% | 37.1% | 36.0% |
| **PL** | 9.0 | 7.4% | 20.6% | 40.7% | 30.9% |
| **PT** | 9.9 | 4.8% | 19.6% | 39.7% | 35.6% |
| **RO** | 9.3 | 6.3% | 19.0% | 43.0% | 31.7% |
| **SE** | 8.4 | 9.2% | 22.1% | 39.7% | 29.0% |
| **SI** | 10.7 | 2.5% | 10.6% | 46.6% | 39.8% |
| **SK** | 11.4 | 2.3% | 10.8% | 36.9% | 48.5% |
| **UK** | 6.3 | 23.9% | 23.2% | 36.6% | 16.4% |

*Source: authors' calculation based on eCORDA*

Table 63 describes the size of networks for UNIV projects by country. It reports the distribution across ranges of number of partners. Approximately 31% of UNIV projects, out of 7,821, relate to solo projects (UNIV projects involving only one participant). About 27.1% are UNIV projects involving from 6 to 10 partners, while the other ranges (2 to 5 partners, 11 to 15, and >15) are, on average, less represented. This means that, when collaborating, participant universities are mainly involved in consortia of 6 to 10 partners.

Again, several EU15 and some extra EU countries (UK, IE, FR, IL and NL show the lowest levels of partnerships as revealed by their high share of solo projects. Some EU13 Member States (MT, HR, SI and SK) are characterised by the highest levels of partnerships as shown by their high share of projects involving more than fifteen partners.

**Table 63 – Network size by country in FP6**

| Country | Projects | Solo projects | 2 to 5 partners | 6 to 10 | 11 to 15 | >15 |
|---|---|---|---|---|---|---|
| **AT** | 616 | 8.0% | 5.8% | 32.8% | 18.7% | 34.7% |
| **BE** | 827 | 6.7% | 7.7% | 26.7% | 19.0% | 39.9% |
| **BG** | 108 | 2.8% | 7.4% | 19.4% | 25.0% | 45.4% |
| **CH** | 809 | 10.3% | 7.8% | 26.8% | 18.2% | 37.0% |
| **CY** | 73 | 19.2% | 5.5% | 26.0% | 11.0% | 38.4% |
| **CZ** | 299 | 2.3% | 5.0% | 27.8% | 23.1% | 41.8% |
| **DE** | 2,205 | 8.1% | 8.6% | 31.7% | 19.9% | 31.7% |
| **DK** | 584 | 9.4% | 7.7% | 27.9% | 16.4% | 38.5% |
| **EE** | 113 | 2.7% | 6.2% | 31.0% | 16.8% | 43.4% |
| **EL** | 626 | 7.8% | 5.9% | 22.4% | 20.4% | 43.5% |
| **ES** | 1,139 | 10.8% | 6.8% | 27.3% | 19.8% | 35.3% |
| **FI** | 472 | 6.6% | 6.8% | 29.2% | 16.3% | 41.1% |
| **FR** | 1,106 | 15.3% | 8.6% | 24.5% | 18.6% | 33.0% |
| **HR** | 57 | 5.3% | 5.3% | 24.6% | 19.3% | 45.6% |
| **HU** | 374 | 7.8% | 5.6% | 27.3% | 22.7% | 36.6% |
| **IE** | 441 | 16.6% | 10.2% | 21.8% | 16.1% | 35.4% |
| **IL** | 288 | 13.9% | 10.1% | 22.2% | 18.8% | 35.1% |
| **IT** | 1,518 | 10.7% | 8.4% | 28.7% | 19.8% | 32.3% |
| **LT** | 102 | 2.9% | 3.9% | 23.5% | 34.3% | 35.3% |
| **LU** | 5 | 0.0% | 20.0% | 20.0% | 20.0% | 40.0% |
| **LV** | 76 | 1.3% | 5.3% | 22.4% | 28.9% | 42.1% |
| **MT** | 40 | 2.5% | 17.5% | 7.5% | 25.0% | 47.5% |
| **NL** | 1,274 | 12.1% | 8.5% | 29.4% | 17.9% | 32.2% |
| **NO** | 282 | 9.2% | 6.7% | 25.2% | 18.8% | 40.1% |
| **PL** | 609 | 6.2% | 8.4% | 26.9% | 18.2% | 40.2% |
| **PT** | 311 | 4.5% | 6.1% | 25.1% | 19.6% | 44.7% |
| **RO** | 142 | 6.3% | 6.3% | 27.5% | 25.4% | 34.5% |
| **SE** | 1,144 | 8.8% | 8.0% | 27.4% | 16.5% | 39.2% |
| **SI** | 160 | 2.5% | 1.9% | 30.0% | 21.3% | 44.4% |
| **SK** | 128 | 1.6% | 3.9% | 19.5% | 30.5% | 44.5% |
| **UK** | 3,272 | 23.7% | 9.0% | 27.1% | 16.4% | 23.7% |

*Source: authors' calculation based on eCORDA*

Table 64 describes the types of partnerships characterizing UNIV projects by country. Organisations participating in FP6 are classified as follows:

- HES Higher Education (i.e. organisations only or mainly established for higher education/training, e. g. universities, colleges);
- REC Research (i.e. organisations only or mainly established for research purposes);
- N/A Undefined;
- OTH Others;
- IND Industry (i.e. industrial organisations private and public, both manufacturing and industrial services, such as industrial software, design, control, repair, maintenance).

On average, universities establish partnership mainly with other universities and REC than with IND. The breakdown by country does not highlight any particular pattern. It must be noted that data on partnerships reported in Table 64 are influenced by the size of networks for UNIV projects shown in Table 63. This explains why UK and CY, characterized by high shares of solo projects, reveal low percentage of participation with other universities.

**Table 64 – Data on partnerships in FP6**

| Country | Projects | Other universities | HES non university | REC | IND | N/A | OTH |
|---|---|---|---|---|---|---|---|
| AT | 616 | 86.9% | 8.1% | 78.7% | 55.8% | 8.0% | 51.5% |
| BE | 827 | 87.7% | 10.0% | 82.8% | 53.9% | 8.7% | 54.1% |
| BG | 108 | 88.9% | 15.7% | 82.4% | 65.7% | 11.1% | 70.4% |
| CH | 809 | 85.4% | 7.4% | 80.6% | 56.5% | 6.7% | 46.8% |
| CY | 73 | 72.6% | 13.7% | 68.5% | 46.6% | 5.5% | 52.1% |
| CZ | 299 | 92.6% | 11.7% | 86.6% | 55.5% | 10.0% | 58.2% |
| DE | 2,205 | 86.2% | 6.6% | 79.7% | 53.7% | 6.8% | 47.3% |
| DK | 584 | 86.5% | 7.4% | 79.5% | 48.8% | 8.2% | 48.8% |
| EE | 113 | 93.8% | 6.2% | 84.1% | 41.6% | 4.4% | 65.5% |
| EL | 626 | 83.2% | 8.1% | 78.6% | 52.6% | 9.7% | 62.3% |
| ES | 1,139 | 81.7% | 8.8% | 78.0% | 50.5% | 9.0% | 51.4% |
| FI | 472 | 90.0% | 6.8% | 83.3% | 54.4% | 6.8% | 53.8% |
| FR | 1,106 | 79.4% | 6.1% | 72.8% | 48.1% | 6.7% | 42.9% |
| HR | 57 | 89.5% | 12.3% | 82.5% | 56.1% | 10.5% | 56.1% |
| HU | 374 | 88.5% | 7.8% | 78.6% | 49.2% | 9.6% | 55.6% |
| IE | 441 | 76.9% | 9.3% | 70.7% | 50.6% | 8.6% | 46.9% |
| IL | 288 | 79.2% | 8.3% | 75.7% | 51.0% | 6.3% | 43.4% |
| IT | 1,518 | 83.1% | 7.2% | 78.3% | 52.4% | 8.1% | 49.7% |
| LT | 102 | 85.3% | 8.8% | 84.3% | 46.1% | 16.7% | 71.6% |
| LU | 5 | 80.0% | 20.0% | 80.0% | 60.0% | 0.0% | 40.0% |
| LV | 76 | 88.2% | 10.5% | 85.5% | 51.3% | 6.6% | 71.1% |
| MT | 40 | 87.5% | 17.5% | 80.0% | 42.5% | 17.5% | 62.5% |
| NL | 1,274 | 83.9% | 8.5% | 75.9% | 45.0% | 6.4% | 44.0% |
| NO | 282 | 85.8% | 10.3% | 79.1% | 44.3% | 7.4% | 47.5% |
| PL | 609 | 85.6% | 8.9% | 80.3% | 53.5% | 8.7% | 57.0% |
| PT | 311 | 91.6% | 9.6% | 83.3% | 56.9% | 6.4% | 56.9% |
| RO | 142 | 85.2% | 7.7% | 77.5% | 49.3% | 6.3% | 59.9% |
| SE | 1,144 | 86.8% | 7.5% | 80.9% | 54.3% | 8.0% | 49.0% |
| SI | 160 | 90.6% | 13.8% | 86.3% | 48.8% | 10.6% | 61.9% |
| SK | 128 | 86.7% | 8.6% | 85.9% | 50.0% | 6.3% | 73.4% |
| UK | 3,272 | 69.1% | 5.1% | 65.8% | 42.0% | 6.5% | 38.7% |

*Source: authors' calculation based on eCORDA*

Table 65 describes the types of partnerships characterizing UNIV projects by Programme. Universities reveal high percentage of collaboration in the "Integrating and strengthening the ERA" and the "Euratom" programmes. Lower percentages of collaboration are associated with the Programme "Structuring the ERA". In all programmes universities establish partnership mainly with other universities and REC.

**Table 65 – Partnership by programme in FP6 (percentage on total projects)**

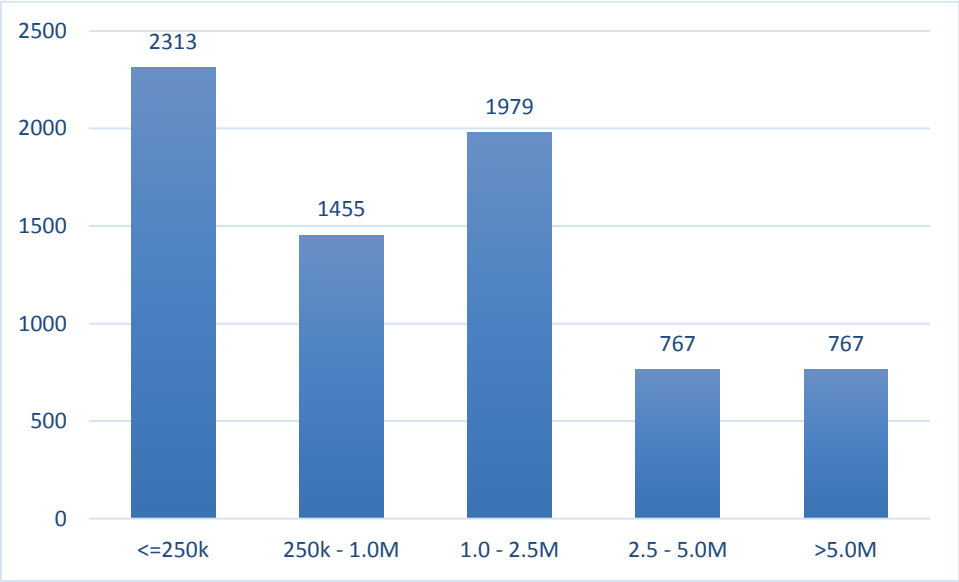
| Programme | Projects | Other universities | HES non university | REC | IND | N/A | OTH |
|---|---|---|---|---|---|---|---|
| **Euratom** | 59 | 79.7% | 16.9% | 91.5% | 57.6% | 0.0% | 78.0% |
| **Integrating and strengthening the ERA** | 3,940 | 80.3% | 5.5% | 87.8% | 64.3% | 8.8% | 57.8% |
| **Structuring the ERA** | 3,282 | 20.2% | 1.6% | 18.3% | 6.3% | 2.2% | 9.2% |

*Source: authors' calculation based on eCORDA*

### 3.4.5 EU funding

This section presents statistics concerning EU funding. Statistics are provided at both the project (UNIV projects) and the participant (universities) levels of analysis. As for FP7, indicators are provided at different levels of breakdowns, e.g. per range of EC funding size, per country, Programme and EC funding instrument. It must be noted that statistics regards the EU financial contribution to granted UNIV projects and not the corresponding project costs. The average EC funding per UNIV project is approximately € 2.06 million. As Figure 26 shows, the distribution of UNIV projects by EC funding size is skewed: a high number of UNIV projects has been granted € 250,000 or less (2,313 out of 7,281 UNIV projects) while a minority of UNIV projects have been granted more than € 5 million (767).

**Figure 26 – Distribution of projects by EC funding size in FP6**




*Source: authors' calculation based on eCORDA*

Table 66 shows the amount of EC funding by country of participants. The third column reports the total EC funding received by universities.

The countries revealing the highest total amount of EC funding received by universities are UK and DE followed by NL, IT and SE. The countries revealing the lowest values are LU, MT, HR and LV.

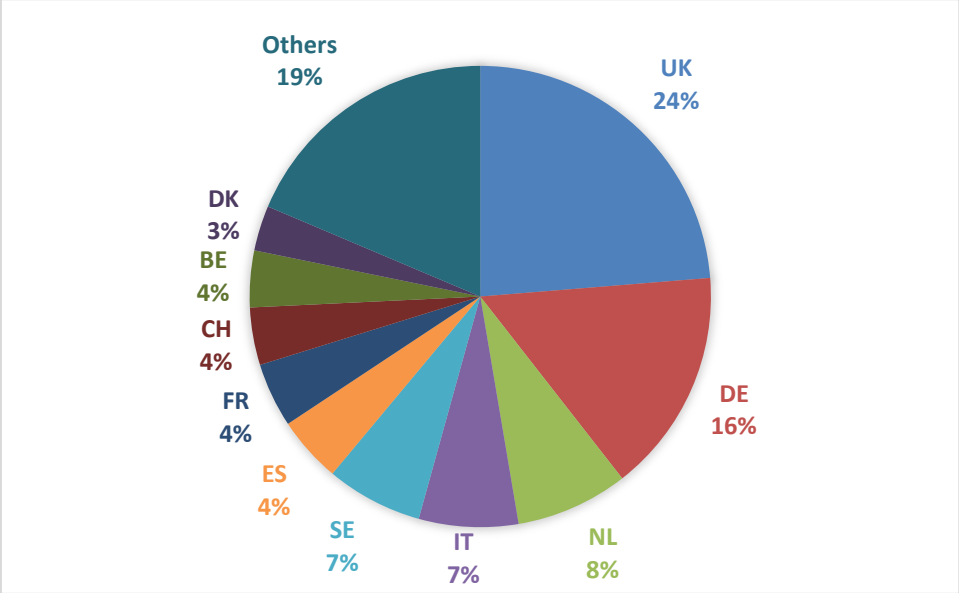
**Table 66 – Amount of EC funding by country of participants in FP6**

| Country | Projects | Total EC funding received by universities (€ million) |
|---|---|---|
| **AT** | 616 | 168.8 |
| **BE** | 827 | 235.3 |
| **BG** | 108 | 12.2 |
| **CH** | 809 | 238.9 |
| **CY** | 73 | 12.6 |
| **CZ** | 299 | 44.3 |
| **DE** | 2,205 | 932.9 |
| **DK** | 584 | 187.8 |
| **EE** | 113 | 12.3 |
| **EL** | 626 | 128.3 |
| **ES** | 1,139 | 273.9 |
| **FI** | 472 | 147.6 |
| **FR** | 1,106 | 267.6 |
| **HR** | 57 | 5.6 |
| **HU** | 374 | 57.2 |
| **IE** | 441 | 134.2 |
| **IL** | 288 | 76.3 |
| **IT** | 1,518 | 412.9 |
| **LT** | 102 | 10.8 |
| **LU** | 5 | 0.9 |
| **LV** | 76 | 8.3 |
| **MT** | 40 | 4.0 |
| **NL** | 1,274 | 467.7 |
| **NO** | 282 | 75.6 |
| **PL** | 609 | 94.0 |
| **PT** | 311 | 56.1 |
| **RO** | 142 | 17.8 |
| **SE** | 1,144 | 401.4 |
| **SI** | 160 | 23.8 |
| **SK** | 128 | 13.1 |
| **UK** | 3,272 | 1405.7 |
| **Total** | **7,281** | **5,928.1** |

*Source: authors' calculation based on eCORDA*

Figure 27 illustrates the share of EC funding for the top 10 recipient countries. Almost half of EC funding (48%) are concentrated in three countries: UK (24%), DE (16%), NL (8%). The other countries included in the top 10 EU funding recipients are IT, SE, ES, FR, CH, BE and DK.

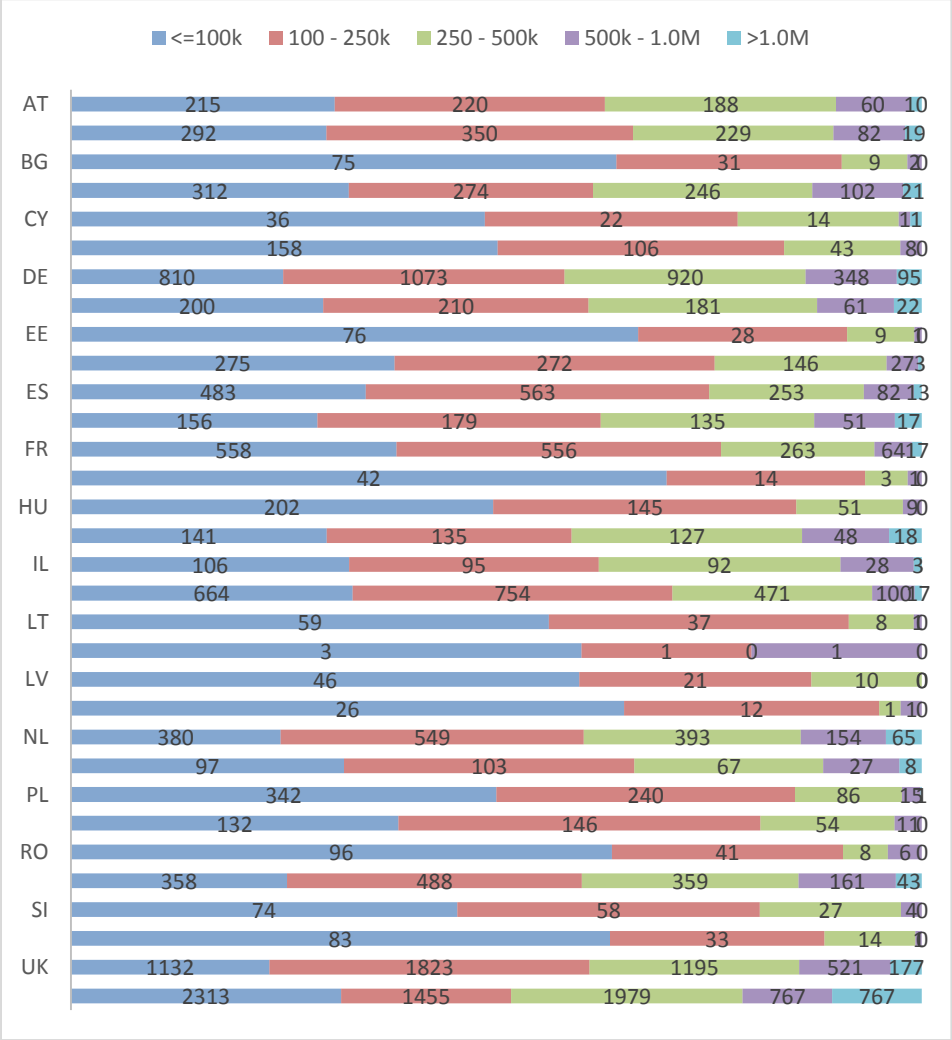
**Figure 27 – Share of EC funding of the top 10 recipient countries in FP6**




*Source: authors' calculation based on eCORDA*

Figure 28 illustrates the number of projects for different ranges of EC funding by country. BG, EE, HR, MT and SK are characterized by a high share of UNIV projects that have been granted € 100,000 or less. On the opposite side, UK, NL, DE and DK are characterized by a high share of UNIV projects that has been granted more than € 1 million.

**Figure 28 – Number of projects by amount of received EC funding in FP6**




*Source: authors' calculation based on eCORDA*

Table 67 shows the breakdown of EC funding by country of participants and Programme. The total amount of EC funding devoted to universities is mostly concentrated in the Euratom Programme followed by "Integrating and Strengthening the ERA" and "Structuring the ERA", respectively. Among the countries characterised by the highest total amount of EC funding received by universities, UK, DE, SE and NL are the main beneficiaries in all the Specific Programmes followed by IT and ES.

**Table 67 – Breakdown of EC funding by country of participants and Programme in FP6 (€ million)**

| Country | Euratom | INTEGRATING AND STRENGHTENING THE ERA | STRUCTURING THE ERA |
|---|---|---|---|
| **AT** | 17.6 | 2,444.1 | 469.6 |
| **BE** | 72.9 | 3,698.6 | 477.3 |
| **BG** | 8.5 | 296.5 | 68.6 |
| **CH** | 23.0 | 4,071.2 | 407.0 |
| **CY** | 14.4 | 162.3 | 118.5 |
| **CZ** | 25.6 | 1,008.9 | 114.3 |
| **DE** | 167.0 | 13,266.8 | 1,674.1 |
| **DK** | 43.8 | 2,601.5 | 356.4 |
| **EE** | 0.7 | 297.3 | 24.3 |
| **EL** | 24.8 | 2,789.0 | 538.6 |
| **ES** | 132.1 | 5,112.8 | 688.8 |
| **FI** | 32.0 | 2,135.8 | 272.4 |
| **FR** | 81.3 | 5,438.1 | 866.0 |
| **HR** | - | 96.9 | 49.9 |
| **HU** | 8.2 | 1,280.3 | 205.8 |
| **IE** | 17.6 | 1,621.6 | 267.9 |
| **IL** | - | 1,094.8 | 291.8 |
| **IT** | 59.5 | 7,526.9 | 812.2 |
| **LT** | - | 219.4 | 128.4 |
| **LU** | - | 5.5 | 6.2 |
| **LV** | - | 256.8 | 113.0 |
| **MT** | - | 126.7 | 107.8 |
| **NL** | 82.4 | 5,478.5 | 798.6 |
| **NO** | 10.9 | 1,155.4 | 187.7 |
| **PL** | 8.1 | 2,299.8 | 439.4 |
| **PT** | - | 1,289.0 | 108.4 |
| **RO** | 2.0 | 301.9 | 112.1 |
| **SE** | 156.7 | 5,941.7 | 744.4 |
| **SI** | 2.0 | 444.8 | 38.3 |
| **SK** | 9.4 | 347.1 | 43.0 |
| **UK** | 177.4 | 17,126.0 | 2,351.9 |
| **TOTAL** | **25,656.9** | **5,272.1** | **3,790.9** |

*Source: authors' calculation based on eCORDA*

### 3.4.6 Network Analysis

Equivalently to the investigations for FP7, we conduct a basic network analysis to deepen our insight on structures and trends of collaboration patterns in FP6. As for FP7, the section provides evidence on the position of universities in the network of relationships, the types of institutional partnerships and the network of collaborations involving universities at both the country and the region level of analysis.

The methodology is described in some detail in Section 3.3.7. However, in contrast to the FP7 analysis, for FP6 we have to draw on data from the AIT EUPRO database. This is related to the fact that eCORDA does not provide harmonized data for the names of FP participants, most universities in FP6 appear in different spelling variants. In terms of network analysis, each name variant would represent a distinct node in the network, without doing intensive name standardisations. Further, during FP6 some universities merged (e.g., Royal Veterinary and Agricultural University and University of Pharmaceutical Sciences were integrated in University of Copenhagen in 2007), but appear in eCORDA as different organisations and, therefore, as different network nodes. The network of universities in FP6 based on eCORDA data would consist of 5,428 network nodes (i.e., spelling variants of universities). In

comparison, the network of universities in FP6 based on EUPRO – using standardised names – consists of 952 network nodes (considering all universities included in ETER, which participated in FP6). Thus, the analysis based on eCORDA FP6 data would lead to inconsistent and highly biased results of the network analysis, in particular concerning the ranking of universities based on their centrality measures. The same university would appear in different spelling variants at different positions in the centrality ranking. The comparison of the ranking of the top 30 universities regarding weighted degree based on eCORDA and EUPRO data respectively show that in some cases the ranking positions of the universities differ remarkable – up to 100 positions.

The results of the FP6 network analysis are therefore based on cleaned and harmonized EUPRO data, which covers 10,077 FP6 projects out of 10,107 projects included in FP6 eCORDA data. As for FP7, we first define the network that we analyse, with all FP6 projects with university participation providing the basis for the definition of the networks; again we distinguish:

- Organisation based network, with nodes representing organisations and the number of joint projects edges
- Country based network, with countries representing nodes and the number of joint projects organisations located in these countries edges
- Region based network, with countries representing nodes and the number of joint projects organisations located in these countries edges

The measures of network centrality accounting for local and global connectedness of nodes are the same as for the FP7 analysis, i.e. Degree centrality, Eigenvector centrality, Closeness centrality and Betweenness centrality. Their formal description and interpretation is given in Section 3.3.7.

Table 68 reports an overview on the top ranked universities in FP6 with respect to their local and global connectedness. As for FP7, there is rather high correlation between the four centrality measures under consideration. However, concerning the role of individual universities, there are some notable differences to FP7. Most interestingly, the National Technical University of Athens (NTUA) shows the highest degree centrality, i.e. the highest number of collaboration partners, while NTUA just comes on rank 32 for FP7. Due to the high number of collaboration partners, NTUA also shows a high betweeness and closeness centrality. However, it is not ranked under the Top 10 in Eigenvector centrality, i.e. it is more connected to peripheral partners than to other central players, like ETH Zürich, Imperial College London, or the universities of Cambridge and Oxford.

**Table 68 – Overview of top ranked universities in FP6**

| University | Degree | University | Eigen-vector | University | Between-ness | University | Closeness |
|---|---|---|---|---|---|---|---|
| www.ntua.gr | 0.12358 | www.dtu.dk | 0.12967 | www.ntua.gr | 0.02214 | www.ntua.gr | 0.529799 |
| www.kuleuven.be | 0.11979 | www.lu.se | 0.12681 | www.kuleuven.be | 0.01937 | www.kuleuven.be | 0.528703 |
| www.lu.se | 0.11399 | www.imperial.ac.uk | 0.11399 | www.uni-stuttgart.de | 0.01654 | www.lu.se | 0.527371 |
| www.dtu.dk | 0.11353 | www.cam.ac.uk | 0.11348 | www.lu.se | 0.01563 | www.dtu.dk | 0.526748 |
| www.imperial.ac.uk | 0.11002 | www.ox.ac.uk | 0.10943 | www.dtu.dk | 0.01479 | www.imperial.ac.uk | 0.525871 |
| www.uni-stuttgart.de | 0.10514 | www.kth.se | 0.10613 | www.kth.se | 0.01333 | www.uni-stuttgart.de | 0.524301 |
| www.kth.se | 0.10393 | www.kuleuven.be | 0.10457 | www.ncl.ac.uk | 0.01162 | www.kth.se | 0.523023 |
| www.ethz.ch | 0.09663 | www.ku.dk | 0.10216 | www.imperial.ac.uk | 0.01161 | www.ethz.ch | 0.521187 |
| www.epfl.ch | 0.09468 | www.ethz.ch | 0.09962 | www.tudelft.nl | 0.01129 | www.epfl.ch | 0.519458 |
| www.ku.dk | 0.09336 | www.epfl.ch | 0.09857 | www.manchester.ac.uk | 0.01121 | www.upm.es | 0.518993 |

As for FP7, the University of Oxford and the University of Cambridge show a high Eigenvector centrality, respectively, while even not appearing under the top 10 for degree, betweenness and closeness centrality, i.e. both universities are more focused connecting to other central players than on integrating peripheral ones. The Technical University of Denmark and KU Leuven that showed the highest number of partners in FP7 come on ranks 4 and 2, respectively, in FP6. Lund University has a much stronger role in FP6 than in FP7, in FP6 coming under the Top 4 in all four centrality measures under consideration. Only four universities show a Top 10 position in all centrality measures, these are Lund University, Imperial College London, KU Leuven, and the Technical University of Denmark. These universities seem to play an important role in both connecting to central and peripheral players, acting as significant knowledge distributors in the whole university network.

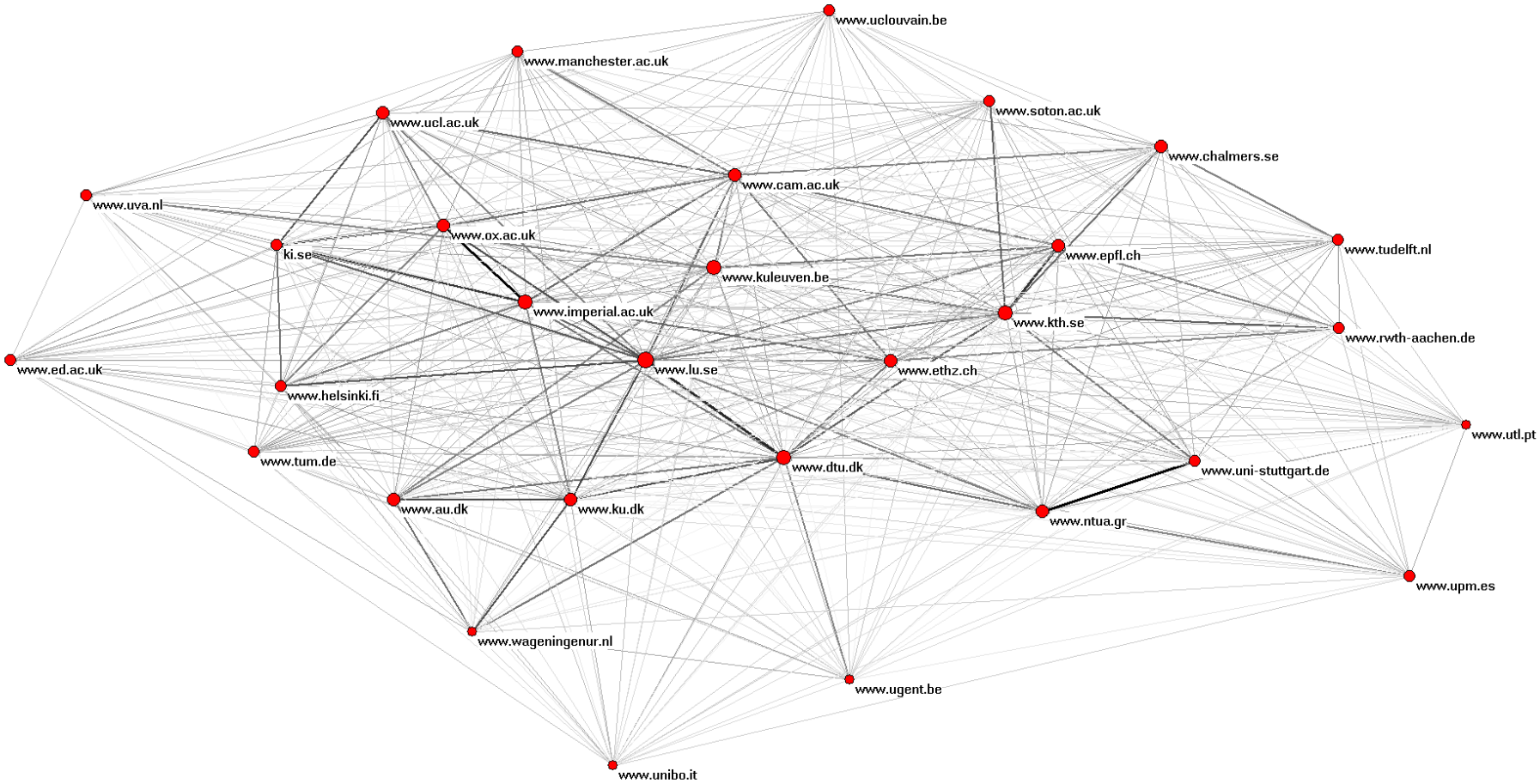
To underline these findings, Figure 29 illustrates the FP6 university network using the top 30 FP6 universities by weighted degree. As for FP7, the network visualisation places nodes with intensive connections close to each other.

Concerning network structure, the results are rather similar than for FP7, pointing to a very densely connected core which again supports conclusions from the centrality analysis, showing strong collaboration links between some central players, many of them located in the UK, and important gatekeeper universities, such as mainly KU Leuven, the Technical University of Denmark and TU Delft in the context of FP7. Also for FP6, the core university network seems not to follow a particular geographical logic, i.e. country clusters or explicit clusters of neighbouring countries are not observable (with the exception of the core UK cluster).

The results of the centrality analysis for the University of Stuttgart and the Technical University of Athens are also underlined by the visualisation. Though they have a high number of partners, they are not placed in the very centre of the network due to a lesser number of links to very central, but more peripheral partner universities (the latter not given under the Top 30). Differing university strategies may be reflected by this, having on the one hand a core that seem to attach to other core partners (Cambridge and Oxford) for reasons of scientific excellence, while others use the FPs as channel to tap additional external funds being not that selective in their partner choice and therefore also cooperating with peripherals universities (University of Stuttgart or Technical University of Athens).

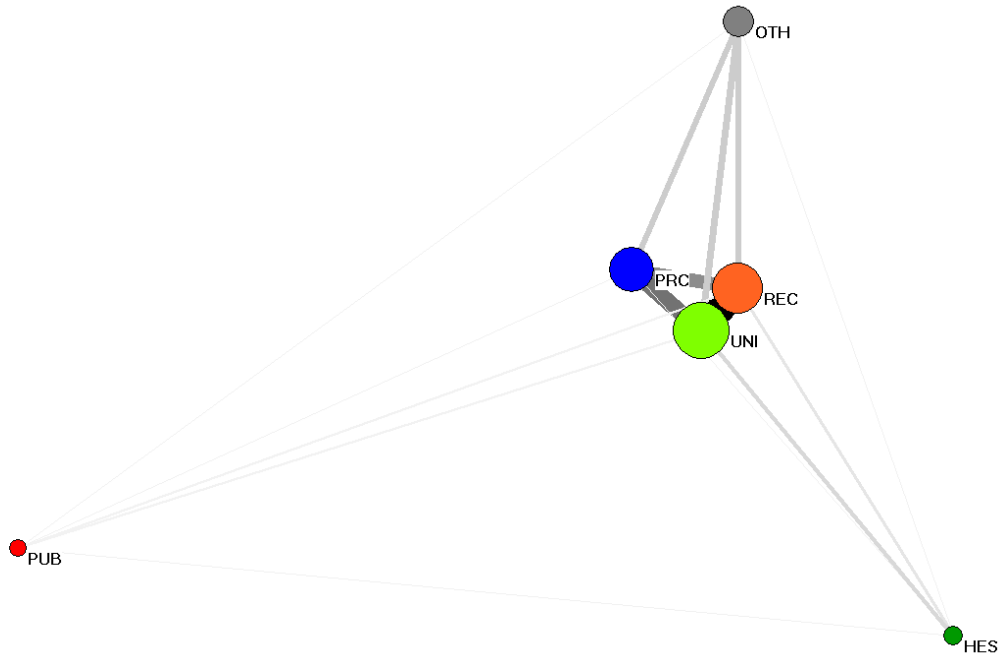
Figure 30 complements the analysis, equivalently as for FP7 illustrating the network of major organisation types in FP6. The network of the institutional partnerships demonstrates the main institution types which are – as for FP7 – firms (PRC), universities (UNI) and research organisations (REC). However, its notable that PRC is the largest component in FP7, while coming just on the third rank in FP6. Further, in FP7 the interaction intensity between the three main components is of similar magnitude, while for FP6 the collaboration intensity between UNI and REC is much higher than between UNI and PRC as well as REC and PRC.

**Figure 29 – Network visualisation by using the top 30 FP6 universities by weighted degree**




*Source: authors' calculation based on EUPRO*

**Figure 30 – Visualisation of the institutional partnerships in FP6**




*Source: authors' calculation based on EUPRO*

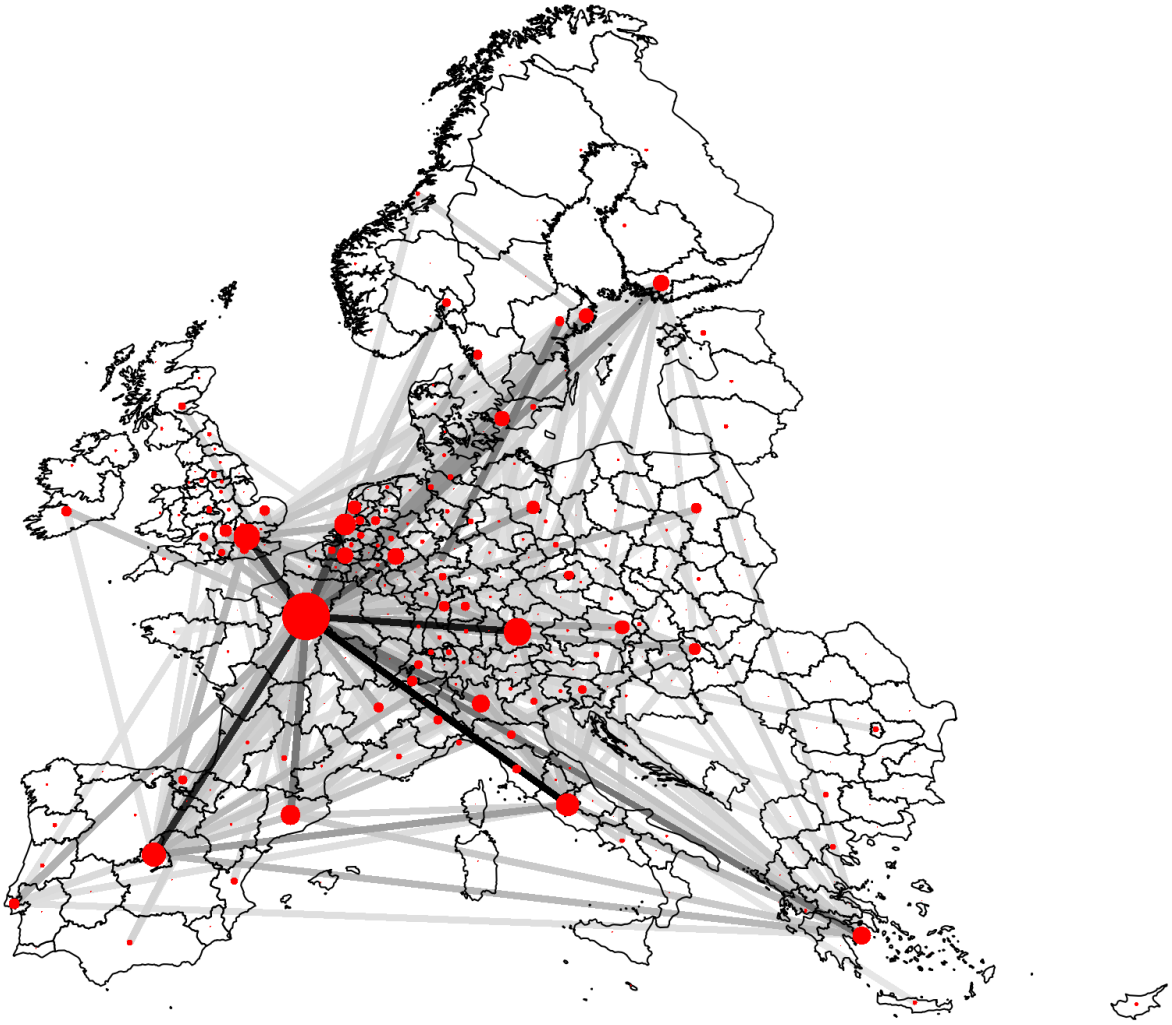
Turning to the spatial perspective in illustrating the country and the region network (see Figure 20 and Figures 21, respectively), it turns out that the spatial structure of the FP6 UNI network only differs from that of FP7 to a minimal extent (visually hardly observable). As for FP7, the UK constitutes the most central country in the FP7 UNI country network, showing the highest number of participations and the highest number of collaborations. The highest number of joint projects is observed for the large central European countries UK, Germany and France. Southern European and Benelux countries are more intensively connected than Northern European countries. The collaboration within Southern European countries is much more intensive than between Scandinavian ones. Eastern European countries are connected to an even lower extent than in FP7, again with Poland constituting the most connected eastern European country.

**Figure 31 – Visualisation of the country network**

*Notes: FP6 projects with UNI participations. Nodes: Countries with size corresponding to the number of projects. Edges: Number of joint FP UNI projects, with darkness corresponding to intensity (the darker, the higher the number of join FP UNI projects between two countries)*
*Source: authors' calculation based on EUPRO*

Also at the regional level (see Figure 21), results are similar than for FP7. Again, Ile-de-France constitutes the central region, pointing to a very centralised system in France. UK, though focused to a significant extent on the London region, is less centralised than France, while Germany is the geographically most diversified country. Most intensive collaborations can be observed between the regions of Ile-de-France and Oberbayern (Germany), and Ile-de-France and Rome. Further, there are strong connections between Ile-de-France and Madrid, and Ile-de-France and Rome. Again, inter-linking of Eastern and Southern European regions is mainly refined to capital regions.

**Figure 32 – Visualisation of the region-level network**



*Notes: FP6 projects with UNI participations. Nodes: NUTS-2 regions with size corresponding to the number of projects. Edges: Number of joint FP UNI projects, with darkness corresponding to intensity (the darker, the higher the number of join FP UNI projects between two regions).*
*Source: authors' calculation based on EUPRO*

As a complement, Table 55 presents the region positioning analysis on top ranked regions in FP6. As for FP7, we observe a stronger correlation between the four centrality measures under consideration than for the analysis at the university level. Results of the regional centralities are quite similar to FP7, with some interesting exceptions. Ile-de-France (FR10) –being on top ranked in all four centrality measures for FP7 – has, of course, also a high centrality in all centrality measures in FP6, but comes not on top for betweenness centrality. In FP6, the region of Brussels (BE10) shows the highest betweenness centrality, organisations located in Brussels and its surrounding seems to constitute important bridges in the network.

**Table 69 – Region positioning analysis on top ranked regions in FP6**

| Region | Degree | Region | Eigenvector | Region | Betweenness | Region | Closeness |
|---|---|---|---|---|---|---|---|
| FR10 | 0.973 | FR10 | 0.473 | BE10 | 0.008 | FR10 | 26.795 |
| EL30 | 0.970 | EL30 | 0.175 | ES51 | 0.008 | EL30 | 26.544 |
| BE10 | 0.963 | BE10 | 0.149 | FR10 | 0.007 | BE10 | 26.508 |
| ES30 | 0.960 | ES30 | 0.236 | EL30 | 0.007 | ES30 | 26.633 |
| NL33 | 0.953 | NL33 | 0.203 | UKI1 | 0.005 | NL33 | 26.603 |
| ITI4 | 0.953 | ITI4 | 0.240 | SE11 | 0.005 | ITI4 | 26.659 |
| ES51 | 0.950 | AT13 | 0.122 | FI1C | 0.004 | ES51 | 26.539 |
| UKI1 | 0.947 | FI1C | 0.146 | ITI4 | 0.004 | UKI1 | 26.625 |
| SE11 | 0.947 | ITC4 | 0.170 | ES30 | 0.004 | SE11 | 26.462 |
| FI1C | 0.944 | UKI1 | 0.234 | NL32 | 0.004 | AT13 | 26.401 |

*Source: authors' calculation based on EUPRO*

## 3.5 Analysis of participation in FP5

This section focuses on the analysis of FP5 participation patterns. EUPRO – a database containing systematic information project from FP1 to FP7, maintained by AIT – is used here since eCORDA does not have systematic, cleaned observations for FP1-FP5. Given the cleaned and comprehensive nature of EUPRO, direct comparison to the results for FP6 and FP7 are feasible. Also note in this context, that information on funding volumes at the organizational level are not given in EUPRO and can therefore not be reported for FP5 and FP4.

As for FP6 and FP7, universities in FP5 have been identified by their geographical location (EU28 plus CH, IL, NO). We have carried out a manual checking based on the European Tertiary Education Register (ETER), samples of FP7 and FP6 universities (see section 3.2) and other web-based available sources.

The data analysis produced the following overall figures for the FP5 university participation:

- 9,991 FP projects have at least one university partner (58.1% of 17,204 FP5 projects in total)
- 966 universities have participated in FP5 (4.5% of 21,341 FP5 participants in total)

### 3.5.1 Overall participation and geographical breakdown

In what follows, we provide a breakdown of aggregate figures on university projects over the total number of projects in FP5 (both in terms of numbers and amount of funding). This is done in parallel to the FP6 and FP7 analysis, in order to identify specific patterns of university participation in FP5. Again, figures are disaggregated by country, programme and funding scheme.

Table 70 reports the respective numbers of UNIV projects by country. It is shown that – as for FP6 and FP7 – UK is has the highest share on the total number of projects (40.6%), followed by DE (26.9%) and IT (17.1%), i.e. the ranking stays the same as compared to FP6 and FP7, while the share of universities was somewhat lower.

5,890 UNIV projects out of 9,991 were coordinated by a university. Again, it is worth noting that, due to the presence of projects including one or more universities as partners but a coordinator that is not a university, the total of the last column (% of university as coordinator on country projects) does not sum to 100%. For FP5, around 59% of the UNIV projects are coordinated by a university, which is the same share recorded in FP6. Countries with a low level of participation of universities as coordinators (<=15%) are mainly Eastern European countries. Countries with a high level of participation of universities as coordinators are Croatia (45.5%, but with a very low level of the share in total projects), UK (40.9%), Norway (32.3%), Belgium (31.4%) and the Netherlands (31.1%).

**Table 70 – Number of UNIV projects by country in FP5**

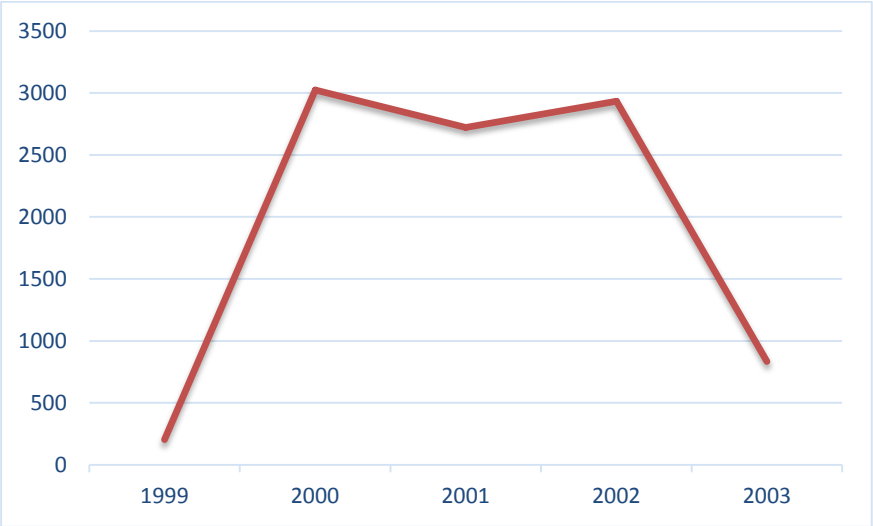
| Country | Number | % on total number of projects | university as coordinator | % of university as coordinator on total number of projects | % of university as coordinator on country projects |
|---|---|---|---|---|---|
| **AT** | 601 | 6.0% | 140 | 2.4% | 23.3% |
| **BE** | 1,008 | 10.1% | 317 | 5.4% | 31.4% |
| **BG** | 169 | 1.7% | 31 | 0.5% | 18.3% |
| **CH** | 739 | 7.4% | 68 | 1.2% | 9.2% |
| **CY** | 53 | 0.5% | 3 | 0.1% | 5.7% |
| **CZ** | 184 | 1.8% | 23 | 0.4% | 12.5% |
| **DE** | 2,684 | 26.9% | 751 | 12.8% | 28.0% |
| **DK** | 833 | 8.3% | 210 | 3.6% | 25.2% |
| **EE** | 100 | 1.0% | 5 | 0.1% | 5.0% |
| **EL** | 866 | 8.7% | 146 | 2.5% | 16.9% |
| **ES** | 1,411 | 14.1% | 332 | 5.6% | 23.5% |
| **FI** | 531 | 5.3% | 100 | 1.7% | 18.8% |
| **FR** | 1,594 | 16.0% | 415 | 7.0% | 26.0% |
| **HR** | 11 | 0.1% | 5 | 0.1% | 45.5% |
| **HU** | 178 | 1.8% | 15 | 0.3% | 8.4% |
| **IE** | 493 | 4.9% | 141 | 2.4% | 28.6% |
| **IL** | 308 | 3.1% | 60 | 1.0% | 19.5% |
| **IT** | 1,712 | 17.1% | 417 | 7.1% | 24.4% |
| **LT** | 63 | 0.6% | 5 | 0.1% | 7.9% |
| **LU** | 1 | 0.0% | 0 | 0.0% | 0.0% |
| **LV** | 69 | 0.7% | 18 | 0.3% | 26.1% |
| **MT** | 15 | 0.2% | 0 | 0.0% | 0.0% |
| **NL** | 1,419 | 14.2% | 442 | 7.5% | 31.1% |
| **NO** | 350 | 3.5% | 113 | 1.9% | 32.3% |
| **PL** | 407 | 4.1% | 79 | 1.3% | 19.4% |
| **PT** | 483 | 4.8% | 94 | 1.6% | 19.5% |
| **RO** | 81 | 0.8% | 7 | 0.1% | 8.6% |
| **SE** | 1,177 | 11.8% | 266 | 4.5% | 22.6% |
| **SI** | 122 | 1.2% | 17 | 0.3% | 13.9% |
| **SK** | 74 | 0.7% | 11 | 0.2% | 14.9% |
| **UK** | 4,057 | 40.6% | 1,659 | 28.2% | 40.9% |
| **TOT** | **9,991** | | **5,890** | **100.0%** | **59.0%** |

*Source: authors' calculation based on EUPRO*

Figure 33 illustrates the trend of UNIV projects across the considered years (1999-2003). It can be seen that the number of university projects highly corresponds to the number of calls for a particular year, with just a low number of calls in 1999 and 2003.

Table 71 reports the number of UNIV projects by country and time intervals (1998-2001 and 2002-2003) in FP5. It emerges that in the time frame 1998-2001 Ireland has the highest percentage of UNIV projects (64.7%). In the time frame 2002-2003 Luxembourg has the highest percentage of UNIV projects (100%), followed by Croatia (63.6%).

**Figure 33 – Trend of UNIV projects in FP5**




*Note: 9,713 FP5 UNIV projects started between 1999 and 2003; though FP5 was launched in 1998 CORDIS reports that only 27 projects started before 1999 and 99 after 2003; for 149 projects the start date is not available. Source: authors' calculation based on EUPRO*

**Table 71 – Number of UNIV projects by country and time intervals in FP5**

| Country | Projects | 1998-2001 | 2002-2003 |
|---|---|---|---|
| **AT** | 601 | 55.9% | 41.8% |
| **BE** | 1,008 | 59.5% | 38.4% |
| **BG** | 169 | 52.7% | 43.2% |
| **CH** | 739 | 59.9% | 37.1% |
| **CY** | 53 | 45.3% | 52.8% |
| **CZ** | 184 | 54.3% | 42.9% |
| **DE** | 2,684 | 57.4% | 40.2% |
| **DK** | 833 | 57.0% | 40.3% |
| **EE** | 100 | 54.0% | 43.0% |
| **EL** | 866 | 56.8% | 39.6% |
| **ES** | 1,411 | 58.0% | 40.0% |
| **FI** | 531 | 60.8% | 37.7% |
| **FR** | 1,594 | 59.3% | 39.4% |
| **HR** | 11 | 36.4% | 63.6% |
| **HU** | 178 | 50.0% | 45.5% |
| **IE** | 493 | 64.7% | 33.1% |
| **IL** | 308 | 62.0% | 35.7% |
| **IT** | 1,712 | 57.7% | 40.7% |
| **LT** | 63 | 57.1% | 42.9% |
| **LU** | 1 | 0.0% | 100.0% |
| **LV** | 69 | 59.4% | 33.3% |
| **MT** | 15 | 53.3% | 46.7% |
| **NL** | 1,419 | 57.4% | 40.3% |
| **NO** | 350 | 57.1% | 41.7% |
| **PL** | 407 | 49.4% | 48.6% |

| | | | |
|---|---|---|---|
| **PT** | 483 | 56.1% | 40.0% |
| **RO** | 81 | 58.0% | 38.3% |
| **SE** | 1,177 | 60.7% | 38.2% |
| **SI** | 122 | 54.9% | 44.3% |
| **SK** | 74 | 52.7% | 45.9% |
| **UK** | 4,057 | 59.5% | 38.4% |

*Source: authors' calculation based on EUPRO*

### 3.5.2 Participation by Specific Programme

This section focuses on participation intensities by programme.

Table 72 reports the count of UNIV projects by programme. 61.8% UNIV projects out of 9,991 have been assigned to the thematic programmes, 35.0% to horizontal programmes, while only 3.2% to Euratom. Universities have not participated in JRC actions.

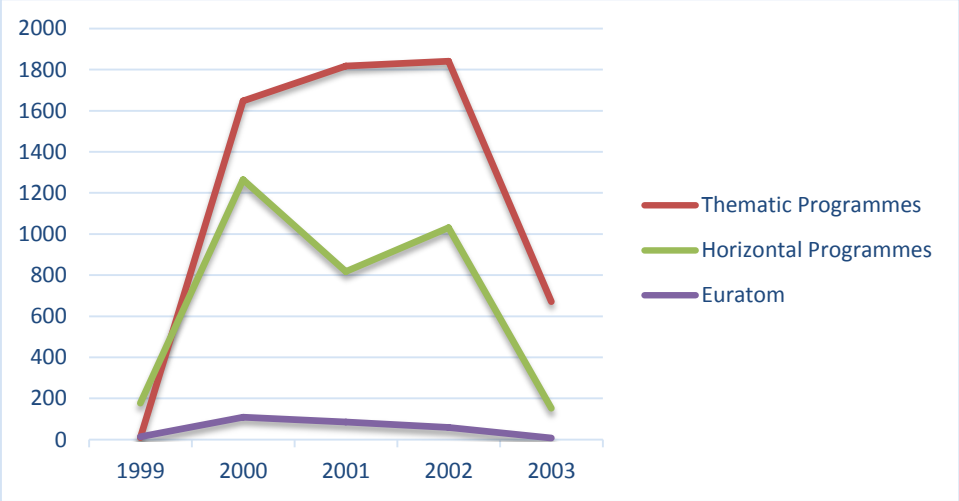
**Table 72 – Number of UNIV projects by Specific Programme in FP5**

| Programme | Number of UNIV projects | % on total number of projects |
|---|---|---|
| **Thematic Programmes** | 6,173 | 61.8% |
| **Horizontal Programmes** | 3,500 | 35.0% |
| **Euratom** | 318 | 3.2% |
| **Joint Research Centre (JRC)** | - | - |
| **TOTAL** | **9,991** | **100.0%** |

*Source: authors' calculation based on EUPRO*

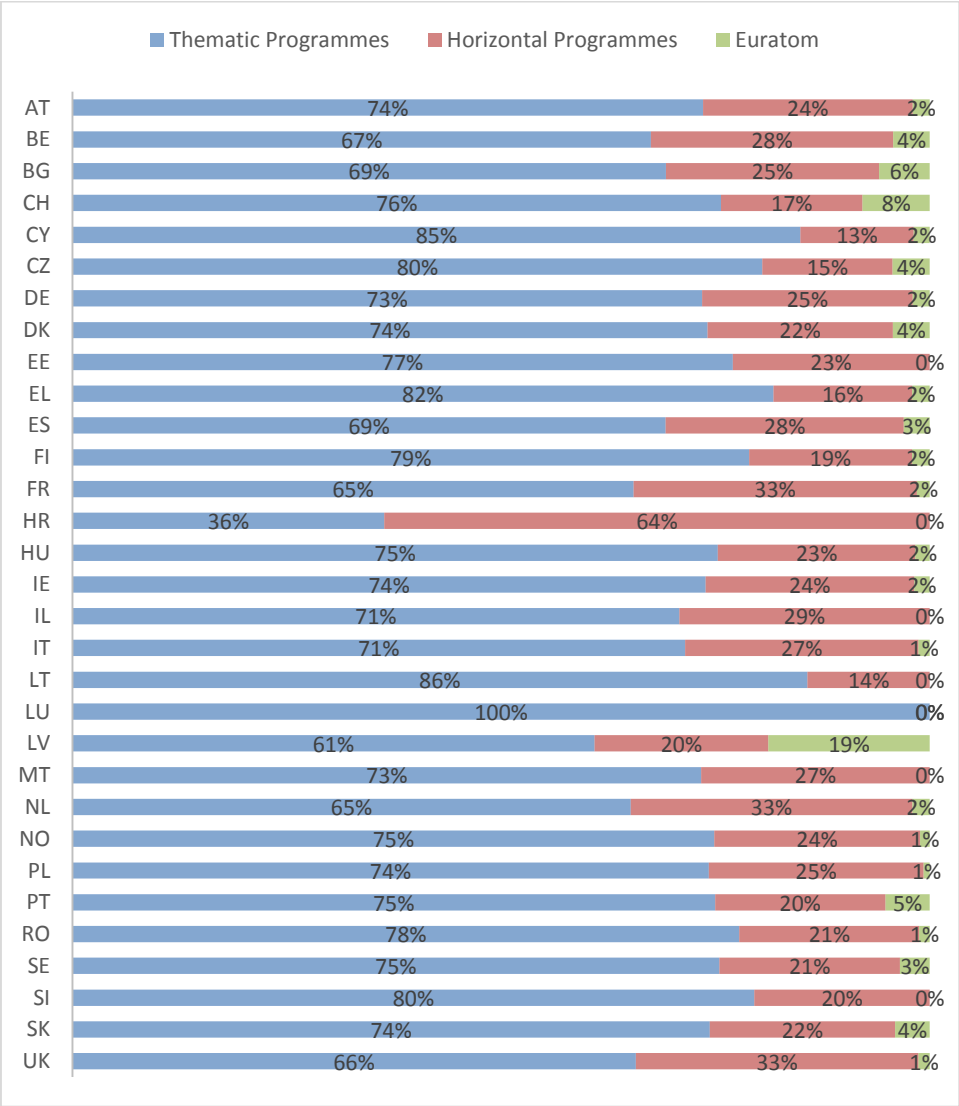
Figure 34 illustrates the trend across the years of the number of UNIV projects by the three FP5 components under consideration. It can be seen that no differences in the trends between the programmes occur, with the exception that the horizontal programmes show a slight decrease for the year 2001. Euratom stays constantly at a low level.

**Figure 34 – Trend of the number of UNIV projects by Specific Programme in FP5**




*Source: authors' calculation based on EUPRO*

**Figure 35 – Portfolio composition of UNIV projects across Specific Programmes by country in FP5**




*Source: authors' calculation based on EUPRO*

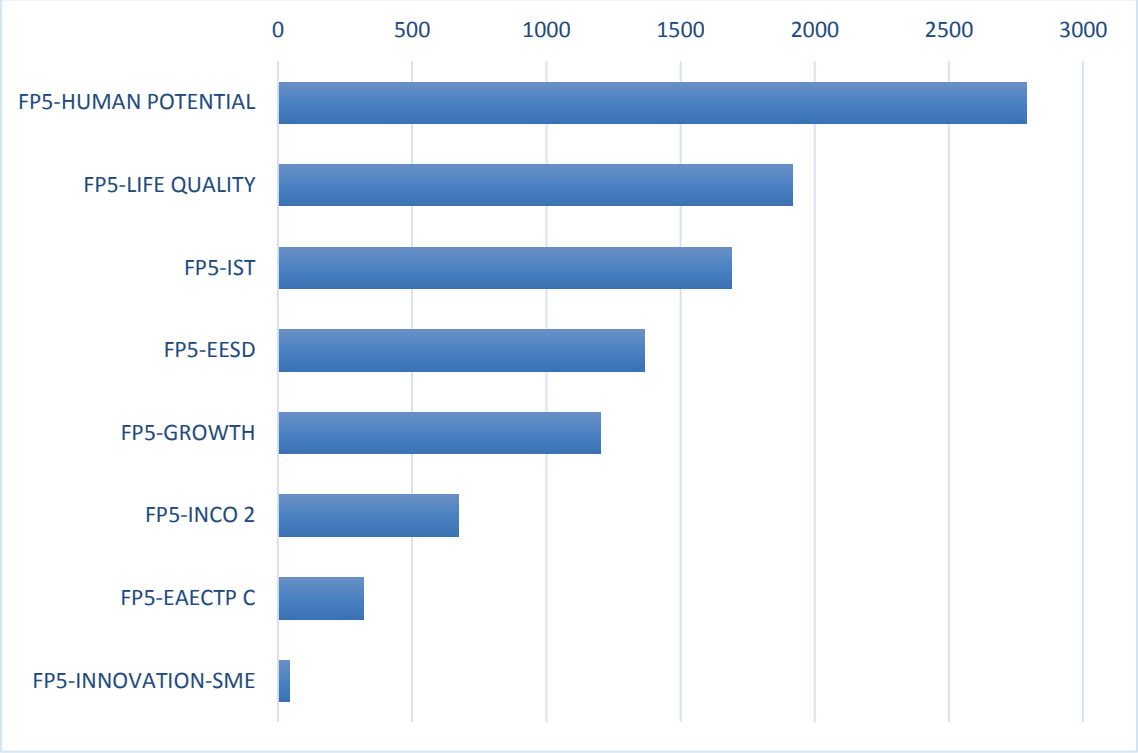
Figure 35 illustrates the composition of the portfolio of UNIV projects across the different programmes by country. Here no specific country patterns appear, with most countries showing a participation share between 60% to 80%, for thematic programmes, and 20% to 35% for horizontal. Exceptions are countries with a very low participation in general, like Luxembourg or Croatia. Table 73 provides an overview of funding by specific programmes, showing that for thematic programmes universities mostly participate in projects with a funding of € 1.0-2.5 million, while for horizontal programmes the share is much higher for projects with a lower budget.

**Table 73 – EC funding by Specific Programme: amount and distribution of UNIV projects in FP5**

| Programme | EC Funding (€ million) | <=0.25 | 0.25 - 1.0 | 1.0 - 2.5 | 2.5 - 5.0 | >5.0 | Not available |
|---|---|---|---|---|---|---|---|
| **Thematic Programmes** | 8,823.0 | 12.7% | 24.7% | 51.5% | 9.1% | 0.9% | 1.1% |
| **Horizontal Programmes** | 1,243.6 | 66.7% | 18.9% | 12.8% | 0.1% | 0.0% | 1.5% |
| **Euratom** | 155.8 | 49.7% | 34.9% | 12.6% | 0.6% | 0.3% | 1.9% |

*Source: authors' calculation based on EUPRO*

**Figure 36 – Number of UNIV projects by Programmes in FP5**




*Source: authors' calculation based on EUPRO*

Figure 36 illustrates the number of UNIV projects by the seven thematic areas (four under thematic programmes and three under horizontal activities). It can be seen that the highest number of UNIV projects is found for the thematic area FP5-Human Potential (2,788 projects), followed by FP5-Life Quality (1,915 projects). A rather low number of projects (41) has been recorded for the FP5-Innovation-SME area.

### 3.5.3 Participation by funding scheme

Table 74 describes the number of UNIV projects by funding scheme. The highest share was attributed to shared-cost actions (42.1%), followed by accompanying measures (13.4%). However, note that for 31.1% of all projects no contract type has been reported. It can be seen that universities have an above

average participation intensity in shared-cost actions (47.3%), but a below average participation in accompanying measures (8.7%), and training fellowships (4.7%).

**Table 74 – Number of UNIV projects by funding scheme in FP5**

| Funding scheme | ALL FP5 projects | % on total | UNIV projects | %on total UNIV projects | % on ALL FP5 projects funded by the scheme | Specialization index |
|---|---|---|---|---|---|---|
| **Shared-cost actions** | 7,242 | 42.1% | 4,729 | 47.3% | 65.3% | 1.12 |
| **Training fellowships** | 1,078 | 6.3% | 466 | 4.7% | 43.2% | 0.74 |
| **Research training networks and thematic networks** | 523 | 3.0% | 442 | 4.4% | 84.5% | 1.46 |
| **Concerted actions** | 167 | 1.0% | 135 | 1.4% | 80.8% | 1.39 |
| **Accompanying measures** | 2,298 | 13.4% | 865 | 8.7% | 37.6% | 0.65 |
| **High Level Scientific Conference** | 465 | 2.7% | 221 | 2.2% | 47.5% | 0.82 |
| **Joint Research Centre research** | 86 | 0.5% | 0 | 0.0% | 0.0% | 0.00 |
| **No contract type reported** | 5,345 | 31.1% | 3,133 | 31.4% | 58.6% | 1.01 |
| **Total** | 17,204 | 100.0 % | 9,991 | 100.0% | 58.1% | - |

*Source: authors' calculation based on EUPRO*

### 3.5.4 Composition of projects

Table 75 shows that on average, UNIV projects in FP5 have involved 4.0 countries. Similarly to FP7 and FP6, FP5 UNIV projects tend to be more internationally oriented than the average of FP5 projects (3.1).

The second column provides the average number of countries involved in UNIV projects by country. Smaller countries tend – as in FP6 and FP7 – to be the most internationally oriented ones in FP5, with MT, SK and LT showing the highest degree of internationalisation. The less internationally oriented countries are the larger countries, like Germany, France and the UK. Further it can be seen that many countries show a rather similar share in projects with partners from 2-5 countries and from 6 to 10 countries, while for more than 10 countries it is much lower.

**Table 75 – Internationalisation: number of countries involved in each UNIV project in FP5**

| Country | Mean | 1 country | 2 to 5 countries | 6 to 10 countries | more than 10 countries |
|---|---|---|---|---|---|
| **AT** | 6.7 | 12.5% | 36.9% | 36.1% | 14.5% |
| **BE** | 6.0 | 16.4% | 37.4% | 35.9% | 10.3% |
| **BG** | 8.6 | 16.6% | 19.5% | 35.5% | 28.4% |
| **CH** | 6.4 | 8.8% | 40.6% | 39.9% | 10.7% |
| **CY** | 8.3 | 3.8% | 28.3% | 50.9% | 17.0% |
| **CZ** | 8.3 | 11.4% | 22.8% | 42.9% | 22.8% |
| **DE** | 6.0 | 11.4% | 46.1% | 36.6% | 5.8% |
| **DK** | 6.5 | 12.0% | 37.9% | 37.7% | 12.4% |
| **EE** | 9.5 | 4.0% | 22.0% | 46.0% | 28.0% |
| **EL** | 6.8 | 7.4% | 38.7% | 41.6% | 12.4% |
| **ES** | 6.1 | 14.7% | 41.0% | 35.2% | 9.0% |
| **FI** | 6.9 | 8.1% | 39.5% | 40.1% | 12.2% |
| **FR** | 5.7 | 18.4% | 42.6% | 32.4% | 6.5% |
| **HR** | 7.5 | 45.5% | 9.1% | 9.1% | 36.4% |
| **HU** | 8.1 | 6.7% | 25.3% | 46.6% | 21.3% |
| **IE** | 6.1 | 14.8% | 40.4% | 34.9% | 9.9% |
| **IL** | 6.3 | 12.3% | 37.0% | 42.9% | 7.8% |
| **IT** | 6.2 | 12.9% | 44.1% | 35.7% | 7.3% |
| **LT** | 11.5 | 7.9% | 14.3% | 33.3% | 44.4% |
| **LU** | 5.0 | 0.0% | 100.0% | 0.0% | 0.0% |
| **LV** | 8.4 | 26.1% | 13.0% | 33.3% | 27.5% |
| **MT** | 15.9 | 0.0% | 6.7% | 20.0% | 73.3% |
| **NL** | 6.0 | 17.6% | 36.2% | 38.0% | 8.2% |
| **NO** | 6.4 | 18.3% | 36.3% | 32.3% | 13.1% |
| **PL** | 7.3 | 17.0% | 21.1% | 44.5% | 17.4% |
| **PT** | 6.8 | 12.4% | 36.4% | 34.8% | 16.4% |
| **RO** | 7.7 | 7.4% | 29.6% | 42.0% | 21.0% |
| **SE** | 6.3 | 11.0% | 38.3% | 41.4% | 9.3% |
| **SI** | 8.1 | 8.2% | 23.8% | 45.1% | 23.0% |
| **SK** | 10.0 | 12.2% | 20.3% | 32.4% | 35.1% |
| **UK** | 5.5 | 22.4% | 43.1% | 29.7% | 4.8% |

*Source: authors' calculation based on EUPRO*

Table 76 describes the size of networks for UNIV projects by country. It reports the distribution of projects by number of partners. Of the 9,991 UNIV projects, 32.1% were solo projects, 14.7% had 2-5 partners, 38.1% had 6-10 partner, 9.8% had 11-15 partner, and 5.4% had more than15 partners. This means that as for FP6 and FP7, when collaborating, participant universities are mainly involved in consortia of 6 to 10 partners. It can be seen that country differences are not particularly evident for FP5, with the exception for small and very low participating countries. For instance Luxembourg reports only one project, leading to a value of 100% in the corresponding range (6-10 partners).

**Table 76 – Network size by country in FP5**

| Country | Projects | Solo projects | 2 to 5 partner | 6 to 10 | 11 to 15 | >15 |
|---|---|---|---|---|---|---|
| **AT** | 601 | 12.3% | 11.8% | 43.6% | 15.8% | 16.5% |
| **BE** | 1,008 | 16.0% | 13.6% | 44.0% | 13.2% | 13.2% |
| **BG** | 169 | 16.0% | 7.7% | 32.5% | 15.4% | 28.4% |
| **CH** | 739 | 8.8% | 11.1% | 50.1% | 16.2% | 13.8% |
| **CY** | 53 | 3.8% | 1.9% | 50.9% | 17.0% | 26.4% |
| **CZ** | 184 | 10.9% | 6.0% | 37.5% | 20.7% | 25.0% |
| **DE** | 2,684 | 11.4% | 13.0% | 49.3% | 15.6% | 10.7% |
| **DK** | 833 | 12.0% | 14.3% | 45.5% | 14.5% | 13.7% |
| **EE** | 100 | 4.0% | 10.0% | 40.0% | 20.0% | 26.0% |
| **EL** | 866 | 6.8% | 10.3% | 47.9% | 17.3% | 17.7% |
| **ES** | 1,411 | 14.0% | 13.1% | 44.4% | 15.1% | 13.4% |
| **FI** | 531 | 8.1% | 14.1% | 43.5% | 18.1% | 16.2% |
| **FR** | 1,594 | 18.3% | 9.0% | 44.6% | 16.3% | 11.8% |
| **HR** | 11 | 45.5% | 0.0% | 18.2% | 9.1% | 27.3% |
| **HU** | 178 | 6.7% | 10.7% | 41.0% | 17.4% | 24.2% |
| **IE** | 493 | 14.4% | 15.2% | 42.8% | 12.4% | 15.2% |
| **IL** | 308 | 12.0% | 11.7% | 52.9% | 12.7% | 10.7% |
| **IT** | 1,712 | 12.7% | 12.3% | 47.3% | 16.2% | 11.5% |
| **LT** | 63 | 7.9% | 4.8% | 22.2% | 19.0% | 46.0% |
| **LU** | 1 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| **LV** | 69 | 26.1% | 4.3% | 29.0% | 11.6% | 29.0% |
| **MT** | 15 | 0.0% | 6.7% | 6.7% | 13.3% | 73.3% |
| **NL** | 1,419 | 17.3% | 12.4% | 42.3% | 15.7% | 12.3% |
| **NO** | 350 | 18.0% | 13.7% | 39.7% | 13.1% | 15.4% |
| **PL** | 407 | 16.5% | 6.6% | 38.6% | 19.4% | 18.9% |
| **PT** | 483 | 12.4% | 11.0% | 39.3% | 16.1% | 21.1% |
| **RO** | 81 | 7.4% | 7.4% | 34.6% | 24.7% | 25.9% |
| **SE** | 1,177 | 10.9% | 13.3% | 47.3% | 15.0% | 13.5% |
| **SI** | 122 | 7.4% | 8.2% | 41.8% | 18.0% | 24.6% |
| **SK** | 74 | 9.5% | 8.1% | 27.0% | 17.6% | 37.8% |
| **UK** | 4,057 | 22.2% | 14.9% | 42.1% | 12.4% | 8.4% |

*Source: authors' calculation based on EUPRO*

Table 77 describes the types of partnerships characterizing UNIV projects by country. The results are striking, providing evidence that universities are mainly seeking university partners as collaborators in FP5, with shares of usually more than 70% across all countries (average of all country shares equals to 81.0%). The second most important group are Research Organizations, with an average of 72.5%, followed by industry partners (average 45.6%). Also here no major country differences appear, again with the exception for very low participating countries.

Table 78 describes the types of partnerships characterizing UNIV projects by FP5 programmes. One aspect that may be highlighted here is that industry partners are more important in thematic programmes than in the horizontal programmes. It is also notable that in horizontal programmes and in Euratom, Research Organisations are more important partners than other universities.

**Table 77 – Data on partnerships in FP5**

| Country | Projects | Other universities | EDU non university | ROR | IND | OTH | N/A |
|---|---|---|---|---|---|---|---|
| **AT** | 601 | 79.7% | 14.1% | 71.9% | 52.4% | 41.6% | 3.3% |
| **BE** | 1,008 | 76.6% | 12.9% | 72.0% | 44.1% | 34.0% | 2.7% |
| **BG** | 169 | 71.0% | 16.6% | 74.0% | 49.1% | 46.7% | 3.6% |
| **CH** | 739 | 84.7% | 11.5% | 78.6% | 51.0% | 31.3% | 3.8% |
| **CY** | 53 | 92.5% | 20.8% | 86.8% | 66.0% | 43.4% | 0.0% |
| **CZ** | 184 | 85.3% | 10.9% | 78.3% | 50.5% | 53.8% | 4.9% |
| **DE** | 2,684 | 78.1% | 10.7% | 72.8% | 51.0% | 35.2% | 2.9% |
| **DK** | 833 | 79.0% | 11.3% | 75.3% | 41.9% | 38.2% | 2.6% |
| **EE** | 100 | 93.0% | 19.0% | 79.0% | 34.0% | 57.0% | 3.0% |
| **EL** | 866 | 79.8% | 12.7% | 77.0% | 63.2% | 49.8% | 3.8% |
| **ES** | 1,411 | 75.7% | 13.2% | 70.4% | 48.6% | 37.8% | 3.1% |
| **FI** | 531 | 85.1% | 14.3% | 78.5% | 46.9% | 39.5% | 2.3% |
| **FR** | 1,594 | 74.9% | 10.6% | 72.7% | 44.0% | 31.0% | 2.4% |
| **HR** | 11 | 54.5% | 18.2% | 54.5% | 27.3% | 45.5% | 0.0% |
| **HU** | 178 | 87.1% | 9.6% | 77.5% | 44.9% | 50.0% | 5.1% |
| **IE** | 493 | 77.5% | 10.3% | 70.2% | 49.5% | 31.4% | 2.6% |
| **IL** | 308 | 81.8% | 10.7% | 74.0% | 42.9% | 24.4% | 2.3% |
| **IT** | 1,712 | 79.5% | 11.4% | 72.9% | 49.5% | 33.6% | 2.6% |
| **LT** | 63 | 88.9% | 28.6% | 84.1% | 52.4% | 63.5% | 3.2% |
| **LU** | 1 | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **LV** | 69 | 69.6% | 18.8% | 68.1% | 39.1% | 43.5% | 2.9% |
| **MT** | 15 | 100.0% | 60.0% | 86.7% | 53.3% | 86.7% | 0.0% |
| **NL** | 1,419 | 76.4% | 13.0% | 69.6% | 38.7% | 30.9% | 3.1% |
| **NO** | 350 | 78.6% | 14.0% | 70.9% | 30.6% | 37.1% | 4.9% |
| **PL** | 407 | 77.6% | 16.0% | 74.7% | 42.5% | 41.3% | 1.5% |
| **PT** | 483 | 80.1% | 13.3% | 74.5% | 52.6% | 43.1% | 2.9% |
| **RO** | 81 | 90.1% | 21.0% | 82.7% | 56.8% | 50.6% | 2.5% |
| **SE** | 1,177 | 82.9% | 11.9% | 73.7% | 45.4% | 33.1% | 3.7% |
| **SI** | 122 | 82.0% | 21.3% | 79.5% | 51.6% | 53.3% | 3.3% |
| **SK** | 74 | 82.4% | 17.6% | 82.4% | 51.4% | 68.9% | 2.7% |
| **UK** | 4,057 | 67.4% | 10.7% | 63.9% | 41.3% | 30.1% | 2.7% |

*Source: authors' calculation based on EUPRO*

**Table 78 – Partnership by programme in FP5 (percentage on total projects)**

| Programme | Projects | Other universities | EDU non university | ROR | IND | OTH | N/A |
|---|---|---|---|---|---|---|---|
| **Thematic Programmes** | 6,173 | 65.0% | 8.1% | 63.1% | 72.9% | 41.1% | 3.4% |
| **Horizontal Programmes** | 3,500 | 23.3% | 9.5% | 5.8% | 25.2% | 9.0% | 1.5% |
| **Euratom** | 318 | 33.0% | 2.5% | 26.7% | 50.0% | 21.1% | 3.5% |

*Source: authors' calculation based on EUPRO*

## 3.6 Analysis of participation in FP4

As for FP5, the study utilizes information from the EUPRO database for the analysis of FP4 participation patterns. As mentioned above, given the cleaned and comprehensive nature of EUPRO, direct comparison to the results for FP6 and FP7 are feasible.

As for FP7, FP6 and FP5 universities in FP4 have been identified by their geographical location (EU28 plus CH, IL, NO). Again, we have employed a manual checking based on the European Tertiary Education Register (ETER), the sample of FP7 and FP6 universities (see section 3.2) and other web-based available sources.

The data analysis produced the following overall figures for the FP4 university participation:

- 8,947 FP projects have at least one university partner (60.7% of 14,731 FP4 projects in total)
- 895 universities have participated in FP4 (5.0% of 17,873 FP4 participants in total).

### 3.6.1 Overall participation and geographical breakdown

As for the other FPs, we start with a breakdown of aggregate figures on university projects over the total number of projects in FP4 (both in terms of numbers and amount of funding). Again, figures are disaggregated by country, programme and funding scheme.

**Table 79 – Number of UNIV projects by country in FP4**

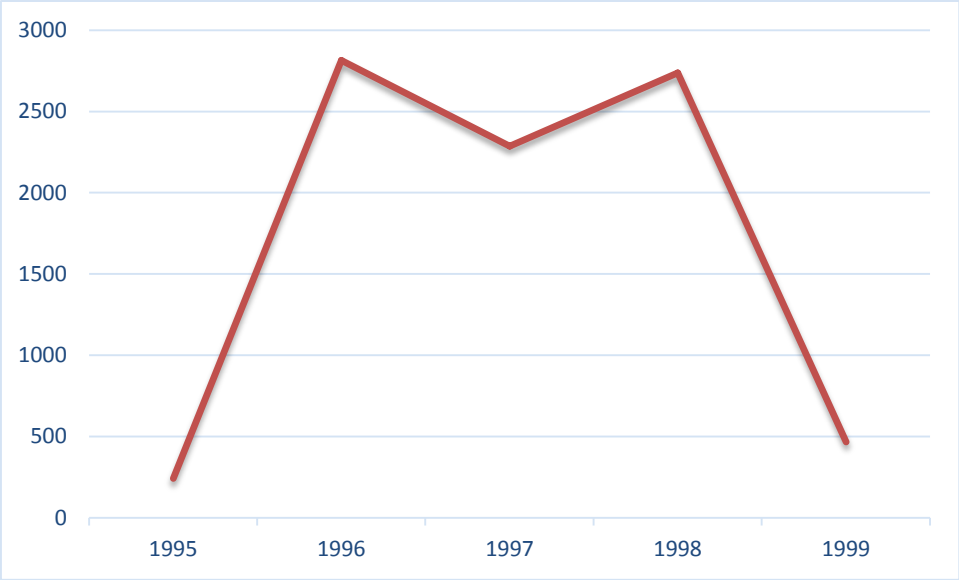
| Country | Projects | % on total number of projects | university as coordinator | % of university as coordinator on total number of projects | % of university as coordinator on country projects |
|---|---|---|---|---|---|
| **AT** | 435 | 4.9% | 99 | 1.9% | 22.8% |
| **BE** | 1000 | 11.3% | 313 | 6.1% | 31.3% |
| **BG** | 73 | 0.8% | 2 | 0.0% | 2.7% |
| **CH** | 446 | 5.0% | 6 | 0.1% | 1.3% |
| **CY** | 8 | 0.1% | 2 | 0.0% | 25.0% |
| **CZ** | 66 | 0.7% | 2 | 0.0% | 3.0% |
| **DE** | 2207 | 25.0% | 569 | 11.1% | 25.8% |
| **DK** | 725 | 8.2% | 180 | 3.5% | 24.8% |
| **EE** | 30 | 0.3% | 2 | 0.0% | 6.7% |
| **EL** | 853 | 9.7% | 247 | 4.8% | 29.0% |
| **ES** | 1152 | 13.0% | 272 | 5.3% | 23.6% |
| **FI** | 424 | 4.8% | 81 | 1.6% | 19.1% |
| **FR** | 1209 | 13.7% | 368 | 7.2% | 30.4% |
| **HU** | 94 | 1.1% | 2 | 0.0% | 2.1% |
| **IE** | 509 | 5.8% | 127 | 2.5% | 25.0% |
| **IL** | 141 | 1.6% | 7 | 0.1% | 5.0% |
| **IT** | 1292 | 14.6% | 277 | 5.4% | 21.4% |
| **LT** | 23 | 0.3% | 2 | 0.0% | 8.7% |
| **LV** | 21 | 0.2% | 0 | 0.0% | 0.0% |
| **MT** | 7 | 0.1% | 0 | 0.0% | 0.0% |
| **NL** | 1315 | 14.9% | 432 | 8.4% | 32.9% |
| **NO** | 264 | 3.0% | 66 | 1.3% | 25.0% |
| **PL** | 106 | 1.2% | 3 | 0.1% | 2.8% |
| **PT** | 483 | 5.5% | 66 | 1.3% | 13.7% |
| **RO** | 45 | 0.5% | 0 | 0.0% | 0.0% |
| **SE** | 1068 | 12.1% | 259 | 5.1% | 24.3% |
| **SI** | 38 | 0.4% | 0 | 0.0% | 0.0% |
| **SK** | 34 | 0.4% | 0 | 0.0% | 0.0% |
| **UK** | 3768 | 42.6% | 1729 | 33.8% | 45.9% |
| **TOT** | **8,836** | | **5,113** | **100.0%** | **57.9%** |

*Source: authors' calculation based on EUPRO*

Table 79 reports the numbers of UNIV projects by country. It is shown that – as for FP5 – UK has the highest share on the total number of projects (42.6%), followed by Germany (25.0%). These two countries also have to highest share in university coordination, with the UK exceeding all other countries by far with a share of 33.8%, while Germany, second in the list, has a share of just 11.1%.

Figure 37 illustrates the trend of UNIV projects across the considered years (1995-2009). As for FP5, It can be seen that the number of university projects simply corresponds to the number of calls for a particular year, with just a low number of calls in 1995 and 1999.

**Figure 37 – Trend of UNIV projects in FP4**




*Note: 8,551 FP4 UNIV projects started between 1995 and 1999; though FP4 was launched in 1994 CORDIS reports that only 8 projects started before 1995; for 388 projects the start date is not available.*

*Source: authors' calculation based on EUPRO*

Table 80 reports the number of UNIV projects by country and time intervals (1995-1997 and 1998-1999) in FP4. It emerges that in the time frame 1995-1997, Romania has the highest percentage of UNIV projects (68.9%). In the time frame 1998-1999 MT has the highest percentage of UNIV projects (71.4%). It is worth noting that most shares decrease, which can be simply explained by the general lower number of projects after 1998. Interestingly, some countries show a lower share in the earlier time period, such as LV and MT. However, the number of outliers is higher for FP4 than for FP5 due to the explicitly low number of projects in general for many small countries.

**Table 80 – Number of UNIV projects by country and time intervals in FP4**

| Country | Projects | 1995-1997 | 1998-1999 |
|---|---|---|---|
| **AT** | 435 | 59.3% | 38.2% |
| **BE** | 1,000 | 63.2% | 33.6% |
| **BG** | 73 | 43.8% | 54.8% |
| **CH** | 446 | 63.7% | 34.3% |
| **CY** | 8 | 62.5% | 37.5% |
| **CZ** | 66 | 51.5% | 47.0% |
| **DE** | 2,207 | 59.2% | 37.9% |
| **DK** | 725 | 61.4% | 36.3% |
| **EE** | 30 | 33.3% | 60.0% |
| **EL** | 853 | 57.6% | 32.1% |
| **ES** | 1,152 | 60.2% | 36.7% |
| **FI** | 424 | 62.5% | 34.9% |
| **FR** | 1,209 | 62.0% | 35.2% |
| **HU** | 94 | 52.1% | 42.6% |
| **IE** | 509 | 61.1% | 35.8% |
| **IL** | 141 | 41.8% | 56.0% |
| **IT** | 1,292 | 60.1% | 37.2% |
| **LT** | 23 | 65.2% | 26.1% |
| **LV** | 21 | 38.1% | 52.4% |
| **MT** | 7 | 28.6% | 71.4% |
| **NL** | 1,315 | 61.0% | 36.5% |
| **NO** | 264 | 61.0% | 37.5% |
| **PL** | 106 | 43.4% | 51.9% |
| **PT** | 483 | 60.2% | 36.9% |
| **RO** | 45 | 68.9% | 31.1% |
| **SE** | 1,068 | 62.1% | 35.5% |
| **SI** | 38 | 50.0% | 50.0% |
| **SK** | 34 | 38.2% | 55.9% |
| **UK** | 3,768 | 60.6% | 36.3% |

*Source: authors' calculation based on EUPRO*

### 3.6.2 Participation by Specific Programme

This section focuses on participation intensities by programme.

Table 81 reports the count of UNIV projects by programme. 61.9% UNIV projects out of 8,947 have been assigned to the thematic programmes, 36.8% to horizontal programmes, while only 1.2% to preceding Euratom activities in form of Research and Training in the Nuclear Sector. This corresponds highly to the distribution in FP5.

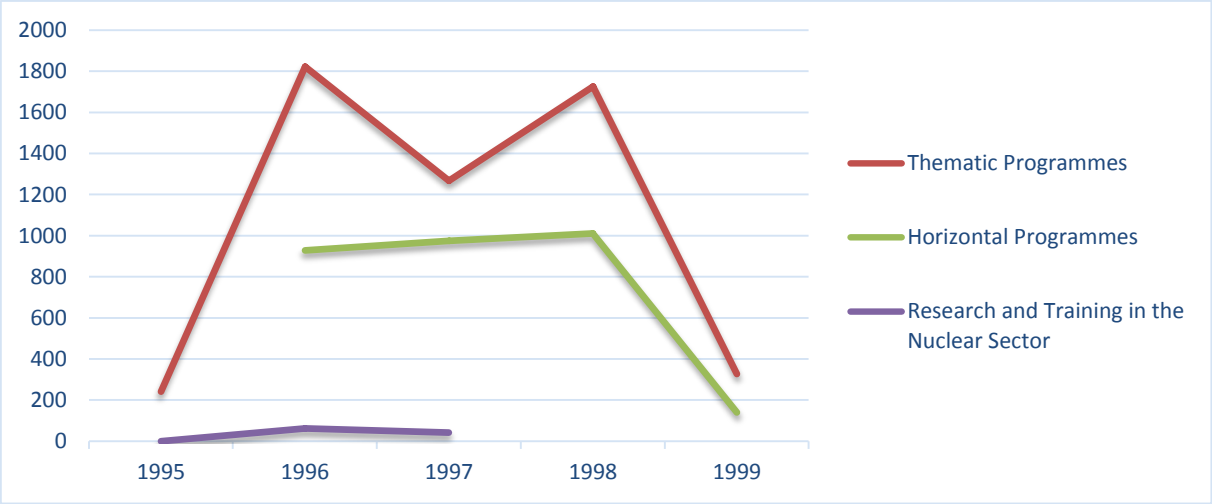
**Table 81 – Number of UNIV projects by Specific Programmes in FP4**

| Programmes | Number of UNIV projects | % on total number of projects |
|---|---|---|
| **Thematic Programmes** | 5,540 | 61.9% |
| **Horizontal Programmes** | 3,296 | 36.8% |
| **Research and Training in the Nuclear Sector** | 111 | 1.2% |
| **TOTAL** | **8,947** | **100.0%** |

*Source: authors' calculation based on EUPRO*

Figure 38 illustrates the trend across the years of the number of UNIV projects by the three FP4 components under consideration. It shows the different development corresponding to the respective calls in the given year, with the thematic programmes pattern being quite similar to the overall FP4 participation pattern. Horizontal programmes just start in 1996, with a slight, increase until 1998, while Research and Training in the Nuclear Sector just shows up with very few projects until 1997.

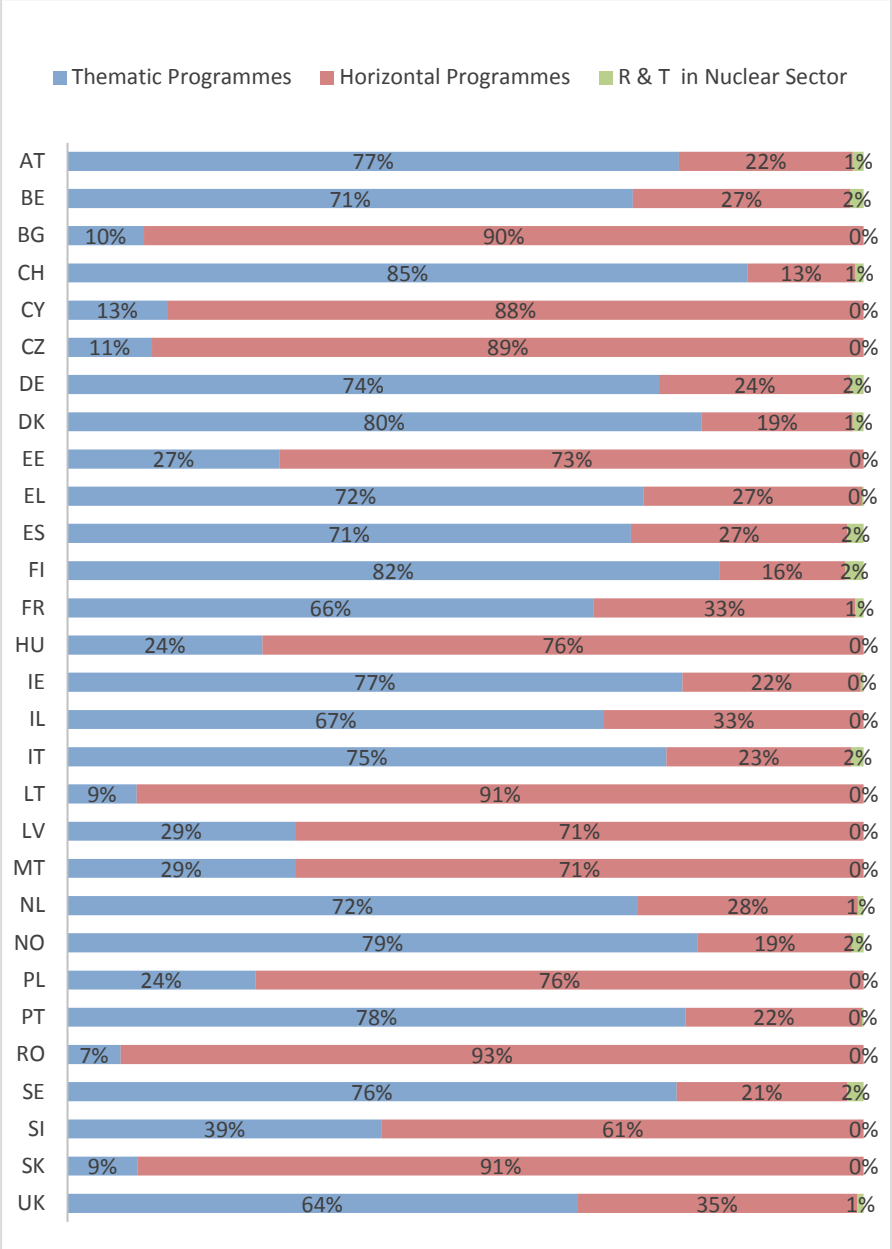
**Figure 38 – Trend of the number of UNIV projects by Specific Programmes in FP4**




*Source: authors' calculation based on EUPRO*

Figure 39 illustrates the composition of the portfolio of UNIV projects across the different programmes by country. As for FP5, no specific country patterns appear, with most countries showing a participation share between 60% to 80%, for thematic programmes, and 20% to 35% for horizontal. As for FP5, we find outliers for some countries that have a very low participation intensity in general, like many Eastern European countries.

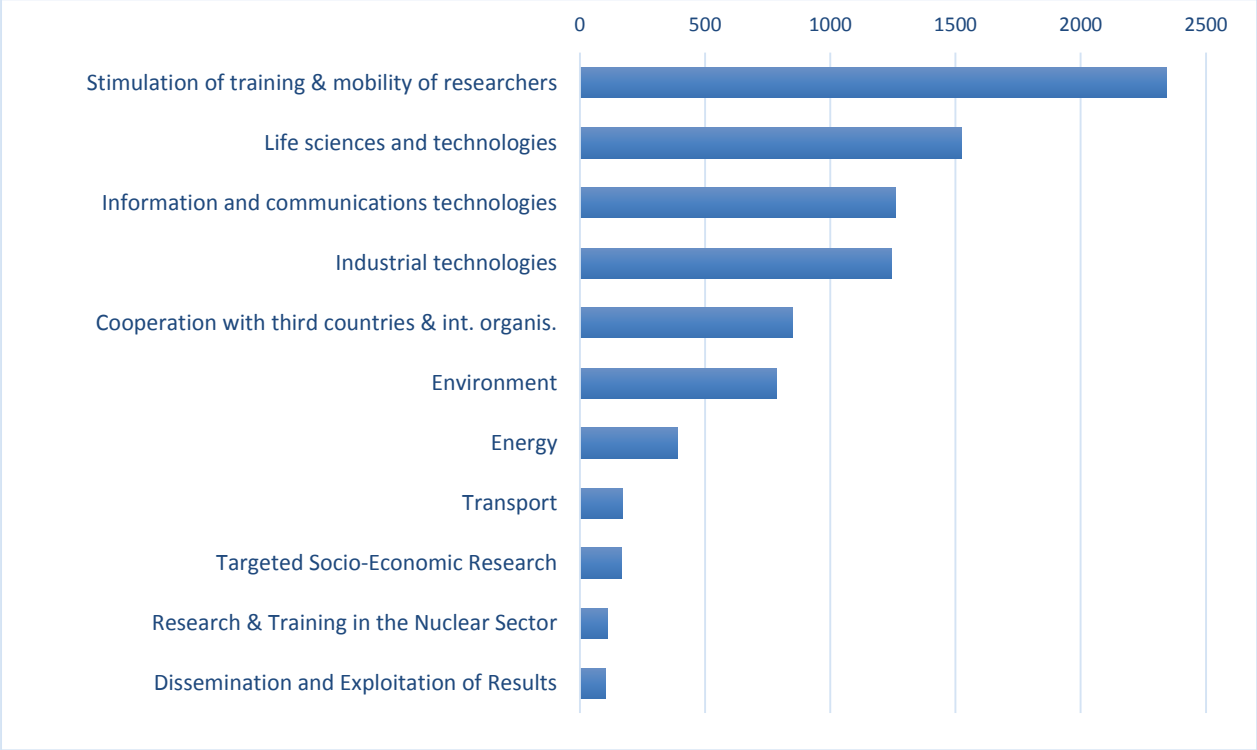
**Figure 39 – Portfolio composition of UNIV projects across Specific Programmes by country in FP4**




*Source: authors' calculation based on EUPRO*

Figure 40 illustrates the number of UNIV projects by the thematic areas. It can be seen that the highest number of UNIV projects is found for the thematic area focusing on Stimulation of training and mobility of researchers, followed by Life sciences and technologies, ICT and Industrial technologies. Lowest number of UNIV projects is reported for research and training in the nuclear sector, as well as dissemination and exploitation of results.

**Figure 40 – Number of UNIV projects by Thematic Areas in FP4**




*Source: authors' calculation based on EUPRO*

### 3.6.3 Participation by funding scheme

Table 82 describes the number of UNIV projects by funding scheme. The highest share was – as for FP5 – attributed to shared-cost actions (62.5%), followed by training fellowships (13.4%). However, in these categories university share is quite similar to the average, while for research training networks and thematic networks the university share is much higher than the average.

**Table 82 – Number of UNIV projects by funding scheme in FP4**

| Funding scheme | ALL FP4 projects | % on total | UNIV projects | % on total UNIV projects | % on ALL FP4 projects funded by the scheme | Specialization index |
|---|---|---|---|---|---|---|
| **Shared-cost actions** | 9,167 | 62.2% | 5,592 | 62.5% | 61.0% | 1.00 |
| **Training fellowships** | 2,992 | 20.3% | 2,000 | 22.4% | 66.8% | 1.10 |
| **Research training networks and thematic networks** | 271 | 1.8% | 263 | 2.9% | 97.0% | 1.60 |
| **Concerted actions** | 504 | 3.4% | 372 | 4.2% | 73.8% | 1.22 |
| **Accompanying measures** | 990 | 6.7% | 257 | 2.9% | 26.0% | 0.43 |
| **No contract type** | 807 | 5.5% | 463 | 5.2% | 57.4% | 0.94 |
| **Total** | 14,731 | 100.0 % | 8,947 | 100.0% | 60.7% | 1.00 |

*Source: authors' calculation based on EUPRO*

### 3.6.4 Composition of projects

Table 83 shows that on average, FP4 UNIV projects have involved 3.8 countries. Similarly to FP7, FP6 and FP5, FP4 UNIV projects tend to be more internationally oriented than the average of total FP4 projects (3.2).

The second column provides the average number of countries involved in UNIV projects by country. As for FP5, smaller countries tend to be the most internationally oriented ones, but the general variation across countries is much lower than in FP5. Further it can be seen that in most countries the highest share of projects involve partners from 2-5 countries, rather than from 6 to 10 countries or more than 10 countries.

**Table 83 – Internationalisation: number of countries involved in each UNIV project in FP4**

| Country | Mean | 1 country | 2 to 5 countries | 6 to 10 countries | more than 10 countries |
|---|---|---|---|---|---|
| **AT** | 6.0 | 3.7% | 52.2% | 33.3% | 10.8% |
| **BE** | 5.1 | 5.1% | 59.5% | 31.2% | 4.2% |
| **BG** | 5.5 | 0.0% | 61.6% | 34.2% | 4.1% |
| **CH** | 6.1 | 0.2% | 53.1% | 39.9% | 6.7% |
| **CY** | 5.0 | 0.0% | 75.0% | 25.0% | 0.0% |
| **CZ** | 5.7 | 1.5% | 62.1% | 30.3% | 6.1% |
| **DE** | 4.9 | 4.3% | 64.3% | 28.5% | 2.9% |
| **DK** | 5.7 | 4.8% | 51.9% | 35.7% | 7.6% |
| **EE** | 6.8 | 0.0% | 63.3% | 23.3% | 13.3% |
| **EL** | 4.9 | 17.8% | 46.7% | 30.7% | 4.8% |
| **ES** | 4.9 | 9.4% | 57.0% | 28.9% | 4.7% |
| **FI** | 5.7 | 2.4% | 55.2% | 36.3% | 6.1% |
| **FR** | 4.6 | 7.0% | 63.4% | 26.9% | 2.6% |
| **HU** | 6.1 | 0.0% | 52.1% | 38.3% | 9.6% |
| **IE** | 5.4 | 7.7% | 52.7% | 33.2% | 6.5% |
| **IL** | 5.3 | 1.4% | 61.0% | 33.3% | 4.3% |
| **IT** | 5.2 | 4.5% | 59.4% | 32.0% | 4.0% |
| **LT** | 6.3 | 0.0% | 39.1% | 56.5% | 4.3% |
| **LV** | 6.5 | 0.0% | 57.1% | 33.3% | 9.5% |
| **MT** | 7.0 | 0.0% | 42.9% | 42.9% | 14.3% |
| **NL** | 4.9 | 6.5% | 59.9% | 30.0% | 3.5% |
| **NO** | 5.6 | 4.2% | 53.4% | 36.0% | 6.4% |
| **PL** | 6.1 | 0.0% | 54.7% | 34.9% | 10.4% |
| **PT** | 6.0 | 1.4% | 53.4% | 35.4% | 9.7% |
| **RO** | 5.4 | 0.0% | 62.2% | 33.3% | 4.4% |
| **SE** | 5.2 | 4.2% | 59.1% | 32.7% | 4.0% |
| **SI** | 6.3 | 2.6% | 47.4% | 39.5% | 10.5% |
| **SK** | 5.8 | 0.0% | 58.8% | 35.3% | 5.9% |
| **UK** | 4.2 | 9.8% | 67.0% | 21.2% | 2.0% |

*Source: authors' calculation based on EUPRO*

Table 84 describes the size of networks for UNIV projects by country. It reports the distribution of projects by number of partners. 11.6% of the 8,947 UNIV projects were solo projects and approx. 88% were cooperative. 41.3% had 2-5 partners, 37.3% had 6-10 partners, 6.7% had 11-15 partners, and 3.1% had more than 15 partners. In this sense, we find different patterns for FP4 than for FP5 as the share of solo projects has increased significantly from FP4 to FP5, while the number of projects with 2-5 partners has decreased. In FP4, when collaborating, participant universities are mainly involved in consortia of 2 to 5 partners. Again, it can be seen that country differences are not particularly observable, with the exception for small and very low participating countries.

**Table 84 – Network size by country in FP4**

| Country | Projects | Solo projects | 2 to 5 partners | 6 to 10 | 11 to 15 | >15 |
|---|---|---|---|---|---|---|
| **AT** | 435 | 3.7% | 24.6% | 47.1% | 12.9% | 11.7% |
| **BE** | 1,000 | 4.9% | 32.8% | 43.4% | 11.8% | 7.1% |
| **BG** | 73 | 0.0% | 30.1% | 61.6% | 5.5% | 2.7% |
| **CH** | 446 | 0.2% | 17.7% | 58.3% | 14.1% | 9.6% |
| **CY** | 8 | 0.0% | 37.5% | 50.0% | 12.5% | 0.0% |
| **CZ** | 66 | 1.5% | 37.9% | 48.5% | 6.1% | 6.1% |
| **DE** | 2,207 | 4.1% | 27.0% | 50.8% | 11.7% | 6.3% |
| **DK** | 725 | 4.8% | 26.9% | 44.1% | 13.8% | 10.3% |
| **EE** | 30 | 0.0% | 40.0% | 33.3% | 13.3% | 13.3% |
| **EL** | 853 | 12.5% | 23.9% | 44.1% | 10.3% | 9.1% |
| **ES** | 1,152 | 5.4% | 31.1% | 44.9% | 11.0% | 7.6% |
| **FI** | 424 | 2.4% | 26.2% | 49.3% | 12.0% | 10.1% |
| **FR** | 1,209 | 6.8% | 29.9% | 45.7% | 10.3% | 7.4% |
| **HU** | 94 | 0.0% | 24.5% | 59.6% | 7.4% | 8.5% |
| **IE** | 509 | 5.3% | 25.7% | 49.9% | 8.8% | 10.2% |
| **IL** | 141 | 1.4% | 33.3% | 51.8% | 9.2% | 4.3% |
| **IT** | 1,292 | 3.6% | 25.5% | 49.7% | 13.2% | 8.0% |
| **LT** | 23 | 0.0% | 21.7% | 60.9% | 8.7% | 8.7% |
| **LV** | 21 | 0.0% | 42.9% | 33.3% | 9.5% | 14.3% |
| **MT** | 7 | 0.0% | 14.3% | 42.9% | 28.6% | 14.3% |
| **NL** | 1,315 | 6.5% | 32.4% | 45.9% | 9.7% | 5.6% |
| **NO** | 264 | 4.2% | 28.8% | 48.1% | 6.8% | 12.1% |
| **PL** | 106 | 0.0% | 33.0% | 45.3% | 13.2% | 8.5% |
| **PT** | 483 | 1.2% | 23.8% | 49.5% | 13.7% | 11.8% |
| **RO** | 45 | 0.0% | 35.6% | 53.3% | 6.7% | 4.4% |
| **SE** | 1,068 | 4.1% | 28.1% | 51.3% | 10.5% | 6.0% |
| **SI** | 38 | 0.0% | 28.9% | 47.4% | 15.8% | 7.9% |
| **SK** | 34 | 0.0% | 17.6% | 73.5% | 5.9% | 2.9% |
| **UK** | 3,768 | 9.6% | 38.6% | 39.7% | 7.6% | 4.4% |

*Source: authors' calculation based on EUPRO*

Table 85 describes the types of partnerships characterizing UNIV projects by country. We find similar patterns as for FP5, with universities mainly seeking university partners as collaborators. The second most important group are Research Organizations. As in FP5 industry partners (41.0%) are more important than others (24.8%) in FP4. Again, significant country differences are not observable with the exception for countries with very low participation intensity. Table 86 finally describes the types of partnerships characterizing UNIV projects by FP4 programmes.

**Table 85 – Data on partnerships in FP4**

| Country | Projects | Other universities | EDU non university | ROR | IND | OTH | N/A |
|---|---|---|---|---|---|---|---|
| **AT** | 435 | 80.0% | 9.2% | 75.4% | 52.4% | 30.6% | 7.1% |
| **BE** | 1,000 | 74.1% | 9.2% | 69.7% | 48.4% | 22.7% | 11.2% |
| **BG** | 73 | 86.3% | 20.5% | 78.1% | 45.2% | 20.5% | 1.4% |
| **CH** | 446 | 91.0% | 7.8% | 82.1% | 53.1% | 23.8% | 2.2% |
| **CY** | 8 | 100.0% | 12.5% | 75.0% | 37.5% | 50.0% | 12.5% |
| **CZ** | 66 | 87.9% | 9.1% | 83.3% | 36.4% | 21.2% | 1.5% |
| **DE** | 2,207 | 73.8% | 7.2% | 70.1% | 54.1% | 25.2% | 7.8% |
| **DK** | 725 | 78.1% | 5.5% | 74.1% | 44.6% | 30.5% | 7.3% |
| **EE** | 30 | 93.3% | 23.3% | 73.3% | 36.7% | 26.7% | 3.3% |
| **EL** | 853 | 68.5% | 6.7% | 62.3% | 51.6% | 28.0% | 8.0% |
| **ES** | 1,152 | 72.6% | 9.0% | 64.2% | 46.7% | 25.4% | 11.8% |
| **FI** | 424 | 82.1% | 8.7% | 73.8% | 49.5% | 26.2% | 6.6% |
| **FR** | 1,209 | 70.9% | 7.8% | 63.7% | 45.1% | 21.0% | 14.0% |
| **HU** | 94 | 93.6% | 17.0% | 79.8% | 44.7% | 18.1% | 6.4% |
| **IE** | 509 | 75.8% | 6.1% | 66.4% | 53.2% | 27.3% | 8.8% |
| **IL** | 141 | 88.7% | 17.7% | 81.6% | 39.7% | 26.2% | 5.0% |
| **IT** | 1,292 | 81.9% | 8.9% | 73.9% | 47.8% | 24.1% | 5.7% |
| **LT** | 23 | 95.7% | 47.8% | 78.3% | 21.7% | 21.7% | 4.3% |
| **LV** | 21 | 66.7% | 4.8% | 95.2% | 28.6% | 14.3% | 14.3% |
| **MT** | 7 | 100.0% | 57.1% | 71.4% | 42.9% | 71.4% | 28.6% |
| **NL** | 1,315 | 74.6% | 8.3% | 69.0% | 41.1% | 19.6% | 10.0% |
| **NO** | 264 | 84.8% | 11.0% | 68.6% | 33.3% | 23.1% | 8.7% |
| **PL** | 107 | 87.9% | 18.7% | 77.6% | 41.1% | 26.2% | 3.7% |
| **PT** | 483 | 83.4% | 12.4% | 73.5% | 51.3% | 29.4% | 7.0% |
| **RO** | 45 | 97.8% | 24.4% | 82.2% | 42.2% | 20.0% | 0.0% |
| **SE** | 1,068 | 82.5% | 8.0% | 73.3% | 43.2% | 24.0% | 7.8% |
| **SI** | 38 | 78.9% | 7.9% | 76.3% | 50.0% | 28.9% | 2.6% |
| **SK** | 34 | 100.0% | 8.8% | 76.5% | 47.1% | 23.5% | 5.9% |
| **UK** | 3,768 | 61.3% | 7.6% | 57.5% | 40.3% | 19.9% | 17.9% |

*Source: authors' calculation based on EUPRO*

**Table 86 – Partnership by programme in FP4 (percentage on total projects)**

| Programme | Projects | Other universities | EDU non university | ROR | IND | OTH | N/A |
|---|---|---|---|---|---|---|---|
| **Thematic Programmes** | 5,540 | 61.2% | 4.7% | 63.3 % | 70.4 % | 27.3 % | 2.3% |
| **Horizontal Programmes** | 3,296 | 25.0% | 11.4% | 10.2 % | 29.9 % | 8.8% | 46.8 % |
| **R & T in the Nuclear Sector** | 111 | 62.2% | 0.0% | 46.8 % | 88.3 % | 27.0 % | 2.7% |

*Source: authors' calculation based on EUPRO*

## 3.7 Comparative analysis across FPs: key findings

In this section we summarise the main results emerging from previous analyses in order to provide a comparison of statistics across the different FPs and derive selected pieces of evidence about the evolution of university participation patterns. In particular, we have reorganized the available evidence along several dimensions reported in the following paragraphs.

Some general trends emerge from the comparison of results on universities participation in the different FPs.

The analysis highlights that the role of universities in EU framework programmes became increasingly more pervasive over time: since FP4 inception, the number of research projects with at least one university among partners has risen and the number of projects coordinated by universities has also grown significantly. Indeed, in FP7 the number of projects in which at least one partner is a university is equal to 19,257 (corresponding to 72.3% of the whole amount of FP7 projects) compared to 7,281 (72.4%) in FP6, 9,991 (58.1%) in FP5 and 8,947 (60.7%) in FP4. Also the incidence of UNIV projects having a university as coordinator is higher in FP7 (71.8%) than in FP6 (59.2%), FP5 (59.0%) and FP4 (57.9%). In all FPs, the international reach of UNIV projects is higher than the average of the whole projects per FPs.

Also in terms of scientific outputs and IPRs, universities show a relevant role in FP7. Indeed, 87.8% of IPRs and 87.1% of scientific publications refer to UNIV projects. Furthermore, the large majority of FP7 projects that report at least one publication is represented by UNIV projects (76.9%). However, as discussed in the following sections, participation is not at all evenly distributed as there is a high degree of concentration in terms of projects and resources in a relatively limited number of countries and organisations.

### 3.7.1 Country-level participation to FPs

The elaboration of data on the participation of universities in the different framework programmes highlights a set of relevant trends at country level.

In a context of increasing university participation there are winners and losers. The former are mostly represented by a limited number of EU15 countries which, together with Switzerland, account for the largest increase registered in resources allotted to universities. This concentration mirrors marked differences in experience and capacity as regards seizing EU funds and related application success rates.

The UK is the EU country with the highest number of projects across all FPs followed by DE and IT. UK shows also the highest incidence of coordinated projects on total projects. In the last two FPs there has been a 164% increase in the number of projects granted to at least one university. If we focus on the subset of projects with a university coordinator, we observe an increase of 220% between FP6 and FP7 suggesting an increase in the centrality of universities in FP7.

The decomposition of these growth rates across countries reveals that among larger EU countries Germany, the UK and Switzerland experienced higher growth rates, while a more moderate increase has been recorded for Italy, France and Spain.

**Table 87 – UNIV Project count and % growth at country level in FP4, FP5, FP6 and FP7**

| Country | FP4 | FP5 | FP6 | FP7 | Growth FP6-FP7 |
|---|---|---|---|---|---|
| **AT** | 435 | 601 | 616 | 1,179 | 91.4% |
| **BE** | 1000 | 1,008 | 827 | 1,493 | 80.5% |
| **BG** | 73 | 169 | 108 | 163 | 50.9% |
| **CH** | 446 | 739 | 809 | 1,982 | 145.0% |
| **CY** | 8 | 53 | 73 | 166 | 127.4% |
| **CZ** | 66 | 184 | 299 | 460 | 53.8% |
| **DE** | 2207 | 2,684 | 2,205 | 4,580 | 107.7% |
| **DK** | 725 | 833 | 584 | 1,245 | 113.2% |
| **EE** | 30 | 100 | 113 | 174 | 54.0% |
| **EL** | 853 | 866 | 626 | 1,006 | 60.7% |
| **ES** | 1152 | 1,411 | 1,139 | 2,281 | 100.3% |
| **FI** | 424 | 531 | 472 | 798 | 69.1% |
| **FR** | 1209 | 1,594 | 1.106 | 1,751 | 58.3% |
| **HR** | 0 | 11 | 57 | 116 | 103.5% |
| **HU** | 94 | 178 | 374 | 415 | 11.0% |
| **IE** | 509 | 493 | 441 | 987 | 123.8% |
| **IL** | 141 | 308 | 288 | 1,139 | 295.5% |
| **IT** | 1292 | 1,712 | 1,518 | 2,933 | 93.2% |
| **LT** | 23 | 63 | 102 | 152 | 49.0% |
| **LU** | 0 | 1 | 5 | 38 | 660.0% |
| **LV** | 21 | 69 | 76 | 90 | 18.4% |
| **MT** | 7 | 15 | 40 | 49 | 22.5% |
| **NL** | 1,315 | 1,419 | 1,274 | 2,878 | 125.9% |
| **NO** | 264 | 350 | 282 | 527 | 86.9% |
| **PL** | 106 | 407 | 609 | 741 | 21.7% |
| **PT** | 483 | 483 | 311 | 569 | 83.0% |
| **RO** | 45 | 81 | 142 | 248 | 74.6% |
| **SE** | 1068 | 1,177 | 1,144 | 2,011 | 75.8% |
| **SI** | 38 | 122 | 160 | 217 | 35.6% |
| **SK** | 34 | 74 | 128 | 150 | 17.2% |
| **UK** | 3768 | 4,057 | 3,272 | 7,986 | 144.1% |
| **TOTAL** | **8,836** | **9,991** | **7,281** | **19,257** | **164.5%** |

*Source: authors' calculation based on eCORDA and EUPRO*

**Table 88 – Number of projects coordinated by a university by country in FP4, FP5, FP6 and FP7**

| Country | FP4 | FP5 | FP6 | FP7 | Growth FP6-FP7 |
|---|---|---|---|---|---|
| **AT** | 99 | 140 | 120 | 354 | 195.0% |
| **BE** | 313 | 317 | 152 | 460 | 202.6% |
| **BG** | 2 | 31 | 9 | 25 | 177.8% |
| **CH** | 6 | 68 | 133 | 779 | 485.7% |
| **CY** | 2 | 3 | 17 | 45 | 164.7% |
| **CZ** | 2 | 23 | 13 | 53 | 307.7% |
| **DE** | 569 | 751 | 485 | 1,440 | 196.9% |
| **DK** | 180 | 210 | 114 | 389 | 241.2% |
| **EE** | 2 | 5 | 10 | 21 | 110.0% |
| **EL** | 247 | 146 | 102 | 257 | 152.0% |
| **ES** | 272 | 332 | 232 | 740 | 219.0% |
| **FI** | 81 | 100 | 76 | 214 | 181.6% |
| **FR** | 368 | 415 | 274 | 573 | 109.1% |
| **HR** | 0 | 5 | 4 | 20 | 400.0% |
| **HU** | 2 | 15 | 42 | 79 | 88.1% |
| **IE** | 127 | 141 | 130 | 374 | 187.7% |
| **IL** | 7 | 60 | 68 | 716 | 952.9% |
| **IT** | 277 | 417 | 341 | 877 | 157.2% |
| **LT** | 2 | 5 | 6 | 11 | 83.3% |
| **LU** | 0 | 0 | 1 | 10 | 900.0% |
| **LV** | 0 | 18 | 4 | 19 | 375.0% |
| **MT** | 0 | 0 | 4 | 9 | 125.0% |
| **NL** | 432 | 442 | 321 | 1,117 | 248.0% |
| **NO** | 66 | 113 | 51 | 152 | 198.0% |
| **PL** | 3 | 79 | 91 | 140 | 53.8% |
| **PT** | 66 | 94 | 37 | 108 | 191.9% |
| **RO** | 0 | 7 | 13 | 22 | 69.2% |
| **SE** | 259 | 266 | 226 | 556 | 146.0% |
| **SI** | 0 | 17 | 10 | 16 | 60.0% |
| **SK** | 0 | 11 | 5 | 13 | 160.0% |
| **UK** | 1,729 | 1,659 | 1,220 | 4,234 | 247.0% |
| **TOTAL** | **5,113** | **5,890** | **4,311** | **13,823** | **220.6%** |

*Source: authors' calculation based on eCORDA and EUPRO*

Each project can be assigned to more than one country. Using such double counting approach we obtain that the top 3 countries accounted for 38.8% of the projects in FP5 and that such incidence goes to 36.4% in FP6 and 40.2% in FP7. Assigning a project to a single country, on the basis of the location of the university coordinator, results in the top 3 countries accounting for 48.4% of projects with a university coordinator in FP5. Such incidence goes to 49.1% in FP7. Overall, the data on the geographic concentration of projects, as reported in the following table, suggest the presence of a slight increase in FP7 with respect to FP6. The top 3 countries account for about half of all the university coordinated projects during all the observed FPs.

**Table 89 – Incidence of top 3 and top 5 countries in terms of participation and coordination across different FPs**

| FP | Coordination | | Participation | |
|---|---|---|---|---|
| | Top 3 countries | Top 5 countries | Top 3 countries | Top 5 countries |
| **FP4** | 53.39% | 60.59% | 40.87% | 54.89% |
| **FP5** | 48.42% | 55.50% | 38.79% | 52.61% |
| **FP6** | 47.46% | 54.91% | 36.43% | 49.03% |
| **FP7** | 49.13% | 55.47% | 40.23% | 53.62% |

*Source: authors' calculation based on eCORDA and EUPRO*

The overall EU funding to universities has increased by 219% between FP6 and FP7. In particular UK and NL, which were among the main beneficiaries in FP6, have experienced a growth of funding equal to 248.5% and 278.9%, respectively. FR and SE have experienced a growth rate relatively lower than the European average.

In both FP6 and FP7 almost half of EC funding to universities is concentrated in three countries: UK, Germany and Netherlands (49.3% in FP7 and 47.3% in FP6).

**Table 90 – Total EC funding received by universities (€ million)**

| Country | FP6 | FP7 | Growth |
|---|---|---|---|
| **AT** | 168.8 | 499.6 | 195.9% |
| **BE** | 235.3 | 721.9 | 206.8% |
| **BG** | 12.2 | 30.2 | 147.5% |
| **CH** | 238.9 | 1,217.8 | 409.7% |
| **CY** | 12.6 | 47.4 | 275.8% |
| **CZ** | 44.3 | 116.3 | 162.4% |
| **DE** | 932.9 | 2,674.0 | 186.6% |
| **DK** | 187.8 | 605.3 | 222.3% |
| **EE** | 12.3 | 39.1 | 217.9% |
| **EL** | 128.3 | 318.5 | 148.3% |
| **ES** | 273.9 | 773.8 | 182.5% |
| **FI** | 147.6 | 370.3 | 150.9% |
| **FR** | 267.6 | 693.6 | 159.2% |
| **HR** | 5.6 | 38.8 | 593.3% |
| **HU** | 57.2 | 100.4 | 75.5% |
| **IE** | 134.2 | 394.3 | 193.8% |
| **IL** | 76.3 | 605.6 | 693.7% |
| **IT** | 412.9 | 1,182.0 | 186.3% |
| **LT** | 10.8 | 22.6 | 109.5% |
| **LU** | 0.9 | 12.8 | 1319.8% |
| **LV** | 8.3 | 19.0 | 128.4% |
| **MT** | 4.0 | 6.0 | 49.2% |
| **NL** | 467.7 | 1,771.9 | 278.9% |
| **NO** | 75.6 | 263.1 | 248.0% |
| **PL** | 94.0 | 182.5 | 94.2% |
| **PT** | 56.1 | 143.6 | 156.0% |
| **RO** | 17.8 | 38.8 | 117.8% |
| **SE** | 401.4 | 1,069.4 | 166.4% |
| **SI** | 23.8 | 39.8 | 67.3% |
| **SK** | 13.1 | 26.0 | 98.2% |
| **UK** | 1,405.7 | 4,899.4 | 248.5% |
| **TOTAL** | **5,928.1** | **18,923.6** | **219.2%** |

*Source: authors' calculation based on eCORDA and EUPRO*

The other countries included in the top10 funding recipients show some variations between FP6 and FP7. As presented in the following table we observe a significant increase in the ranking of Switzerland and the entry of Israel in the list. France and Spain experience a decrease in their ranking position.

**Table 91 – Ranking of top 10 countries by funding received by participating universities in FP6 and FP7 (€ million)**

| Position | FP6 | | FP7 | |
|---|---|---|---|---|
| | Country | Funding | Country | Funding |
| 1 | UK | 1405.7 | UK | 4899.4 |
| 2 | DE | 932.9 | DE | 2674 |
| 3 | NL | 467.7 | NL | 1771.9 |
| 4 | IT | 412.9 | CH | 1217.8 |
| 5 | SE | 401.4 | IT | 1182 |
| 6 | ES | 273.9 | SE | 1069.4 |
| 7 | FR | 267.6 | ES | 773.8 |
| 8 | CH | 238.9 | BE | 721.9 |
| 9 | BE | 235.3 | FR | 693.6 |
| 10 | DK | 187.8 | IL | 605.6 |

*Source: authors' calculation based on eCORDA and EUPRO*

As far as the success rate in FP7 is concerned, IL reveals the highest success (24.7%) followed by CH (22.8%), UK (19.4%), IE (19.3) and NL (19.0%). Countries with smaller research and innovation systems register the lowest values.

### 3.7.2 University-level participation

Statistics on the participation of universities in the different framework programmes highlight a set of relevant trends also at the institution level.

Participation is highly concentrated among a relatively small set of participants. The first ten universities in terms of number of projects in FP7 represent the 28.9% of the entire sample of UNIV projects. If the first 20 universities are considered, the percentage rises to 46.1%.

In terms of EC funding, the top ten universities get the 16.2% of the total FP7 EC funding granted to the universities. Instead, the top 20 universities receive one fourth of the total EC funding.

Table 92 presents the top 25 universities by number of granted projects in FP7. These universities represent the 2.0% of the entire sample of beneficiary universities and the 53.4% of the entire sample of UNIV projects. They are mainly located in UK (13) followed by SE (4), DK (3), CH (2), BE, DE and NL (1).

Table 93 presents the top 25 universities by received EC funding in FP7. Results show that these universities represent the 28.8% of the total amount of EC funding received by universities in FP7. They are mainly located in UK (8) followed by CH, SE and NL (4), DK and IL (2), BE (1).

**Table 92 – Top 25 universities by number of granted projects in FP7**

| Rank | University - EU15 Countries | Country | Project count |
|---|---|---|---|
| 1 | UNIVERSITY OF CAMBRIDGE | UK | 737 |
| 2 | UNIVERSITY OF OXFORD | UK | 719 |
| 3 | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 657 |
| 4 | UNIVERSITY COLLEGE LONDON | UK | 609 |
| 5 | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH | CH | 562 |
| 6 | KATHOLIEKE UNIVERSITEIT LEUVEN | BE | 545 |
| 7 | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 508 |
| 8 | DANMARKS TEKNISKE UNIVERSITET | DK | 409 |
| 9 | TECHNISCHE UNIVERSITEIT DELFT | NL | 406 |
| 10 | UNIVERSITY OF EDINBURGH | UK | 405 |
| 11 | KOBENHAVNS UNIVERSITET | DK | 397 |
| 12 | UNIVERSITY OF MANCHESTER | UK | 385 |
| 13 | KARLSRUHER INSTITUT FUER TECHNOLOGIE | DE | 340 |
| 14 | KAROLINSKA INSTITUTET | SE | 329 |
| 15 | UNIVERSITY OF SOUTHAMPTON | UK | 318 |
| 16 | LUNDS UNIVERSITET | SE | 317 |
| 17 | KUNGLIGA TEKNISKA HOEGSKOLAN | SE | 315 |
| 18 | UNIVERSITY OF BIRMINGHAM | UK | 309 |
| 19 | UNIVERSITY OF BRISTOL | UK | 306 |
| 20 | UNIVERSITY OF SHEFFIELD | UK | 303 |
| 21 | KING S COLLEGE LONDON | UK | 291 |
| 22 | UNIVERSITY OF NOTTINGHAM | UK | 289 |
| 23 | UNIVERSITY OF LEEDS | UK | 283 |
| 24 | CHALMERS TEKNISKA HOEGSKOLA | SE | 274 |
| 25 | AARHUS UNIVERSITET | DK | 269 |

| Rank | University - EU13 Countries | Country | Project count |
|---|---|---|---|
| 1 | UNIVERZA V LJUBLJANI | SI | 159 |
| 2 | UNIVERZITA KARLOVA V PRAZE | CZ | 117 |
| 3 | BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM | HU | 113 |
| 4 | UNIVERSITY OF CYPRUS | CY | 105 |
| 5 | TARTU ULIKOOL | EE | 101 |
| 6 | UNIWERSYTET WARSZAWSKI | PL | 93 |
| 7 | CESKE VYSOKE UCENI TECHNICKE V PRAZE | CZ | 90 |
| 8 | POLITECHNIKA WARSZAWSKA | PL | 81 |
| 9 | UNIWERSYTET JAGIELLONSKI | PL | 67 |
| 10 | KOZEP EUROPAI EGYETEM | HU | 62 |
| 11 | MASARYKOVA UNIVERZITA | CZ | 62 |
| 12 | KAUNO TECHNOLOGIJOS UNIVERSITETAS | LT | 52 |
| 13 | VYSOKE UCENI TECHNICKE V BRNE | CZ | 51 |
| 14 | AKADEMIA GORNICZO HUTNICZA W KRAKOWIE | PL | 50 |
| 15 | DEBRECENI EGYETEM | HU | 50 |
| 16 | UNIVERSITA TA MALTA | MT | 49 |
| 17 | POLITECHNIKA WROCLAWSKA | PL | 48 |
| 18 | VILNIAUS UNIVERSITETAS | LT | 46 |
| 19 | SOFIISKI UNIVERSITET SVETI KLIMENT OHRIDSKI | BG | 45 |
| 20 | UNIVERSITATEA POLITEHNICA DIN BUCURESTI | RO | 45 |
| 21 | EOTVOS LORAND TUDOMANYEGYETEM | HU | 44 |
| 22 | TALLINNA TEHNIKAULIKOOL | EE | 44 |
| 23 | SZEGEDI TUDOMANYEGYETEM | HU | 41 |
| 24 | LATVIJAS UNIVERSITATE | LV | 39 |
| 25 | RIGAS TEHNISKA UNIVERSITATE | LV | 37 |

*Source: authors' calculation based on eCORDA*

**Table 93 – Top 25 universities by received EC funding (€ million)**

| Rank | University | Country | EC Funding |
|---|---|---|---|
| **1** | UNIVERSITY OF OXFORD | UK | 437.21 |
| **2** | UNIVERSITY OF CAMBRIDGE | UK | 424.03 |
| **3** | UNIVERSITY COLLEGE LONDON | UK | 352.75 |
| **4** | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH | CH | 336.89 |
| **5** | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 325.25 |
| **6** | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 304.73 |
| **7** | KATHOLIEKE UNIVERSITEIT LEUVEN | BE | 263.00 |
| **8** | UNIVERSITY OF EDINBURGH | UK | 225.97 |
| **9** | KAROLINSKA INSTITUTET | SE | 197.86 |
| **10** | TECHNISCHE UNIVERSITEIT DELFT | NL | 195.16 |
| **11** | KOBENHAVNS UNIVERSITET | DK | 191.35 |
| **12** | DANMARKS TEKNISKE UNIVERSITET | DK | 186.62 |
| **13** | WEIZMANN INSTITUTE OF SCIENCE | IL | 176.89 |
| **14** | UNIVERSITY OF MANCHESTER | UK | 176.68 |
| **15** | STICHTING KATHOLIEKE UNIVERSITEIT | NL | 176.49 |
| **16** | KING S COLLEGE LONDON | UK | 175.64 |
| **17** | HEBREW UNIVERSITY OF JERUSALEM | IL | 158.31 |
| **18** | LUNDS UNIVERSITET | SE | 152.52 |
| **19** | UPPSALA UNIVERSITET | SE | 148.93 |
| **20** | KUNGLIGA TEKNISKA HOEGSKOLAN | SE | 142.81 |
| **21** | STICHTING VU VUMC | NL | 142.33 |
| **22** | UNIVERSITY OF SHEFFIELD | UK | 142.13 |
| **23** | UNIVERSITAET ZUERICH | CH | 139.47 |
| **24** | UNIVERSITEIT UTRECHT | NL | 139.40 |
| **25** | UNIVERSITE DE GENEVE | CH | 138.07 |

*Source: authors' calculation based on eCORDA*

Table 94 presents the top 5 universities by granted projects and received EC funding (€ million) in each Specific Programme.

**Table 94 – Top 5 universities by granted projects and received EC funding (€ million) in each Specific Programme**

| Programme | University | Country | Project count | University | Country | EC Funding (€ million) |
|---|---|---|---|---|---|---|
| COOPERATION | KATHOLIEKE UNIVERSITEIT LEUVEN | BE | 337 | UNIVERSITY COLLEGE LONDON | UK | 152.40 |
| | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 300 | KATHOLIEKE UNIVERSITEIT LEUVEN | BE | 137.70 |
| | UNIVERSITY COLLEGE LONDON | UK | 300 | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 133.48 |
| | DANMARKS TEKNISKE UNIVERSITET | DK | 285 | DANMARKS TEKNISKE UNIVERSITET | DK | 130.54 |
| | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 283 | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 127.89 |
| IDEAS | UNIVERSITY OF OXFORD | UK | 150 | UNIVERSITY OF CAMBRIDGE | UK | 228.85 |
| | UNIVERSITY OF CAMBRIDGE | UK | 141 | UNIVERSITY OF OXFORD | UK | 226.01 |
| | UNIVERSITY COLLEGE LONDON | UK | 110 | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH | CH | 159.86 |
| | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH | CH | 95 | UNIVERSITY COLLEGE LONDON | UK | 153.57 |
| | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 90 | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE | CH | 143.42 |
| PEOPLE | UNIVERSITY OF CAMBRIDGE | UK | 298 | UNIVERSITY OF OXFORD | UK | 73.34 |
| | UNIVERSITY OF OXFORD | UK | 296 | UNIVERSITY OF CAMBRIDGE | UK | 72.46 |
| | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 253 | IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE | UK | 67.29 |
| | UNIVERSITY COLLEGE LONDON | UK | 176 | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH | CH | 53.71 |
| | KOBENHAVNS UNIVERSITET | DK | 163 | KOBENHAVNS UNIVERSITET | DK | 49.56 |
| CAPACITIES | UNIVERSITY OF MANCHESTER | UK | 45 | PANEPISTIMIO KRITIS UNIVERSITY OF CRETE | EL | 13.24 |
| | UNIVERSITY OF OXFORD | UK | 40 | KARLSRUHER INSTITUT FUER TECHNOLOGIE | DE | 12.66 |
| | BRUNEL UNIVERSITY | UK | 40 | UNIVERSITY OF MANCHESTER | UK | 12.62 |
| | DANMARKS TEKNISKE UNIVERSITET | DK | 38 | UNIVERSITY OF OXFORD | UK | 12.10 |
| | KARLSRUHER INSTITUT FUER TECHNOLOGIE | DE | 37 | UNIVERSITY OF EDINBURGH | UK | 10.70 |
| Euratom | KARLSRUHER INSTITUT FUER TECHNOLOGIE | DE | 55 | KARLSRUHER INSTITUT FUER TECHNOLOGIE | DE | 18.00 |
| | KUNGLIGA TEKNISKA HOEGSKOLAN | SE | 25 | KUNGLIGA TEKNISKA HOEGSKOLAN | SE | 5.00 |
| | UNIVERSITY OF MANCHESTER | UK | 20 | CHALMERS TEKNISKA HOEGSKOLA AB | SE | 3.82 |
| | CHALMERS TEKNISKA | SE | 19 | UNIVERSITY OF | UK | 3.75 |

| | | | | | |
|---|---|---|---|---|---|
| HOEGSKOLA AB | | | MANCHESTER | | |
| UNIVERSIDAD POLITECNICA DE MADRID | ES | 18 | UNIVERSITA DEGLI STUDI DI PAVIA | IT | 3.14 |

*Source: authors' calculation based on eCORDA*

### 3.7.3 Networking patterns

A fundamental objective of FPs is to foster the creation of research and innovation networks among institutions and companies at national and international level. Given such objective we have analysed in details the composition of partnerships in all examined university projects across different FPs. In the case of FP7, approximately 42.1% of UNIV projects out of 19,257 relate to solo projects (i.e. involving only one participant). On average, UNIV projects in FP7 have involved a lower number of countries than those in FP6 (3.7 vs. 5.1). In all FPs, UNIV projects tend to be more internationally oriented than the average of the whole projects per FPs.

The international reach of university projects in terms of average number of countries involved did not change substantially over time. However, the autonomy of universities seems to have grown as shown by the higher frequency of solo projects. The capacity to carry out projects without establishing international partnerships seems to be directly related to country size and hence to the critical mass of their national innovation systems. Preference for solo projects is not necessarily a positive outcome because it may contrast the mission of programmes aiming at fostering cooperation and integration of European research but also because individual projects tend to be less successful in the selection process.

By a country-level perspective we observe that projects involving university in Israel, UK and Switzerland show the lowest levels of partnerships as revealed by their high share of solo projects (equal to 58.3%, 37.4% and 31.7% respectively). Smaller EU13 countries are characterised by the highest levels of partnerships as shown by their high share of projects involving more than fifteen partners. In line with previous results, it appears that universities located in smaller countries with a relatively weaker research system participate to projects involving a higher number of partners. The data reported in the following table indicate that for some countries, such as Switzerland, Belgium, Netherlands and the UK. there has been a relevant increase in the incidence of solo projects.

**Table 95 – Incidence of partnership size by country and FPs**

| Country | FP5 | | FP6 | | FP7 | |
|---|---|---|---|---|---|---|
| | 1 country | 2 to 5 countries | 1 country | 2 to 5 countries | 1 country | 2 to 5 countries |
| AT | 12.50% | 36.90% | 7.90% | 22.40% | 17.50% | 8.10% |
| BE | 16.40% | 37.40% | 7.00% | 20.60% | 18.10% | 8.60% |
| BG | 16.60% | 19.50% | 5.40% | 13.40% | 10.40% | 5.50% |
| CH | 8.80% | 40.60% | 10.20% | 19.90% | 31.70% | 8.40% |
| CY | 3.80% | 28.30% | 19.50% | 14.30% | 21.10% | 4.20% |
| CZ | 11.40% | 22.80% | 2.70% | 19.30% | 9.30% | 7.00% |
| DE | 11.40% | 46.10% | 8.10% | 26.60% | 16.50% | 10.90% |
| DK | 12.00% | 37.90% | 9.70% | 18.00% | 20.70% | 7.50% |
| EE | 4.00% | 22.00% | 2.60% | 16.50% | 8.00% | 9.80% |
| EL | 7.40% | 38.70% | 8.80% | 17.80% | 11.70% | 9.70% |
| ES | 14.70% | 41.00% | 11.20% | 20.30% | 20.90% | 10.00% |
| FI | 8.10% | 39.50% | 7.40% | 18.60% | 15.30% | 9.30% |
| FR | 18.40% | 42.60% | 15.70% | 24.60% | 23.30% | 13.40% |
| HR | 45.50% | 9.10% | 5.30% | 15.80% | 14.70% | 5.20% |
| HU | 6.70% | 25.30% | 8.50% | 16.50% | 15.70% | 6.70% |
| IE | 14.80% | 40.40% | 17.00% | 19.70% | 18.40% | 10.80% |
| IL | 12.30% | 37.00% | 14.50% | 20.80% | 58.30% | 6.40% |
| IT | 12.90% | 44.10% | 11.20% | 25.40% | 12.60% | 13.10% |
| LT | 7.90% | 14.30% | 3.80% | 15.10% | 5.90% | 8.60% |
| LU | 0.00% | 100.00% | 16.70% | 0.00% | 15.80% | 10.50% |
| LV | 26.10% | 13.00% | 2.50% | 12.70% | 8.90% | 13.30% |
| MT | 0.00% | 6.70% | 2.30% | 20.50% | 10.20% | 6.10% |
| NL | 17.60% | 36.20% | 12.10% | 21.90% | 23.90% | 9.20% |
| NO | 18.30% | 36.30% | 9.50% | 17.00% | 16.90% | 6.60% |
| PL | 17.00% | 21.10% | 7.40% | 20.60% | 10.90% | 12.30% |
| PT | 12.40% | 36.40% | 4.80% | 19.60% | 10.40% | 11.60% |
| RO | 7.40% | 29.60% | 6.30% | 19.00% | 5.60% | 8.10% |
| SE | 11.00% | 38.30% | 9.20% | 22.10% | 17.20% | 9.40% |
| SI | 8.20% | 23.80% | 2.50% | 10.60% | 3.70% | 10.10% |
| SK | 12.20% | 20.30% | 2.30% | 10.80% | 7.30% | 6.00% |
| UK | 22.40% | 43.10% | 23.90% | 23.20% | 37.20% | 11.10% |

*Source: authors' calculation based on eCORDA and EUPRO*

**Table 96 – Average network size by country of participating universities in FP6 and FP7**

| Country | FP6 | FP7 | Difference |
|---|---|---|---|
| **AT** | 16.3 | 12.2 | 4.1 |
| **BE** | 17.8 | 11.0 | 6.7 |
| **BG** | 21.5 | 14.5 | 7.0 |
| **CH** | 16.5 | 9.1 | 7.3 |
| **CY** | 21.4 | 14.0 | 7.5 |
| **CZ** | 18.6 | 14.5 | 4.2 |
| **DE** | 14.7 | 10.6 | 4.1 |
| **DK** | 17.4 | 12.0 | 5.4 |
| **EE** | 18.6 | 14.7 | 4.0 |
| **EL** | 18.6 | 12.6 | 6.0 |
| **ES** | 16.3 | 10.6 | 5.7 |
| **FI** | 17.8 | 12.7 | 5.1 |
| **FR** | 15.1 | 10.0 | 5.0 |
| **HR** | 20.6 | 13.2 | 7.4 |
| **HU** | 17.3 | 12.8 | 4.5 |
| **IE** | 16.1 | 11.0 | 5.1 |
| **IL** | 15.9 | 5.7 | 10.2 |
| **IT** | 14.9 | 11.3 | 3.7 |
| **LT** | 17.1 | 14.4 | 2.7 |
| **LU** | 11.4 | 11.9 | -0.5 |
| **LV** | 18.3 | 16.9 | 1.4 |
| **MT** | 21.0 | 22.6 | -1.5 |
| **NL** | 14.7 | 10.1 | 4.6 |
| **NO** | 19.6 | 13.0 | 6.6 |
| **PL** | 17.7 | 12.2 | 5.5 |
| **PT** | 19.7 | 13.2 | 6.5 |
| **RO** | 16.9 | 14.3 | 2.6 |
| **SE** | 16.6 | 11.7 | 4.9 |
| **SI** | 17.8 | 14.0 | 3.7 |
| **SK** | 18.8 | 14.9 | 3.9 |
| **UK** | 11.6 | 7.7 | 3.9 |
| **TOTAL** | **8.9** | **6.0** | 2.9 |

*Source: authors' calculation based on eCORDA and EUPRO*

### 3.7.4 Scientific outputs and intellectual property rights

For the projects granted under FP7 we have performed an analysis of outputs in terms of scientific publications and intellectual property rights. The analysis is based on self-reported data by beneficiaries.

As far as Intellectual property rights are concerned, the patenting output of the funded FP7 projects appears to be quite low, especially taking into consideration the aggregated financial support by the EC. It is important to recall that such evidence might be partly due to an underestimation of the actual number of patents stemming from the projects for two reasons: first, beneficiaries might have not reported patent applications; second, at the moment of the analysis not all FP7 projects are closed.

We have obtained that 1,726 IPRs are associated with projects under the FP7, of which 1,470 are patents, 25 are utility models, 30 are registered designs and 73 are trademarks. 1,516 IPRs or 87.8% of a total of 1,726 refer to UNIV projects. A total of 572 UNIV projects have at least one IPR. These numbers suggest that only about 2.6% of the analysed UNIV projects report at least one patent application. If we exclude projects under the IDEAS program for which data is not available, such percentage is equal to 3.15%. As expected, the highest number of projects with patents results from

interactions with companies. 5.3% UNIV projects, of a total of 7,452 with at least one company among the partners, have patents (for a total of 1,001 patents and 393 projects). Moreover, only 22.6% of the total number of patents associated with UNIV projects is the result of UNIV projects that do not involve a company.

As far as scientific publications are concerned, we have analysed 39,729 publications related to UNIV projects. We obtained that 3,550 UNIV projects, 18.4% of a total of 19,257, have at least one associated publication, such percentage goes to 22.4% when we exclude IDEAS projects for which data on outputs is not available.

Projects vary considerably in terms of scientific productivity. 39.0% of UNIV projects, out of 3,550 projects with at least one publication, have from 2 to 5 publications, 28.2% has from 6 to 20 publications and 20.3% has one publication. Only 3.9% of UNIV projects with publications has more than 50 associated publications. The overall evidence from the analysis of publications across projects confirms the presence of a significantly skewed distribution with a median of just 4 publications per project and a 90$^{th}$ percentile of 25 publications.

By a scientific specialisation perspective we obtain that 49.4% of publications refer to Life Sciences and Biomedicine, 28.3% to Physical Sciences and 20.0% to the Technology field. Social Sciences and Arts and Humanities account for less than 3%. The observation of the data on the distribution of publications in terms of quality of the journals and of citations received suggest the presence of a remarkable above average scientific standing of the publications stemming from the analysed projects[16]. Moreover, the data indicate that publications from projects of larger size (> € 5 million) have on average a higher quality as captured by the number of citations received and the impact factor of the scientific journal in which they been published. About 46% of analysed publications have from 2 to 5 authors, around one third of publications have between 6 and 10 authors. Finally there are about 3% of publications with very large co-authorships. More than 80% of UNIV publications involve collaboration across different institutions. In most of the cases such collaboration involved 2 to 5 organizations. Although we observe anon-negligible incidence of papers co-authored by researchers affiliated to more than 10 organizations. On average the analysis of co-authorships confirm the presence of significant inter organizational research collaborations in the context of FP projects.

## 3.8 Concluding remarks and policy implications

The analysis of the data on Universities participation in FPs highlights that the role of universities in EU framework programmes has become increasingly more pervasive over time.

In particular, more than 1,200 academic institutions across European countries received FP7 funding. The incidence of UNIV projects having a university as coordinator is higher in FP7 (71.8%) than in FP6 (59.2%), FP5 (59.0%) and FP4 (57.9%). In all FPs, the international reach of UNIV projects is higher than the average of the whole projects.

In the last two FPs there has been a 165% increase in the number of projects involving at least one university. The breakdown of this growth rates across countries reveals that among larger European countries, Germany, the UK and Switzerland experienced higher growth rates, while a more moderate increase has been recorded for Italy, France and Spain. The data on the geographic concentration of projects suggest a slight increase in FP7 with respect to FP6. Moreover, we observe a significant increase in the funding received by institutions from extra-EU countries such as Switzerland and Israel. In FP7 the

[16] Note that analysis of citations received by each article and of the impact factor of the related journal has been carried out for a subsample of publications for which the ISSN and the DOI codes were available in the original data. See section 3.3.6.2 for methodological details.

top three countries by number of coordinated projects account for approximately 50% of all projects and such percentage increases to 61% when considering the top 5 countries.
The evidence on the geographical concentration of resources to a large extent mirrors the presence of marked differences across countries in the scientific standing and in the capacity to seize EU funds. However, the significant country-level concentration of financial resources in FP7 is mitigated by the cooperative nature of most of the analysed projects. Approximately 58% of the 19,257 UNIV projects are collaborative (UNIV projects involving more than one participant).
As regards transnational cooperation, among collaborative projects we found that the incidence of project with more than 5 countries is considerable and it varies across countries: it is lowest in the UK and Israel (respectively 37.2% and 27.2%) and highest in Eastern European countries such as Slovakia (75.3%) and Estonia (74.8%). The overall evidence clearly suggests that institutions located in the EU13 countries tend to be more often partners of projects with an above-average international reach.
The comparison of aggregated statistics for FP6 and FP7 reveals a decrease in the average number of participant per project and in the incidence of international collaboration. The latter evidence can be to some extent attributed to the IDEAS programme in FP7 (that includes ERC projects) that mostly targets single institutions. In this respect it has also to be stressed that the largest part of FP6 expenditure aimed at generating an integration effect on Europe's research resources. The key pillars of FP6 indeed consisted in structuring and strengthening a European Research Area by stimulating a coherent development of research and innovation through collaborative projects and joint actions conducted across nations and regions. Such fundamental integration objectives are clearly present also in FP7, mostly within the "Cooperation" Programme that supports trans-national cooperation in different forms across the European Union and beyond. At the same time, also in order to capitalise the results of previous FPs, a significant amount of FP7 resources have been dedicated to promoting frontier research. The objective of supporting the generation of scientific and technological breakthroughs has been pursued through the IDEAS Programme that clearly emphasise research excellence. Moreover, the Specific Programme "People" in FP7 has been articulated in a number of actions aimed at promoting knowledge circulation through the support to researchers' careers and international mobility. This channel for knowledge diffusion and integration is not captured by the project-level data on international collaborations.
When the unit of analysis moves to the university level, we find evidence of a marked concentration of EC funding in a relatively small number of institutions. About 22% of the 1,274 single institutions that were granted at least one project in FP7 received a total funding between € 1 and 10 million, 24% are in the range € 10-15 million and 1% received more than € 15 million. The top 25 universities by number of granted projects in FP7 account for 53.4% of the entire sample of university projects. They are mainly located in the UK (13) followed by Sweden (4), Denmark (3), Switzerland (2), Belgium, Germany and the Netherlands (1). The top ten institutions get 16.2% of the total FP7 funding granted to universities. Within EU13 countries, there is also a small group of universities with a non-negligible record of granted projects: 5 participants have obtained more than 100 projects and 15 participants have obtained more than 50 projects.
Key results from the social network analysis on universities collaboration indicate the presence of strong links between a set of central universities, many of them located in the UK. The highest number of joint projects is observed for the largest European countries: the UK, Germany and France. Moreover, the data reveal the presence of a small group of universities with high participation scores that appears to play the role of "gatekeepers": such universities act as knowledge hubs by interacting also with more peripheral nodes of the network and hence allowing the flow of knowledge towards institutions with lower participation performance.
From a policy perspective, the illustrated evidence raises some relevant issues. While targeting excellence in research is undoubtedly a perquisite for keeping in a highly competitive position the European scientific system, the presence of self-reinforcing mechanisms in the structure of the research collaboration networks among top performing institutions and countries might have negative implications for cohesion

at European level. In this regard, it is advisable to design policy instruments which allow pursuing excellence and at the same time facilitating the collaborations with countries with relatively less developed scientific and innovation systems. In particular, the persistent structural inequalities among European countries revealed by participation data might be addressed by a broad set of interventions related to capacity building. These can include schemes for the involvement of top universities in training activities for institutions located in less performing countries, with the objective of improving both scientific skills as well as organisational and management capacities. In light of the evidence from the social network analysis, this type of intervention should aim at increasing the number of European elite universities that effectively play a role of gatekeepers, thus connecting the core of the network of high performing universities with more peripheral nodes. In sum, the data on the concentration of resources call for a policy approach that, while preserving the fundamental driving role of the key players and the value of their network of collaboration, guarantee sufficient entry opportunities for lagging regions and institutions. In this regard, entry barriers might be lower for projects of relatively smaller size, focused on capacity building and/or addressing more incremental types of research and innovation activities. The persistent high concentration of funding both at the country and institution level could be the result of a limited international mobility of researchers as a consequence of a still fragmented job market for scientists in Europe during the analysed years. This point is relevant in light of the EC objective to generate an effective European Research Area and of the considerable financial resources dedicated to programmes for international mobility such as the Marie Curie initiative. In this respect we believe that it would be important to analyse - after an adequate time lag - what the actual net flows of internationally mobile researchers across European Countries have been. This is fundamental to assess the extent of EU internal brain drain and to measure the direct and indirect effects on sending and receiving countries.

The data indicate that although in the analysed projects universities establish partnerships mainly with other universities, private companies play a significant role. Indeed, across the full sample of FP7 university projects, in more than 60% of the projects there was a collaboration with at least one private company. Among EU countries, such incidence ranges between 44.5% for projects involving a UK university to 71.8% in the case of projects involving a Romanian university. These data reflect well the growing involvement of European universities in technology transfer activities and the important impact of FPs in supporting the set-up of university-industry links.

The evaluation of the long-term economic impact of university-industry collaborations is a complex task due to the difficulties in measuring the intangible outcomes of funded projects. In this regard, patents are clearly just a partial indicator. The analysis of the available data on patents related to FP7 projects seems to suggest a quite weak impact on innovation: only about 500 out of 19,257 UNIV projects in FP7 have generated at least one patent. Such evidence might be partly due to an underestimation of the actual number of patents stemming from the projects for two reasons: first, beneficiaries might have not reported patent applications that have occurred after the project closing date; second, at the moment of the analysis not all FP7 projects were concluded. In general, the data show that there are significant opportunities for improvement in relation to the industrial exploitation of projects outcomes. In this area, an important effect might be exerted by funding schemes for university projects that include specific financial resources for enhancing technology transfer. In particular, we refer to the provision of complementary funding for covering the costs of downstream activities such as proof-of-concept, early prototyping, patent prosecution, technology landscaping and market analysis. Beside this policy suggestion we also stress that the currently available data does not allow a proper monitoring – on a comprehensive scale – of the actual impact of industry-university collaborations supported by FP projects. The focus on intellectual property rights is indeed likely to generate a biased view of the phenomenon and to overlook key dimensions of impact, related to the creation of intangible infrastructures and skills in beneficiary firms. The identification of indicators for capturing long-term effects of industry-university collaborations is still debated in the science policy literature.

In the study we have examined the scientific output of the projects trough publications. We obtained that overall about 22% of projects have at least one associated publication. Projects vary considerably in terms of scientific productivity. Such heterogeneity is partly explained by the characteristics of the Programmes: IDEAS is the Specific Programme with the highest average number of publications per project (13.1), followed by Euratom (5.5), Cooperation (3.8) and Capacities (3.3). The data on the distribution of publications in terms of quality of the journals and of citations received suggest the presence of an above average scientific quality of the publications stemming from the analysed projects. More than 80% of UNIV publications involve collaboration across different institutions. The evidence highlights also that publications resulting from large UNIV projects (those worth more than € 5 million) are more cited, appear on higher quality journals and involve more authors than smaller projects. The analysis of publications related to IDEAS projects has revealed a significant incidence of scientific articles that have appeared in leading scientific journals. This result is consistent with the objective of the IDEAS programme to support research excellence. Finally, it is worth stressing that an effective and comprehensive assessment of the quality of scientific and technological outputs generated by the granted projects would require a significant improvement in the data (on publications, patents, new products or new know-how) collected from participants; this gap was also confirmed by external experts in the final workshop.

# 4 Task 4 – Case studies of individual institutions

## 4.1 Methodological approach

### 4.1.1 Selection of cases and data collection

The case studies of individual institutions aim to explore the following issues: main drivers for engagement of universities in EU framework programmes, assessment of industry–university collaboration, analysis of selected features of the pathways to innovation.

The research design involves the comparison of 75 case studies. The unit of analysis is the university and the focus is on their multiple experiences in FP7. Detailed case studies of 25 Top Universities integrate these 75 (see Task 5).

The analysis of eCORDA highlighted that the participating universities are not simply a subset of the HES (Higher or secondary education establishments) group. There are numerous universities that have not been classified as HES but were included in the group of "N/A" (in the database of FP7 proposals), and few other universities were included in the other categories. In order to consider the real distribution of universities in the selection of cases, these misclassifications have been taken into account, as far as possible, and all participants were considered.

Since the attention is on universities (not higher education institutions at large), the first step was therefore to select a sample of organizations that can be identified as "universities" (see Task 2 for information on data cleaning and reorganisation).

The data referring to granted projects extracted from eCORDA is the basis for the selection of cases. The sample is not random and in order to ensure a balanced selection of case studies, as proposed in the technical offer, we have taken into account the following parameters:

1. % distribution of total participant universities by country
2. % distribution of the EU contribution by country
3. % distribution of the total number of participations
4. average number of participations by country, to allow, as far as possible, proper representation of States with high participation rates despite the total number of universities and the received contribution (e.g. NL in the EU15).

The application of such criteria led to an indicative target in terms of number of cases per country.

From the online survey we received answers from more than 75 universities (i.e. complete answers concerning 124 organisations). This allowed selecting, for the case studies of some countries, the best replies from those received (in terms of completion and wealth of information). For the final cases shown in the following table, the above selection criteria as well as the quality of the answers were taken into account. It is worth noting that the selected cases are not meant to be the most prominent organisations in their countries but those who were willing to participate in the survey and provided the most satisfactory and complete answers.

**Table 97 – List of 75 mini-case studies by country**

| Country group | Country | Individual cases |
|---|---|---|
| EU15 | Austria | • UNIVERSITAET FUER WEITERBILDUNG KREMS |

| | | |
|---|---|---|
| (51 cases) | | • BOKU |
| | Belgium | • UNIVERSITEIT HASSELT<br>• INSTITUTE OF TROPICAL MEDICINE |
| | Germany | • UNIVERSITAET HOHENHEIM<br>• UNIVERSITAET KASSEL<br>• HAMBURG<br>• HANNOVER<br>• KAISERSLAUTERN<br>• MUENSTER<br>• OFFENBURG<br>• GREIFSWALD<br>• AACHEN - RHEINISCH WESTFAELISCHE TECHNISCHE HOCHSCHULE |
| | Denmark | • COPENHAGEN BUSINESS SCHOOL |
| | Greece | • TECHNICAL UNIVERSITY CRETE |
| | Spain | • POLYTECHNIC UNIVERSITY OF CATALONIA<br>• OVIEDO |
| | Finland | • LAPPEENRANNAN TEKNILLINEN YLIOPISTO<br>• TURKU - TURUN YLIOPISTO<br>• OULU |
| | France | • UNIVERSITÉ LYON 1 CLAUDE BERNARD<br>• ÉCOLE NORMALE SUPERIÉURE<br>• UNIVERSITÉ PARIS 8 VINCENNES SAINT DENIS<br>• EVRY VAL D'ESSONNE<br>• ECOLÉ CENTRALE LYON |
| | Ireland | • LIMERICK |
| | Italy | • UNIVERSITÀ DEGLI STUDI DI TRIESTE<br>• POLITECNICO DI TORINO<br>• UNIVERSITÀ DEGLI STUDI DI SIENA<br>• UNIVERSITÀ DEGLI STUDI DI BRESCIA<br>• UNIVERSITÀ DEGLI STUDI DI TRENTO<br>• UNIVERSITÀ POLITECNICA DELLE MARCHE |
| | The Netherlands | • UNIVERSITEIT LEIDEN<br>• AMSTERDAM<br>• FONTYS<br>• GRONINGEN |
| | Portugal | • LISBOA<br>• PORTO |
| | Sweden | • GOETEBORGS UNIVERSITET<br>• LANTBRUKS - SVERIGES LANTBRUKSUNIVERSITET<br>• LULEA |
| | United Kingdom | • QUEEN MARY UNIVERSITY OF LONDON<br>• UNIVERSITY OF STRATHCLYDE<br>• CARDIFF UNIVERSITY<br>• UNIVERSITY OF EAST ANGLIA<br>• UNIVERSITY OF YORK<br>• HERIOT WATT UNIVERSITY<br>• UNIVERSITY OF DURHAM<br>• DE MONTFORT<br>• LOUGHBOROUGH UNIVERSITY<br>• SUSSEX |
| | Bulgaria | • VARNA MEDICAL UNIVERSITY |
| EU13 (17 cases) | Cyprus | • OPEN UNIVERSITY CYPRUS |
| | Czech Republic | • UNIVERZITA PARDUBICE<br>• CHARLES PRAGUE |

| | | |
|---|---|---|
| | Estonia | • TARTU ULIKOOL |
| | Croatia | • SVEUCILISTE U RIJECI |
| | Hungary | • PECSI TUDOMANYEGYETEM UNIVERSITY OF PECS<br>• OBUDAI |
| | Lithuania | • VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS |
| | Latvia | • DAUGAVPILS<br>• RIGA TECHNICAL UNIVERSITY |
| | Poland | • AKADEMIA MORSKA W GDYNI<br>• JAGIELLONIAN<br>• UNIVERSITY OF LODZ |
| | Romania | • UNIVERSITATEA BABES BOLYAI |
| | Slovenia | • UNIVERZA V LJUBLJANI |
| | Slovak Republic | • ZILINA |
| | Switzerland | • HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE<br>• LUZERN<br>• GENEVE |
| Extra EU (7 cases) | Israel | • TEL AVIV UNIVERSITY<br>• HAIFA |
| | Norway | • BERGEN<br>• OSLO |

Tests on the distribution of Universities by number of participant for project, number of countries involved in each project and by funding by programme (i.e. Cooperation, Ideas, People, Capacities and Euratom) show non-significant difference between sampled Universities and the population of Universities in eCORDA. In other words the sample is representative with respect to the mentioned dimensions.

As a first step, a questionnaire containing a mix of open, closed-end and multiple choice questions, was prepared and tested. An online survey tool was used to collect data in order to deal with the time constraints of the study and, at the same time, the complexity of some questions which may need preparation.

The data collection was launched in the third week of April 2015 and continued until mid-June 2015.

The questionnaires were addressed to key people in the universities such as the rector and the research strategy office, whom were also encouraged to collect the views of a limited number of researchers that successfully submitted FP7 proposals.

A list of contacts was manually assembled from the Internet for a sample of approximately 400 universities.

### 4.1.2 Structure and scope of individual case studies

75 **mini case studies** with a modular structure have been prepared with a view to be able to cross-analyse them according to **three layers of analysis**: engagement, collaboration, innovation pathways.

A common template was used for the case studies. Each case is a **stand-alone *fiche*** of approx. 2 pages whose main goal is to provide a picture of the university based on the results of previous Tasks (2-3) of

the present study, and value added in the form of a narrative capable to highlight specific features of motivation, collaboration, and innovation which cannot fully emerge from quantitative data only.

The combination of qualitative and quantitative data can be highly synergic. On the one hand, qualitative data (i.e. interviews) are necessary for understanding the rationale of universities' approach towards FPs and practices, on the other hand, quantitative data can reveal relationship which may not be noticeable to the researcher or can provide a direction in interpreting the collected information by avoiding influencing the researcher by false impressions emerging from interviews.

The balance and presentation of the individual elements may vary, depending on the available information in each specific case, its strengths, weaknesses and the best practices emerging from the case (e.g. capacity to work as incubator for spin-offs, excellence in PhD training…). Nonetheless, the case studies have a common structure to allow aggregation and synthesis.

**Table 98 – case study outline, following the tests**

| Section of case study | Contents | Main source |
|---|---|---|
| Introduction | • Basic information on the organisation<br>• Location, specialisation, size (e.g. students and researchers)<br>• Functional separation education/research<br>• Data on FP participation from Task 2/3 | • ETER<br>• Task 2 and 3<br>• University website |
| 1. Main drivers for the engagement (with a focus on FP7) | • University motivations for participation<br>• Alternative funding instruments available<br>• Features of the university strategy with respect to facilitating participation<br>• Features of internal support structures<br>• Obstacles for participation<br>• Main effects of participation, according to the experience of respondents also as regards cross-border cooperation | • Responses to the survey |
| 2. Collaboration with industry and other research organisations | • Type of external collaboration with other research organisations<br>• Type of industry-university collaboration fostered by Framework Programmes<br>• Industry-university mobility programmes<br>• Post-degree training<br>• University role in the national and regional Innovation system | |
| 3. Pathways to innovation | • Spin-off and start up support<br>• Services provided to facilitate commercialisation of knowledge<br>• Perceived impact of participation on capacity to commercialise knowledge, incubate spin-off, promote university-industry mobility and patenting | |
| 4. Additional remarks | • Recommendations on how to strengthen cooperation and commercialisation of results | |

The tests conducted before launching the full survey and carrying out the analysis highlighted that knowledge of different issues is spread among a number of different offices within universities and it is very time consuming to collect it centrally. The tests also highlighted that FP beneficiaries receive a large number of requests therefore their propensity to collaborate is low especially as regards compiling open questions.

Considering these lessons, the questionnaire was considerably simplified and the number of open questions was reduced. Moreover, some technical adaptations were introduced to allow forwarding the survey, e.g. by the Rector, to as many relevant contacts as needed and to allow accessing it multiple times until the final responses are submitted.

### 4.1.3 Synthesis analysis across case studies

As in typical inductive research, data analysis is carried out by first building individual case studies and then comparing cases to construct a conceptual framework to provide empirical evidence. In particular we synthesize cases, analyse within cases and analyse cross cases. To avoid errors arising from halo effects and other interpretation biases, the compiled questionnaires and the transcribed notes were used by a set of team members to establish a preliminary framework. We followed an iterative process of marking quotes and concepts and reviewing our notes to identify patterns or common themes across interviewees. As already stated, the first step of our analysis was writing universities' individual cases. In

the second step the data were rearranged in a conceptual order searching for common and conflicting themes while, in the third step, we made cross case analysis to discover regularities and patterns.

This cross case analysis is focused on explaining the findings, on identifying commons patterns, draw overarching conclusions on the extent engagement, university-industry collaboration and innovation are affected by participation in the FPs.

The "layers" for cross-case analysis are set out below. For more information on these and corresponding evaluation questions, please refer to the Inception Report.

**Layer 1 -** Exploring the **main drivers of engagement** is essential for analysing the role and participation of universities in the FPs. As regards engagement, the evaluation questions required in the ToR can be grouped according to five categories of drivers; these are linked to:

- University motivations;
- Obstacles for participation;
- University Strategies;
- University Organization and Management;
- Other related issues (e.g. institutional impact of FP participation, follow up of funding…).

**Layer 2 - Industry-university collaboration** is an important form of public-private partnership and the case studies assess the university cooperation arrangements with industry as well as academia-industry mobility. In particular, the study focuses on: the industry support of individual university researchers via grants and contracts, where available; the presence of permanent university laboratories funded by industry consortia; the presence and importance of technology 'incubators'. The evaluation questions can be grouped according to the following categories of items:

- External collaboration with other universities or research organisations and with industry
- Industry-university mobility
- Post-degree training
- Collaboration with industry based on co-development of knowledge
- University role in the national and regional Innovation system

**Layer 3 -** In relation to **innovation path-ways**, the goal is to clarify and assess the strategic role of universities in stimulating innovation and economic growth, primarily though knowledge transfer. The evaluation questions listed in the tender's specifications can be grouped in two categories of items:

- Strategic role in stimulating innovation (e.g. to what extent universities work as incubators for spin-offs)
- Strategic role in stimulating economic growth (e.g. knowledge and technology transfer services to industry, commercialization of knowledge)

The following sections provide firstly an analysis across cases and then the individual fiches grouped by distinguishing between EU15, EU13 and Extra EU countries.

The choice to group cases on the basis of the geography was taken following the analysis of projects and participations carried out in the previous tasks which highlighted a strong concentration of participations and resources in western, central European and Nordic countries. In particular in a limited number of states and institutions which presumably have a critical mass that allows them to be more active and successful. This concentration clearly favours EU15 countries to the detriment of Eastern Europe which manages to attract less resources despite being able to compensate, in some way, their weaknesses by drawing upon Cohesion Policy which also allows them to invest considerably in research and innovation.

This sort of exclusion of an important part of Europe, mainly EU13 countries, seems a relevant policy issues which contrasts with the goal of creating an integrated ERA and facilitating the reduction of disparities also as far as research and innovation performance is concerned.

Finally the sample of cases, as it was previously pointed out, was selected with the goal of providing a balanced geographical coverage, hence the distinction of the three country groups allows emphasise the extent this coverage is actually achieved.

For the cross case analysis, all the 124 valid questionnaires collected are used, as far as possible. Therefore, the general statistics presented in the following paragraphs are relative to 124 cases rather than 75, unless differently specified.

## 4.2 Horizontal analysis of motivations, collaborations and pathways to innovation

### 4.2.1 Drivers for the engagement

**Main motives for participating in the EU Framework Programmes**

The objective of this section is to explore engagement of universities in Framework Programmes, with a focus on FP7. The organisations covered in the analysis were asked to rank the main motives for participation choosing from a list of options and indicating additional motives when relevant.

The main motives for participating are:

- satisfying funding needs, especially in a context of austerity and decreasing national financial support, which is ranked 1st by 35% of respondents;
- enhancing institutional reputation and international competitiveness (30%);
- positive effects on quality and quantity of scientific outputs (19%).

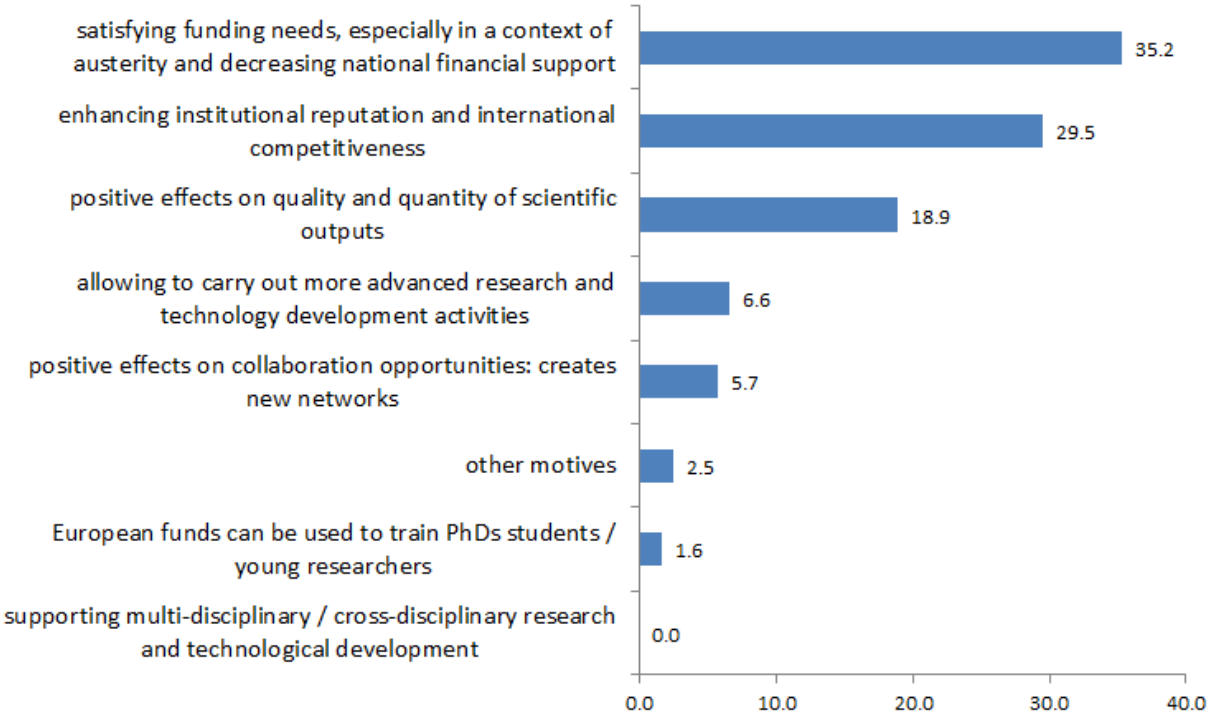
While the first motive is actually the consequence of a need, a necessary condition to conduct research, the second and third motives are underlined by an improvement strategy rather than being driven by a "material" necessity.

The analysis tells us that overall, the will to improve competitiveness and quality (when motivations 2 and 3 are considered together) represents the most important driver for the engagement of universities.

Motivations such as the possibility to support multi-disciplinary research and training of PhD/young researchers are considered much less important. However, also these motives can fall in the category of improvement, therefore they reinforce the claim previously made, namely a dedication improve the quality and competitiveness of the university is the most important reason behind participation.

If country groups are considered separately, it is worth noting that enhancing institutional reputation is the first motive in EU13 and Extra EU countries. A considerable number of EU13 cases believe that an important motivation is related to the positive effect of participation on quality and quantity of scientific outputs. In the Extra EU group, participation in FPs is also seen as an opportunity to carry out more advanced research and development initiatives.

**Figure 41 – Main motives for participation in Framework Programmes (% of respondents ranking 1st a specific motive)**



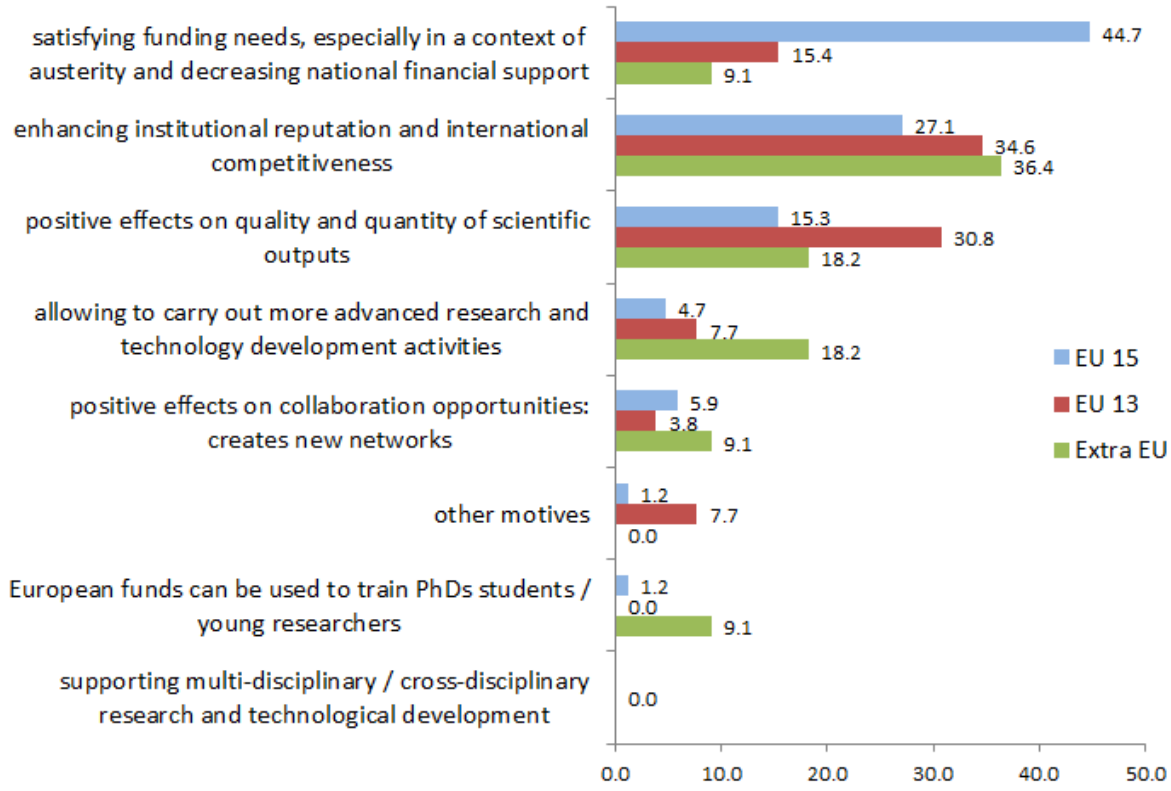

*Source: own elaboration on survey data*

**BOX 1: Motives for participation in EU Framework Programmes: the cases of EU 15 countries versus EU 13 and extra EU countries**

For many universities in EU15 countries, reputation is not an important driver for participation, and in any case, it is not as important as satisfying funding needs in a context of decreasing national financial support. For instance, the Claude Bernard University of Lyon, located in the south east of France and the Copenhagen Business School, located in Denmark do not mention institutional reputation at all among their motives while they stress the scarcity of funding and that, differently from other instruments, EU programmes support multidisciplinary and cross disciplinary research and technological development. Furthermore the two Institutions argue that participation has also positive effects on networking opportunities.
On the contrary, for a large number of EU13 and Extra EU universities institutional reputation is the main driver for the engagement. For example, Babes-Bolai University in Romania, the University of Pecs in Hungary, the University of Rijeka in Croatia, the Vilnius Gediminas Technical University in Lithuania and the University of Zilina in Slovakia as well the Extra EU Universities of Geneve and Oslo highlight that joining the European Framework Programmes is essential to either build up or strengthen institutional reputation.

Other motives, though of marginal importance, were mentioned. These are mostly linked to building up experience, easier pathways to apply for other grants or the possibility to contribute to regional development and employment.

**Figure 42 – Main motives for participation in Framework Programmes by country group (% of respondents ranking 1st a specific motive)**




*Source: authors' elaboration on survey data*

In most cases (98% of the responding organisations) the intended effects underlying the listed motives for participating in FPs were achieved through carrying out the projects.

Nonetheless, FPs are not the only option available to carry out high quality research. 86% of the universities which responded positively to the survey highlighted that there is one or more examples of funding scheme which are similar to the EU FPs, including national, regional and European instruments (e.g. Structural Funds). Examples of similar schemes, in the opinion of universities, are listed in the individual case studies where relevant (see Annex).

**BOX 2: Similar but alternative funding instruments: the cases of France, United Kingdom and Italy**

Most of the Universities highlight that there are several alternative but similar funding instruments available both at regional and national level. These, sometimes funded by the national government, sometimes co-financed by the EU (e.g. ERDF), are often perceived almost equivalent to the FP schemes, especially as far as collaborative research is concerned, and can produce considerable displacement effects.

The British Universities (i.e. Loughborough University, De Montfort University, Queen Mary University of London, University of Strathclyde) mention: Innovate UK funding streams managed by Innovative UK and funded by the Central Government; ERDF co-financed initiatives; Establishment of national Catapult technology innovation centers managed and funded by Government; Research Councils UK - RCUK (EPSRC, BBSRC, ESRC etc.) managed by the National Government; Knowledge Exchange Partnerships managed by the National Government; Newton funds.

The French Universities (i.e. Claude Bernard University Lyon 1, Ecole Normale Superieure, University of Paris VIII) mention: Investissements d'avenir and Fonds Unique Interministeriel (in the first case the funding source is the Government while in the second one it is a mix of national, regional and local sources); ANR projects (Agence nationale de la recherché); the scheme Appel a projects generique, managed by the National Government; DIM, managed and funded by Region Ile de France; the scheme Appel a projects structuration de la recherché managed by Excellence French Initiative and funded by PSL (Paris Sciences et Lettres – Research university).

The Italian Universities (i.e. University of Brescia, Polytechnic University of Turin, University of Siena, University of Trento, University of Trieste) mention: the Life programme managed by the Ministry of Environment and financed by the EU; the PRIN and SIR schemes managed by the Ministry of Education and University Research; other schemes financed by foundations such as Fondazione Cariplo, the Telethon foundation and AIRC, Italian Association for Research on Cancer; several regional initiatives co-financed by ERDF.

### Obstacles to participation

The universities were requested to express their views on the most important obstacles to participation, focusing on the most recent projects carried out as part of FP7. In particular, they were asked to assess a number of obstacles by means of a 5-point Likert scale. The results are shown in the figure below.

Considering that the score 3 indicates neutrality, the respondent agree on the fact that all items displayed in the figure are actual obstacles, except the lack of information on calls. This is clearly not an issue as the respondents highlight that there is, on the contrary, abundance of information on funding opportunities.

The most important obstacles include: the probability of failure, which is too high, considering the cost of applying; the lack of time available among researchers, who are too busy with education and routine research activities, while EU projects require a considerable coordination effort; finally, bureaucracy is also considered an important constraint.

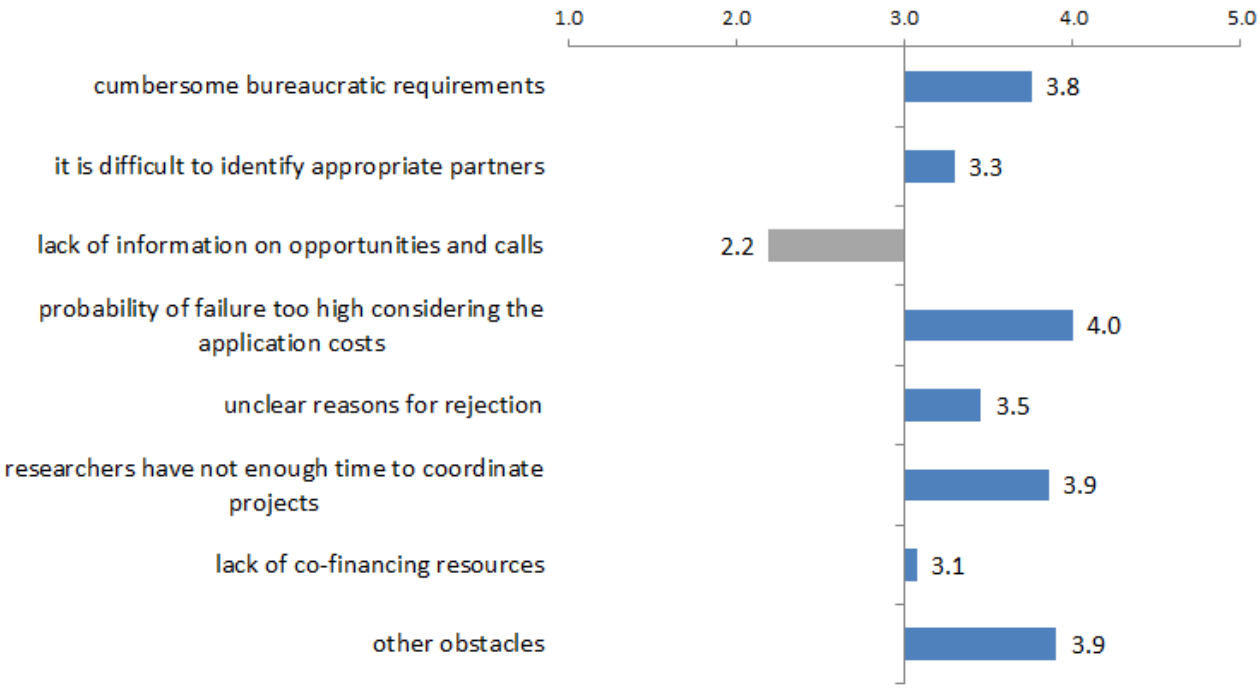
While the first obstacle is more exogenous, as it is related to the costs of applying which are considered in general high, the following obstacles are endogenous in nature, as they are much more related to internal capacities and competences.

The analysis reveals the complex nature of the implementation process and suggests that application costs significantly affect differences in participation status and the outcome of a support programme.

This result contrasts with the idea that the mere increase of available funds to promote R&D will inevitably lead to greater benefits. In fact, an increased amount of dedicated resources may only partially affect self-selection mechanisms in the eligible population of universities. The existence of significant application costs suggests that, rather than increasing the amount of public funds, measures for reducing application costs, such as help desks or information networks, greater transparency, minimisation of bureaucracy and simplification and standardisation of application procedures can contribute to increase application rates of eligible organisations.

Other limits, though less important, include: unclear reasons for rejection which do not allow learning and improving adequately the quality of proposals; difficulty in identifying appropriate partners for collaborative research.

**Figure 43 – Obstacles to participation (5-point Likert scale: 1=strongly disagree, 5=strongly agree)**

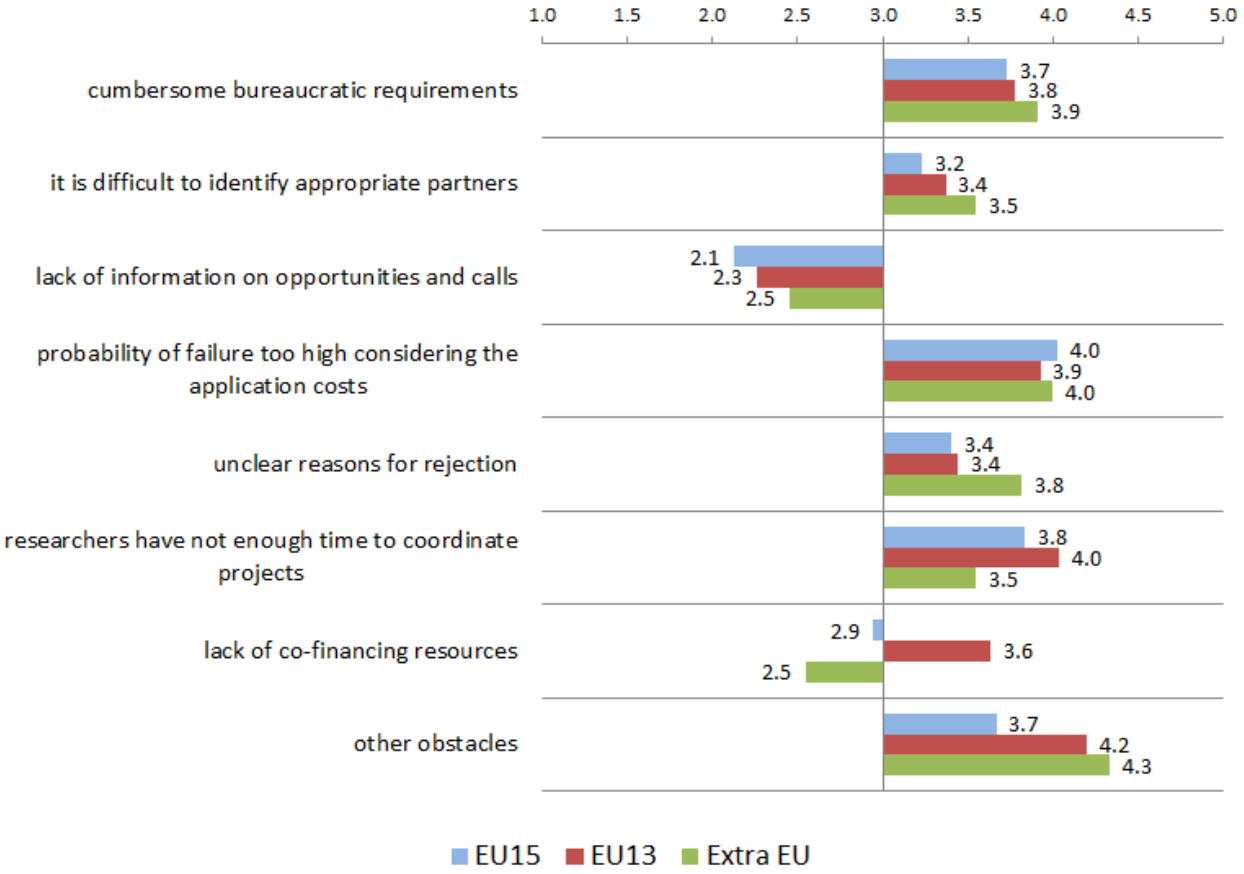



*Source: authors' elaboration on survey data*

There are other specific obstacles which were highlighted by the organisations. Some institutes from EU15 Member States pointed out that there is a perception among academics that national research funding is easier to get and still relatively abundant. In other words, FPs are often displaced by national/regional instruments. Moreover, some respondents highlighted that FP calls are too much oriented towards industry. An approach which is too much inter-disciplinary is not in line with the research activities and objectives of many University's researchers. According to some respondents, some fields of research (Humanities, etc.) are not well represented. Finally, language (i.e. English) is still considered an issue sometimes.

In the EU13, other obstacles include: lack of funds to initiate international meetings - to start and enhance international contacts, collaborations etc.; lower success rate of projects coordinated by newer Member States of the EU; national barrier as regards staff financing; the lack of time and personnel competent in professional and bureaucratic issues, and in general, a lack of experience with international projects. Some respondents highlight that there are lobbies of countries or organisations formed in previous successful projects and hence there are "entry barriers" difficult to penetrate.

**Figure 44 – Obstacles to participation across country groups (5-point Likert scale)**




*Source: authors' elaboration on survey data*

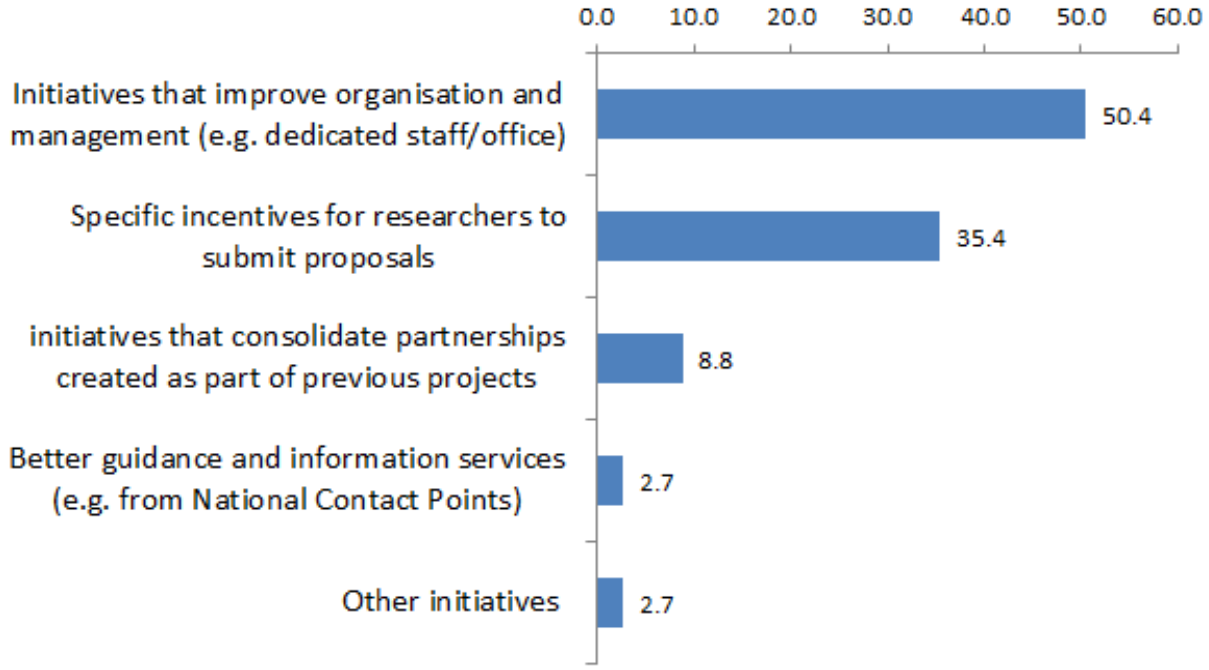
In the Extra EU countries covered in the analysis, Switzerland, Norway and Israel, additional obstacles mentioned by respondents include: lack of international networks; teaching workload; difficulty to motivate scientific staff since the quality of European research is sometimes considered not as high as that carried out in other contexts (e.g. in the USA); finally, the calls' topics are not always relevant.

The university representatives were asked to assess what initiatives, in their experience, could increase participation in current and future Framework Programmes (Horizon 2020 and beyond). They had to rank a number of possible options from the most to the least important. The results of this ranking are shown in the figure below.

Improving organisation and management of international projects by strengthening a dedicated structure, when it exists, or setting it up when it is does not exist, is the most important initiative. This option is ranked 1st in approx. 50% of the cases.

In 35% of the cases, specific incentives for researchers that submit proposals are deemed essential, considering also the importance of the lack of time to coordinate EU projects which is one of the most important obstacles to participation.

**Figure 45 – Initiatives that could increase participation in future FPs (% of respondents ranking 1st a specific motive)**



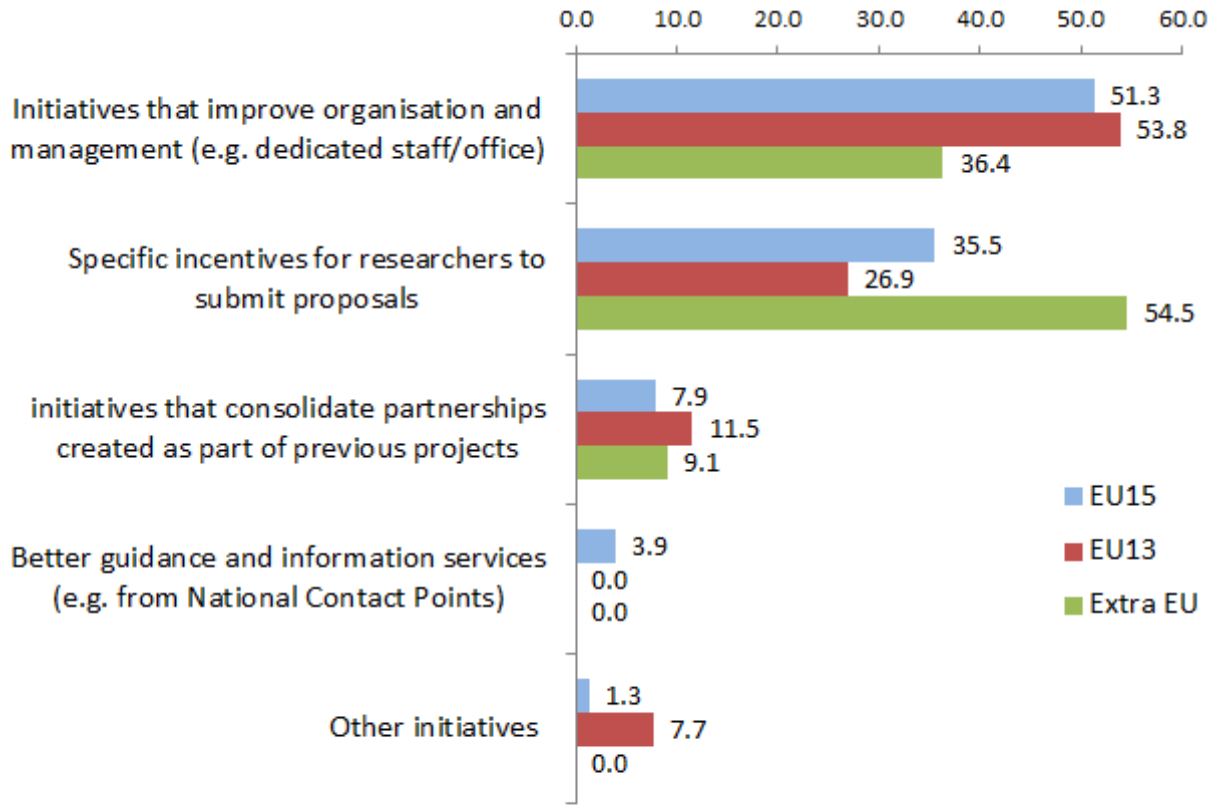

*Source: authors' elaboration on survey data*

Another initiative to increase future participation, mentioned by respondents, is foreseeing a financial support to assist prepare applications and consortium building. This is something that could well be financed by, for instance, ERDF Operational Programmes. Some respondents from Eastern Europe highlight that their teams had to accept penalising financial conditions, when joining consortia; they highlight that academics in western countries can earn a multiple of their fees for conducting the same tasks.

Differences in views are not considerable across country groups. The views of EU15 and EU13 countries are more or less in line. Extra EU universities that participated in the survey highlight that the most important initiative to boost participation would be focusing on specific incentives for researchers to submit proposals.

As regards the need to improve organisation and management, 90% of respondents already have a dedicated support structure; 78% of them provide a web link. This information is included in the individual cases attached to the report.

**Figure 46 – Initiatives that could increase participation in future FPs across groups of countries (% of respondents ranking 1st a specific motive)**

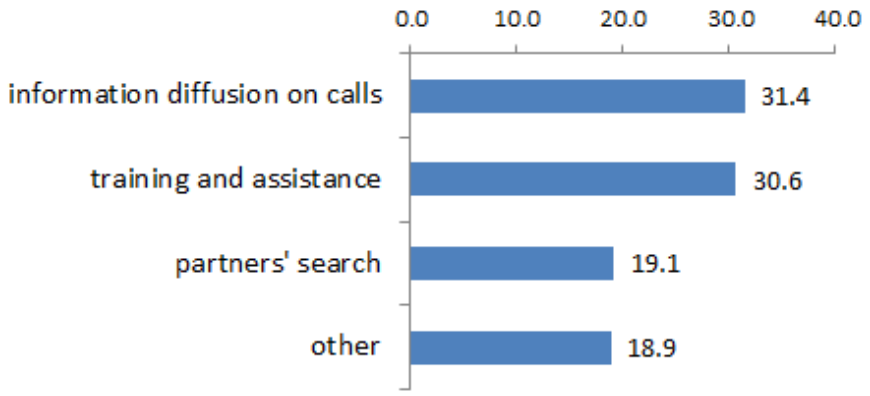



*Source: authors' elaboration on survey data*

The services provided by the offices that support participation in EU tenders include, in order of importance: 1) information diffusion on calls, 2) training and assistance, 3) partners' search and other services such as IPR support, review of proposals, 4) organisation of events and workshops, engagement of political stakeholders etc. The following figure shows the percentage of respondents ranking 1st a specific motive.

It is worth noting that despite the large majority of institutions can count on one or more specialised structure which is in charge to support participation in collaborative projects, this does not seem to mitigate the problem of limited time of researchers which is indicated as one of the main obstacles to seizing EU funding. This result suggest that a lot needs to be done to strengthen and empower these structures and universities seem to be aware of this issue as they rank first initiative to improve dedicated structures among the set of actions which could improve participation.

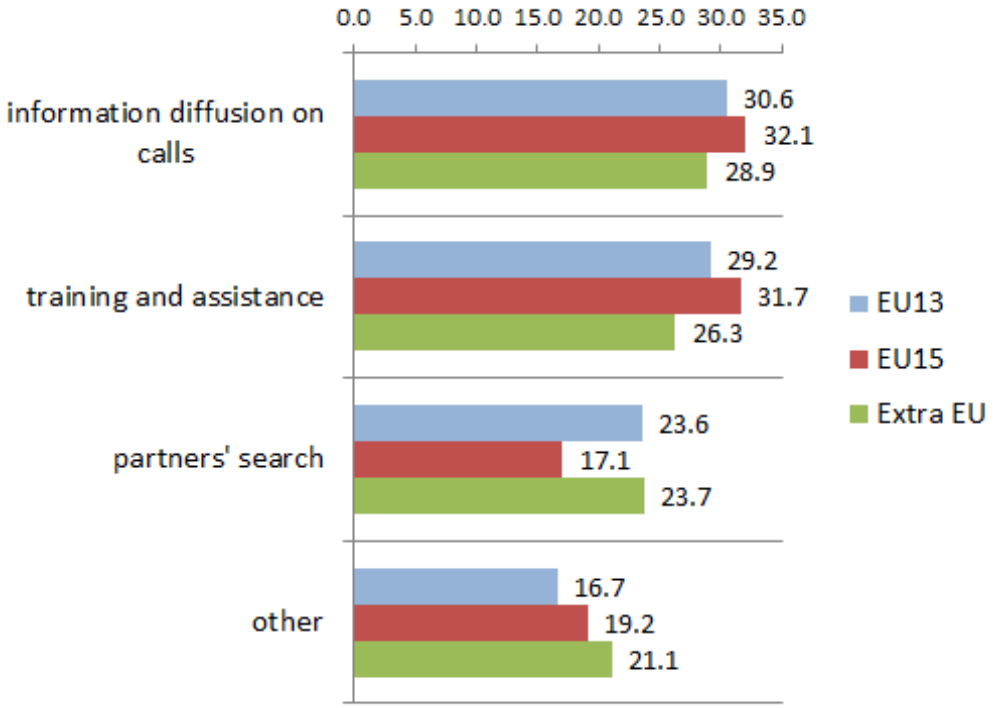
**Figure 47 – Services provided by dedicated structures (% of respondents ranking 1st a specific motive)**




*Source: authors' elaboration on survey data*

The figure below shows the relative importance of services provided across EU country groups. No considerable differences emerge in comparison with aggregate data.

**Figure 48 – Services provided by dedicated structures across country groups (% of respondents ranking 1st a specific motive)**




*Source: authors' elaboration on survey data*

**BOX 3: Dedicated support structure for facilitating participation in EU programmes: the Loughborough University case**

The Research Office coordinates the University's efforts to manage its research activity in a strategic, streamlined and effective manner. The office reports to the Pro-Vice-Chancellor for Research.
In 2011/12, the office processed some 897 applications for external funding (per year), with a total value of £ 170.63 million, resulting in a research income of £ 41.4 million.
The office is divided in three main teams: Pre-award, Planning & Policy, Development. It works closely with academic schools and a number of professional service teams including the Research Student Office, the Graduate School, and the Enterprise Office.
The Pre-Award staff has responsibility for: assistance with costing, pricing and authorization of all externally funded research applications, research contract negotiation, acceptance of grants, contracts and awards, issuing of project codes. The Planning & policy staff has responsibility for: research assessment exercises, LUPIN - Loughborough University Publications INformation system, research governance and ethics, research data and benchmarking, public engagement. The Development staff has responsibility for: supporting the development of complex funding bids, coordinating the development of research partnerships, and identification of major funding opportunities.

web link: http://www.lboro.ac.uk/service/research/offcampus/

**BOX 4: Dedicated support structure: the Grants Office of Lulea University**

The Grants Office facilitates Lulea University participation in EU projects. The Office supports researchers in finding the best ways to finance their ideas.
The team offers advisory services in the following areas: strategic planning for research funding on international, national and regional levels; identification of suitable support programmes for a particular research project; assistance in the preparation of funding applications, including budgeting; seminars and workshops about external funding; identification of funding for PhD students and other personnel.
The expertise of the Office covers: the EU Framework Programmes and in particular HORIZON 2020; national programs within VINNOVA (innovation agency), the Swedish Research Council VR, FORMAS, FORTE etc.; Regional programmes, such as those co-financed by the European Regional Development Fund (ERDF), the European Social Fund (ESF), as well as cross border cooperation programs (Interreg, Bothnia Atlantica, Nord, Baltic Sea, Kolarctic etc.).

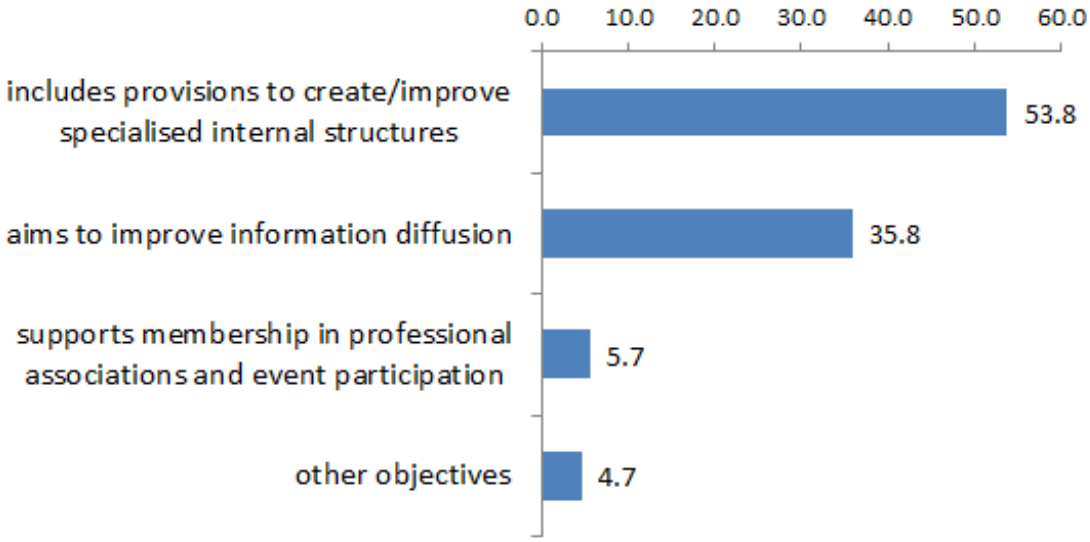
web link: http://www.ltu.se/research/Forskningsfinansiering?l=en.

### Strategy to facilitate participation

According to the case studies, 87% of the responding organisations have a strategy which includes provisions and initiatives aiming at increasing participation in EU programmes. There are minor differences across country groups meaning that the largest majority of universities do have a strategy. However, in only 25% of the universities the strategy is available online and can be accessed externally.

The respondents were asked to rank in order of importance the main features of the strategy as regards improving participation in EU research programmes. The most important features are shown below: 1) provisions to strengthen or create specialised support structures; 2) information diffusion; 3) facilitate networking through support to membership in professional associations and event participation.

**Figure 49 – Features of the university strategy as regards improving participation in EU FPs (% of respondents ranking 1st a specific motive)**




*Source: authors' elaboration on survey data*

There are no substantial differences across country groups, apart from Extra EU respondents for which strengthening support structures and information diffusion are equally important.

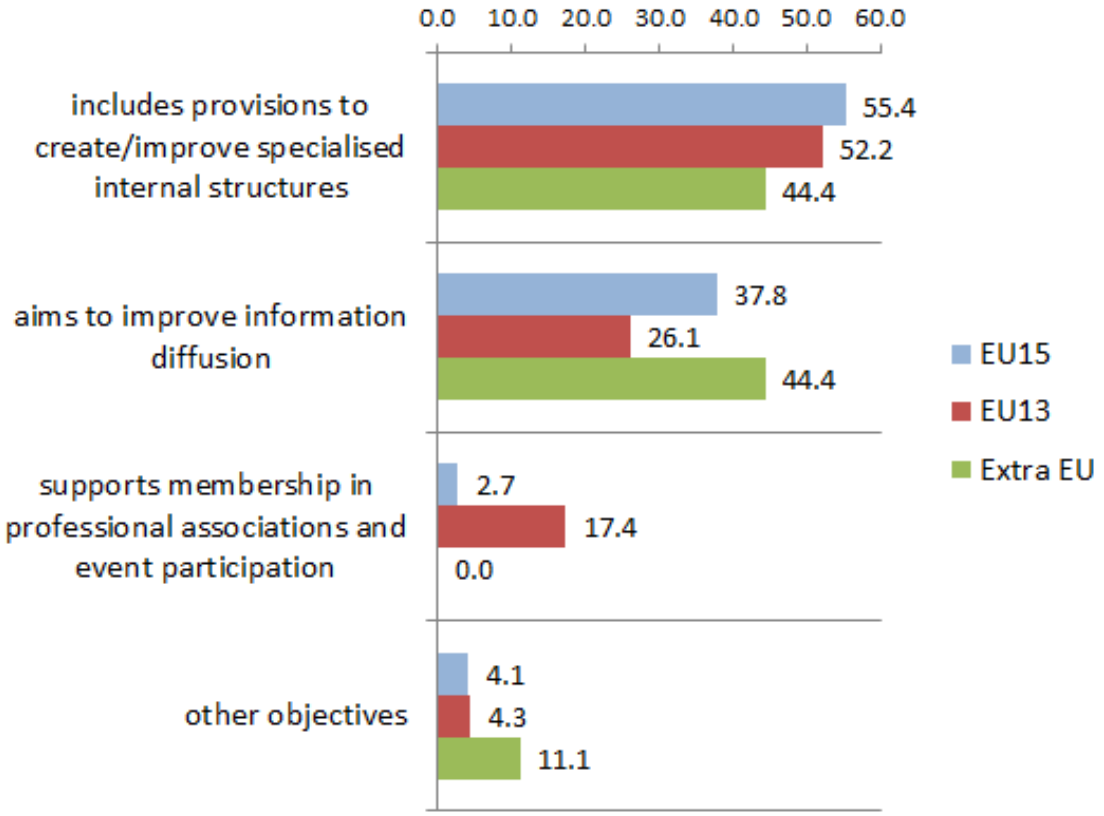
In the EU15, other relevant features of the strategy include:

- Develop the capability of academics to prepare competitive applications
- Efficient management of granted projects
- Encouraging more academics to become expert evaluators/peer reviewers
- Provide financial support to researchers engaging in EU applications
- Participation in Technology Platforms
- Training of staff, support on writing proposal, advice on cost declaration and audit.

In the EU13, strategic provisions aiming at increasing participation include:

- internal evaluation of researchers that function as a motivational system;
- a separate HR unit dedicated to support local, incoming and outgoing researchers;
- strengthening start–up financing, and facilitating the creation of new research laboratories;
- liaising with consulting organisations in order to provide adequate support in preparing high quality applications.

**Figure 50 – Features of the university strategy as regards improving participation in EU FPs (% of respondents ranking 1st a specific motive)**




*Source: authors' elaboration on survey data*

### 4.2.2 Collaboration with other research organisations and industry

**External collaboration**

Participation in FPs facilitated research cooperation with other universities, other research organisations or regions in all cases, according to respondents.

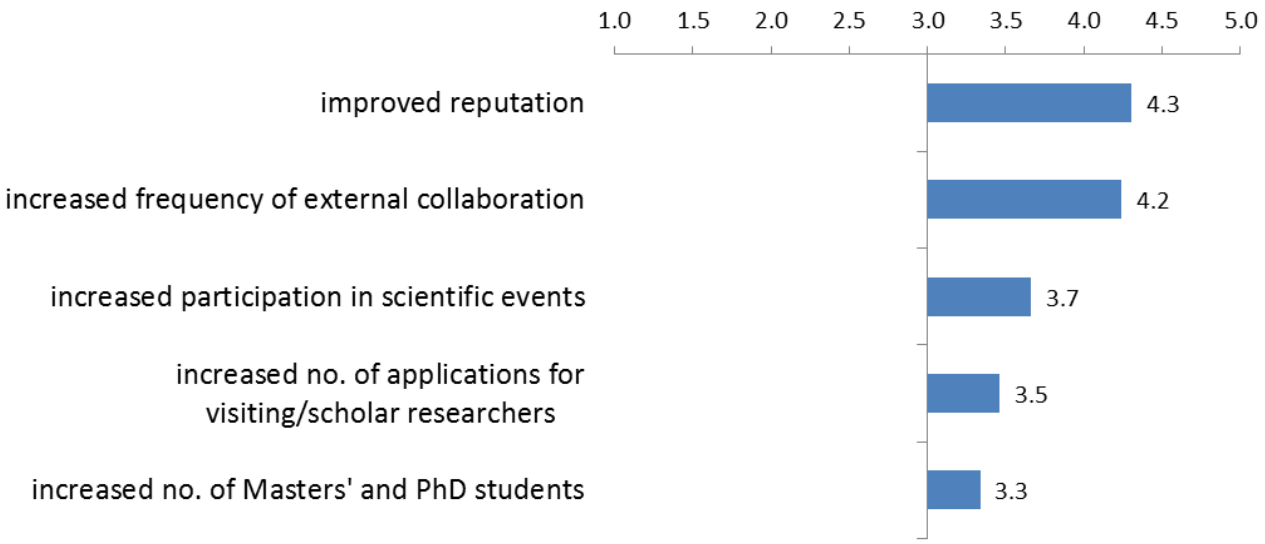
Cooperation is mostly international/cross border, involving organisation from different regions. It can be both short term or long term, when it continues after the conclusion of the projects. In a considerable number of cases the universities highlight that cross border cooperation is long term.

The universities were asked in what way participation in EU Framework Programmes improved the attractiveness of the organisation. In particular, they were asked to assess a number of effects of participation by means of a 5-point Likert scale. The results are shown in the figure below.

The respondents believe that participation had mostly positive effects and they do not disagreed with any of the claims. According to the universities, participation in EU FPs enhanced reputation, competiveness and excellence. Several universities highlight that their international visibility improved considerably. Moreover, participation increased the frequency of external collaborations, strengthening, in particular, international relations. Respondents moderately agree, on average, on the claim that greater reputation attracts more talents as showed by the number of applications for visiting research positions and by the number of Master's or PhD students.

Reputation is the second motive underlying participation, as previously emphasised. Therefore, the responses point out that the intended improvements are achieved as far as reputation is concerned. The other improvements are either not very important among the motives (e.g. increase frequency of collaboration) or not a motive at all (e.g. higher number of PhD and Masters' students). Hence, there are also positive effects of participation in FPs which emerged spontaneously and were not directly "looked for".

**Figure 51 – How participation in EU FPs improved university attractiveness (5 point Likert scale)**




*Source: authors' elaboration on survey data*

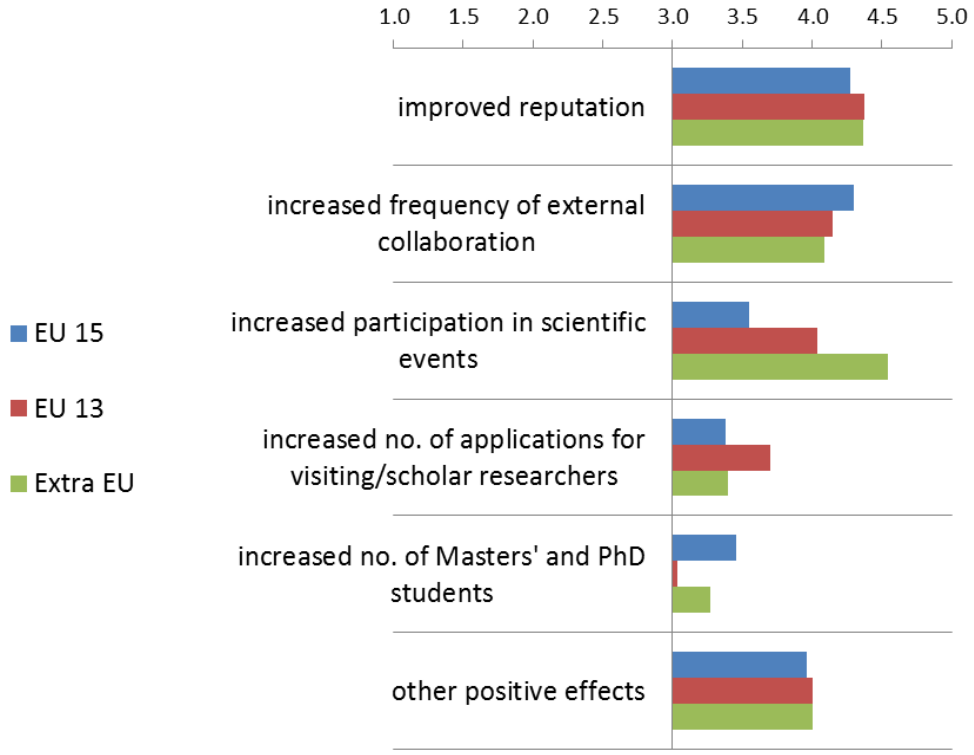
Other positive effects of participation include:

- Significant additional resources available for research in general which allow investments and upgrade at labs level, through better infrastructures and equipment.
- EU-funded projects are positively evaluated in all assessment exercises at national level, with increase national funds for the University and visibility on media.
- Better research quality and contact with the private sector.
- Increased experience of the staff.
- Creation and/or further development of European research networks.
- Increase in the number of publications.

It is worth noting that some universities point out the lack of quantitative monitoring indicators on results and effects and hence the impossibility to go beyond perceptions and qualitative assessments.

Some differences in the responses by country groups are highlighted in the following figures. While all universities have roughly the same opinions on the positive effects of participation in FPs on reputation and external collaboration, the opportunity to participate in scientific events is particularly important for Extra EU and EU13 countries and the increase in visiting researchers is considered more visible in Eastern Europe.

**Figure 52 – How participation in EU FPs improved university attractiveness across EU country groups (5 point Likert scale: 1=strongly disagree, 5=strongly agree)**




*Source: authors' elaboration on survey data*

**University-industry cooperation**

Respondents were asked to provide an assessment, based on their experience, of the perceived impact of participation in EU Framework Programmes on university-industry cooperation and in particular on university-industry mobility. Universities are very positive in relation to effects on mobility and post-

degree training. Nearly all of them highlight that there was a positive impact of participation in this respect even though they are not able to "isolate" and quantify FPs outcomes.

In approximately half of the cases covered in the analysis there are academia-industry mobility programmes in place (financed by the government, the EU or with own resources) aiming at increasing the mobility of students or researchers. The individual cases provide examples of these schemes, with information on who manages them and on results in terms of number of students or researchers hired, when available.

**BOX 5: Academia-industry mobility programmes: the case of Deutschlandstipendium at University of Hamburg**

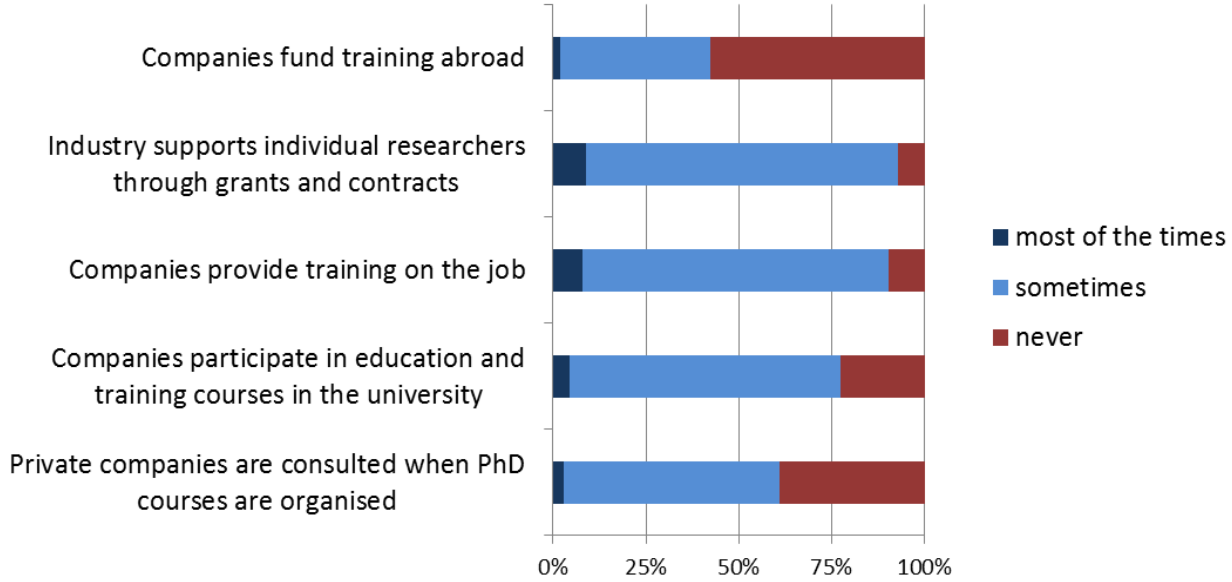
The University of Hamburg participated 91 times in the FP7 and coordinated 25 projects. The total amount of EU funding received is approx. EUR 47.8 million. The university ranks 18th in the country by no. of projects (out of 188 German universities) and 115th in Europe (out of 1,274 universities). The University of Hamburg manages the Deutschlandstipendium, an example of academia-industry mobility programme.
The mentioned scheme is co-financed by the Industry and BMBF. The Deutschlandstipendium provides financial and non-material support to high-achieving and committed students from all over the world. Modelled after the principle of public-private partnership, companies, foundations or individuals sponsor young talents with a pledge of € 150 per month. The Federal Government matches this amount with additional € 150. Many universities and private sponsors also support Deutschlandstipendium holders through concurrent mentoring programmes, networking events and internships.

**BOX 6: Academia-industry mobility programmes: the case of Huawei-UvA Telecom Seeds for the Future Programme at the University of Amsterdam - UvA**

The University of Amsterdam participated 192 times in the FP7 and coordinated 87 projects. The total amount of EU funding received is approx. EUR 110.5 million. The University ranks 8th in the country by no. of projects (out of 35 Dutch universities) and 53th in Europe (out of 1,274 universities). The university manages "Seeds for the Future", an interesting example of academia-industry mobility programmes, together with Huawei Technologies Netherlands B.V. which also finances the scheme.
Huawei, a global ICT solutions provider, and the University of Amsterdam have joined forces to offer the first innovative mobility programme of this kind in the Netherlands. The programme, which was officially launched in 2014, gives UvA students the opportunity to develop their ICT skills and industry expertise, while also helping them gain experience in cross-cultural work practices and introducing them to Chinese culture. Top students in the fields of Science & ICT and Economics & Business went through a strict selection process. A total of 15 students were selected on the basis of their resume, grades, letters of motivation and a short introductory video. These students travelled to China where they attended a cultural immersion course at the Beijing University of Language and Culture, learned the basics of the Chinese language and received an introduction to Chinese culture. Moreover, as part of the programme, they get hands-on experience and gain new technical expertise at Huawei's headquarters in Shenzhen.

Nearly all universities point out that companies participate in curricula design and training of PhDs. The following figure shows how private firms participate: mostly by supporting individual researchers through grants, by providing training on the job or participating in education and training courses. Often, though less frequently, companies contribute to design PhD courses and fund training abroad.

**Figure 53 – How companies participate in curricula design and training of PhD**




*Source: authors' elaboration on survey data*

Universities were asked to indicate examples of university laboratories permanently funded by industry and/or industry consortia and, if possible, to indicated a web link.

In 22 cases, universities can provide at least one example of laboratory which is permanently financed by industry. Six universities, from Austria, Germany, Italy, UK, Poland and Cyprus, are able to indicate two examples of laboratories. Three universities from Austria, Italy and Cyprus list 3 examples.

**BOX 7: University laboratories permanently funded by industry: the case of CAT and E.ON ERC at RWTH Aachen University**

The RWTH University of Aachen participated 230 times in the FP7 and coordinated 39 projects. The total amount of EU funding received is approx. EUR 97.9 million. The university ranks 4th in the country by no. of projects (out of 188 German universities) and 40th in Europe (out of 1,274 universities). The Aachen University hosts two of labs permanently funded by industry: the CAT Catalytic Centre (www.catalyticcenter.rwth-aachen.de) and the E.ON Energy Research Center ERC (www.eonerc.rwth-aachen.de).

CAT key expertise' is in the triangle of catalyst development, reaction engineering and material development. In a proprietary approach, CAT studies catalysis and acts as a catalyst between academia and industry. It receives its basic funding by the three partners: RWTH Aachen University, Bayer Material Science and Bayer Technology Services. Project-related funding enhances the financial basis of CAT. Bayer Material Science had invested approx. EUR 6.05 million as initial funding into CAT Catalytic Center, Bayer Technology Services invested about EUR 1.25 million and the State of North Rhine-Westphalia and RWTH Aachen University contributed with EUR 2.7 million.

The mission of the E.ON is to develop a comprehensive understanding of how sustainable energy can be realized. It is the result of a public-private partnership between industry (one of the largest European energy companies) and the scientific community. RWTH Aachen University has explicitly declared that it will continue to support this research center beyond the initial financially guaranteed period of ten years. Under these prerequisites the E.ON ERC has every opportunity and right to maintain this position on a long-term basis and to develop it further in the future.

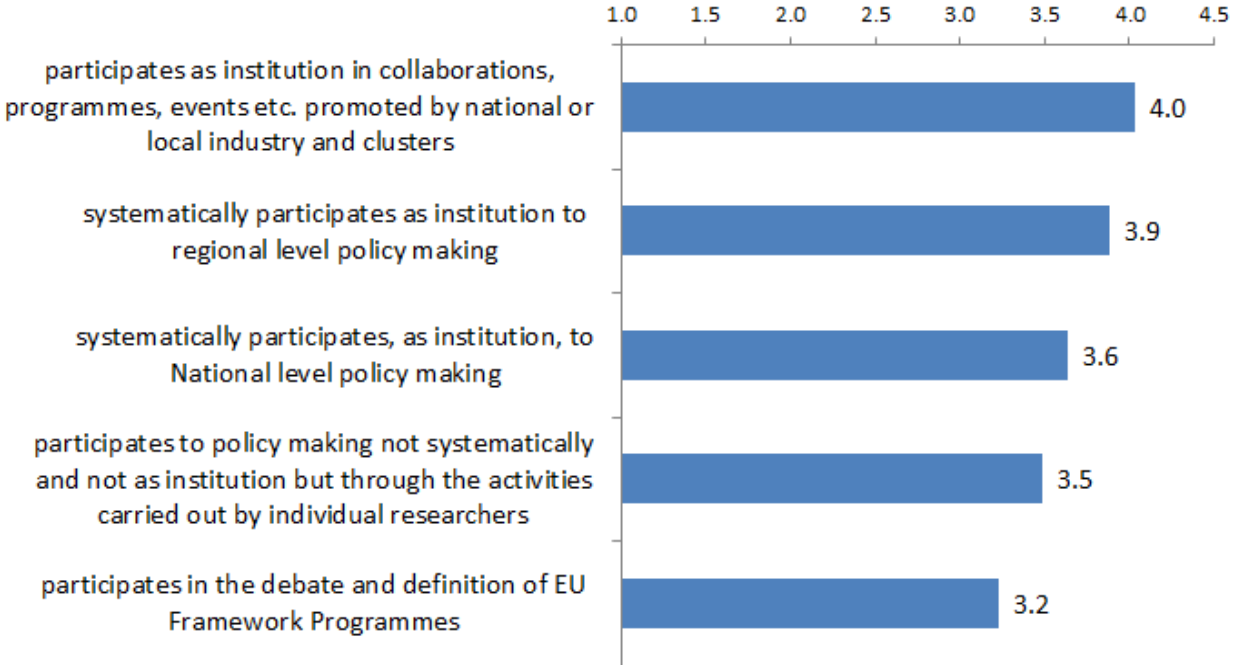
Industry-university cooperation activities established thanks to the EU programmes tend to continue after the duration of the project financing in the large majority of cases (95% of respondents). In nearly all cases, the university participates as institution in collaborations, programmes, events etc. promoted by national or local industry and clusters.

In order to understand the wider role of universities in the national or regional innovation system, participants were asked their view on the engagement in local industry activities as well on the contribution to policy making. In particular, they were asked to assess a series of claims by means of a 5-point Likert scale. The results are shown in the figure below.

**BOX 8: University laboratories permanently funded by industry: the case of CWC at the University of Oulu**

The Finnish University of Oulu participated 77 times in the FP7 and coordinated 18 projects. The total amount of EU funding received is approximately EUR 34 million. The university ranks 4th in the country by number of projects (out of 21 Finnish universities) and 124th in Europe (out of 1,274 universities). An example of University laboratory permanently funded by industry and consortia in the University of Oulu is the Center for Wireless Communication, CWC (http://www.cwc.oulu.fi/home/index.php).
CWC is a large university-based research group operating within the Department of Communications Engineering. It aims at mastering future wireless communications, the myriad of requirements and related potential technological solutions. In its activities, CWC need to react rapidly to changes occurring in its operational environment as well as to the expectations and needs expressed by its national and global research partners. 75-80% of CWC funding is granted by external sources including the European Commission, the European Defence Agency, Tekes, the Academy of Finland, and national and international companies. The research group runs 40-50 externally funded research projects annually. The organisation aims at building knowledge continuously and fostering academic achievements. These objectives are harmonised with the demands of project work where the interests of all cooperation partners are combined to achieve ideal results. CWC's research partners include a broad variety of organisations such as national and foreign companies, national governmental organisations, multinational organisations and foundations.

**Figure 54 – Role of the universities in the national innovation system (5-point Liker scale)**

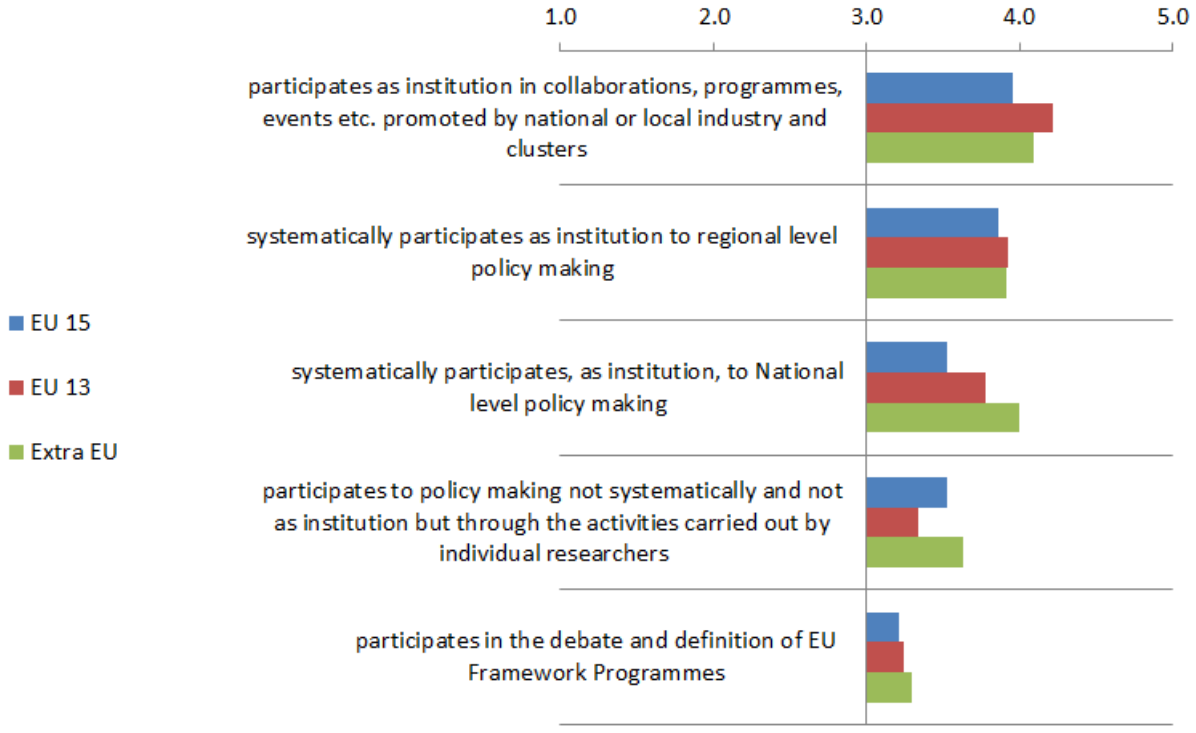



*Source: authors' elaboration on survey data*

The results of the assessment of the role of universities in the national innovation systems, across groups of countries, are shown in the following figure. There are no considerable differences, though respondents

from Extra EU and EU13 believe to be more active as institution in relation to national policy making. EU15 and Extra EU highlight that an important channel for contributing to policy making is through the activities of individual researchers.

**Figure 55 – Role in the national innovation system across country groups (5-point Likert scale)**




*Source: authors' elaboration on survey data*

Universities were asked also whether they participated in the development of the regional Smart Specialisation Strategy, an ex-ante conditionality of the Cohesion Policy 2014-2020 and an important tool for promoting coherence between EU and regional policy and contribute to achieve EU2020.

Approximately 60% of respondents confirm that the universities participated in the development of the Strategy to a varying degree such as:

- Producing preparatory studies: foresights, position papers etc.
- Assisting the public administrations in drafting the strategy, carrying out the analysis, mapping research and innovation strengths, selecting investment priorities etc.
- Taking part in *ad hoc* working groups, meetings, discussions with the policy makers and regional stakeholders (industry and other universities and research organisations).
- Participating in public consultations and online surveys on Smart Specialisation.
- Not institutionally but through the involvement of individual researchers in scientific and consulting activities.

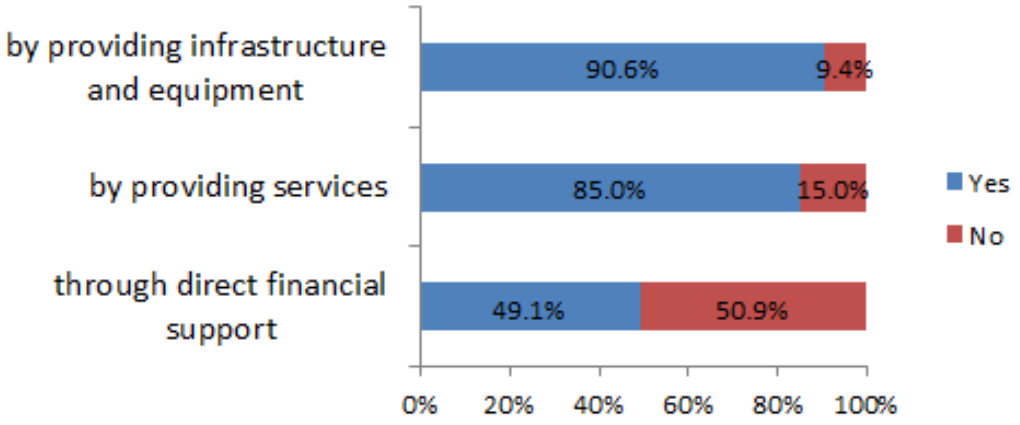
### 4.2.3 Pathways to innovation

**Spin-offs and incubators**

The universities were asked to provide an assessment, based on their experience, of the effects of participation in EU Framework Programmes on spin-off incubation. 70% of respondents believe that participation in EU FPs had a positive effect on incubation of spin-offs.

As part of their current activities, 75% of universities covered in this analysis support spin-offs. They do so mostly by providing services or infrastructures and, to a lesser extent, by means of direct financial support as shown in the following figure.

**Figure 56 – How universities support spin-offs**

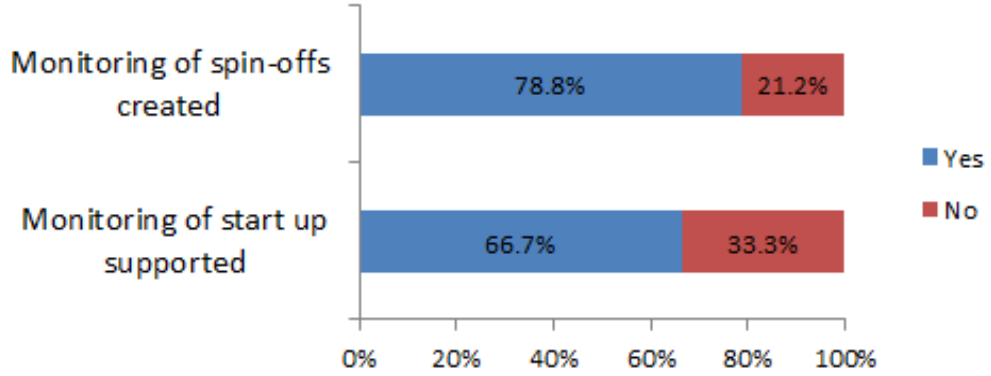



*Source: authors' elaboration on survey data*

Support services mostly include:

- Information and advice such as specialized training and guidance on business planning and management, preparation of proposals
- Fund raising and negotiation with potential investors
- IPR management and free licencing of IPR
- Market research in cooperation with 3rd parties
- Technology reviews and assessment of market opportunities, proof of concept activities
- Search of external commercial expertise to develop ideas "from research to retail".

**Figure 57 – To what extent universities monitor the creation of spin-offs and the start-up supported**

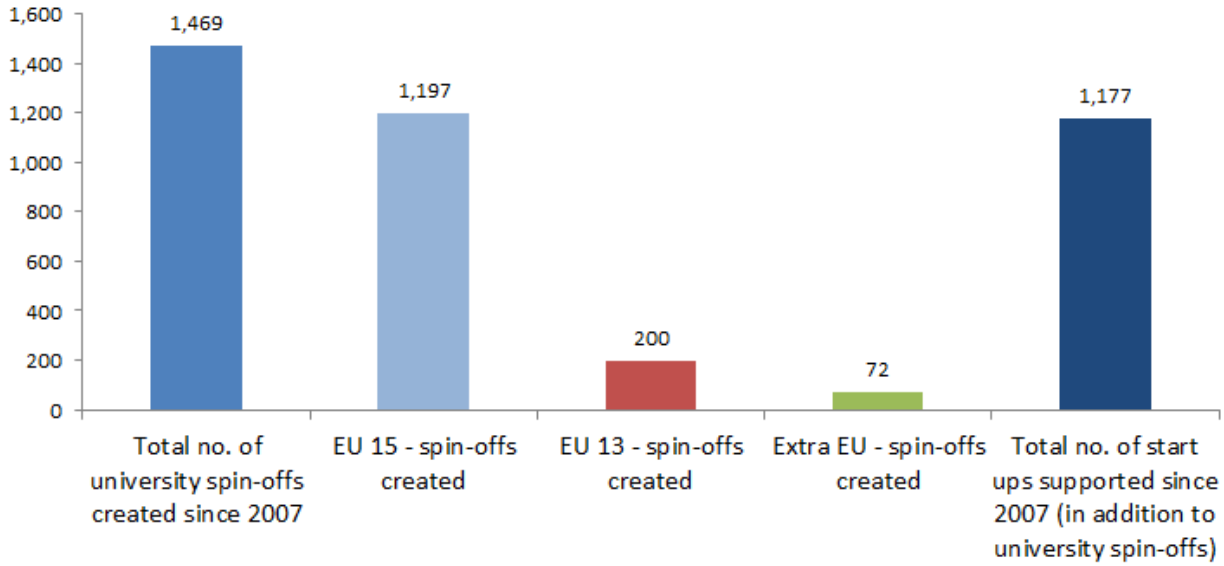



*Source: authors' elaboration on survey data*

Only a share of universities (approx. 60% of those covered) seems able to provide information on spin-offs and support to start ups depending on their monitoring systems. The estimated figures on university spin-offs and, more generally on start-ups supported since 2007 are displayed in the figure below. The individual cases show that among the universities that monitor these features there is a strict relation between presence of an incubator (or a start-up accelerator) and the results in terms of generation of spin-offs.

Since this figure shows only monitored spin-offs and start-ups, this is likely to be an underestimate of the actual figures.

**Figure 58 – Spin-offs created and start-ups supported since 2007**




*Source: authors' elaboration on survey data*

Half of the universities covered in the case studies were able to provide some information on the spin-offs created in relation to FP7 projects carried out but only approx. 1/5th (26 institutes) were able to quantify the share of spin-offs emerging from the FP7 (as % of total spin-offs created by university researchers). For these universities, on average, 1 out of 7 spin-off created (or approx. 14%) was somehow related to FP projects carried out since 2007.

**BOX 9: Spin-offs support and incubators: the example of the University of Oslo**

The University of Oslo participated 154 times in the FP7 and coordinated 53 projects (approx. 1/3 of the total participated). The total amount of EU funding received is approximately EUR 89.3 million. The university ranks first in the country by number of projects (out of 24 Norway universities) and 72nd in Europe (out of 1,274 universities).
Most universities help spin-offs and start-ups by providing different types of support and a variety of services. The University of Oslo supports spin-offs by providing infrastructure, equipment and services such as business planning, finance, legal and tax assistance. Sometimes it also provides direct financial support.
There is an incubator, Inven2, for spin-offs and start-ups (http://www.inven2.com/no). Inven2 is the largest contributor in Norway within the field of commercialisation of research. It is owned by the University of Oslo and Oslo University Hospital, Norway's largest and leading university and hospital which carries out pioneering medical research.
The incubator is responsible for: commercialising innovations; administration of research funds and administration and financial follow up of clinical trials.

**Technology transfer**

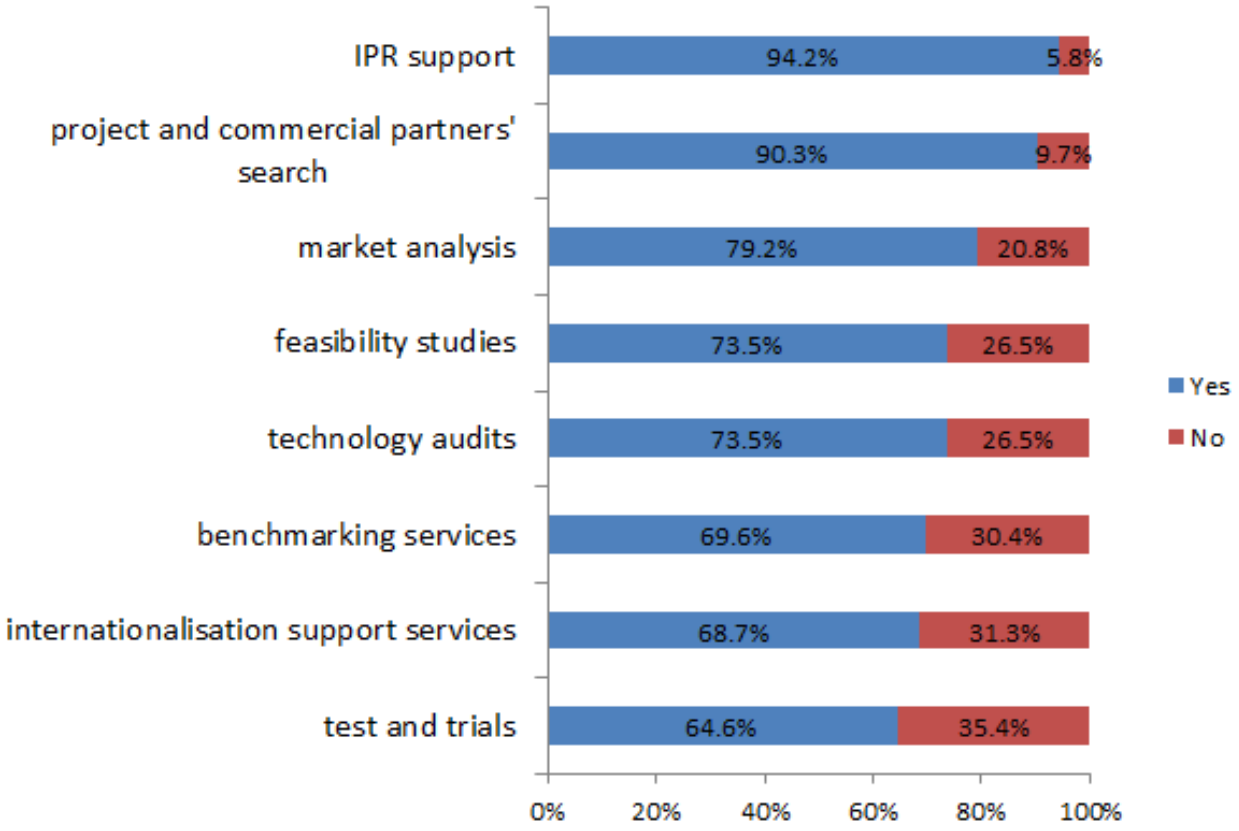
The large majority of universities covered in the case studies (83%) believe that, overall, participation in EU programmes had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge. This is because the FP7, in particular the Cooperation and Capacities programmes, facilitated, as it is implicit in their mission, interaction and collaboration with firms.

In 84% of the cases, the universities provide knowledge and technology transfer services to industry. There are specialised structures (e.g. knowledge transfer offices) in charge of providing these services, facilitating cooperation with industry and attracting private investments.

The individual cases include examples of these structures, such as liaison offices, and provide a web link to them wherever available.

The services provided by offices in charge of knowledge diffusion and technology transfer are mostly those listed in the following figure in order of frequency: IPR support (e.g. patents' applications, licencing, re-sale of licences), partners' search, market analysis and feasibility studies, technology audits, benchmarking services, support to internationalisation, tests and trials.

**Figure 59 – Type of services provided (in addition to spin-off incubation) to facilitate commercialisation of knowledge**




*Source: authors' elaboration on survey data*

Other typologies of services provided by the offices in charge of knowledge transfer and technology diffusion include the following:

- managing collaboration with local authorities
- fund raising
- organisation of workshops/events.
- administration of funds for early stage commercialisation activities
- secondments to and from relevant partners
- R&D project management
- specialised training (e.g. to develop entrepreneurial skills)

In conclusion, based on their experience, the large majority of respondents highlighted positive effects of participation in FPs on commercialisation of knowledge, spin-off incubation, university-industry mobility and post-degree training. Nonetheless they are seldom able to isolate FPs participation outcomes and effects and quantify them.

Much less positive is the assessment of the effect of participation in FPs on patenting activities, first of all because it is even more difficult, if at all possible for the universities, to link patenting outcomes with projects. Approximately half of respondents point out that the effect on patenting is positive while the remaining half either does not know or believes there was no effect at all.

**BOX 10: Technology transfer services: internal structures vs. external providers**

Most universities have specialised internal structures which support technology transfer. Others rely on external partners. In the first group, for example, the Polytechnic University of Catalonia carries out knowledge diffusion and technology transfer services through its Technology Transfer Centre (CTT - http://www.ctt.upc.edu). The Polytechnic University of Catalonia participated 172 times in the FP7 and coordinated 39 projects. The total amount of EU funding received is EUR 52.6 million. The University ranks 4th in the country by no. of projects (out of 71 Spanish universities) and 98th in Europe (out of 1,274 universities). In the university, the CTT provides a customised information service about the organisation's technological output and strategic advice. The CTT also offers teaching and research staff a range of services to support research promotion and management, the evaluation of results and technology transfer. These services can be classified into four main groups: strategic advice and technical support for RDI projects; technical and financial management of RDI; detection, assessment and exploitation of research results; promotion and dissemination of technological output; IPR (patent and licensing) support. The Polytechnic University of Catalonia is particularly active in patenting as it holds 577 patents (2007-2014), a significant number of those are related to FP7 projects.

Differently from this case, the Hannover Medical School provides knowledge diffusion and technology transfer services to industry through an external company. The Hannover Medical School participated 71 times in the FP7 and coordinated 11 projects. The total amount of EU funding received is approximately EUR 25 million. The school ranks 25th in the country by number of projects (out of 188 universities in Germany) and 129th in Europe (out of 1,274 universities). Ascenion (web link: http://www.ascenion.de) is an IP asset management company focused on the life sciences which provides technology transfer services for the Hannover Medical School. The services of the company include project and commercial partners' search, IPR support and technology audits. Sometimes, the centre provides market analysis, benchmarking services, test and trials as well as feasibility studies.

De Montfort University in Leicester is a mixed case. The university participated 24 times in the FP7 and coordinated 8 projects. The total amount of EU funding received is approximately EUR 5.9 million. The university ranks 57th in the country by number of projects (out of 135 UK universities) and 422$^{nd}$ in Europe (out of 1,274 universities). De Montfort University has its own structure (the Directorate of Research, Business and Innovation) but also in part relies on external providers as it has entered into a partnership with ProspectIP (http://www.prospectip.com/about-us.htm) which provides independent advice, guidance and practical assistance on IP matters. In addition, De Montfort University's Legal Services team advises on all contracts to ensure that IP is adequately protected and exploited.

### 4.2.4 Concluding remarks and policy implications

The case studies highlighted that the will to improve competitiveness, reputation and quality represents overall the most important driver for the engagement of universities. Financial needs are another key driver but FPs are not the only option available to carry out high quality research. 86% of the universities pointed out that there is one or more examples of similar funding scheme, including national, regional and European instruments (e.g. Structural Funds). This variety of hypothetically similar schemes implies that there are potential displacement effects. This is confirmed by a perception, among universities responding to the questionnaire, that national research funding is easier to obtain and it is also confirmed by the survey of rejected proposals which found alternative sources of funding.

Overlapping with other schemes and displacement of FPs can be an actual problem if it leads to inefficient use of resources. In the experience of practitioners who participated in the workshop, FPs really managed to select mostly research excellence in each country, therefore, institutions and researchers who seek other sources of funding do so with less ambitious projects, from a scientific and technological perspective.

Nonetheless, the issue of alignment between policy remains open. In other words, understanding to what extent there are synergies or substitution effects and to what extent national policy contexts (e.g. existence of similar R&D support schemes, and distribution of competences in relation to research policy) play a role is to be further examined.

Exploring policy alignment was outside the scope of this study, however, recent policy developments provide signs of a growing coordination across Europe; for instance, the Smart Specialisation Strategies (S3), an ex-ante conditionality for Cohesion Policy, provided a contribution towards more alignment of regional policy, including research and innovation, across Europe.

There are "exogenous" and "endogenous" obstacles to participation. The former are mostly related to the costs of applying which are considered too high, the latter are related to internal capacities and competences (e.g. lack of available time by researchers). One consequence of exogenous obstacles is that a mere increase of available funds to promote R&D will not necessarily lead to greater benefits while there is a need for reducing application costs. As regards endogenous obstacles, 90% of the universities covered in the case studies have a dedicated support structure which helps them participating. However, despite the help from these structures, the limited time of researchers is still considered a constraint and more could be done to mitigate this problem.

The workshop with practitioners remarked that incentives for researchers to facilitate participation (e.g. pre-funding, seed funding) can be helpful.

Furthermore it would be useful to identify best practices for enhancing university success and what measures may facilitate free entry of new comers, catching up of lagging universities/regions. Human resources strategies put in place by top Universities to support researchers, overcome inequalities, promote capacity building, develop infrastructures, deal with bureaucracy can be a basis for training and learning in less performing universities. Twinning and teaming initiatives under Horizon 2020 are certainly a good start: teaming (partnerships) of excellent research institutions and low performing RDI regions allows investing in Europe's research and innovation potential through supporting the creation or upgrade of Centres of Excellence; twinning of research institutions aims to build on the potential of networking for excellence through knowledge transfer and exchange of best practice between research institutions and leading partners.

Universities are very positive in relation to the effects of participation on cooperation with other research organisations and with firms, on post-degree training as well as on academia-industry mobility. Nearly all of them highlight that there was a positive effect of participation in these respects. However, apart from personal assessments based on experience, universities find it difficult to provide evidence and data on

outcomes and effects. The large majority of universities covered in the case studies (83%) also believe that participation in the FP7 had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge. Furthermore, 70% of respondents believe that participation in EU FPs had a positive effect on incubation of spin-offs. However, only a minor share of universities seems able to provide information on results in terms of creation of spin-offs and support to start ups, depending on their monitoring systems. The assessment of the effect of participation in FPs on patenting activities is not equally positive and, in this case, there is an even greater lack of quantitative monitoring indicators on results and effects and, hence, the difficulty to go beyond perceptions and qualitative assessments is more severe.

Individual cases are presented by country group and in alphabetical order in the Annex 1.

# 5 Task 5 – Europe's top research universities

As part of this task, 25 case studies were developed, focusing on a specific sub-set of universities that fit with the notion of top research universities, elaborated in the literature, often encompassed under the label 'world class universities' (WCUs).

World-Class universities are commonly referred to as the most prestigious research universities ranked high in one or more world rankings (Wang et al., 2011). This represents a clear, simple but too much restrictive definition of what a high standing academic organization really is. In order to understand the complexity behind this term, it can be recalled the argument of Altbach (2004) who observed with respect to the increasing race for achieving the title of World Class University engaged by several academic institutions and national governments that "*everyone wants one, no one knows what it is, and no one knows how to get one".*

## 5.1 Top research universities: definition and characteristics

The reference to international rankings is often used as major criterion to define top research universities, mapping the positioning of universities into global competition through empirically verifiable measures compared to other universities. Nonetheless the definition can refer to scientific excellence or its reputation and prestige, thus to the status (Podolny, 1993), in the national and international arena for scientific achievements as well as the capacity of an academic institution to be competitive in a globalized world, and to contribute to the economy and society (Hazelkorn, 2008, 2011). Hence, the need to provide an operational definition, exploiting concepts as excellence, competition, prestige, reputation, social and economic achievements, going beyond a definition limited to the positioning in international rankings for research output.

Some authors refer to top-ranked research universities as academic institutions committed to "creating and disseminating knowledge in a range of disciplines and fields, delivering elite education at all levels, serving national needs and furthering the international public good" (Altbach, 2009; Liu, 2009). This definition is not related to university positioning in international rankings only, but encompasses several dimensions, which allow to depict and to measure the whole performance of an academic institution.

According to the mentioned approach, the term world class/top research could be used interchangeably with definitions as elite, global research universities or flagship universities (Altbach and Salmi, 2011; Salmi, 2009, Marginson, 2012). In fact, many authors refer to universities well embedded in their local and social context, with strong connections worldwide, positioned among top academic institutions for research output and scientific performance which allow them to claim for a global reputation. Douglass (2014) provides a profile of Flagship Universities which includes the following features: being comprehensive institutions, thus strength in several disciplines, broadly accessible to the population, autonomous and publicly funded, focused on self-improvement, sharing a common-strategic-view with the political, cultural and socio-economic world they serve.

*Characteristics of top research universities*

European policies stressed the importance of pursuing excellence to sustain the global competition and the production of national wealth, supplying better graduates and PhDs, researchers and research, as well as education and training (EC-CREST, 2009). The managerial paradigm dominating the political discourse in many European countries, the emergence of rankings as new means for "measuring" an

intangible concept such as excellence, making it a comparable objective to be accomplished by policy makers and stakeholders, urged universities to be concerned with visibility.

Salmi (2009, 2011) outlined three complementary sets of factors, which characterize top-level universities: a high concentration of talent, abundant resources, and favourable and autonomous governance. So far, universities should be able to select and attract the best students and most talented professors and researchers, to possess abundant funding sources and to offer a rich learning and research environment, and to rely on governance practices and regulatory framework which allow them to face global challenges.

Looking at the mentioned debate, we can figure out some key features of top research universities:

- They are relative homogeneous organizations. Halffman and Leydesdorff (2009) suggest 'an on-going homogenisation in terms of publication and productivity patterns among the top 500 universities in the world' (Halffman and Leydesdorff, 2009, 15), which is explained by two factors: on the one hand, the Matthew effect may have reached its limit in generating concentration of reputation and resources; on the other, isomorphic pressures may have pushed universities towards producing similar levels of SCI outputs.
- The high degree of stability at the top of international quality, whatever the criterion and the quality assessment method (Paradeise and Thoening, 2013). Stability also implies that the universities ranked at the very top (the first 30-35 positions of international rankings) remain stable, and the possibility for other universities to reach them is impeded by the presence of these big 'champions', which become a sort of paradigmatic examples of what quality should be, their habits and performance a benchmark for other universities that want to engage themselves in bettering the quality level.
- The capacity to produce ground breaking research output recognized by peers and prizes as well as the capacity to generate innovative ideas and produces both applied and basic research (Salmi, 2009). Thus, the research outputs of scientific activities of universities as well as its exploitable outcomes are considered relevant characteristics that make world class universities internationally recognized as top research institutions.
- The attractiveness towards best students and talented professors and researchers. Wildavsky (2012) recognized as a common attitude of world class universities to favour a "skilled immigration" that is to pursue the attraction and selection of best students as well of star scientists through a system of incentives and rewards and facilities that allow WCUs to attract and to retain most talented scientists.

*The participation of top research universities in the European Framework Programmes*

Being a top-class university can have several effects on the participation in the EU FPs since it impacts on motivations, on the role the participants want to assume, on the type of research developed within the EU FP projects, on the additional advantages that FPs ensure in comparison with other funding sources, in terms of scientific outputs, networking, collaboration patterns, innovation etc.

Using the EUMIDA and EUPRO data, Lepori et al. (2014) analysed the determinants of participation in EU-FPs, using a sample of 1,376 research universities in 28 European countries. The investigation confirmed a very strong concentration of participations in a very small numbers of universities. The number of participations per university can be predicted from organizational characteristics (size and international reputation first and foremost), and the possibility of participating in EU-FPs programs is quite limited for universities below an academic staff size of around 500 FTEs. Further, the number of participations tends to grow proportionally to organizational size, but it is strongly influenced by international reputation, and to a lesser extent, by research intensity and specialisation in sciences and engineering. Countries factors have become less important in determining participation to EU FPs (Lepori, et al. 2015). Thus University

participation is largely affected by a self-reinforcement process, which tends to concentrate participation and funding in few actors within Europe. Understanding how differently this process impacts on top-level universities provide important information on a targeted group of outstanding actors, whose performance is particularly interesting.

The evaluation questions for this task listed in the tender specifications can be grouped according to three categories of items:

- Participation: to what extent the universities participate, their distribution across programmes and thematic priorities, the share of funding, the nature of participation;
- Effects of participation: e.g. on motivations, additional advantages that FPs ensure in comparison with other funding sources in terms of scientific output, networking, collaboration patterns, innovation etc.
- Ranking: the position of top research universities against well-known ranking.

## 5.2 Criteria for selection

The identification of the sample of 25 European high performing research universities is based on the number of participations in the several generation of FPs, and the standing of the organization in terms of research activities. More precisely the criteria adopted for the selection are the following ones (ranked by importance):

- World standing in research activities (positioning in the University Ranking – check done on Shanghai Ranking, Leiden Ranking, and Multi-rank rankings);
- High participation in EU FPs (baseline EU FP6 and FP7);
- A balanced presence of generalist universities and technical universities;
- Geographical representation, in order to avoid having a sample representing only one or two countries. This circumstance would introduce a bias in the analysis, due to low possibility to generalize the results obtained.

Despite the sampling aim was to generate also a country-balanced distribution, no Eastern universities could be selected according to the mentioned criteria; since we have to deal with top research universities with a high participation in EU FPs, the geographical coverage has a lighter weight than other criteria such as the positioning in the university rankings and the FPs participation. On the other hand, we do not concentrate too much the sample on few leading countries (first and foremost UK), in order to get a broad overview of the motivations and effects of the EU FPs participation in different contexts.

The following table presents the list of the universities selected for this study at the very beginning.

**Table 99 – 25 EU high performing universities – First selection**

| Country | Institution |
|---|---|
| **UK** | UNIVERSITY OF CAMBRIDGE |
| **UK** | UNIVERSITY OF OXFORD |
| **UK** | IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE |
| **UK** | UNIVERSITY COLLEGE LONDON |
| **UK** | THE UNIVERSITY OF EDINBURGH |
| **UK** | THE UNIVERSITY OF MANCHESTER |
| **UK** | KING'S COLLEGE LONDON |
| **CH** | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH |

| | |
|---|---|
| **CH** | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE |
| **SE** | KAROLINSKA INSTITUTET |
| **SE** | LUNDS UNIVERSITET |
| **SE** | UPPSALA UNIVERSITET |
| **DE** | KARLSRUHER INSTITUT FUER TECHNOLOGIE |
| **DE** | TECHNISCHE UNIVERSITAET MUENCHEN |
| **BE** | KATHOLIEKE UNIVERSITEIT LEUVEN |
| **BE** | UNIVERSITEIT GENT |
| **ES** | UNIVERSIDAD POLITECNICA DE MADRID |
| **DK** | DANMARKS TEKNISKE UNIVERSITET |
| **DK** | AARHUS UNIVERSITET |
| **NL** | TECHNISCHE UNIVERSITEIT DELFT |
| **NL** | STICHTING KATHOLIEKE UNIVERSITEIT |
| **NL** | UNIVERSITEIT UTRECHT |
| **NL** | TECHNISCHE UNIVERSITEIT EINDHOVEN |
| **IT** | POLITECNICO DI MILANO |
| **FR** | PIERRE AND MC (PARIS 6) |

A number of back up universities have been also considered in case of failure of some contacts with one or more of the selected universities; they are listed in the table below.

**Table 100 – Back up EU high performing universities**

| Country | Institution |
|---|---|
| **DK** | KOBENHAVNS UNIVERSITET |
| **UK** | UNIVERSITY OF SOUTHAMPTON |
| **SE** | KUNGLIGA TEKNISKA HOEGSKOLAN- KTH Royal Institute of Technology |
| **UK** | THE UNIVERSITY OF BIRMINGHAM |
| **UK** | UNIVERSITY OF BRISTOL |
| **UK** | THE UNIVERSITY OF SHEFFIELD |
| **UK** | THE UNIVERSITY OF NOTTINGHAM |
| **UK** | UNIVERSITY OF LEEDS |
| **SE** | CHALMERS TEKNISKA HOEGSKOLA |
| **NL** | WAGENINGEN UNIVERSITY |
| **NL** | STICHTING VU-VUMC |
| **NO** | UNIVERSITETET I OSLO |
| **IT** | ALMA MATER STUDIORUM-UNIVERSITA DI BOLOGNA |

University generally show a good willingness to collaborate for the development of the case studies; only three universities declared they would not participate since they have direct contacts with the Commission for the assessment of the engagement in EU FPs; another group of three universities never answered the messages sent.

The final sample used in Task 5 is shown in the following table.

**Table 101 – Selected 25 top EU high performing universities**

| Country | Institution |
|---|---|
| UK | KINGS' COLLEGE LONDON |
| UK | UNIVERSITY OF CAMBRIDGE |
| UK | THE UNIVERSITY OF LEEDS |
| UK | UNIVERSITY COLLEGE LONDON |
| UK | THE UNIVERSITY OF EDINBURGH |
| UK | THE UNIVERSITY OF MANCHESTER |
| UK | UNIVERSITY OF NOTTINGHAM |
| CH | EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH |
| CH | ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE |
| SE | KAROLINSKA INSTITUTET |
| SE | LUNDS UNIVERSITET |
| SE | UPPSALA UNIVERSITET |
| SE | CHALMERS TEKNISKA HOEGSKOLA |
| DE | KARLSRUHER INSTITUT FUER TECHNOLOGIE |
| BE | KATHOLIEKE UNIVERSITEIT LEUVEN |
| ES | UNIVERSIDAD POLITECNICA DE MADRID |
| DK | DANMARKS TEKNISKE UNIVERSITET |
| DK | AARHUS UNIVERSITET |
| DK | UNIVERSITY OF COPENHAGEN |
| NL | TECHNISCHE UNIVERSITEIT DELFT |
| NL | UNIVERSITEIT UTRECHT |
| NL | TECHNISCHE UNIVERSITEIT EINDHOVEN |
| IT | POLITECNICO DI MILANO |
| IT | ALMA MATER STUDIORUM-UNIVERSITA DI BOLOGNA |
| FR | PIERRE AND MC (PARIS 6) |

## 5.3 Methodological approach

The methodological approach for this task integrates:

- Descriptive analysis of the top universities participation and success rate based on EUPRO and eCORDA datasets (see the methodology under Task 2 and 3),
- Descriptive analysis based on the positioning of the considered universities in the selected rankings (Shanghai, THE Ranking, Leiden and Multirank),
- Qualitative information coming from the web-based questionnaire developed under Task 4,
- Qualitative information coming from direct interviews to the top research universities of the sample.

The following table outlines the items to be explored, the related evaluation questions, and the methods and sources to be used.

**Table 102 – Items explored**

| Item | Questions | Methods and sources |
|---|---|---|
| **Participation** | To what extent do Europe's top research universities participate in the framework programmes?<br>What is the nature of their participation?<br>Are they more likely to be project coordinators than non-top universities? | Statistical analysis of:<br>• Participation of the top universities across the specific programs, thematic priorities.<br>• EC funding share awarded to the top research universities.<br>Source: EUPRO and eCORDA database |
| **Motivations and Effects of participation** | What are the motivations for EU FP participation?<br>What are the lasting effects of the FPs funding for universities | Interviews based on a web-based questionnaire as in Task 4 and other qualitative information coming from direct interviews (based on few examples of good practices) |
| **Ranking** | Analyse the position of top research universities against well-known university ratings.<br><br>Explore what contributions are provided by participation to EU framework programmes | Analysis of positioning of the selected universities in the Shanghai ranking, THE Ranking, Leiden Ranking, U-Multirank<br>Source: Shanghai Ranking, Leiden Ranking, U-Multirank<br>Interviews (based on few examples of good practices) |

### 5.3.1 Data analysis

The aim of this activity is to provide for each University selected a descriptive fiche with a summary of most relevant general information, based on ETER dataset (2012) and other web-based information, as well as with information about participation to EU FPs based on eCORDA data. To this end at this stage the following data from ETER database have been used:

- Year of establishment
- Total staff (Full Time Equivalent-FTE)
- Total academic staff (Head Count-HC and FTE; national and foreigner)
- Total graduated ISCED 6-7
- Total graduates at ISCED 8 (research higher degree)
- Total students ISCED 6-7
- Total students enrolled ISCED 8 (research higher degree)

Descriptive analysis of the top universities participation and success rate based on the eCORDA datasets (see the methodology under Task 2 and 3), have been presented, based on the analysis provided for the whole universities. Also the rankings within the country and in EU by number of projects and by fund are presented.

### 5.3.2 Rankings

Positioning of the selected universities in the three rankings is also analysed considering Shanghai, Times, Leiden and U-Multi-rank in order to draw a descriptive analysis of selected universities accordingly. Main information retained have been:

- Academic Ranking of World Universities (ARWU) for overall performance in academic ranking and for scientific performance in academic ranking by broad subject field and by subject field. Also information about enrolled international students (total) has been considered.
- Times Ranking, as a global ranking providing the universities positioning in the global performance.

- CWTS Leiden ranking for the scientific impact of Universities through the Impact PP10% indicator [proportion of top 10% publications], and the Collaboration Indicator (proportion of publications with international co-authorship).
- U-Multi-rank to collect wide information about research publications citations rates and interdisciplinary publications, knowledge transfer, international orientation, regional engagement.

*Shanghai Ranking*

ARWU actually ranked in total more than 1200 universities, and the best 500 are published on the web. Universities are ranked by several indicators of academic or research performance, including alumni and staff winning Nobel Prizes and Fields Medals, highly cited researchers, papers published in Nature and Science, papers indexed in major citation indices, and the per capita academic performance of an institution. The ARWU website explains that for each indicator, the highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score. The distribution of data for each indicator is examined for any significant distorting effect; standard statistical techniques are used to adjust the indicator if necessary. Scores for each indicator are weighted as shown in the following table to arrive at a final overall score for an institution. The highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score. Thus, an institution's rank reflects the number of institutions that sit above it.

**Table 103 – Indicators and weights for ARWU**

| Criteria | Indicator | Code | Weight |
|---|---|---|---|
| Quality of Education | Alumni of an institution winning Nobel Prizes and Fields Medals | Alumni | 10% |
| Quality of Faculty | Staff of an institution winning Nobel Prizes and Fields Medals | Award | 20% |
| | Highly cited researchers in 21 broad subject categories | HiCi | 20% |
| Research Output | Papers published in Nature and Science* | N&S | 20% |
| | Papers indexed in Science Citation Index-expanded and Social Science Citation Index | PUB | 20% |
| Per Capita Performance | Per capita academic performance of an institution | PCP | 10% |

* For institutions specialized in humanities and social sciences such as London School of Economics, N&S is not considered, and the weight of N&S is relocated to other indicators.

*Source: ARWU website*

*Times Ranking*

As stated in the official website, The Times Higher Education World University Rankings are the global university performance tables to judge research-led universities across all their core missions - teaching, research, knowledge transfer and international outlook. It employs 13 carefully calibrated performance indicators to provide the most comprehensive and balanced comparisons, which are trusted by students, academics, university leaders, industry and governments. The methodology for the 2013-2014 is identical to that used since 2011-2012, offering a year-on-year comparison based on true performance rather than methodological change. The 13 performance indicators are grouped into five areas:

- *Teaching*: the learning environment (worth 30 per cent of the overall ranking score)
- *Research*: volume, income and reputation (worth 30 per cent)
- *Citations*: research influence (worth 30 per cent)
- *Industry income*: innovation (worth 2.5 per cent)
- *International outlook*: staff, students and research (worth 7.5 per cent).

To calculate the overall rankings, "Z-scores" were created for all data sets except for the results of the academic reputation survey. The calculation of Z-scores standardises the different data types on a common scale and allows fair comparisons between different types of data - essential when combining information into a single ranking.

*U-Multirank*

U-Multirank is a multi-dimensional, user-driven approach to international ranking of higher education institutions. The dimensions it includes are teaching and learning, research, knowledge transfer, international orientation and regional engagement. Based on empirical data U-Multirank compares institutions with similar institutional profiles and allows users to develop personalised rankings by selecting performance measures/indicators in terms of their own preferences.

The first ranking – 2014 – covers more than 850 higher education institutions, 1,000 faculties and 5,000 study programmes from 74 countries around the world. It provides an institutional ranking of whole institutions as well as field-based rankings for electrical and mechanical engineering, business studies and physics.

All indicator scores derived from bibliometric analysis are based on information extracted from publications that are indexed in the CWTS-licensed edition of the Web of Science (WoS) database. Five indicators have been chosen for the aim of this study, namely:

- *Top Cited Publication:*

The proportion of the university's research publications that, compared to other publications in the same field and in the same year, belong to the top 10% most frequently cited.

- *Interdisciplinary Publications:*

Percentage of research publications within the field's top 10% publications with the highest interdisciplinary scores.

- *Patents Awarded (Size-Normalized):*

The number of patents assigned to (inventors working in) the university over the period 2001-2010 (per 1000 students).

- *Industry Co-Patents:*

The percentage of the number of patents assigned to (inventors working in) the university over the period 2001-2010, which were co-applied with at least 1 applicant from the industry.

- *International Joint Publications:*

The percentage of the university's research publications that lists at least one affiliates author's address in another country.

*Leiden Ranking*

The website of the CWTS Leiden Ranking 2015 presents the ranks of 750 universities worldwide with the largest publication output in international scientific journals. The ranking is based on data from the Web of Science database. A sophisticated data collection methodology is employed to assign publications to universities. It provides statistics not only at the level of science as a whole but also at the level of the following five main fields of science:

- Biomedical and health sciences
- Life and earth sciences
- Mathematics and computer science
- Physical sciences and engineering
- Social sciences and humanities

The Ranking 2015 is based on publications in Thomson Reuters' Web of Science database (Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index).

Impact indicators and collaboration indicators are provided. The impact indicators in the Leiden Ranking can be calculated using either a full counting or a fractional counting method. The full counting method gives equal weight to all publications of a university. The fractional counting method gives less weight to collaborative publications than to non-collaborative ones. The fractional counting method leads to a more proper field normalization of impact indicators and therefore to fairer comparisons between universities active in different fields. For this reason, fractional counting is the preferred counting method for the impact indicators in the Leiden Ranking. Collaboration indicators are always calculated using the full counting method. The following indicators for impact and collaboration were chosen to compare universities at the level of science and at the level of fields:

*Impact indicator:* PP (top 10%). The proportion of a university's publications that, compared with other publications in the same field and in the same year, belong to the top 10% most frequently cited. This indicator is regarded as the most important impact indicator of the Leiden Ranking.

*Collaboration indicator:* PP (International collaboration). The proportion of university's publications that have been co-authored by two or more countries

Both indicators have been collected for three-years periods from 2006 to 2013.

### 5.3.3 Interviews

Recently the main motivations driving the participation to joint programmes and generally to engage in competitive funded projects have been investigated in the frame of a project funded by the European commission (Reale et al. 2013; Reale et al., 2014). Motivations have been operationalized as a set of opportunities, provided by large international and competitive programmes as in the case of EU FPs, while benefits from programmes have been operationalized as mobilized opportunities:

- Perceived opportunities, that are the possibilities for research as they are perceived to be provided by (potential) beneficiaries;
- Mobilized opportunities, what effectively the beneficiaries exploit of the opportunities the programme provided.

The advantage of mentioned approach is the possibility to figure out how high standing universities perceive the added value that EU FPs are able to provide, and external contextual factors that can influence the decision to participate; on the other side, what of the perceived benefits top research universities effectively realized and what different unintended and unexpected effects occur.

The interviews have been carried out mostly using phone or Skype. Two interviews on average per university were envisaged; the mentioned circumstance has been decided in agreement with the university surveyed, which indicated the person(s) to be interviewed among those involved in the government bodies (Chancellor, Member of the Board, Central Administrator) after checking the interview protocol. In all the cases it was agreed to have one interview per university with the participation of all the relevant persons that can address the issues of the interview protocol.

Before addressing the selected universities, a desk research was carried out in order to:

a) Checking the most reliable persons for the interviews (universities often have Professor(s) with a specific delegation for all the affairs linked to the participation in European and international research programmes; in some cases also a dedicated Unit can be identified);

b) Collecting materials and data available about the university participation to the EU FPs or about the university strategy toward internationalisation of the research activities. The desk research was carried out mainly exploiting the universities web sites.

No site visits have been carried out; the universities generally agree to contribute to the projects. Visits on site were foreseen according to budget and time availability and to the need to get in contact with some university showing some reluctance to provide an interview at the distance, which was not the case. Visits on site would be also useful to deepen aspects emerging from the interviews which might concern research outputs and outcomes (e.g. scientific facilities as datasets, digital repositories of data or local laboratories created after the participation to EU FPs) new structures (e.g. as incubator facilities for industry-universities collaborations in R&D) or new services for students (e.g. new areas on campus for improving communications). However, the mentioned information emerge from the interviews; more in depth would be useful to disentangle as far as possible the real contribution of the EU FP participation to the outcome, which in many respect was reported as difficult to assess, but time constraint does not allow to perform this further investigation.

The interview protocol is structured into three main sections:

- The first concerns general information about the University and respondent (position and role, personal information will not be asked)
- The second section in mostly based on a structured protocol allowing respondents to be guided through some key items concerning expected benefits from participation to EU FPs
- The third section in mostly organized as a semi structured interview and include more descriptive questions in order to go in depth key concepts concerning the benefits mobilized by the participation to Framework Programs. This section so far includes a number of open questions, which would allow a fine-grained analysis of effective benefits EU FP participation provided to the University.

Moreover, the interviews investigate the University participation to EU FP but references to personal experiences were asked in order to let good practices of participation to emerge. To this respect it was asked whether the University runs a monitoring activity about participation to EU FPs or rather if this activity is performed at the level of Faculties/Departments. The Protocol was revised according to the refinement of the questionnaire and the preliminary results from the pilot test on two universities (Annex A).

For each university an Individual case study summarising data and information collected, ranking analysis as well as the outcomes of the interviews – that were analysed using a content analysis, has been developed.

The following sections provide the horizontal analysis of the 25 case studies, which also integrates the results of the questionnaires developed under Task 4 for 18 out of 25 of the selected universities.

### 5.3.4 Characterization of the sample

In this section the eCORDA data, the information derived from the ETER dataset and the data coming from the Global Rankings are used to characterize the sample of the top EU research universities under analysis.

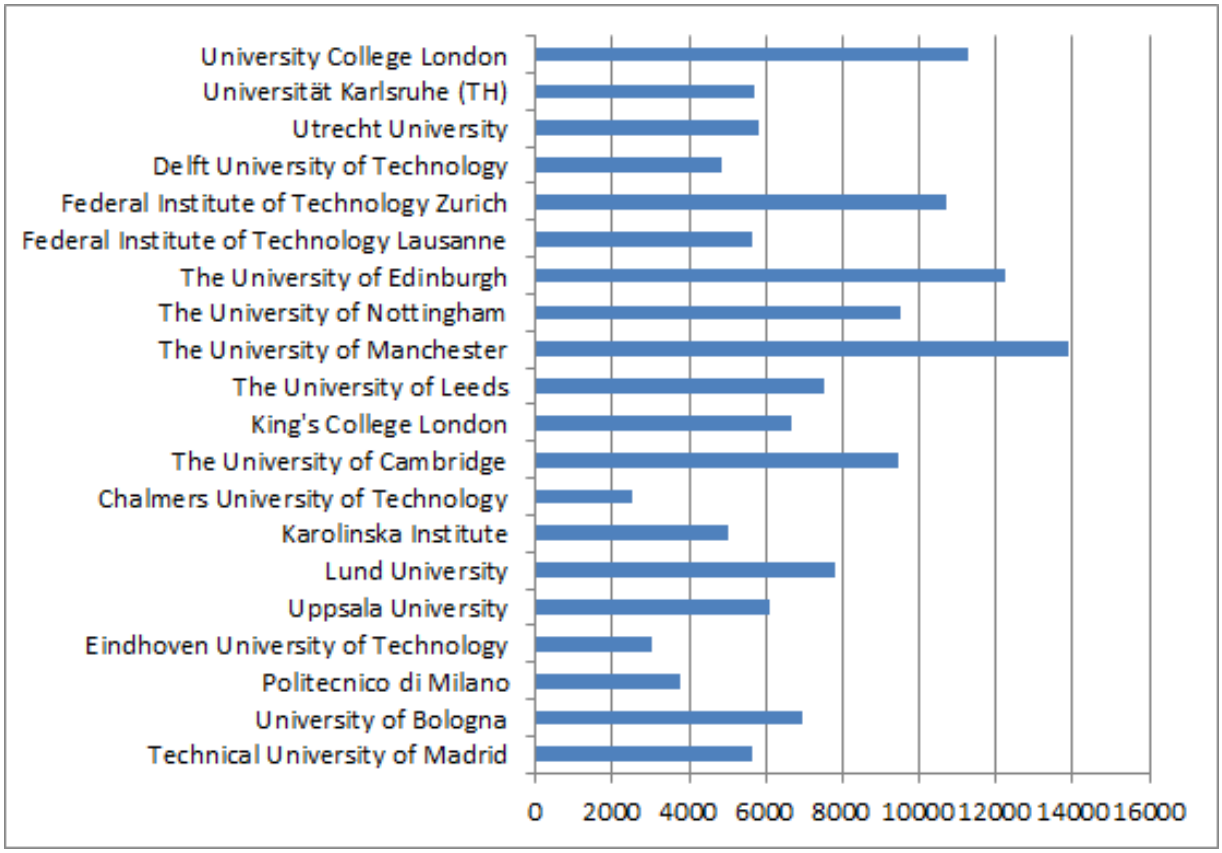
*The ETER data*

The universities selected have different foundation years; 6 have been founded before 1600, 13 between 1600 and 1900 and a group of 6 universities are more young than the others, since their foundation year is after 1900. Old and young universities are present in all the countries considered, so the sample has a balanced representation as to the age of the universities.

The number of total staff (HC) provides a proxy of the university dimension. The following figure shows the data available in the ETER dataset for 2012: six out of 20 universities of the sample[17] have a total staff higher than 8000 units, three universities have less than 4000 units, and the other universities have a staff between 4000 and 8000 units. Five out of seven universities located in UK are large universities, three of them very large (more than 10000 units of total academic staff). No university in the sample can be considered a small university (sized less than 500 FTE).

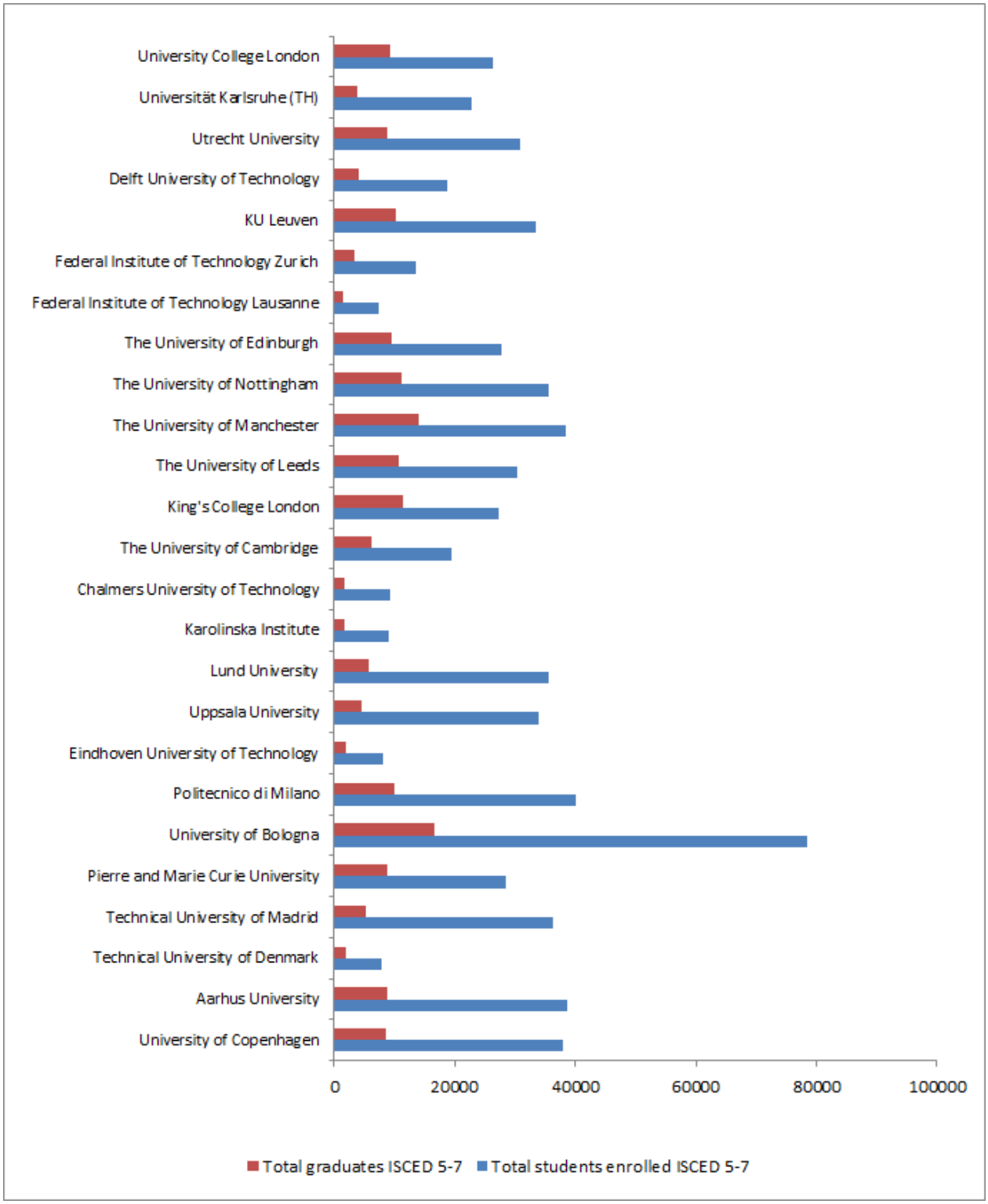
[17] For five universities the data are not available.

**Figure 60 – Total staff (HC)**




*Source: ETER Database, 2012*

**Figure 61 – Students and graduates ISCED 5-7**




*Source: ETER Database, 2012*

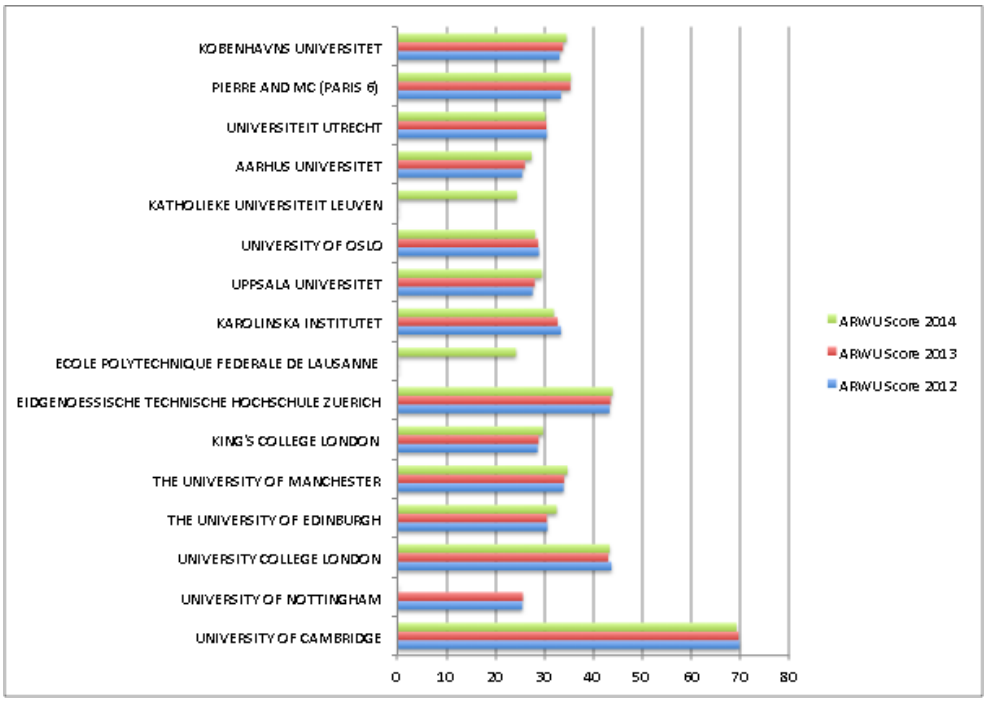
The above figure shows the number of students enrolled and graduates ISCED 5-7; as to the former indicator, 5 out of 25 universities of the sample have less than 10.000 students, and 10 have more than 30.000. The universities with a low number of students are all technical universities; nonetheless a low number of students cannot be considered a characteristic of this type of academic institutions: in the sample there are cases of technical universities with more than 30.000 students. 13 universities graduate

more than 8.000 units ISCED 5-7 in 2012, 5 universities –those with the lowest number of students enrolled, graduate less than 2.000 students. Thus, all the universities in the sample have a strong commitment with teaching activities; no specific correlation emerge with the country where the university is located, the age or size.

*Global Ranking*

Global rankings supply some interesting information, which largely confirm the results presented in the literature on top-class universities. Only 15 out of the 25 top research universities leading in EU FP participation are included in the highest positions of the ARWU ranking (see following figure), a fact that is not surprising considering the indicators that form the base of calculation for ARWU. The scores for the 15 universities indicate that 3 of them, namely Cambridge, ETHZ and the University College of London, score more than 40% and other 4 score more than 30% in all the considered years (2012-2014).

**Figure 62 – ARWU Ranking - Score 2012-2014**



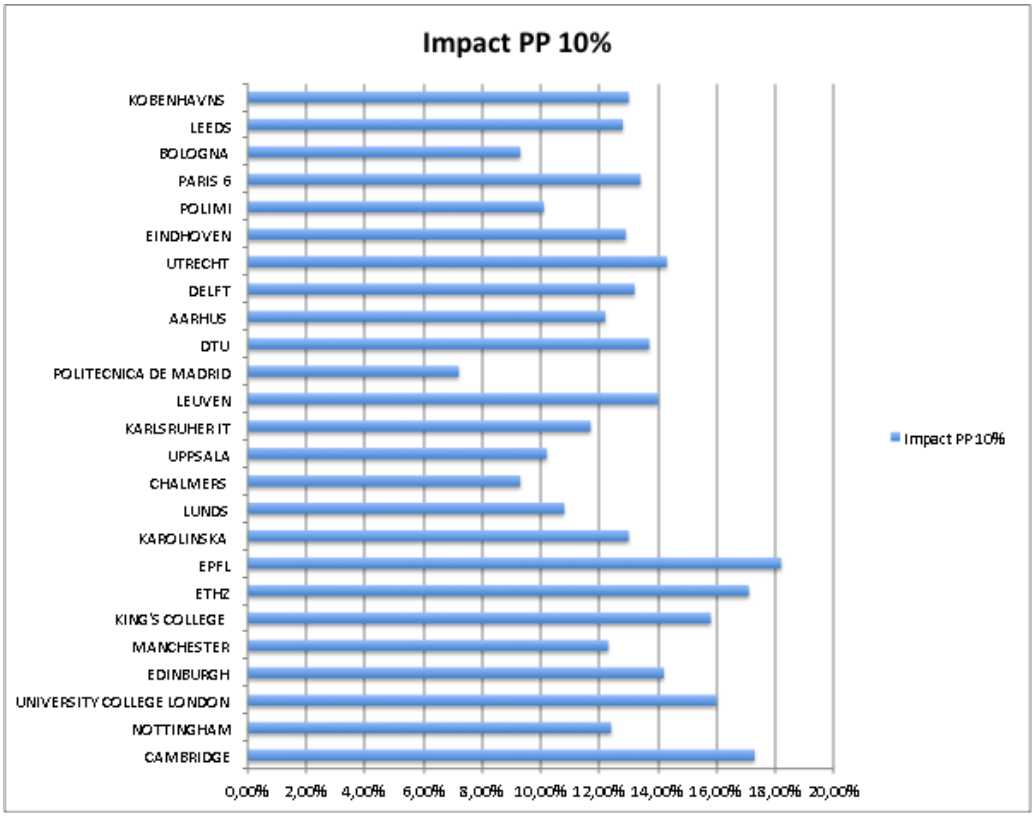

*Source: ARWU 2015*

The following figures present two indicators of the Leiden ranking namely the Impact PP 10% - indicator and the Collaboration indicators. All the 25 top-research universities of the sample are represented in the Leiden ranking. Both the indicators confirm a strong concentration of the best performance in few universities: 3 out of 25 academic organizations rank more than 16% in the former indicator (Cambridge, EPFL and ETHZ), and 4 rank more than 14% (University College of London, Edinburgh, King's College and Utrecht). It is also evident the concentration of the best performance of the Impact PP10% indicator in the universities located in UK and in CH; on the other hand, 2 out of 3 universities scoring less than 10% are located in two different countries in the South of Europe.

The indicators deriving from the Leiden ranking have been collected for the period 2006-2009 to the period 2010-2013. The tendency is toward the growth of the impact as measured by the proposed indicator: 19 out of 25 universities show a positive trend, which in some cases is very positive, and only 6 universities have an impact value with a low decrease. Among the universities with an intensive growth of the impact indicator there are Cambridge, Nottingham, Kings' College and EPFL (Lausanne).

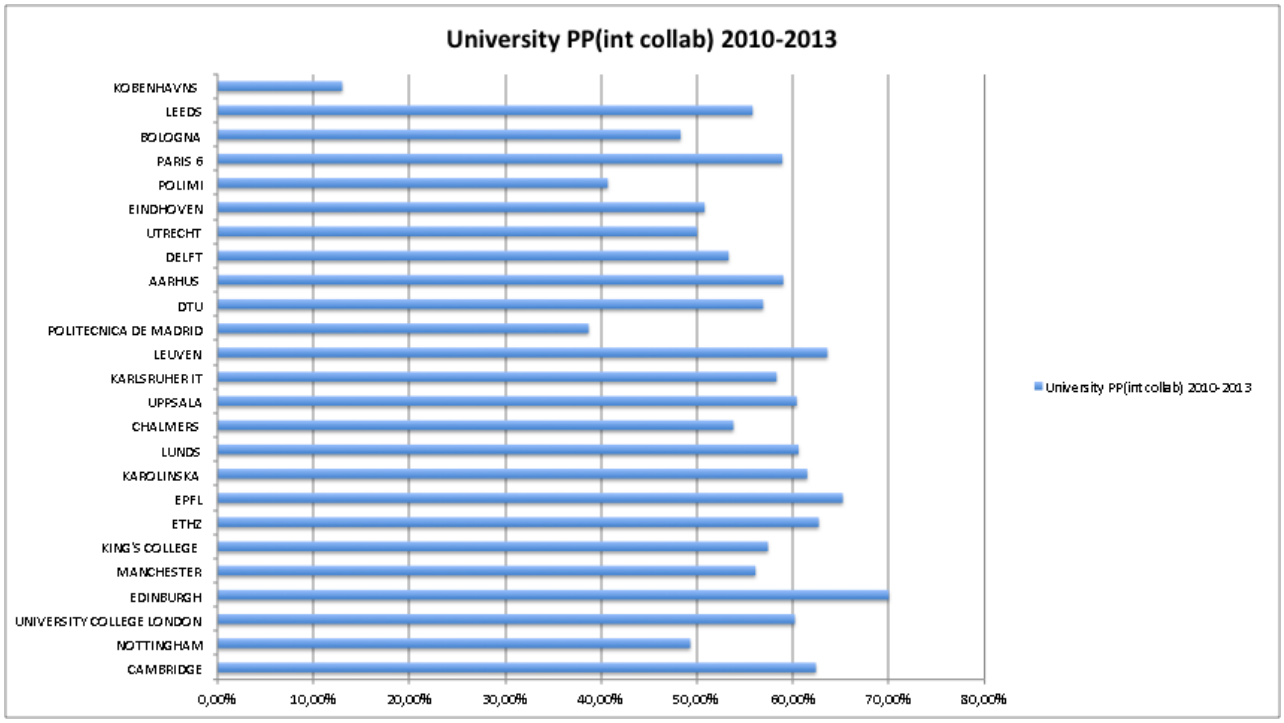
As to the international collaboration, 8 out of 25 universities show a value higher than 60%, although most of the universities in the sample have values higher than 50%. This is an interesting result that confirms the global tendency toward enlarging the collaboration between research groups located in different countries in the production of new scientific knowledge, especially in developed countries (Wagner et al., 2015). It also raised the question about how far this global tendency is a result of public policies, incentives or dedicated funding instruments (as EU FPs for instance), or it is a process deriving from the internal dynamics of the science, eventually pushed by external factors such as the extensive use of ICT, which is likely to reduce the cost of travels.

**Figure 63 – Leiden Ranking – Impact PP 10% (All Sciences) 2010-2013**




*Source: Leiden Ranking 2015*

**Figure 64 – Leiden Ranking – Impact PP International collaboration (All Sciences) 2010-2013**




*Source: Leiden Ranking 2015*

In sum, the global ranking, such as the ARWU, based on a set of indicators aimed at figuring out the top university performers, confirms the presence of a small number of universities positioned very high in the scale, which are outstanding ones (Cambridge, EPFL, ETHZ, Edinburgh), and other universities that position themselves at a very high level as well (more than 50% of the score values). Along the years the former group of universities shows a tendency toward maintaining their special positioning; the same holds true for the second group, and the possibility of other universities to gain the same ranking does not emerge as an easy objective.

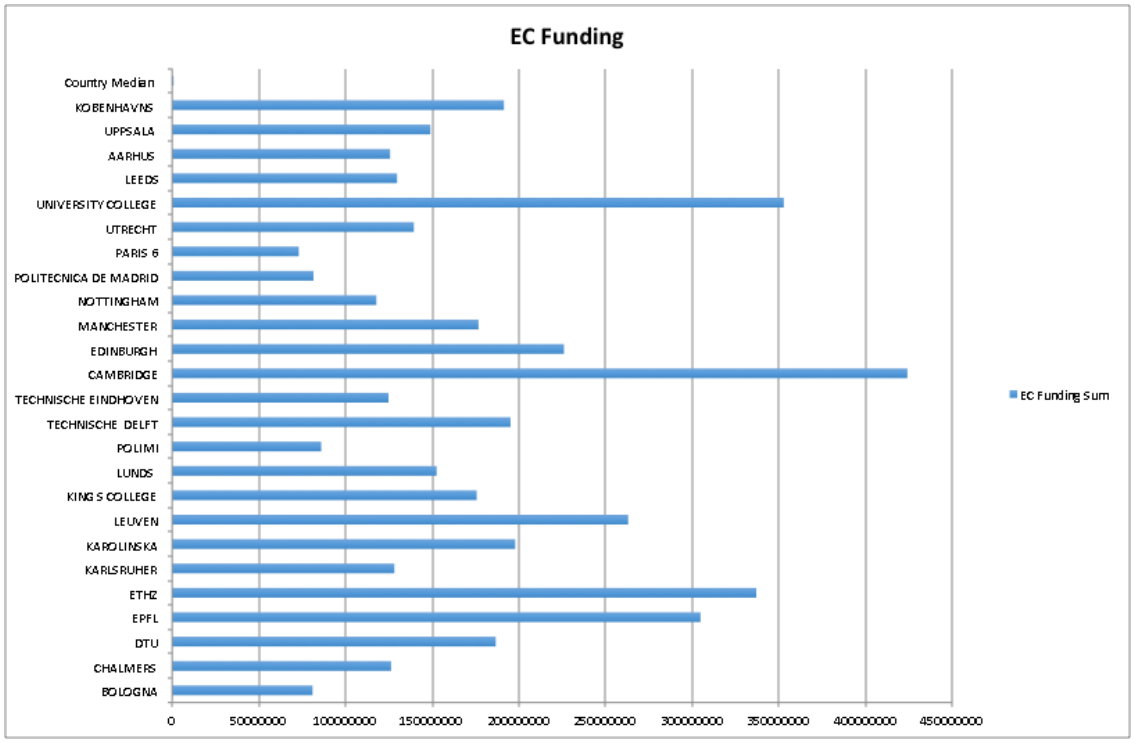
The Leiden ranking allows further considerations as to the capability of the universities to produce high-quality research –measured by the impact indicator, and to have effective research collaboration –measured by the collaboration indicator. The former indicator shows a significant differentiation between the selected universities, with few of them ranking very high, which continue to grow; the latter indicator shows how international collaboration is diffused and effective in the universities of the selected sample, although few high-performing universities still emerge.

*The eCORDA data*

In this section the eCORDA data on the participation of the 25 top research universities in EU FP7, which are illustrated for each university in the individual case studies, are analysed in order to discuss convergences and differentiations in the sample. In fact, due to the criteria used to select the 25 universities, the sample is far to be a homogeneous one.

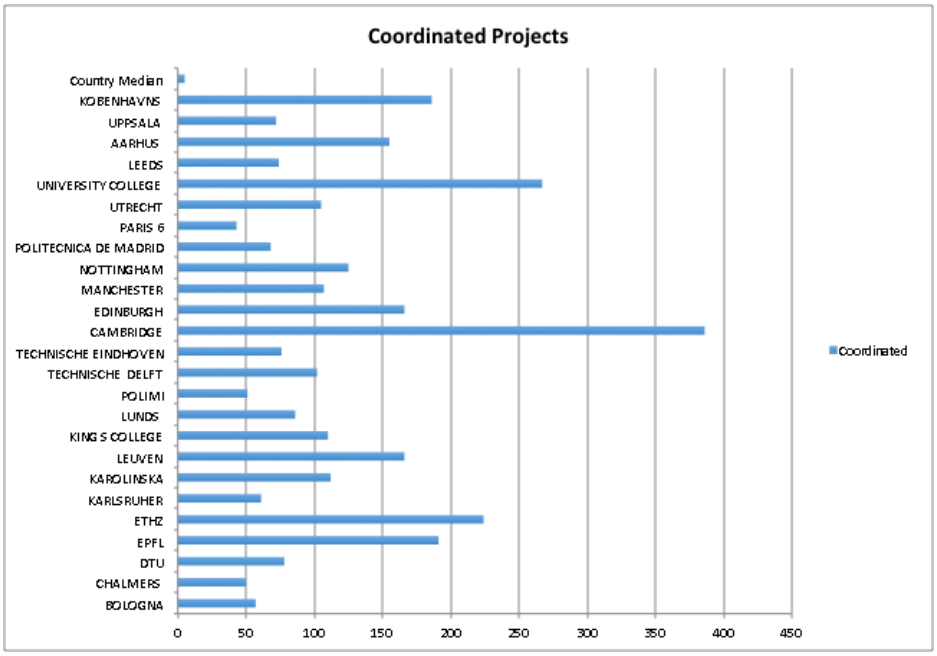
The following figure for instance shows very different performance of the universities in terms of funding deriving from EU FP7, with an outstanding position of the technical universities –indeed an expected result, and few universities, those located in ES, IT and FR, with the lowest values. The following figure shows the number of coordinated projects by the universities: 13 out of 25 universities coordinate more than 100 projects in EU FP7, but only 7 out of 25 coordinate more than 150 projects.

**Figure 65 – EU FPs funding of the 25 selected universities**




*Source: eCORDA 2015*

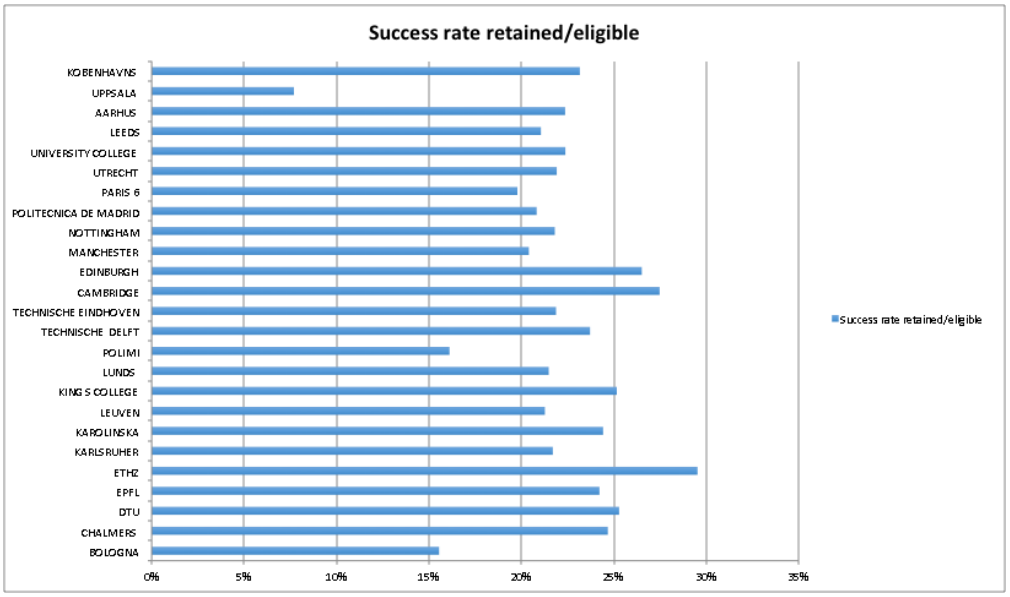
**Figure 66 – Number of EU FPs coordinated project by the 25 top research universities**




*Source: eCORDA 2015*

In the following figure the success rate in EU FP7 of the 25 universities are presented; data in this chart must be carefully considered since the dataset presents several inconvenient for the disambiguation of the names of the universities. A small group of 4 universities is visible with a very high success rate – more than 25%, while on the opposite side a very low value characterizes the universities localized in IT and the University of Uppsala. Almost all the other universities have a success rate higher than 20%, which means that all in all the universities in the sample but few ones have a very good performance in this indicator.

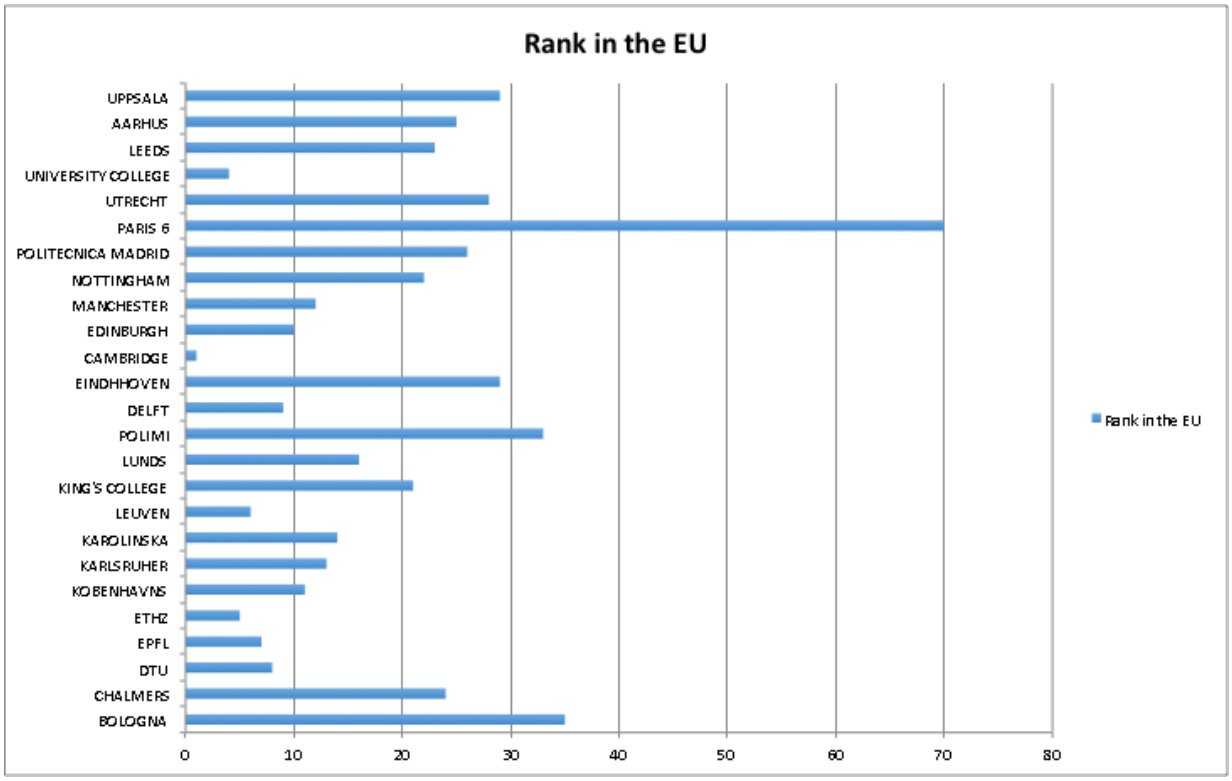
**Figure 67 – Success rate (retained project /eligible EU FPs project) by the 25 top research universities**




*Source: eCORDA 2015*

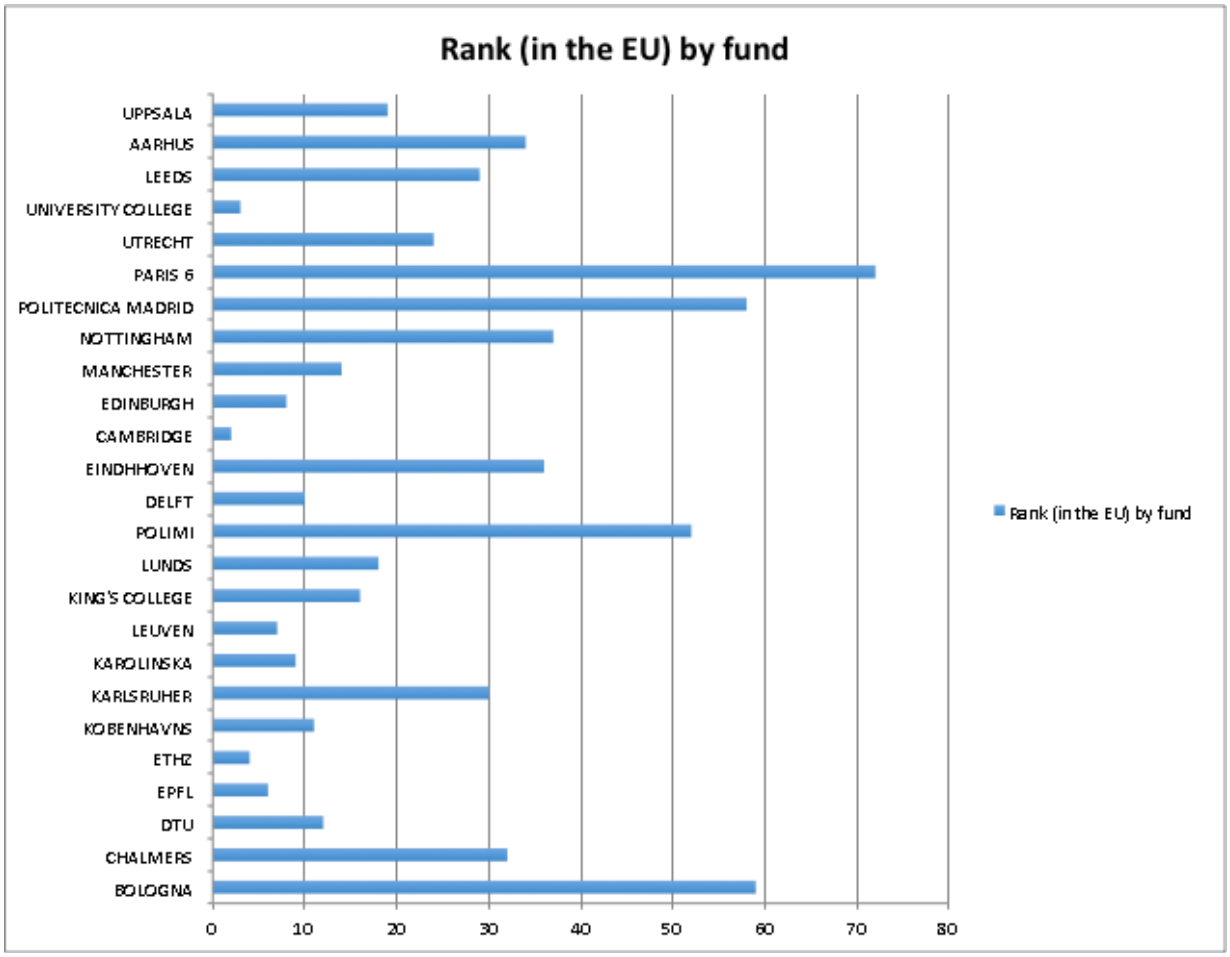
The following figures rank the top-research universities in EU, by number of projects and by funding in EU FP7. As to the former, 7 out of 25 universities rank in the first ten positions (Cambridge, ETHZ, EPFL, DTU, Edinburgh, Delft, University College) and 12 universities rank more than 20; as to the second indicator we find a similar ranking, thus confirming the phenomenon of concentration of EU FP participation in few high-standing performers.

**Figure 68 – Rank in the EU of the selected universities by number of EU FP projects (EU FP7)**




*Source: eCORDA 2015; Note: the lower the value the higher is the position of the University in the ranking*

**Figure 69 – Rank in the EU of the selected universities by funding from EU FP projects (EU FP7)**




*Source: eCORDA 2015; Note: the lower the value the higher is the position of the University in the ranking*

Few data on the top universities in Europe as to the number of EU FPs granted projects and funding received can be also recalled:

- 18 universities of our top research university sample are included in the group of 25 universities that received the highest number of granted projects in EU FP7. This is not surprising since one of the most important criteria for selecting the top research universities was the high performance in EU FP participation. Nonetheless, the university ranked 1st (Cambridge) and the university ranked 25th (Aarhus) show respectively a project count of 737 and 269;

- The same big difference between the first university in the rank and the last university in the rank can be found in the amount of EC funding received (respectively 424.03 min€ and 139.40 min€).

The mentioned data confirm that the phenomenon of concentration of EU FPs projects and funding in few actors is so strong that affect also the group of 25 top research universities investigated in this study, producing significant differences between them.

Network analysis also supplies some indications on the diversification of the strategies of few top-ranked universities (7 out of 25, namely Cambridge, Leuven, Delft, Manchester, ETHZ, EPFL, DTU) when they join new networks by the way of the participation in EU FP7. We refer to the indicators described in the Section 3.3.7 of this Report and to the table 54, which uses four main indicators, namely:

- The Degree of centrality, which shows the prestige of a node due to its number of connections with other nodes,

- The Eigen-vector centrality signalling whether a university is linked to other high-linked universities or to peripheral ones.
- The Between-ness centrality, which indicates the positioning of the actors in the shortest part between many actors, thus in a key position for reaching the full range of benefits from the networking (controlling the information flow and perform a gatekeeping function).
- The Close-ness centrality, which indicates a high efficient reach/spread of information within a network.

The seven top-level research universities included in our sample have different positioning with respect to the mentioned indicators: Cambridge and ETHZ rank high – 1 and 3- in the Eigen-vector centrality, and quite low – 7 and 6- as to the Degree of centrality and the Closeness centrality. On the contrary, Leuven and Delft rank high in the Degree of centrality -2 and 3- and in the Close-ness indicator, but low in the Eigen-vector centrality -7 and 10.

EPFL ranks low in three out of four indicators (10 in the degree of centrality, 9 in both Eigen-vector and Between-ness), while Manchester ranks 5 in four out of five indicators, and 6 in the Eigen-vector centrality.

Thus, the network analysis confirms the strong tendency of the outstanding universities of our sample to join other high-linked universities mainly following a self-reinforcing strategy. Other universities show an interest to maintain a large number of connections with other nodes, also joining more peripheral universities, but want to maximize both the benefits coming from the networking and to perform highly efficiently in the circulation of information. These universities develop a strategy that pays attention to both leading the search of complementarities for new collaborations, and to efficiently perform in the networking. Other universities do not present a clear strategy, according to the selected indicators.

Summing up, the analysis of the data confirm that the sample of top research universities is less homogeneous than expected; furthermore, it is difficult to group the selected universities according to the levels of performance in EU FPs participation, or according to other indicators coming from the ETER database, the global ranking of Universities and the eCORDA database. However, the data collected converge on two aspects: a) there is a clear indication that the countries where the universities are located play a significant role, a fact that has been also tested through the qualitative analysis of the interviews (see Section 5.4.1). This evidence confirms what literature recalls on the influence of the geographical localization and national conditions as determinants of the success in public grant allocation and in European programmes participation; b) there is a clear coherence of the data related to the high performance in the EU FPs participation and the scientists productivity at the very top level of the universities, which confirms the cumulative and self-reinforcing mechanisms affecting the EU FPs and more generally, the public grant allocation.

Finally, there is a small group of outstanding universities, which is composed by both technical universities and generalist universities, of different size (very large and medium-sized universities are both present) and different age (very old and more recent universities are both included). This group is characterized by stability in the ranking positioning -eventually getting higher along the years, very high performance in all the indicators on scientific productivity, excellence, and collaboration in knowledge production, and a strategy of networking aimed at joining similar high-level performers. These universities all rank at the very top level in EU FP participation both considering the number of projects and the amount of funding in EU; most of them are located in UK and in CH. On the other hand there is a group of universities whose performance in EU FPs participation is good but far from the former group; the performance of these universities, mainly located in IT, ES and FR is very high at the national level and there are also evidences of a common tendency toward reinforcing the international standing in terms of top-cited publication, international networking, and EU FPs participation.

## 5.4 Horizontal analysis of motivations, collaborations and pathways to innovation

In this section the information collected from the web-based questionnaire developed under Task 4[18] and the results of the interviews are presented in order to outline what are the main motivations for university engagement, what are the obstacles for participating, and the strategies adopted by the universities in relation to EU FP engagement. The section also discusses how participation in EU FPs improves the universities collaboration with other research organization and industry, and the concrete actions developed by the universities toward supporting innovation.

The analysis wants to figure out what is special and diverse in the top research universities considering both their engagement in EU FPs and the effects the participation produced, and what are the patterns of differentiation between them.

### 5.4.1 Drivers for the engagement

**Main motivations of top EU-research universities for participating in the EU Framework Programmes**

The most important motivation for participation in EU FPs coming from the web-based questionnaire (following figure) is the positive effect the universities perceive the participation might produce on quality and quantity of scientific outputs. Other two important motives for participation are the enhancement of scientific reputation and international competitiveness and the positive effects on collaboration opportunities that the networking of EU FPs is likely to generate. This result is significantly different from the other universities observed under the present study, which ranked as first motivation the satisfaction of funding needs, especially in a context of austerity and decreasing national financial support, and rank only 3rd the effects on scientific outputs. A different position is also given to the motive of positive effects on collaboration opportunities, which rank 4th in the sample of top research universities and 5th in the other universities. Interestingly enough the support to multi-disciplinary or cross-disciplinary research and technological development is not ranked high, and the use of European funding to train PhD students or young researchers is not listed at all.

The interviews confirm the aforementioned results. The possibility to work with colleagues internationally makes EU FPs very appealing and strengthens the willingness to engage. Universities pointed out in different ways that for collaborative research, also the access to specialized research equipment is sometime important especially in fields as for instance biotech where equipment is very expensive.

Two important benefits expected from the participation to EU FPs concern for the high-ranked universities the possibility to improve international collaborations and to access funding for basic high-risk research, this especially as far as Marie Curies and ERC are concerned. These universities often pointed out the possibility provided by EU FPs to carry out frontier research and research on cross disciplinary topics, to join new networks of partners and, the last motivations as for importance, the possibility to access knowledge not available at the university and to improve reputation: "ERC grants and EU FP are both at the centre of attention of the University. ERC grants and collaborative projects are used very differently and they have very different reputation ERC considered a way to show excellence, it improves reputation

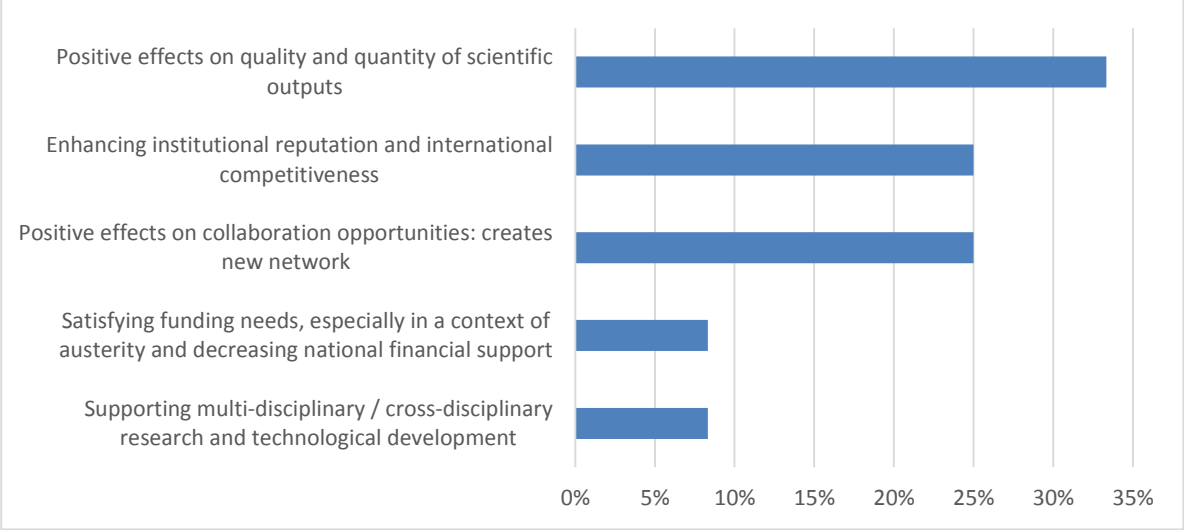
[18] The issues summarized in the figures have been investigated even during the interviews in order to have a complete a picture also for the universities that did not answer the web-based questionnaire (5 universities) or answer it not completely (2 universities). It means that the analysis can be referred to all the 25 universities investigated in this task even if some universities did not answer the questionnaire.

quality is seen as universal standard of excellence other collaborative projects are mostly seen as a way to improve collaboration and to collaborate with partners, it is always seen as something difficult. It is not in the same way prestigious, it is more necessary".

Although other factors as funding represent important drivers for participation, the possibilities provided by EU FPs concerning collaborations and exchange of knowledge across Europe are considered to be the key expected benefits.

As for the possibility to increase collaborations with industries this is perceived mostly as an opportunity in H2020; it is not the same in EU FP7 and EU FP6 when cooperation with industries was not a strong motivation.

**Figure 70 – Main motives for participation in Framework Programmes (% of respondents ranking 1st a specific motive)**




*Source: authors' calculations on survey data*

**Benefits deriving from participation**

All the respondents but one indicate that participation to EU FP contributes most of the time to achieve the intended effects; further motivation for participation producing the expected benefits were indicated as for instance "the focus of EIT (more or less part of H2020) helps our university to integrate a focus on delivering impact with a curiosity drive in fundamental research" or "Close engagement with industry within projects".

Respondents also underline as the bottom up approach of Marie Curie and ERC is extremely positive: "ERC represents a quality stamps for research"; "In EU FP7 we improved quality and visibility thanks to the success in ERC grants. They improved the reputation in the scientific community and this was not an expected effect of the EU FP7 when this started, it is not expected to be the same in H2020 because of the programme structure". Long duration of EU FPs and grant is also considered a very positive aspect of EU FPs. Marie curies actions and ERC have enabled a large number of researchers and PhDs to be trained, this representing a specific benefit mostly accounted to the two programs compared to the whole EU FPs. There is also a very positive impact on international and collaborative publications, and a broad effect consolidating the university prestige and reputation.

Effects and rewards on researchers career are also reported: this is not a specific effects of EU FPs but it largely applies to the fact that researchers are more and more competitive for research grants no matter where they come from, measures for rewards being almost the same across programs. In this respect it

was not possible to highlight gender differences as for the opportunities provided by EU FPs to career improvements or in recruitment opportunities related to EU FPs participation.

Participation so far enhances institutional reputation and international competitiveness, also important, although to a limited extent, is the possibility they provide to satisfy funding needs (e.g. personnel costs), especially in a context of austerity and decreasing national financial support. Here the respondents provide different answers according to national conditions, mainly the level of resources invested in R&D and the range of alternative funding opportunities in place.

When universities were asked about the outputs coming from the EU FPs participation: most of the answers very clearly pointed out that the contribute of EU FPs participation on scientific publication in high ranked journals was very important, the same cannot be stated for the commercial outputs such as patents or spin off, because the identification of the causal link between the EU FPs and the result is not clear. In fact, several projects concur to produce innovative outputs, especially when it looks promising from a commercial point of view

The impact of EU FPs participation on mobility and post-degree training occurred sometimes or most of the time. Interviews outlined in this respect different positions of the universities as to the impact of the participation in EU FPs but Marie Curie Actions: while Marie Curie are considered the proper tool for realising this type of impact, the participation to other programmes not always produce the same due to the structure of the research projects or due to national rules on post-degree training: "EU FPs very much support the "engine room" of research above and along funding from our national research funding".

As to the uniqueness of EU FPs all the respondents provide one or more examples of funding instruments at national or international level that provides similar benefits. So the interviews investigated how far EU FPs participation is one opportunity among others of the same value or it has some special features that make them particularly attractive. The respondents from the universities almost unanimously indicate the special opportunity the EU FPs supply is the possibility to build networks that can include different types of actors from different countries -and even non-European countries. This possibility of having a wide European participation is not generally assured by the national project funding schemes.

DTU reported for instance that the Danish system provides funds, which are more or less equivalent to Marie Curie and research fellowship but mostly within the Danish system or allowing recruitment in certain countries only, not all over Europe. So far there are significant differences between the opportunities provided by EU and national funding.

The results are coherent with the evidences about the low degree of openness of the national programmes in European countries (Primeri et al., 2014); furthermore the respondents recall also the reputational effect linked to the participation in EU FP.

### Obstacles to participation

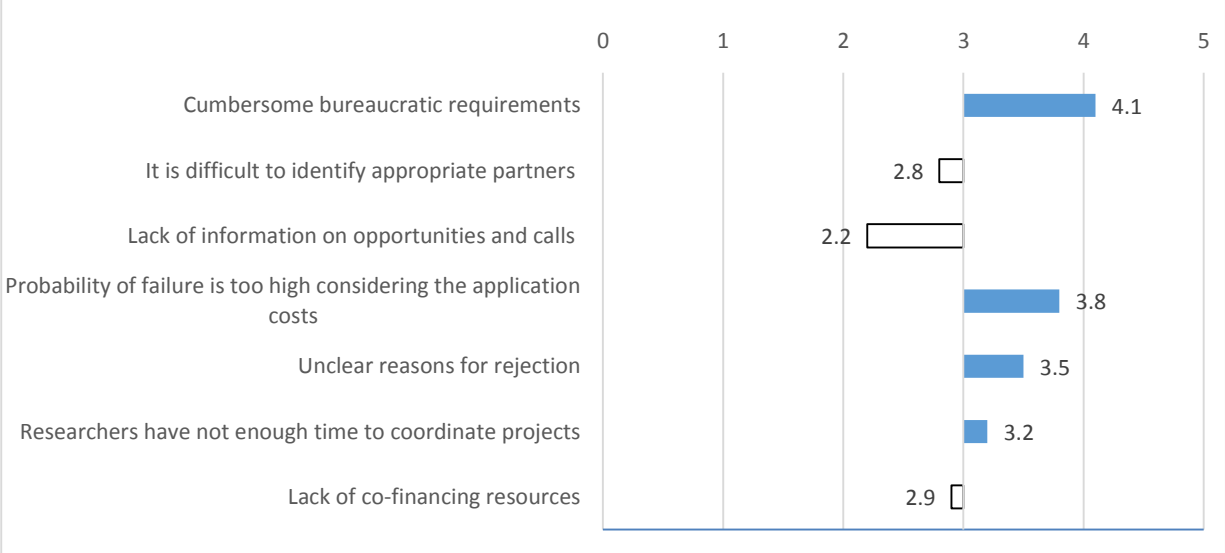
Bureaucratic requirements are generally considered the most important obstacle to participation in the sample of top research universities, the second being the probability to failure that is judged too high considering the application costs in terms of time and resources mobilized (following figure). The latter obstacle rank similar to the presence of unclear reasons for rejection, which is something affecting the evaluation process transparency and clearness. The sum of the costs linked to the hard effort required for the project submission with the unclear reasons in case of rejection is an issue that can discourage researchers, especially in sectors where the burden of education task is very high; moreover, this motive has the same rank also in the group of 75 universities, meaning that it is a matter of concern for EU FP participation.

However, the rank of bureaucratic constraints in the top research universities of the sample is higher than for the other universities (where it ranks 3rd), and the same holds true for the probability of failure,

which rank 1st in the other group of universities. Another difference relates to the difficulty to identify appropriate partners, which rank 2,8 in this group of universities contrary to 3,3 for the others, while the lack of information on opportunities and call is not an obstacle for these universities as for the others.

The interviews always pointed out the problem of bureaucracy, which was very emphasised by the respondents as affecting the phase of the project submission and the following steps when the proposal is approved. It is also confirmed the problems linked to the probability of failure that can discourage the participation when the risk or the uncertainties about the evaluation process combine with the presence of other funding schemes at national or international level that can be addressed to pursue the same research objective, and have simpler processes for proposals submission than EU FPs, and evaluation processes perceived as more transparent and reliable (see also the results of the survey on advantages of alternative support schemes in comparison with EU FP7 in Figure 65 of Section 6.3.3).

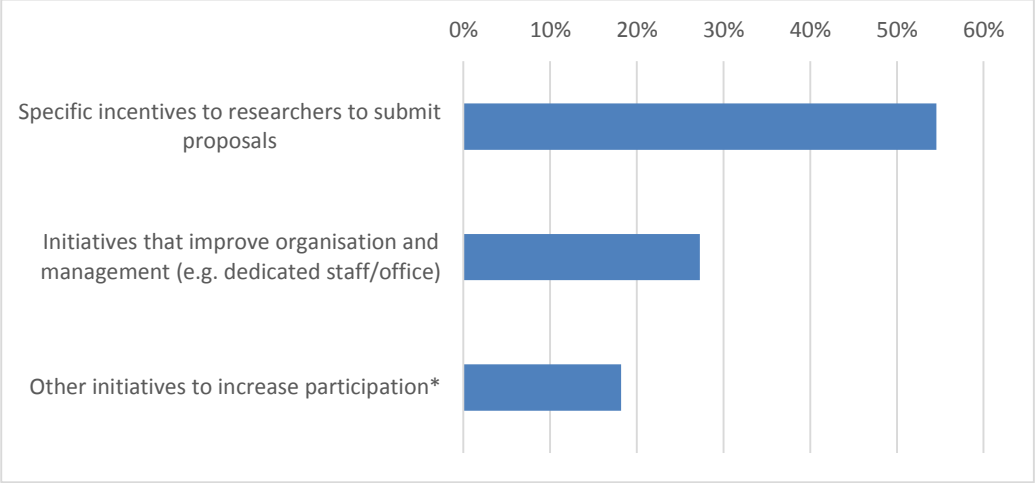
**Figure 71 – Obstacles to participation (5-point Likert scale: 1=strongly disagree, 5=strongly agree)**




*Source: authors' calculations on survey data*

The initiatives that could increase the participation in EU FPs are obviously related to overcome the mentioned obstacles by specific incentives to researchers to submit proposals and initiative to improve the organization and the management of the participation (following figure).

**Figure 72 – Initiatives that could increase participation in future FPs (% of respondents ranking 1st a specific motive)**




*Source: authors' calculations on survey data*

Here it is interesting to note the different importance of the former with respect to the latter: more than 50% of the respondents of the top research universities rank 1st the incentives devoted to support the researchers, while the presence of dedicated staff and offices rank 1st only for less than 30% of the respondents. These results are not fully in line with those of the other universities, where the improvement of organization and management is much more important than the specific incentives to researchers. An explanation rests on the fact that specialized structures providing support to researchers for the participation in international competitive call have a long tradition in all the top research universities, and what is really discouraging the researchers to apply are the transaction cost of preparing the proposal despite the help they can get from the university.

A further result that can be outlined is the importance given by the top research universities to other initiatives, which was ranked 1st by the 18% of the respondents; initiatives to increase participation include reducing "the burden of administration for projects balanced by an increased focus on genuine collaboration between project partners", as well as "to put resources on instruments devoted to improve prestige and visibility" (one example provided is for ERC, which could also envisage a quality label for innovation), and "especially improved access to more (!) competitive EU funding (for collaborative research, there is almost no alternative in Europe than the FP)". Other universities reported the need to increase the success rates, to simplify the application process, to have "less detailed reporting" and the "acceptance of normal institution practice".

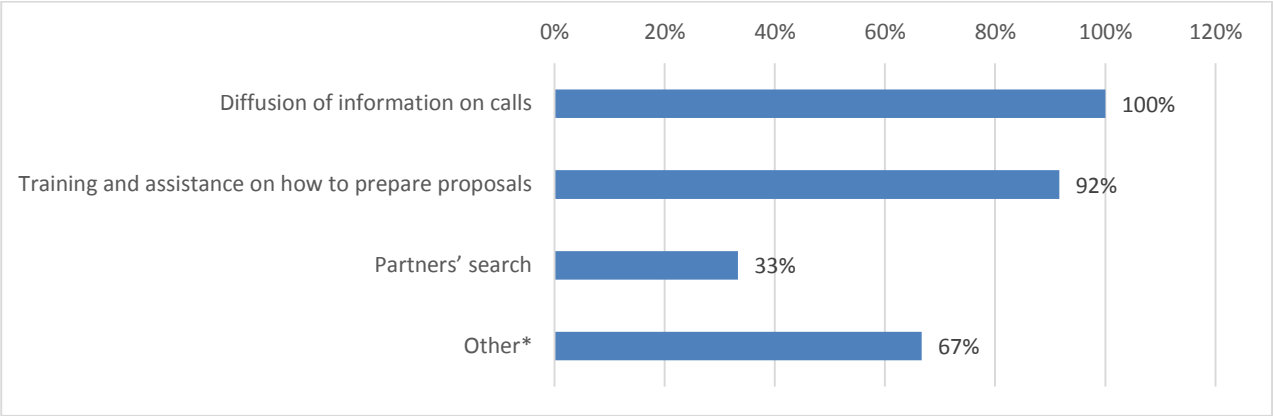
This result coincides with the outcome of the interviews: the need to have some repayment of the work devoted to prepare the proposals is extremely important (the cost of preparing a proposal is quantified in term of overwhelmed teaching duties and papers that have been delayed to accomplish this task), and few Universities mobilize some money to support the groups of the most promising proposals that want to apply to EU FPs calls. Nonetheless the interviews also outline that reducing the bureaucratic constraints is essential to improve the participation.

All the top research universities have special offices dedicated to support the participation in international programmes, which is thus a sort of standard in this segment of academic organizations. As to EU FPs, the following figure indicates the relative importance of the services provided by the dedicated structures. The most interesting evidence is related to the percentage of respondents that rank 1st services other than diffusion and information on the call or training and assistance.

"Other" includes in several cases the proposal writing or co-authoring of (non-science elements of), preparing project finances, reading feedback, administrative, legal and finance support, the strategic support to management and researchers, which means to have a look at what are the most important requirements for a proposal is positively assessed, what is missing, what must be improved; all kind of administrative tasks e.g. reporting, budget calculation, examine and monitor contracts, etc.; positioning and engagement with Brussels stakeholder scene; project management support of funded projects; assistance/guidance in management of projects, financial reporting, guidance for audits.

In sum the picture the universities provided in the interviews is mostly related to the heavy bulk of duties that goes with the proposal submission and –in case the proposal succeeds, its implementation. This fact has been negatively reported also because the bureaucratic workload required is the same whatever the size of the project (providing a very large funding or a relatively small one). Finally, it is interesting to note that the interviews did not directly address the issue of bureaucratization and workload for proposal writing (see the interview protocol in Annex 3), rather the mentioned issues emerged spontaneously and were often associated with some negative remarks about evaluation outcomes.

**Figure 73 – Services provided by dedicated structures**




*Source: authors' calculations on survey data*

### Strategy to facilitate participation

The top research universities have a strategy to facilitate the participation in EU FPs; the strategy is generally included in one official document such as the multi-year planning or in the annual Report. However, the interviews outline very clearly that the strategy is part of a more general attention of the organizations towards improving the internationalisation of the research activities, to achieving and maintaining reputation and prestige worldwide, joining new high-performing research groups and consolidating the existing ones, and taking the leadership of research proposal especially in emerging and promising research fields (biotech, nanotech, new materials, etc..). This result is coherent with the main motivations to participate in EU FPs, and with the special advantages the top research universities attribute to the participation in European programmes with respect to other existing funding schemes.

The following figure ranks the features of the university strategy as regards improving the participation in EU FPs. The values are the same as for the other universities surveyed in Task 4; other specific features include:

- Positioning the university "to compete successfully for funding from Europe and beyond, including by influencing and engaging with EU priorities for Horizon 2020, professionalising our approach to securing EU funding, and supporting our staff to be successful consortium leaders "

- Develop "financial incentives for participation: (1) part of the overhead (indirect costs) can be freely used by the researcher (to invest in research); (2) preparatory funding for coordinator initiatives from KU Leuven research budget; (3) runners-up funding for highly ranked". This comment is interesting because it reports how the strategies of the universities are designed to overcome the obstacles to participation.

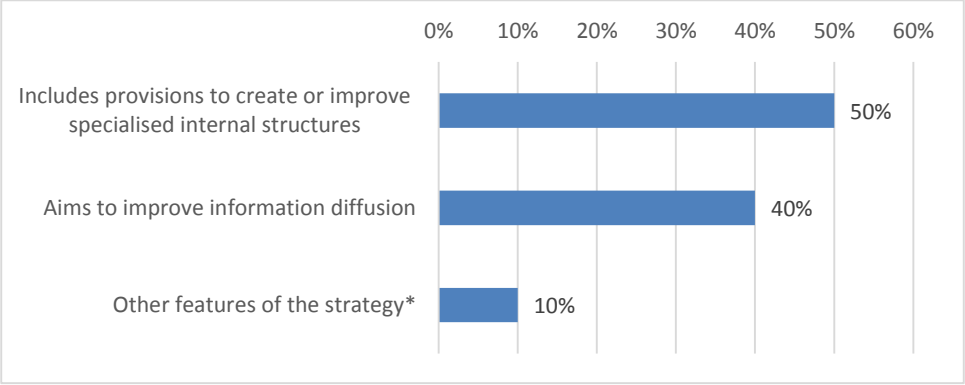
- Improve "closer partnerships with industry (including SMEs), raising our ability to develop competitive project proposals"

- Launch "structured training programme for researchers and support staff".

The mentioned examples have been also reported in the interviews by other top class universities: the strategies the universities put in place are always driven on the one hand to easy the work for the researchers enlarging the number of applicants, on the other hand to facilitate the assumption of a leading role within the research consortia. eCORDA data testify that this result was largely achieved in EU FP7.

Most of the top research universities, first and foremost the outstanding ones, are also proactive actors in the European scene, activating contacts and inter-personal exchanges in Brussels, encouraging researchers to be involved in the evaluation or peer review processes of the EU FPs, whose advantage is perceived very high since it allows to understand more concretely the mistakes to avoid writing the proposals.

**Figure 74 – Features of the university strategy as regards improving participation in EU FPs (% of respondents ranking 1st a specific motive)**




*Source: authors' calculations on survey data*

### Strategic aims pursued

Universities were asked in the interviews to assess what was the most important strategic aim pursued with EU FPs participation. EU FPs are considered to foster internationalisation and to allow improving the quality of university, as to the possibility to maintain and eventually improve the publications in high-ranked journals, and eventually to pursue commercial outputs; joining new supranational networks is also considered as a strategic aim.

The main strategic aims for high ranked universities are more circumscribed: quality and excellence, with ERC funding as the true strategic action. The aims are also: i) to positioning the university to compete successfully for funding from Europe and beyond, ii) including by influencing and engaging with EU priorities for Horizon 2020, iii) professionalising the approach to securing EU funding, and iv) supporting the staff to be successful consortium leaders. In this respect the strategies might include the

improvement of the specialized internal structures for participating to international and national tenders, and to foster the coordination of research projects.

Some universities report recruitment of talents is a strategic aim as well as the use of EU FPs as a mean to send talented people abroad for a period of time. Participation in EU FP also represents a way to recruit or to promote careers. Holding an ERC or a Marie Curie grant at the start of the career can help build individual and also university reputation in academic world. However the impact of EU FPs on rankings and quality standards, at least formally, is difficult to be assessed.

One common result for all the universities in the sample is that the concepts related to the creation of the European Research Area (ERA) and European integration do not come as aims that are part of the strategy. Integration is not a recognized concept, rather all the universities report the need to improve (enlarging and consolidating) collaborations with existing and emerging groups; top ranked universities also reported the need to coordinate research effort with other research partners.

Collaboration between partners, networking and in some cases, when the collaboration is a long lasting one, good coordination of the research efforts in order to succeed in the project funding competition are reported as very important aims; in no case EU FPs have been indicated as streams providing the opportunities of a better integration of research activities between different European universities. Collaboration and networking are means for the universities to pursue better research results joining good partners, improving the quality of research and eventually its impact, gaining more reputation in the European arena, fostering a leading position between different competitors at least as far as EU FPs participation is concerned.

### 5.4.2 Collaboration with other research organisations and industry

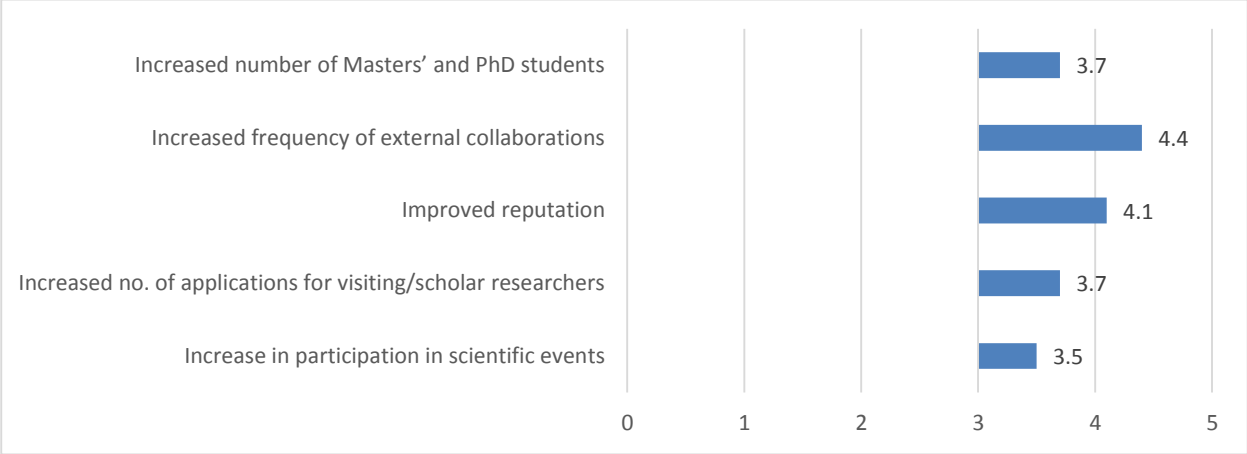
#### External collaboration

Collaboration at international level is a key feature of the EU FPs, which make them different from the other funding schemes. The possibility to associate in the EU FPs also partners outside Europe is another important advantage for researchers, especially those working in research fields such as life sciences, where important research group are located in non-European countries.

However, the top research universities of the sample pointed out some differences affecting the collaboration with research organization and the collaboration with industry. In the former case the advantages are positively perceived by all the universities; in the latter case, the possibility to find other funding schemes that provide similar or even more adapt funding instruments for the research purposes has been reported in the interviews, especially for transnational research programmes funded by EU. One example is EUREKA, but also other transnational initiatives managed by national funding agencies as Nordforsk can be mentioned.

The following figure outlines the assessment the universities made of the capability of the EU FPs to improve the university attractiveness along several type of benefits. The most important effects are the increased frequency of external collaborations and improved reputation. Also the other benefits have been positively assessed. In this case the perceptions of the top research universities are as the other universities, meaning that despite the fact that motivations are different, the participation in EU FPs produce in any case similar positive effects to the universities involved.

**Figure 75 – How participation in EU FPs improved university attractiveness (5 point Likert scale)**




*Source: authors' calculations on survey data*

All the top research universities included in the sample reported that most of the time collaborations with external partners within the EU FPs facilitate cross border cooperation activities with other universities. The cooperation with other research institutions or regions is facilitated by EU FPs as well only for half universities of the sample; in the other cases the EU FPs have a positive effect only sometime. No university reports any effects of the EU FPs on collaboration with external partners other than universities. As one university points out: "though most cooperation is initially with already known partners, there are always new partners in the consortia, which sometimes leads to new contacts."

The duration of the cross border cooperation activities generally is a short-term one, linked to the project duration; long term duration have been reported by the outstanding universities, although it has been outlined that "the aim and wishes is of course that new collaboration will continue, develop and lead to further cooperation in those cases, it is of value to both parties."

The interviews also outline EU FPs have some effects on the internal organization of the university, which let emerge trans-disciplinary research groups composed by researchers belonging to different Faculties, continuing to work and to apply for funding even after the EU FP project completion. This event has always an impact on teaching activities when the topic has a potential for educational purposes (as in the case of emerging fields like biotechnology or nanotech).

## University-industry cooperation

There are several signals indicating the level of interactions between a university and an industry; some of them have been investigated in the web-based survey in order to understand whether the participation in EU FPs changes in some way the actual cooperation with industry and how this phenomenon is different for the top research universities and other European universities.

The interviews outline that the university-industry cooperation is not a central motivation for participation. Saying differently, EU FPs are not perceived as funding instruments leading to innovation although there are several very good examples of projects developed in cooperation with industry, which produced innovative outcomes.

University-industry cooperation activities established thanks to the EU FPs participation are neither stable nor occasional; universities reported that sometime as short term ones and sometime they continue after the end of the financial support of the EU project. Sometime collaborations occur because there are already relationships in place between the universities and the industry, but in some cases the

relationships develop because of the participation in the same consortium: "Collaborations with industries not so much developed in the EU FP7 framework, they are mostly national it is hard to get international collaborations with industries".

Universities also provide several examples of participation in the development of the regional Smart Specialization Strategy; among them we can outline the Aarhus University is represented in the regional Growth Forum, which is responsible for regional SSS[19]; Chalmers_works closely with the regional authority on strengthening regional clustering and innovation capacity[20]. Edinburgh fed into the consultation exercise of Scottish Enterprise and the Scottish Funding Council.[21] As to Bologna, Emilia Romagna Region identified five thematic research areas according to the industrial potential of the regional economic contest, and organised round tables with relevant stakeholders in order to collect inputs to draft policy documents and guidelines. The University was involved since the beginning and participated in the round tables to define technological priorities and regional strategic assets. Nonetheless the linkage between these kinds of activities and the engagement in EU FPs is not clear: universities in most of the case recognize that their involvement in regional activities was just one factor among others facilitating the engagement in EU FPs.

Interestingly enough, the universities indicated in their answers some academia-industry mobility programmes in place aiming at increasing the mobility of students and researchers; these programmes were mainly based on Marie Curie Actions, which in fact is one of the action recalled as a strategic one by the top research universities. Interviews in this respect clearly outline a common very positive judgement for Marie Curie programme, which is undoubtedly considered the most important instrument for training PhD students and early researchers through mobility within different academic, non-academic and private organizations within Europe.

The following figure provides examples of university industry cooperation curricula design and PhD training. The results are not so different from those of other universities but the case of 'industry supports to individual university researchers through grants and contracts' has a significant higher number of occurrences for 'most of the time' than in other universities and there are no universities, which indicate 'never'. The same situation occurs for companies providing training on the job; the role of industries is really marginal when the PhD course is organized and for education and training courses carried out.

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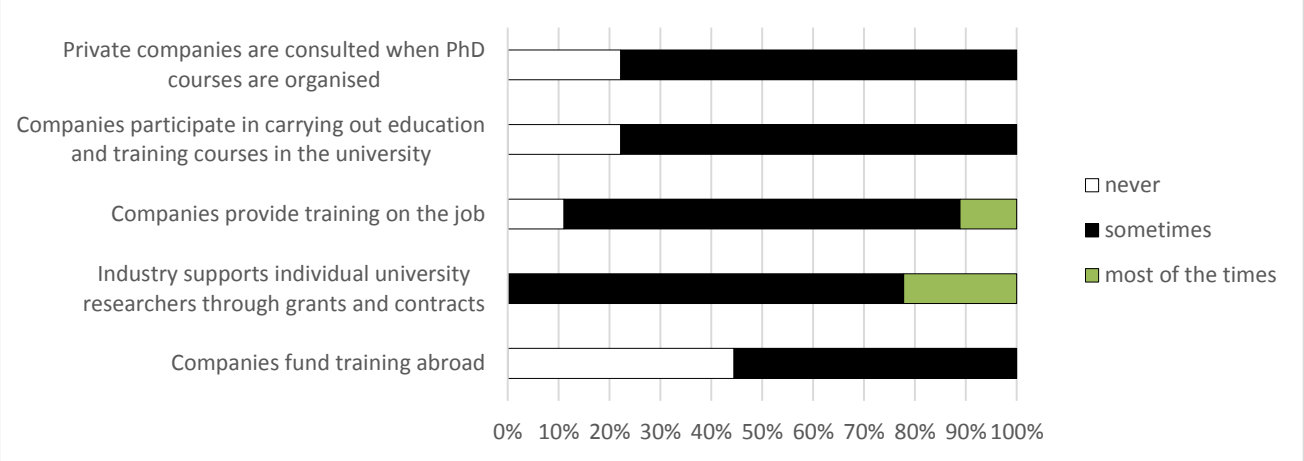
3 http://www.rm.dk/om-os/english/regional-development/about-regional-development/growth-forum/

20 Cf. e.g. http://www.vgregion.se/fiveclusters

21 The S3 for Scotland focuses on: Tourism, Food & Drink, Financial & Business Services, Life Science, Energy, Creative Industries, Enabling Technologies (Sensors/Informatics), and Universities. These are very much aligned with the Universities strengths.

http://www.scottish.parliament.uk/S4_EuropeanandExternalRelationsCommittee/Inquiries/Submission_from_Scotland_Europa_Scottish_Enterprise_Highlands_and_Islands.pdf

**Figure 76 – How companies participate in curricula design and training of PhD**




*Source: authors' calculations on survey data*

Another signal of effective collaborations between university and industry is the presence of university laboratories funded by industry on a permanent base and/or industry consortia. This was investigated through the web-based questionnaire and the desk research on the universities' website; an example of three laboratories is presented in Box 11.

**BOX 11 – University-industry laboratories**

**GigaHertz Centre (GHz Centre)** is a ten-year agreement between Chalmers University of Technology, research institutes, company partners and the Swedish Governmental Agency for Innovation Systems (VINNOVA) to carry out research and innovation in wireless communication and sensor technologies. All partners jointly invest resources in the GHz Centre in order to carry out research projects along a common plan. The projects are selected from common needs among the industrial partners. The GHz Centre is administered and hosted by Chalmers, Department of Microtechnology and Nanoscience - MC2.GHz Centre is a VINN Excellence Centre partly funded by VINNONA

Source: http://www.chalmers.se/en/centres/ghz/about/Pages/default.aspx

**Lighthouse** is a unique multidisciplinary maritime competence and research centre, which is based on a triple helix cooperation between industry, academy and public sector. With a national platform for research, development and innovation, there is a growing possibility for increased funding. Key figures 2006-2015: the Swedish Shipowners' Association invested 100 million SEK in a ten year period Leveraged *2,5 directly Leveraged about *9 indirectly; more than 100 research projects; more than 500 scientific papers produced; more than 50 PhD students.

Source: http://www.lighthouse.nu/about

**SAFER Vehicle and Traffic Safety Centre** at Chalmers is a competence centre using competence from 33 partners from the academy, society and the industry. SAFER provides excellent multi-disciplinary research and collaboration to eliminate fatalities and serious injuries, making Swedish society, academy and industry a world leader in vehicle and traffic safety. Research at SAFER spans a broad base, covering several disciplines and encompassing both traffic and vehicle safety in real environments. The centre's activities engage the very elite in the field of traffic safety, and the results contribute to increasing the competitive advantages of the centre's partner companies and organisations.

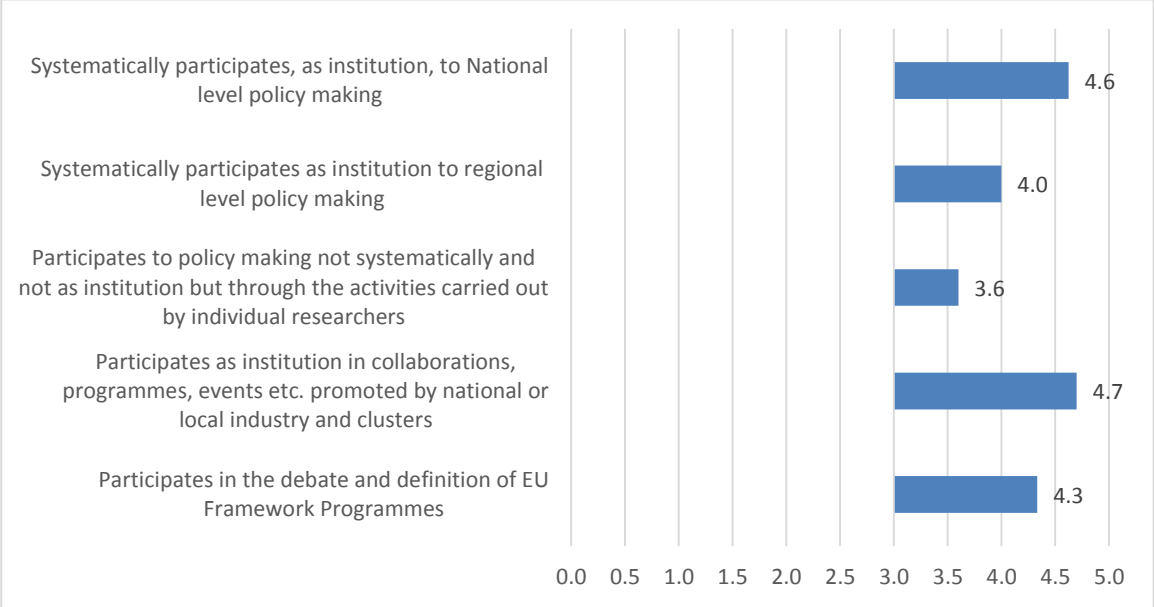
Chalmers University of Technology hosts the centre and VINNOVA is the main funder. By using the multidisciplinary scientific competence available within the centre, the university wants to make it a hub for excellence within the field of vehicle safety.

Source: http://www.chalmers.se/safer/EN/about

It is evident that the possibility of this type of collaboration is strongly affected by the presence of a national policy from the local funding agency toward supporting joint research labs, as the cases of Chalmers University show. No impact of EU FPs participation emerges from the mentioned experiences.

The following figure reports the assessment the respondents made of the role of the universities in the national innovation system on the base of a Liker scale. The values of this assessment let us understand how the top research universities are aware of their role and capability to participate and influence other institutions through collaborations, programmes events promoted by national or local industrial partners; the same holds true for the systematic participation of the universities to national level policy making, and in the debate and definition of EU FPs.

**Figure 77 – Role of the universities in the national innovation system (5-point Liker scale)**




*Source: authors' calculations on survey data*

### 5.4.3 Pathways to innovation

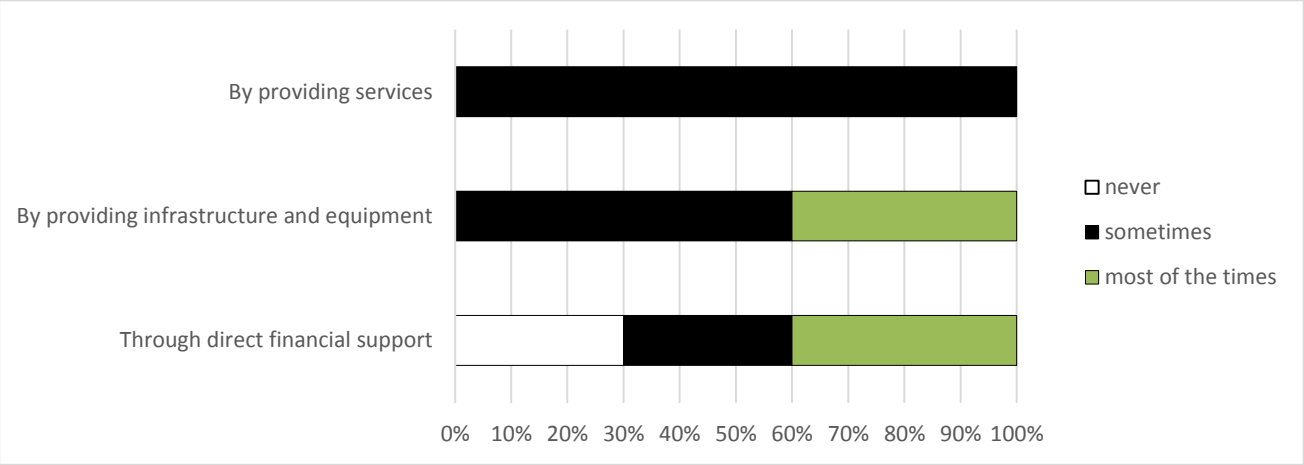
#### Spin-offs and incubators

Top research universities have a strong interest toward playing a leading role also in the development of innovative outputs and to generate an impact on economy and society through among others, spin-off and technology transfer.

All the universities in the sample support spin- off creation and the 40% of them most of the time provide infrastructure and equipment and direct financial support (following figure). However, financial support is concentrated on outstanding universities or in universities with a strong collaboration in research with industry: 30% of the respondents in fact never provide it, a percentage that is very low if compared with the other universities (about 60% do not supply direct financial support).

The universities always develop monitoring activities on spin-off created by the university and the start-up supported; this is indeed a further example of the investment of this group of universities toward innovation.

**Figure 78 – How universities support spin-offs**




*Source: authors' calculations on survey data*

The universities do not provide data on spin off created during the interviews and answering the survey but few of them. Statistics are not always easy to found and the comparability between countries of the data collected looking at the internal Reports is very low. The same situation can be referred also for data on patents.

Nonetheless, all the top research universities have an incubator or an accelerator for spin-offs and start-ups; through the desk research we collect stories of excellent results in producing innovative outcome, as it is testify by the two examples of incubators outlined in Box 12 and Box 13. However, the participation in EU FP7 was not reckoned as having a positive impact on incubation of spin offs but sometimes. Since all the universities but 2 provide the same answer, this can be considered an evidence of the disputable effect of EU FP participation on the production of results related to innovation.

## Technology transfer

Technology transfer is an important part of the mission for top research universities, beside the participation in EU FPs. Dedicated structures operate in all the universities to foster interactions with the industries and commercialization of research results. One major example is the practice of the Cambridge University (see Box 14), but also other cases could be outlined in all the universities of the sample. The following figure provides information on the type of services the top research universities provide in addition to spin-off incubation, to facilitate commercialization of knowledge. All the outstanding universities supply the mentioned services most of the time. The percentage of universities that do not provide internationalisation support services and benchmarking services is very low (10% of the universities; the difference with the other universities is very high since a percentage of 30% do not provide this type of services); also the percentage of universities not providing test and trials and technology audit support is low.

**BOX 12 - INCUBA at AARHUS University**

INCUBA's mission is to strengthen knowledge and research-based companies' networks, innovation and growth through infrastructure, services and counselling.

INCUBA builds commercial premises to meet the business requirements of its tenants and provides an effective professional palette of services and facilities – including reception services, meeting and canteen facilities, switchboard, fast broadband and free parking.

The incubator contributes with sparring and consulting services and utilises its extensive network of major innovation players and commercial partners to promote the innovation activities and growth of the resident businesses. In close proximity to local research and educational institutions, INCUBA's locations generate synergy effects that give its many diverse enterprises excellent opportunities for commercial innovation.

The dynamic and innovative environments also house more established companies as well as development divisions from major companies and temporary projects. Players promoting trade and industry continue to make a significant contribution to INCUBA's environments. There is a total of 30,000 m2 of office and laboratory space. The share capital is of DKK 47 million.

*Source: http://www.incuba.dk/about_incuba.asp*

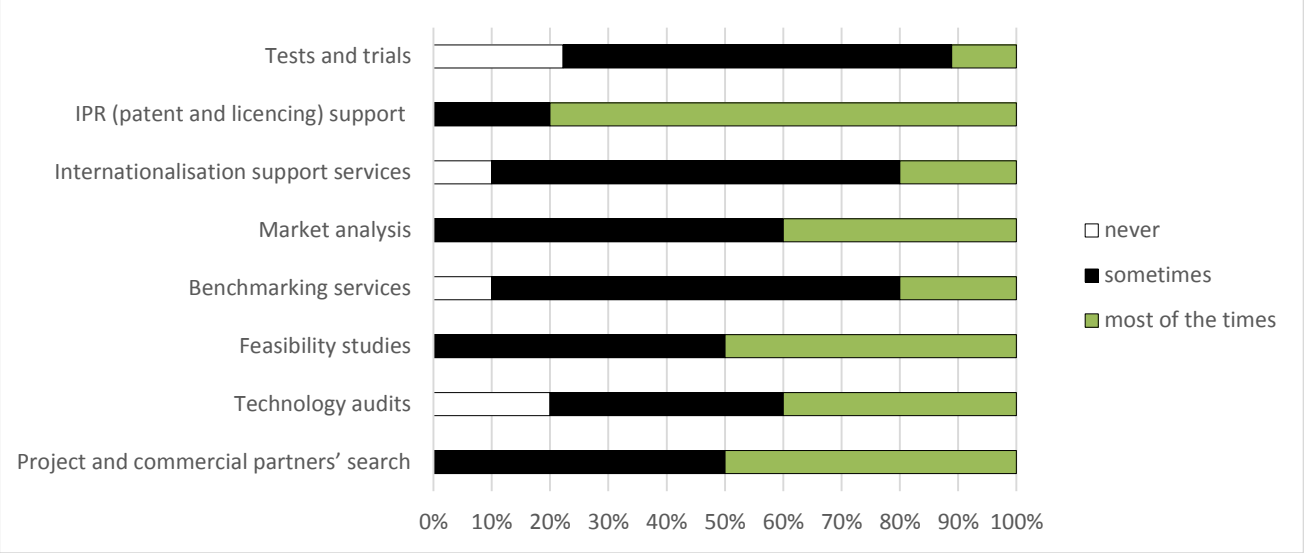
**BOX 13 - The Edinburg Technology Transfer Centre**

The Edinburgh Technology Transfer Centre opened its first incubation facility on the University of Edinburgh's King's Buildings campus in 1987. Since then, it has expanded, taking on additional facilities and activities and, as a crucial contributor of the University's Company Creation and Development strategy, is committed to providing an effective and facilitating bridge between the University's research labs and the business world. The Edinburgh Technology Transfer Centre provides specialist laboratories and high-spec office accommodation to spin-out and start-up companies and project teams involved in research and development programmes.

The Centre provides key business development support to incubates, including access to business development professionals, workshops, networking opportunities and, perhaps most importantly, the chance to share experiences with other small technology companies. The Edinburgh Technology Transfer Centre currently manages three incubation activities: ETTC and ETTC BioSpace, which are incubator facilities providing office and biotech / biomed laboratory units respectively, and ETTC Campus, which provides incubation services to companies which require specialist facilities only available within the Schools of the University's College of Science and Engineering. These three activities act as a launch pad for start-up and spin-out companies from a hugely diverse but consistently world-class research base.

*Source: http://www.ettc.co.uk*

**Figure 79 – Type of services provided (in addition to spin-off incubation) to facilitate commercialisation of knowledge**




*Source: authors' calculations on survey data*

**BOX 14 - Cambridge enterprise**

Cambridge Enterprise helps students and staff commercialise their expertise and ideas. Cambridge Enterprise was designed to work in concert with the University of Cambridge, supporting research initiatives as they relate to consultancy, intellectual property management and the creation of spin-out companies.

**Aims**

- Aid the transfer of knowledge from the University via commercialisation by helping staff and students to make their ideas more commercially successful
- Ensure that society and the economy benefit from commercialisation stemming from the University
- Build strong relationships with University academics to encourage the disclosure of ideas, know-how and inventions, and offer cooperative management, guidance and support of the most promising innovations
- Produce a financial return for inventors, departments and the University
- Be an attractive partner for industry and investors to take University ideas forward through commercial channels.

**Results in 2014**

- Income from knowledge and technology transfer – £16.5 million
- Distributions to academics, the University and others – £14.7 million
- Costs (staff and other operating costs) – £3.1 million
- Investment in patent assets (patent and proof of concept) – £1 million
- 268 consultancy contracts signed
- 124 new technology disclosures
- 239 new patent filings
- £7.5 million raised in proof of concept and follow-on funding to assist inventors
- 11 companies receiving new or follow-on investment

Cambridge Enterprise currently manages close to 1,000 active IP, licensing and consultancy projects and more than 60 equity contracts, working with more than 1,320 researchers at all stages of the commercialisation process.

*Source: www.enterprise.cam.ac.uk/*

The most important service provided by the Technology transfer offices is the IPR support, more specifically the support to patenting and licensing. The assessment of the impact produced by the participation in EU research programmes on patenting received more positive answers by the respondents than spin offs. Half of the universities surveyed agree that the EU FPs have had a positive effect, although patenting is produced through converging research efforts coming from different sources of funding. The other universities but 2 are neutral as to the impact of EU FPs participation.

Finally, it is interesting to highlight suggestions coming from universities on how to strengthen the cooperation with industry and the university-industry mobility within European Research Programmes:

> "European funding programmes need to focus more on promoting excellent science. The administration of Framework Programme funding is inflexible and is more concerned with milestones and deliverables and not the results and their impact. Follow-on funding would be a positive change as would allowing small companies to be involved as subcontractors rather than full partners to ease the cost of their participation."

> "Incentive systems at universities. 1. A small part of basic funding should be dependent on interaction with industry and innovation activities, based on measurements. 2. A small percentage of funding could be allocated for activities that promote innovation, commercialisation and interaction with industrial and societal partners. 3. Job-rotation financing programs for temporary experience in industry for academics and vice versa."

> "Increased focus on outputs from industry partners in EU projects, and increased focus on collaboration between academic and industry partners within projects"

> "Increased support to pre-competitive research, the middle ground between fundamental basic research conducted in universities, and proprietary research performed in corporate laboratories, can strengthen both cooperation with industry and university-industry mobility."

or to improve the knowledge diffusion and commercialisation of research results:

> "Making follow-on funding available to more easily develop outputs further and test viability to market. Acknowledge impact is long-term and that basic/fundamental research needs to be funded in order to have a future impact."
>
> "Incentive system. 1. Small part of basic funding should be dependent on interaction with industry and innovation activities, based on measurements. 2. A small percentage of funding could be allocated for activities that promotes innovation, commercialisation and interaction with industrial and societal partners."
>
> "Access to proof-of-concept funds to follow on from EU funding within our commercialisation team. This is available for EPSRC funded projects in the UK ( so called 'Impact Accelerator Accounts')."
>
> "A greater emphasis on cooperation between actors (both individual and corporate) in creation
>
> of values around innovations generated in EU-supported projects, will both improve knowledge diffusion between the actors and commercialization of innovations".

### 5.4.4 Concluding remarks and policy implications

The case studies pointed out elements about motivations and strategies of the top research universities, which differentiate them from the other universities. At the same time data and ranking indicates that the sample of top research universities shows important differences between universities, with few organizations ranking very high with respect to the others. The investigation was developed at the central institutional level; it means that important insights and best practices, able to contribute to explain enabling conditions at the basis of the performance of top research universities in EU FPs as well as the strategies developed within different research fields or sectors, cannot be captured.

Despite the existing differences, the most important motivation of the top research universities for participating in EU FPs is the positive perceived effect on scientific outputs. Other important motives for participation are the enhancement of scientific reputation, international competitiveness and the unique and positive effects on collaboration opportunities that the networking of EU FPs is likely to generate. This result is significantly different from the other universities observed under the present study, which highlighted the importance of satisfying funding needs, among motives, and ranked the effects on scientific outputs only 3$^{rd}$. The special opportunity the EU FPs supply in comparison with other existing funding schemes at national level is the possibility to build networks that can include different types of actors from different countries and even non-European countries.

The responses gathered through the analysis confirm the main benefits from EU FPs for top universities that are: the possibility to improve international collaborations and the opportunity provided to access funding for basic high-risk research, this especially through Marie Curies and ERC programmes. The internal strategies also mainly addressed at supporting and encouraging the participation in the ERC grants, which are considered more suited to improve the actual academic standing. This may suggest that, differently from other universities, participation of top ranked universities is mostly concentrated on actions that allow improving excellent scientific performance rather than being fragmented, in pursuit of different priorities.

The availability of government institutional funding and project funding opportunities at national level emerge as elements that differentiate some universities in the sample, because of the importance given

to the motivation "more money". In relation to external and academia-industry collaborations, top research universities acknowledge the limited effect of EU FPs on academic industrial collaborations and consider H2020 programme as a major opportunity on this respect. H2020, in fact, is perceived as oriented towards improving collaborations through a participative decision making process. In this respect, it emerges as EU FPs impact mostly on the capacity to publish internationally (thus confirming Leiden ranking evidences) while patenting capacity is difficult to be assessed because it is difficult to capture the link between the project and its exploitation.

The analysis and, first and foremost, the interviews present very clearly that the evolution of the objectives and scope of EU FPs is very well understood, and the strategies of the top research universities tend to change accordingly. The progress from FP6 to FP7 for instance, was very positively reported, since universities consider the support to excellence as a core objective. The transition from FP7 to Horizon 2020, focused on innovation, is positively judged as it allows to improve the collaborations with the industry, although some hesitations emerge as far as social sciences and humanities are concerned. This good understanding of the EU FPs aims is also linked to a very good impact of the EU FPs themselves: top research universities realised most of the benefits they expected from FPs participation, and unexpected consequences were mostly linked to the unexpected positive results of ERC and Marie Curie. Collateral effects did not emerge from the interviews but some problems linked to bureaucratic fulfilments and the time required to prepare the project proposal, which might negatively affect research productivity, were highlighted. In fact, the probability of failure is judged too high considering the application costs in terms of time and resources mobilised. Moreover, complains against the lack of transparency of the evaluation (motivations of the reviewers) emerged. There is a clear convergence of top research universities and other universities in the sample in this respect.

These results suggest some key policy implications. Firstly, top ranked universities confirm that participation is concentrated in few universities which benefit of a competitive advantage gained through continued participation in EU FP (the so called Matthew effect) deepening the gap, in terms of capacity to compete in the EU arena, between them and other academic institutions. As a consequence, a concentration of resources around a limited number of major players, mostly northern European countries, can be observed which raises a question on whether FPs support the ERA and its integration or rather they mainly support self-reinforcing (success) mechanisms. Secondly, it could be questioned whether such resource concentration does not pair with an outstanding academic status and to what extent it is consistent with ERA objectives. Secondly, it could be questioned whether such resource concentration is consistent with ERA objectives. In fact, a competitive advantage clearly emerge for the sample of top universities which, however, consider the ERC and the Marie Curies the only two programmes really fostering quality and excellence or allowing strengthening the existing leadership status of top universities.

Hence, FPs emerge more and more as instruments which favour few participants only, mostly prestige academic institutions in 1 or 2 countries, allowing then a concentration of resources around universities, countries and specific thematic priorities. On the other side, the concentration of resources, mostly financial ones, raises a question on whether FPs tend to reinforce lock in mechanisms in EU collaborations, weakening possibilities to enlarge the ERA community and undermining its attractiveness, while strengthening inequality across EU academic institutions. Such limits are highlighted with respect to several countries, especially East European Member States. A support through specific training activities on how to be competitive in the European scene and dedicated cohesion measures might help those countries to increase participation hence overcoming the existing imbalances.

The extent to which bureaucracy is likely to burden participation from young promising researchers or from less "competitive" institutions which do not benefit of supporting structures (e.g. EU grant offices) is another key question. This may increase the information asymmetry which often characterises less performing institutions, as opposed to experienced research groups and leading investigators. In this

respect, mobility between more and less experienced academic institutions might represent a strategic solution to improve competitive capacity of less successful universities. Nonetheless, a relevant policy question that emerges is whether the assessment procedures are perceived to be reliable and transparent, beyond the bureaucratization of EU FP procedures for application and management. Also it might be questioned the extent to which bureaucracy is likely to weaken the quality of the EU FPs participation.

Summing up, top research universities, despite some differences, show specific common features that differentiate them from other universities covered in this study. Firstly, top research universities show a prominent interest to instruments provided by the EU FPs to achieve high academic quality, to strengthen excellent reputation, to increase possibility for international networking with top academic institutions and to improve competitiveness, especially when high-risk research activities are concerned. Secondly, almost all top universities have a strategy for participation in EU FP which is mainly aimed at improving academic standing and maintaining a leading position, gaining also the leadership in new fields and in the European arena. Thirdly, top universities are concentrated in two-three countries and success stories seem to be strongly rooted in the academic life so that participation is perceived as strengthening an already existing outstanding position in EU FPs competition.

Individual cases on top research universities are presented in alphabetical order in the Annex 2.

# 6 Task 6 – Participation vs. non participation

## 6.1 Objectives of the analysis

The lack of information on the causes of project rejection is one of the main gaps emerging from the analysis of revised eCORDA data which was carried out in the foregoing Tasks of this study.

Considering the significant amount of time spent by applicants in setting up partnerships, preparing the proposals, submitting and following them up, and by reviewers in evaluating the projects, it is essential for the policy maker to have a clear picture of the strengths and weaknesses of the selection process and, ultimately, of its effectiveness.

The potential loss in terms of missed innovation could be considerable, both when proposals are submitted and later on, if the propensity of some applicants to participate in EU FPs is discouraged by an "unsatisfying" selection process.

Given the need for better understanding the motives of rejection and what happens after a negative decision on project funding has been taken, the present Task intends to contribute to fill the existing knowledge gap by:

- Exploring the reasons of rejection;
- Examining the paths of non-successful project proposals and analysing the effects of not being selected;
- Comparing, as far as possible, some features of the revised proposals, financed by other sources, such as costs and results with those of EU funded initiatives.

The main activities which have been implemented as part of the task include:

- the design of a questionnaire for unsuccessful applicants aiming at collecting data, comments and recommendations on the above issues;
- the selection of a sample of projects where universities applied without being successful;
- a test of the questionnaire on a limited number of applicants and fine-tuning;
- set-up of a help-desk;
- the collection of data on this sample through an online survey; the questionnaire was accessible for 2 months through web-link; 4 reminders were sent to recipients.
- an analysis of gathered data aimed at answering a set of evaluation questions which are summarised in the following table;
- a synthesis of the findings and of the conclusions that emerge from the analysis and may be relevant for EC policy management and future developments.

**Table 104 – Key issues and questions addressed in the survey**

| Main issue | Key questions |
|---|---|
| Rejection and quality of selection process | • What are the main reasons for the rejection of proposals? (basic statistics on the distribution of proposals by key reason…)<br>• Was the received feedback clear, satisfactory and useful to improve the proposal, for learning and increase chances of future success?<br>• Do the applicants agree with the final outcome of the project evaluation? If not, what are the reasons for not agreeing? What are the |

| | |
|---|---|
| | features of the selection process that deserve improvement in their experience? |
| Paths of non-successful project proposals | • What was the fate of the rejected proposals? What is the share of project is abandoned and what is the share of projects that are re-used?<br>• How are the rejected proposal re-used? What are the calls the projects are re-submitted to?<br>• What are the key revisions made to the original proposals before re-submitting them? (scientific content, team composition etc.) |
| Features and results of revised project proposals | • What are the perceived main advantages of alternative research support schemes?<br>• What are the differences between the original costs and those of the revised projects? Is there a reduction or an increase in project size and scope following the revision?<br>• What are the main results of the new projects? According to the applicants, to what extent are they in line with the experience of FP7 projects? |

## 6.2 Methodological approach

The analysis of eCORDA data highlighted that it is possible to extract information on applicants that submitted a proposal and were unsuccessful. Their proposals are labelled "rejected", as opposed to the "mainlist" and the "reserve" list. Therefore, a sample on non-successful proposals was extracted from the group of "rejected" applications.

Differently from the preceding Tasks on case studies (both 75 cases and the 25 top universities), here **the level of analysis is** clearly **the project proposal** rather than a specific organisation. Moreover, in this task we focus on coordinators because these are more likely to be informed on the paths of the un-successful proposals.

From the analysis of eCORDA we also learned that university proposals are not a sub-group of HES proposals only. Indeed, some un-successful projects submitted by universities fall within the N/A group.

The fact that eCORDA data does not provide further information on reasons for rejection is a considerable limit for the analysis of "non-participation" as it does not make possible to differentiate between applications according to their flaws. Moreover, the lack of some basic information on rejection made it more difficult to design a questionnaire which had to be done from scratch without a base of information on, for instance, most frequent causes of being rejected. This lack of a base of information affected the questionnaire structure by forcing to include a considerable number of open questions and also entailed a fair amount of qualitative work aiming at codifying answers in order to identify similar patterns and categories.

The present analysis is, therefore, a first attempt, straightforward but at the same time precious, to shed light on reasons of rejection and their consequences for research proposals designed and submitted by universities, considering the lack of information on this issue.

The data collection was carried out by means of an online questionnaire which includes a mix of approximately 30 close- and open-ended questions. In relation to each question, regardless of its type (e.g. open vs. closed, multiple choice vs. numerical box), the applicant was given the opportunity to add a comment box to provide additional explanations if necessary.

A link to the online questionnaire was sent to a list of 1,500 applicants characterised by **full contact details** of project coordinators (email addresses and telephone contacts).

These applicants were selected from a database of 44,688 applications extracted from the "rejected" group and submitted to the Cooperation and Ideas programmes which are the most relevant FP7 strands as far as research projects carried out by universities are concerned. "Cooperation" mostly supports trans-national collaborative research among different actors (universities, research centres, enterprises, etc.) in specific thematic areas, each comprising several scientific and technological topics. In addition to research quality, participation in this programme reflects the ability of academic departments and units to take part in international networks and to launch common activities in collaboration with other public and private organisations. "Ideas" supports frontier research activities, on the basis of bottom up proposals submitted by individual researchers in any field of scientific and technological research. Participation in this programme reflects the capacity of individual researchers (and the University as a whole) to produce research of excellence.

Apart from the completeness of contact details of coordinators, in selecting a manageable list of 1,500 target applicants, a balanced coverage of the EU and Extra EU universities was pursued on the basis of: the distribution of the total number of applications across countries and the distribution of the total project costs across countries.

The online survey obtained a response from 150 applicants, mostly principal investigators or other contacts who took care of coordinating the proposals. The questionnaires, coherently completed and usable, are 108. Therefore, the actual response rate was 7.2%. The following analysis is based on these responses.

The following tables show the distribution of responses by country and country groups as well as by FP7 sub-programmes (Cooperation vs. Ideas) and country group.

Data collection was more challenging than expected. Despite the considerable size of the contact list and four targeted reminders, the propensity to answer the questionnaire and provide information on the rejected project and its following path was limited and it took a longer time than planned to achieve the target of minimum 100 observations envisaged in the ToR and in the Inception Report.

Even though we filtered projects with full contact details, several of them had to be replaced because, for instance, the email was not active anymore or the person moved out of the department/university. The most desirable situation in case of email failure is when the need for replacement is clear (e.g. we received an automatic email from the recipient server). However, this is not always the case. It is possible that a larger number of contacts than those which were replaced is not active, rather than being the applicants unwilling to collaborate, but we simply do not know.

The following section on the survey results is divided in three paragraphs which focus on the main issues and the relative questions highlighted in the first paragraph on objectives of the analysis. Hence, the upcoming paragraphs deal with: reasons of rejection, paths of non-successful proposals and their features and results of revised projects. The text includes, at the end, a section with concluding remarks.

**Table 105 – Distribution of the sample of non-participants by country**

| Country group | Country code | Country name | % |
|---|---|---|---|
| EU13 | BG | Bulgaria | 1.9 |
| | CY | Cyprus | 1.9 |
| | CZ | Czech Republic | 0.9 |
| | PL | Poland | 4.6 |
| | RO | Romania | 2.8 |
| | SI | Slovenia | 0.9 |
| *Total* | | | *13.0* |
| EU15 | AT | Austria | 0.9 |
| | BE | Belgium | 2.8 |
| | DE | Germany | 8.3 |
| | DK | Denmark | 1.9 |
| | EL | Greece | 0.9 |
| | ES | Spain | 5.6 |
| | FR | France | 3.7 |
| | IE | Ireland | 2.8 |
| | IT | Italy | 13.9 |
| | NL | Netherlands | 5.6 |
| | PT | Portugal | 2.8 |
| | SE | Sweden | 0.9 |
| | UK | United Kingdom | 21.3 |
| *Total* | | | *71.3* |
| Extra EU | CH | Switzerland | 8.3 |
| | IL | Israel | 3.7 |

| | | | |
|---|---|---|---|
| | NO | Norway | 3.7 |
| *Total* | | | *15.7* |
| Total | | | 100.0 |
| **no. of cases** | | | **108** |

*Source: authors' elaboration on survey data*

**Table 106 – Distribution of the sample of non-participants by FP7 Programme**

| | Cooperation | Ideas | Total |
|---|---|---|---|
| EU15 | 55 | 22 | 77 |
| EU13 | 9 | 5 | 14 |
| Extra EU | 9 | 8 | 17 |
| Total | 73 | 35 | 108 |
| | 67.6% | 32.4% | 100.0% |

*Source: authors' elaboration on survey data*

## 6.3 Findings of the survey

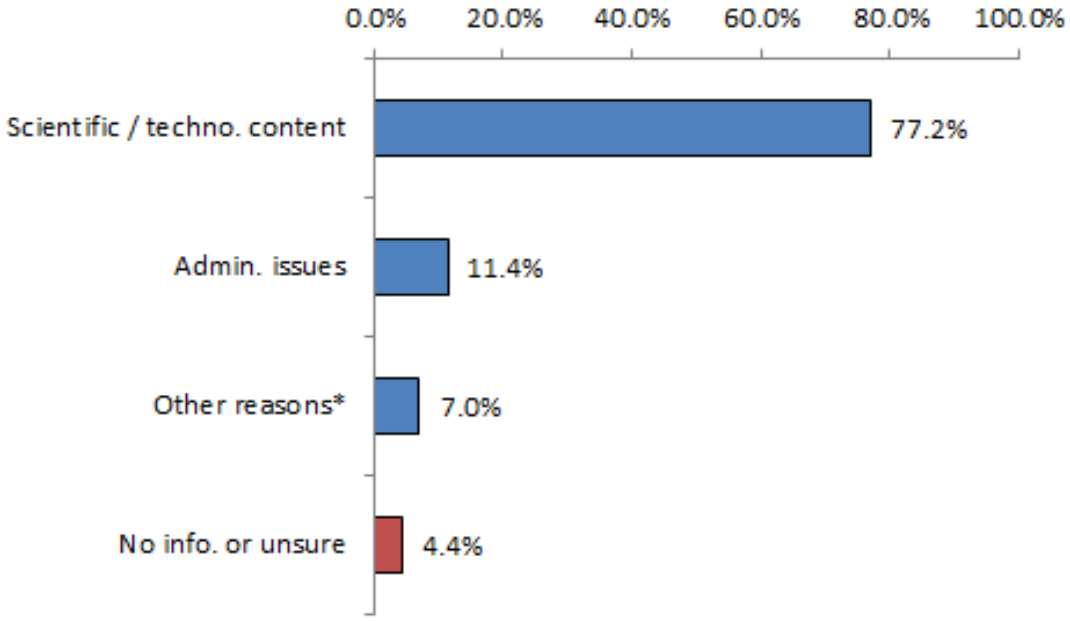
### 6.3.1 Reasons for rejection and quality of the selection process

**Main reasons for rejecting the proposals**

The principal investigators, or alternative contacts available, were asked to specify the main reasons for rejection. In most of the cases, several causes are mentioned. Overall the main reasons are those shown in the figure below.

Issues related to the scientific and technological contents of the project are the main cause of rejection which concerns about 77% of failures. In most of these cases the "impact of the project" was considered unsatisfactory in the assessment or, alternatively, the project was considered too ambitious by the reviewers given the time, resources and existing knowledge. Administrative issues follow and concern approx. 11% of the applications.

**Figure 80 – Main reasons for rejection**




*Source: authors' elaboration on survey data*

Other reasons are also mentioned in 7% of the cases. These mostly include lack of financial resources available, when the project despite being considered of good quality and eligible for funding was not "high enough in the ranking" and thus was not financed, and/or poor organisational capacity, justified at times by highlighting errors in the budgets, no business plan etc.

Finally, it is worth mentioning that a residual share of applicants, approx. 4.4%, did not really understand the prevailing reasons or claim that they did not receive information on the assessment except for a notice of rejection.

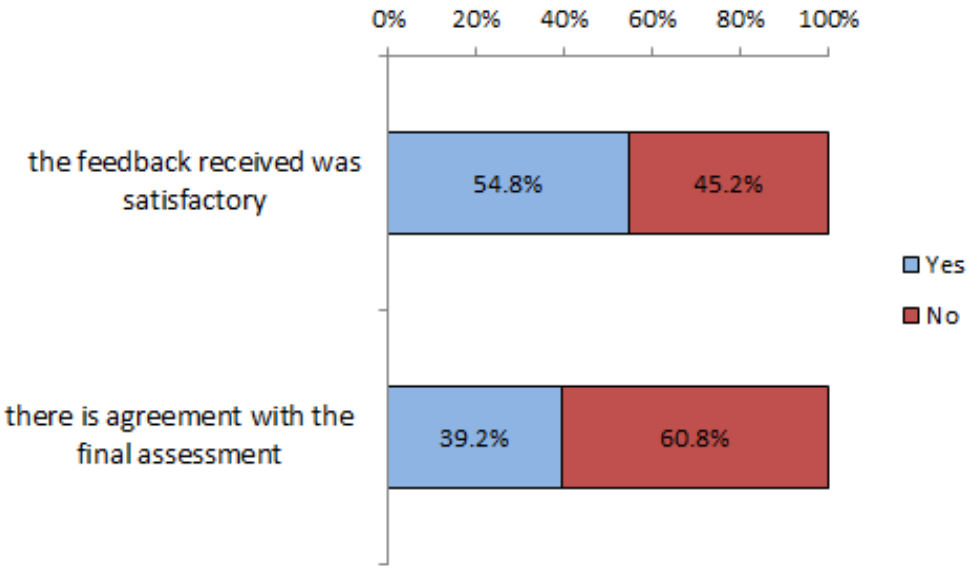
**Quality of the feedback received from reviewers**

In the questionnaire, the projects coordinators were also asked to assess the quality of the feedback received. In particular, they were questioned on whether they got a detailed and exhaustive explanation of the reasons behind rejection. Clearly, the assessment of those who claim that they did not receive feedback or just a notice was not positive in this respect but they are not the only ones to be unsatisfied.

Furthermore, the contacts were asked whether they agreed or not with the final evaluation of their projects and with the motivations provided to justify the rejection.

The following figure summarises both their assessment of the quality and exhaustiveness of the feedback and of the final evaluation of their proposals as well as the related motivations brought forward to justify rejection.

**Figure 81 – Quality of the feedback and to what extent applicants agree with the project evaluation**




*Source: authors' elaboration on survey data*

As regards the **received feedback**, responses are polarised. Approximately half of the applicants (55%) believe that the feedback received was satisfactory; in other words the explanation was clear and exhaustive. The other half, on the contrary, are very unsatisfied.

The reasons for being unsatisfied are summarised in the questionnaire commentary. Overall, they seem to agree on that comments on the projects are very brief and superficial, considering the great deal of work that the majority of respondents had to do to put the bid together. On the basis of such superficial comments it is hard to understand how the bid could be possibly improved.

Superficial comments are particularly despised when the applicants end up just below the threshold which would have allowed to see their projects financed, especially when the proposal is considered of good quality and fundable by the reviewers.

Some principal investigators, more familiar with EU projects, highlight that in their experience the feedback is most of the times not exhaustive. The argument often used by reviewers is that a project is not as good as another one, which is considered fair. What these respondents are not happy with is shallow feedback (e.g. "one line of comment which did not really relate to the content of the project").

In some cases, the respondents point out a mismatch between flattering comments and a negative score which casts doubts on the coherence between the two and the utility of the assessment. In some occasions, according to respondents, several reviewers seem to have agreed that the innovation potential, the quality of the concept and the budget were high quality. Yet, the project was not ranked enough to obtain funding.

The comments are considered generic not only when they concern the scientific and technological features but also as regards quality and efficiency of the implementation and management systems (e.g. claims such as "risks are addressed and contingency plans are discussed but not in sufficient detail" do not provide any information on the desired level of detail).

Sometimes, the feedback obtained was incomplete (e.g. it only concerned the S&T criterion) or a final rejection was never received despite a number of reminders sent by the applicants to the Commission.

**Agreement with the final evaluation in the light of the evidence provided**

When it comes to overall agreement with the evaluation of the project proposal, the share of applicants that are **unsatisfied** grows to **61%**, regardless of their opinion on the quality and detail of the feedback received. The agreement with the final evaluation is clearly closely linked with the quality of the feedback. They recognise that the evaluation involves some degree of subjectivity but, in general, they claim that the assessment should be much more based on facts and requires specific competences that are not clearly demonstrated through the assessment.

Sometimes, the panel interviews in Brussels (e.g. "too many trivial questions asked", according to some applicants) confirmed the respondents' scarce faith in the competences of the reviewers.

According to some respondents, the low score on the technical section is not properly justified as sometimes the argumentations are speculations or opinions about possible outcomes rather than facts (e.g. "the project aims at niche markets"; "previous similar projects have failed" etc.). In such cases, their impression is that the reviewers did not fully understand the overall approach, the potential or the degree of innovation which characterised the proposal.

The respondents are passionate about their projects and in most cases go on explaining the technical reasons why their ideas are worth. For example, one researcher remarks that the panel was not convinced that "a viable scientific strategy stands behind the formally well written project"; after rejection, the same proposal was funded by another scheme and she was able to prove that the strategy worked and the panel was instead too "close minded".

In other cases, they simply highlight apparent misjudgements and lack of coherence between the evaluation and the call, in their view, which raise doubts on the competences or attention of reviewers (e.g. for instance one applicant pointed out a comment received on "lack of preclinical studies" while "the call was focused on trials"). As an example, one project coordinator emphasises that the proposal was submitted twice and rejected in both cases. The comments of the panel in his view were contradictory which casts serious doubts on the coherence of the evaluation approach.

Some of the flaws (e.g. need for completing the team with some experts/competences; spreading the funding more evenly among the partners; lack of detail on one budget item) seem minor and could be positively addressed and fixed by the applicants, if they had a chance, while should not lead to a rejection.

Some respondents disagree more generally with the evaluation approach by pointing out that criticism was too strong, showing that evaluators are too much opinionated considering that we are talking about research which can be ground-breaking. Moreover, evaluation criteria do not always match well some specific calls while they should be differentiated (e.g. a call for a Proof of Concept grant requires specific criteria).

Often, too much attention is given to some peculiar aspects while the novelty of the proposed project is not been properly valued in their opinion. According to some, EU research tend to favour professional management over innovative R&D. This may lead to funding being monopolized by large organizations whose only competence is in proposal writing and smooth management.

Lack of interaction with the policy maker is considered frustrating. For instance some coordinators highlight that they would have liked to a have a rebuttal included and a decision to be made by EC after judging the rebuttal.

Some respondents even claim to have received misleading directions from EU officers about eligibility of their project ideas during the phase of preparing their proposals.

Thanks to the survey, a number of **recommendations** could be collected from the applicants on how **to improve the selection process**, especially from those not satisfied with the procedure, the received feedback and the final outcome of the evaluation. These recommendations are summarised in the following points:

- Make sure that reviewers are really competent in the topics, are motivated, more open minded about innovation and neutral. Many applicants highlight that the understanding of the problem, especially scholarly problems, was not clearly demonstrated through the feedback. It would be important to provide some information, in the evaluation report, regarding the technical background of the reviewers. It would be good to foresee the possibility for the applicants to suggest a number of well-known reviewers, like for referees of scientific publications. In general, there is a perception of little transparency; it is unclear how the proposals are actually reviewed. Overall, some applicants believe that luck plays a significant role: if the proposal is reviewed by someone who has relevant specific expertise there are good chances to go ahead. Therefore, the selection of evaluators should be more transparent.
- Avoid being superficial. Much more specific feedback is needed for learning and improving the quality of proposals. The criticisms and weak points identified by the evaluators need to be strongly justified by them in order to be credible and eliminate the degree of subjectivity, and to provide useful directions to improve the projects or the quality of future applications.
- Discuss about the topic with the applicant, if necessary, to understand what there is behind the proposal and evaluate the research groups involved. Allow applicants to reply to the reviews through simple clarifications and provide feedback. Several applicants highlight that it would be beneficial to foresee face-to-face or Skype meetings when necessary. An appeal phase would enable to resolve some unfair assessments in their view. Possibilities for scientific and administrative arbitration could be also provided. In this respect one applicant suggests the possibility to introduce a rebuttal process similar to what the top Computer science conference do. In general, it is suggested to allow the people that submit the proposal to have access (email, skype, phone) to the Officers involved, up to the date of submission. Certainly the feasibility of some of this suggestions could be an issue but the raised problem is important and a solution desirable.
- Reviews should be made publicly available and DG Research could consider providing full reviews rather than their summaries.
- Speed up the process and officially inform the applicants on the result. Ensure that the final decisions are clearly communicated. The lack of information makes it difficult for the partners, especially for researchers on fixed term contracts, to forward planning other research projects.
- Be more constructive and differentiate between grants by matching them with different stages of innovation (e.g. (i) exploratory PoC demonstrating that the project is viable for further exploration; (ii) business case PoC demonstrating that the project can be developed for private investment).

- The PoC call should take into account the specificity of Humanistic research where societal benefits and applications should be taken into account instead of "commercialisation". In general revise the proof of concept scheme in such a way as to be more friendly to social science proposals.
- Some remarks from the reviewers concerning what should be improved would be useful. Distinguish between 'fatal flaws' as opposed to 'fixable faults' that could be put right for a subsequent bid.
- DG Research could have a team of officers to contact principal investigators whose proposals are not funded despite being considered by reviewers both fundable and of high quality. Otherwise, some researchers may lose any incentive to apply again. If this suggestion is not feasible or practicable then better eliminating a category of rejection where the applicant is told that the proposal is fundable but not funded.
- Increase page limits and allow for appendices in the submission as several applicants highlight that they were required more detail which could not be provided due to the limits.

### 6.3.2 Paths of non-successful project proposals

#### The fate of rejected projects

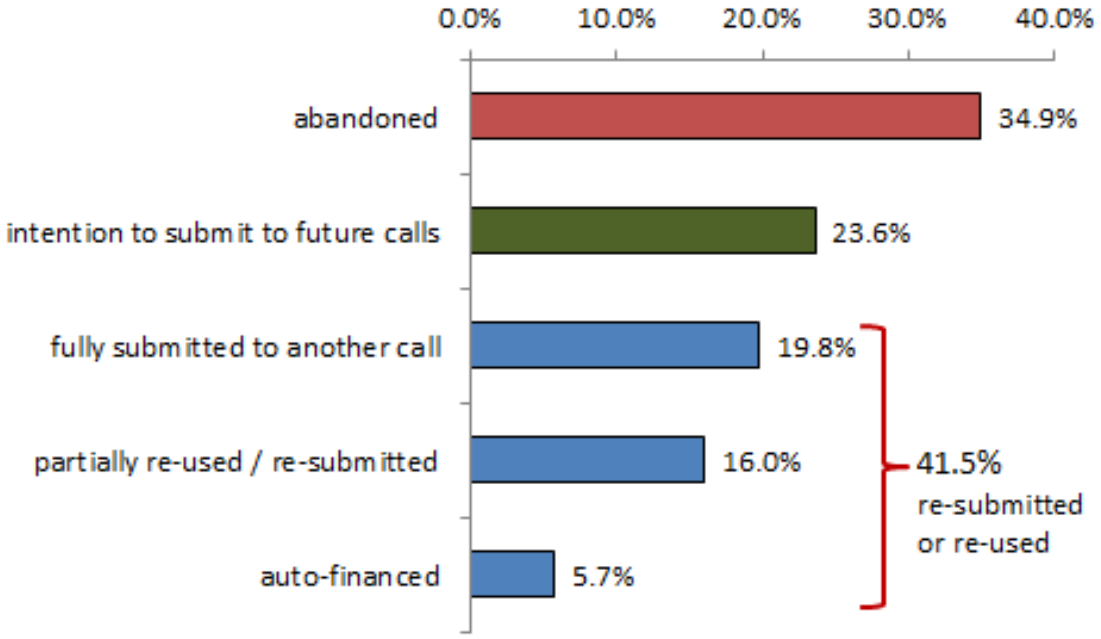
In order to explore the paths of non-successful proposals, the contacted applicants were asked to specify first of all whether the project was abandoned after being rejected or, alternatively, it was re-submitted and/or re-used.

The answers are shown in the following figure. Approx. 35% of the projects, which is a considerable share, were abandoned following the negative assessment within FP7. Nonetheless, the large majority of rejected proposals, about 65% did not end-up "in the bin".

In nearly 24% of the cases, the applicants claim that they intend to submit them to future calls but they are still unsure on which and when.

In about 42% of the cases the project was submitted in full or in part to another call or self-financed. Within this group, approx. 20% of applicants have already submitted the project to another call and 16% of them re-used parts of the project for other applications. Finally nearly 6% were auto-financed, by the university or privately.

**Figure 82 – Main fate of rejected proposals**




*Source: authors' elaboration on survey data*

Overall, the applicants disagree, on average, that the evaluation was instrumental to improving the proposal of the newly submitted project, mostly for the shortcomings of the feedback which were previously underlined and which greatly constraint its utility.

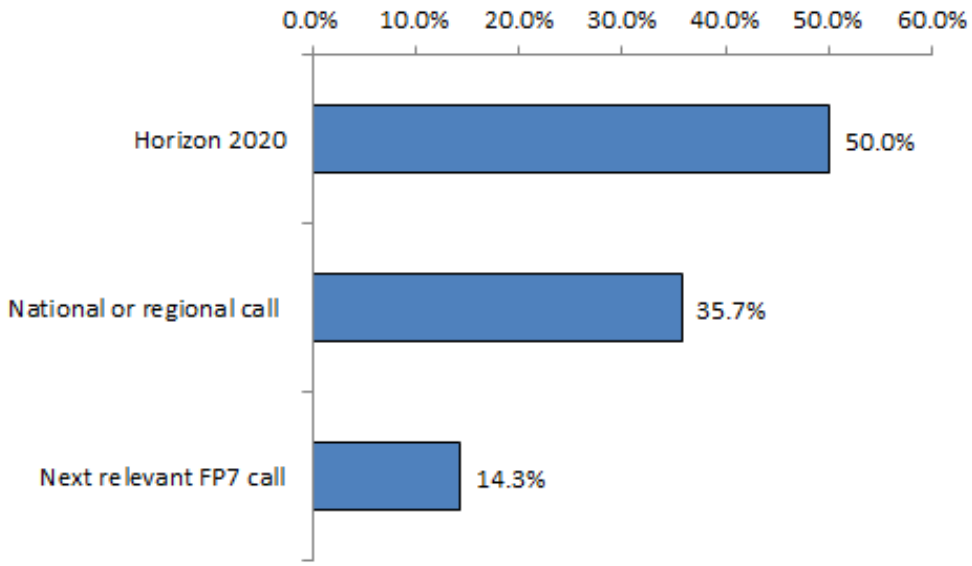
As previously pointed out, the evaluation is considered useful only in the cases when the criticisms is strongly justified and clearly explained by the evaluators, or when comments focus on the proposal structure and specific sections (e.g. improving risk mitigation and simplifying deliverables etc.).

**Alternative paths undertaken and key changes to the proposals**

The projects which were successfully "recycled" or, in other words got financed despite the initial FP7 rejection, have been submitted to other schemes as summarised in the following figure.

Most of the successfully re-used projects were submitted to Horizon 2020 (50%), followed by national and regional calls / schemes (35.7%). Finally, approx. 14% of the projects were successfully re-submitted to the FP7.

**Figure 83 – Calls the project was successfully submitted to (fully or partly)**




*Source: authors' elaboration on survey data*

The questionnaire also asked the applicants to summarise the main changes or amendments to the original proposal that were carried out before submitting the project successfully to another call or scheme.

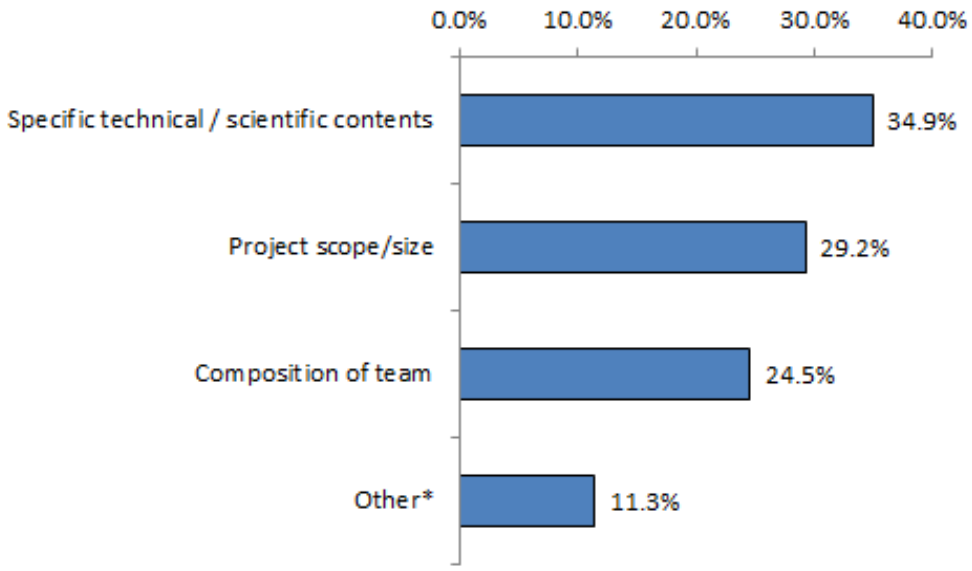
The following figure shows that the main areas of intervention are the scientific and technical contents of the proposal. In other words, when a project was revised, it was revised substantially in its content.

In 30% of the cases, the revision concerned the scope of the project and in particular its financial size or the amount of requested public resources. The types of revision (scientific contents vs. financial size) are obviously not exclusive but can and should be related, meaning that the same project can be subject to multiple revisions.

In nearly 25% of the cases, the main changes concerned the composition of the project team with the integration of specific competences and professional profiles, both as regards scientific areas as well as management and organisational skills. The respondents are not able to provide a great deal of details as regards team composition but seem to refer to both the inclusion of project managers and of thematic experts as the most frequent adjustments.

Finally, about 11% of applicants carried out other typologies of amendments. Some examples are described below.

**Figure 84 – Key changes to the original proposal**




*Source: authors' elaboration on survey data*

Sometimes, the applicants claim to have improved the interface between academia and industry, or the description of the management arrangements and the business model. These changes to the original proposal can be somewhat related, to a varying degree, to the main typologies of adjustment mentioned above.

In other cases, the project was simplified and streamlined, even against the instinct of the applicant. Indeed some respondents highlight that simplification is not necessarily a good thing since it can translate in less challenging projects which is it against the "intuition or wishes" of a good researcher.

More importantly, it is emphasised that sometimes changes are neither related to comments or wanted choices concerning science and technology issues or organisational arrangements but are forced. Indeed, as time goes by, some technological solutions and innovations risk to become obsolete while partnerships change if some key people are not anymore available, for instance because, in the meantime, they took other professional/research obligations.

### 6.3.3 Features and results of revised projects

#### Advantages of alternative support schemes

In general, applicants believe that alternative support schemes which financed their proposals are characterised by some advantages in comparison with FP7.

The most frequent advantageous features mentioned by applicants are shown in the following figure in order of importance. Over half of the respondents experienced a procedure, within the alternative scheme, which is simpler with less bureaucratic requirements.

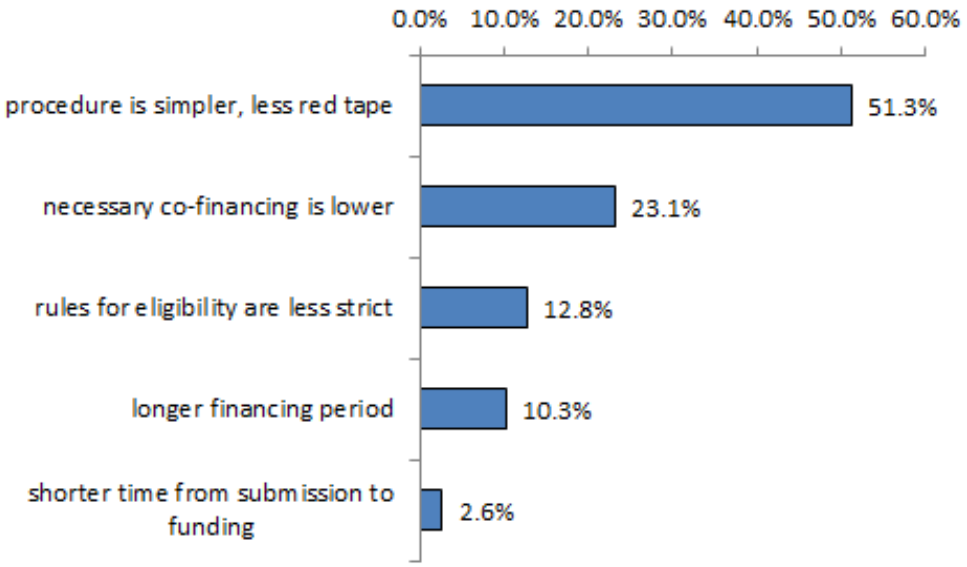
For about 23% of applicants, the advantage of the alternative scheme is related to lower co-financing; in other words the support is considered more generous in financial terms. For approximately 13% of applicants, the eligibility rules are less strict meaning that they were able to claim a wider range of cost items.

About 10% of respondents highlight that the alternative scheme benefits from a longer coverage (longer financing period). Finally, approx. 3% of applicants appreciated a shorter time elapsing from the submission of the proposal to funding, compared with the experiences within the FP7.

Schemes are not really comparable and results cannot be generalised but, on average, the selection process of the alternative schemes (covered in the questionnaires) lasts less than 5 months while the selection process of FP7 took almost 6 months.

In expressing their views on advantages of other instruments and providing their comments, applicants, beside the answers summarised above, tend to go back to the issue of transparency and feedback. Some of them highlight that the new scheme ensured a transparent evaluation process with adequate feedback and the possibility of adjusting the project.

**Figure 85 – main advantages of the alternative support scheme in comparison with FP7**




*Source: authors' elaboration on survey data*

Another mentioned issue is related to the need, according to some respondents, to pursue a more bottom-up process rather than top-down as in FP7, especially in relation to Cooperation. At times, they feel that, despite the science community knows better its needs than the European Administration, projects have to be customised too much to the calls requirements which can be a disadvantage and may result in a waste of money and productivity. By some, this is considered to be a fundamental problem of FP7 as well as H2020 calls.

It is worth mentioning that, as applicants highlight, in 2/3 of the cases the revised projects are not concluded, therefore, it is somehow premature to provide definite assessment of advantages. However, applicants have certainly developed a fair understanding and have some clues on the differences between FPs and other instruments which allow them to formulate useful comments.

**Costs of projects financed by alternative schemes in comparison with FP7**

In order to understand the possible differences between EU funded initiatives in comparison with projects financed by other sources, the applicants were asked to provide some information on project costs and outputs.

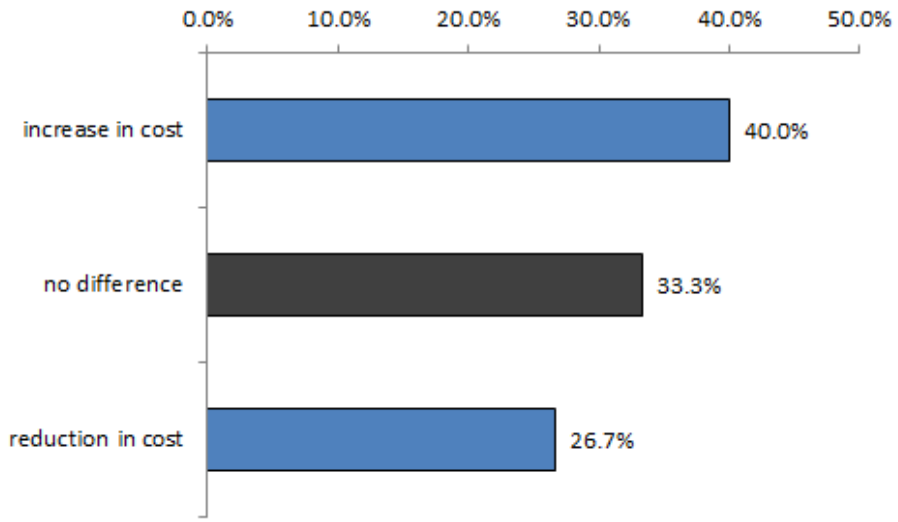
Through the questionnaires, we collected data on the total original cost (before rejection), which is also available on eCORDA, and tried to collect data on the total costs of the revised project (after FP7 rejection) and the corresponding public contribution requested.

The capacity of applicants to provide consistent figures on costs (even just estimates) or to consult their "archives" turned out to be very limited, as some respondents clearly express in the commentary. Many figures provided where inconsistent (e.g. meaningless amounts, too small to be realistic; only the original value entered but no value of the amended project available). As a consequence, a number of observations had to be cancelled and reliable data could be gathered from 30 applicants only.

As the following figure shows, in 4 cases out of 10 the cost of the project increased as a consequence of "scaled-up" scope and ambition, often accompanied by larger partnerships.

There is no difference between costs before and after revision in 33% of applications while there is an actual reduction of total costs in nearly 30% of the cases. These budget resizes reflect scientific and technological adjustments as well as changes in the partnerships (e.g. some partners pulling out).

**Figure 86 – Difference in project costs, before and after revision**



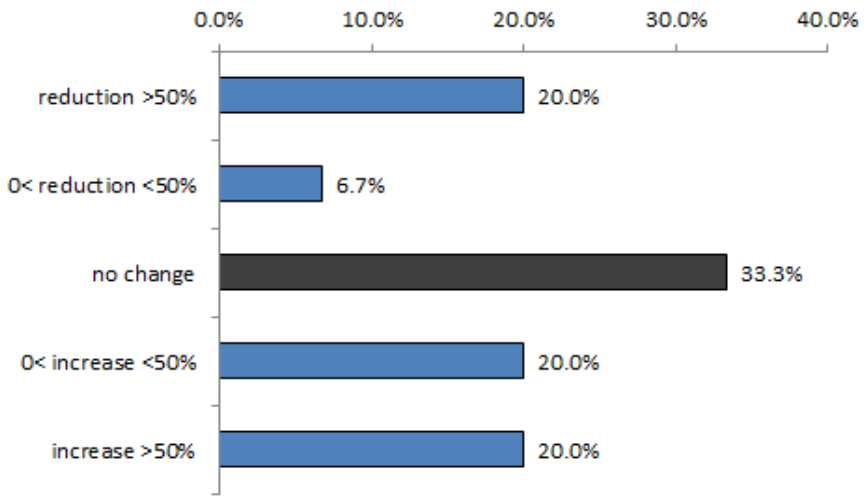

*Source: authors' elaboration on survey data*

The following figure provides some information on the difference between the costs of the revised projects and those of the original applications expressed as % variation with respect to the original budget.

For the projects whose value was reduced after the revision, such reduction is larger than 50% of the original budget in 20% of the cases. In approx. 7% of the cases, the reduction is between 0 and 50%.

As regards the projects which were scaled-up after being revised, in 20% of cases the budget increase is less than 50% of the original value and in an equal percentage of projects it is more than 50% of the initial cost.

**Figure 87 – Cost difference between revised and original proposal as % of original budget**




*Source: authors' elaboration on survey data*

**Results of projects financed by alternative schemes**

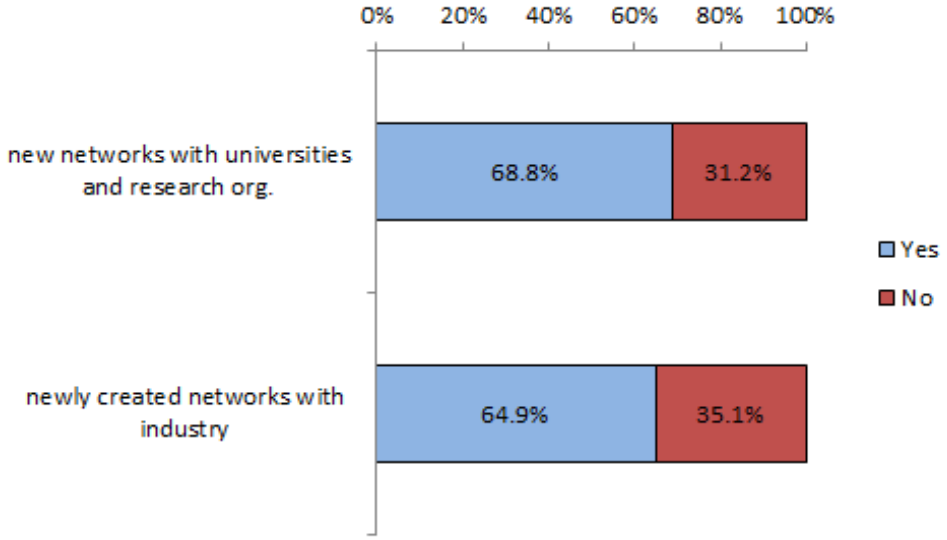
As regards the results of the projects financed by alternative schemes, the most relevant ones are short-term outcomes (considering that most of the projects are still ongoing) related to the establishment of novel research cooperation networks, either with other research organisations or with private companies.

The projects facilitated the creation of new research cooperation networks with other universities or research organisations in nearly 70% of the cases, as shown in the following figure. The creation of new networks with industry was facilitated, according to responding applicants, in 65% of the cases.

Overall, the achievements of alternative schemes are in line with the EU FPs projects, considering that in the majority of cases the FP7 projects led to the creation of new networks with other university, research organisations and/or industry (see for instance the case studies illustrated in Task 4).

The geography of newly created networks is mostly characterised by a transnational dimension. Therefore, according to applicants, despite the alternative schemes are not necessarily co-financed at the supranational level (e.g. FP7 or other EU schemes such as INTERREG programmes), they still allow to establish far reaching collaboration linkages.

**Figure 88 – Creation of new research cooperation networks thanks to the project**

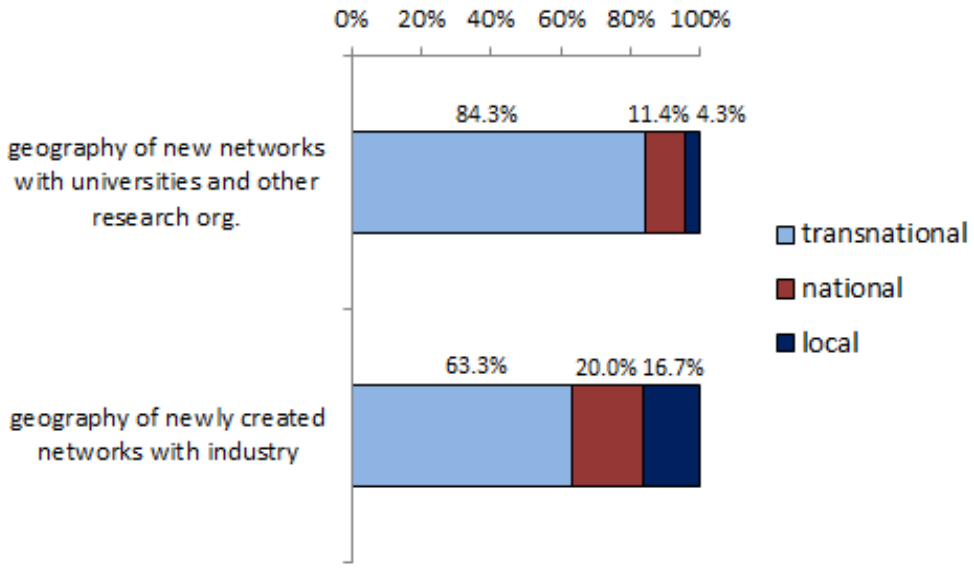



*Source: authors' elaboration on survey data*

The following figure shows the geographic dimension of newly created research cooperation networks thanks to the projects financed by schemes alternative to the FP7. As said, these new networks are mostly transnational according to applicants but the frequency of transnational networks is considerably higher in the case of partnerships with universities and other research organisations.

The newly established cooperation networks with firms are also mainly transnational (63%) but, in this case, the national and the local dimensions of production linkages play a much stronger role, compared to the cases of collaboration with universities and other research organisations.

**Figure 89 – Geography of newly created networks**




*Source: authors' elaboration on survey data*

The questionnaire also allowed to collect some information on the outputs (publications and innovations) of the project but the number of valid answers in this respect is scarce to be able to build up a complete picture and carry out comparisons.

Overall, 167 scientific publications were produced as outputs of the projects. This means on average nearly 5 articles per project, considering that 36 projects were already scientifically "productive" according to applicants who could hence provide a figure.

Put into perspective, this number is just 1% of the total average annual publications of the departments which designed the proposals, although the variability is quite high ranging from as low as 0.3% of annual publications to 80% for smaller institutions.

The results of the projects are very modest in relation to patenting, as only three projects led to patents' registration, as far as the applicants are able to say. The results of spin-off creation are also negligible as only 9 project conducted to the creation of new firms according to the data provided.

## 6.4 Concluding remarks and policy implications

The data on 108 rejected FP7 university proposals, collected through the survey, allowed to carry out a first exploration of reasons of rejection, adequacy of the selection process, path of non-successful applications, features and results of the revised projects. This limited but at the same time fresh and unprecedented evidence enables to draw some useful conclusion which are summarised below.

- The FP monitoring system, which is reflected in the data available on eCORDA, has some clear limits with respect to the information which it contains on rejections. There is too little data on causes as well as on critical issues encountered in the selection process, considering the amount of time invested both by applicants and reviewers and the potential loss in terms of missed innovation, both at the time of submission, in relation to the specific project rejected, and in the future, if the propensity of some applicants to submit proposals is discouraged. Applicants clearly signal that to preserve their propensity to bid for EU FPs, more evidence is needed in supporting the (negative) evaluation of their effort. The current limits of the monitoring system constrain not only research but, above all, policy management which cannot count on fuller information to steer and adjust their initiatives.
- A considerable share of applicants is unsatisfied by the feedback and 61% do not agree with the final evaluation (rejection). This is, in a way, not surprising considering that they can be frustrated and dissatisfied with their projects being rejected. However, the fact that more than half of the proposals (65%) have been either successfully recycled or it is intended to do so in the future tell us that the applicants believe in the project ideas and these can be actually worth, given that other financing sources were found.
- The selection process would benefit from some improvements suggested by the majority of respondents. More transparency is a must. In particular applicants would like that full reviews are made available, rather than a summary of the feedback, and they recommend to provide information on the background/curricula of reviewers and allow, as in scientific publications, to suggest a number of reviewers. These adjustments could lead to more transparency and eventually increased credibility of the evaluation.
- A greater detail in the provided feedback or less superficiality is equally important. This is a necessary condition for learning and improving the success rate of applicants. In addition to providing a more exhaustive and useful feedback, a greater interaction with the Commission is considered essential for both learning and transparency. All the applicants highlight the need for being given the chance to better explain certain points or overcome minor flaws.

- There are alternative, competing schemes "on the market" often more generous or less strict in terms of requirements that seem to reward high risk innovation. This fact was highlighted and documented also by the case studies which include some examples, where available, of equivalent instruments available for the universities at national or regional level which can have displacement effects on FPs. At a limited cost, the FPs monitoring system could be enhanced to: 1) collect information on paths of non-successful proposals which would allow strengthening retention and reward; 2) store useful information to improve processes, policy efficiency, effectiveness and maximise coordination (or minimise displacement) with competing instruments.
- What is interesting on the cost issue is that rejected proposals are not necessarily downscaled but, on the contrary, their scope and size is often increased and this seems to be unrelated to the feedback received from FP7 reviewers, as the latter is considered of very limited value, if any. This urges to improve the selection in order to minimise the loss of potentially worth and innovative projects.
- To sum up, the survey, even though it is an embryonic attempt to collect information on almost totally unexplored subjects and therefore it pays the lack of knowledge and especially of data on the issue, it highlights that many improvements are possible and provides some specific recommendations on how to go in relation to: quality of the feedback, interaction with applicants, effectiveness of the monitoring system etc.
- The workshop practitioners also emphasised that the analysis produced some new, non-existing, evidence on rejection and path of unsuccessful proposals; it was also pointed out that it would be interesting to explore rejection motives further.

# 7 Task 8 – Study conclusions and policy implications

This concluding section summarises the main findings emerging from the various tasks carried out and, by doing so, it identifies critical success factors and significant weaknesses to be addressed in the future.

The section is structured around the main objectives of the analysis, namely: identifying and contribute to better understanding of the drivers for the engagement and obstacles to university participation; how FPs support cross-country knowledge diffusion and integration; how FPs support cooperation between academia and industry; how research excellence is fostered; emerging trends and pathways to innovation.

## 7.1 Drivers for the engagement and obstacles to university participation

### 7.1.1 Key results from case studies

- The literature has identified several factors that are useful to explain the participation of universities in publicly sponsored projects. The institutional characteristics of the universities, the way of operating of funding agencies and the selection mechanisms adopted to allocate funds are relevant features explaining university participation in publicly sponsored projects and success rates in getting the funding. Concerning the characteristics of universities, important elements determining the participation to publicly sponsored projects are the size, the geographical location, the scientific research productivity, the collaborative networks and the scientific orientation. Less is known about the motivations for participating in FPs.
- The case studies of 75 individual universities carried out in Task 4 highlighted that the main motives for participating in FPs, according to respondents, are: satisfying funding needs, especially in a context of austerity and decreasing national financial support; enhancing institutional reputation and international competitiveness; expected positive effects on quality and quantity of scientific outputs. While the first motive is actually the consequence of a need, a necessary condition to conduct research, the second and third motives are underlined by an improvement strategy rather than being driven by a "material" necessity. Therefore, the will to improve competitiveness and quality (when motivations 2 and 3 are considered together) represents the most important driver for the engagement of universities.
- Motivations such as the possibility to support multi-disciplinary research and training of PhD/young researchers are considered much less important. Other motives, though of marginal importance, were also mentioned. These are mostly linked to building up experience, easier pathways to apply for other grants or the possibility to contribute to regional development and employment.
- There are some differences among country groups. Enhancing institutional reputation is the first motive in EU13 and Extra EU countries. A considerable number of EU13 cases believe that an important motivation is related to the positive effect of participation on quality and quantity of scientific outputs. In the Extra EU group, participation in FPs is also seen as an opportunity to carry out more advanced research and development initiatives.
- In the experience of respondents, the main motives behind participation and the university objectives are achieved most of the times. Indeed participation in EU FPs enhances reputation, competiveness and excellence. Several universities highlight that their international visibility improved considerably and respondents moderately agree, on average, on the claim that greater

reputation attracts more talents as showed by the number of applications for visiting research positions and by the number of Master's or PhD students.

- Other achievements include: significant additional resources available for research in general which allow investments and upgrade of labs; EU-funded projects are positively evaluated in all assessment exercises at national level, with increased national funds for the University and visibility on media; better research quality and contact with the private sector; increased experience of the staff; creation and/or further development of European research networks; increase in the number of publications.
- While all universities have roughly the same opinions on the positive effects of participation in FPs on reputation and external collaboration, the opportunity to participate in scientific events is particularly important for Extra EU and EU13 countries and the increase in visiting researchers is considered more visible in Eastern Europe.
- The most important obstacles to participation are: the probability of failure, which is too high, considering the cost of applying; the lack of time available among researchers, who are too busy with education and routine research activities; bureaucracy. While the first obstacle is somehow exogenous, as it is related to the costs of applying which are considered in general high but can be potentially mitigated by the policy maker, the following obstacles are endogenous in nature, as they are much more related to internal capacities and competences.
- Application costs significantly affect differences in participation status and the outcome of a support programme. Therefore, a mere increase of available funds to promote R&D will not inevitably lead to greater benefits. Measures for reducing application costs, such as help desks or information networks, greater transparency, minimisation of bureaucracy and simplification and standardisation of application procedures can contribute to increase application rates of eligible organisations.
- In addition, other initiatives which could increase participation in current and future Framework Programmes include: improving organisation and management of international projects by setting up or strengthening dedicated structures in the university; specific incentives for researchers that submit proposals; a financial support to assist prepare applications and build consortia. The workshop with practitioners remarked that various incentives for researchers to facilitate participation (e.g. pre-funding, seed funding) can be helpful. Furthermore, it would be useful to identify best practices for enhancing university success and what measures may facilitate free entry of new comers.
- Overlapping with other schemes and displacement of FPs can be an actual problem if it leads to inefficient use of resources. In the experience of practitioners who participated in the workshop, FPs really managed to select mostly research excellence in each country, therefore, institutions and researchers who seek other sources of funding do so with less ambitious projects, from a scientific and technological perspective. Nonetheless, the issue of alignment between different policy levels remains open: to what extent there are synergies or substitution effects between FPs and national/regional policy.
- 90% of the universities covered in the case studies already have a dedicated support structure. The services provided by these structures are, in order of importance: 1) information diffusion on calls, 2) training and assistance, 3) partners' search, other services such as IPR support, review of proposals, 4) organisation of events and workshops, engagement of political stakeholders etc. Despite the help from these structures, the limited time of researchers is still considered a big constraint and a lot more needs to be done to mitigate this problem.
- 87% of the responding organisations have a strategy which includes provisions and initiatives aiming at increasing participation in EU programmes. The strategies mostly aim at strengthening support offices, information diffusion, facilitation of networking through support to membership in professional associations and event participation.

### 7.1.2 Key results from the analysis of top universities

- The most important motivation of EU Top universities for participating in EU FPs is the positive perceived effect on quality and quantity of scientific outputs. Other two important motives for participation are the enhancement of scientific reputation and international competitiveness and the positive effects on collaboration opportunities that the networking of EU FPs is likely to generate. This result is significantly different from the other universities observed under the present study, which ranked as first motivation satisfying funding needs, especially in a context of austerity and decreasing national financial support, and ranked the effects on scientific outputs only 3rd.
- Two important benefits expected from the participation to EU FPs are the possibility to improve international collaborations and to access funding for basic high-risk research, this especially as far as Marie Curies and ERC are concerned. These universities often pointed out the possibility provided by EU FPs to carry out frontier research and research on cross disciplinary topics, to join new networks of partners and, last in terms of importance, the possibility to access knowledge not available at the university and to improve reputation. Also in this case top universities show very different expectations with respect to the other universities investigated in the present study, linked to the maintenance of the leadership of important research networks using the position of coordinators in EU FPs, and to improve the reputational standing based very high level of on academic outputs.
- Beside the mentioned measures, the availability of government institutional funding and project funding opportunities at national level are key elements that differentiate some universities in the sample because of the importance given to the motivation "more money" as to the participation in project funding. In different words, the availability of national resources is something relevant also for top research universities providing competitive advantages and possibilities to differentiate the strategies for proposal submission.
- Although other factors as funding represent important drivers for participation, the possibilities provided by EU FPs concerning collaborations and exchange of knowledge across Europe are considered to be the key expected benefits.
- The possibility to increase collaborations with industries is perceived mostly as an opportunity in H2020; it is not the same in EU FP7 and EU FP6 when cooperation with industries was not a strong motivation. This confirms that universities have a good understanding of the changes affecting the rationale behind the different EU FPs, and tend to modify the strategies of participation accordingly.
- All the respondents but one indicate that participation to EU FP contributes most of the time to achieve the intended effects. The bottom up approach of Marie Curie and ERC is extremely positive. Long duration of EU FPs and grant is also considered a very positive aspect of EU FPs. Marie curies actions and ERC have enabled a large number of researchers and PhDs to be trained, this representing a specific benefit mostly accounted to the two programs compared to the whole EU FPs. There is also a very positive impact on international and collaborative publications, and a broad effect consolidating the university prestige and reputation. Nonetheless, differently from the other universities of the present study, the positive perception of top universities is mainly related to the ERC funding and Marie Curie Action which provided unexpected good results, improving both the research excellence – especially with the starting grants for young scholars, and the university visibility. Interestingly enough, the outstanding universities in the sample of the top research universities also reported an extremely positive feeling about the effects of the mentioned actions.

- The contribution of EU FPs participation on scientific publication in high ranked journals was very important, the same cannot be stated for the commercial outputs such as patents or spin off, because the identification of the causal link between the EU FPs and the result is not clear. In fact, several projects concur to produce innovative outputs, especially when it looks promising from a commercial point of view. In this respect, the availability of national funding is one key factor that allows a university to differentiate its strategies according to funding opportunities in place (see above).
- A positive impact of EU FPs participation on mobility and post-degree training occurred sometimes or most of the times. Interviews outlined in this respect different positions of the universities as to the impact of the participation in EU FPs. Marie Curie Actions: are considered the proper tool for realising this type of impact; the participation in other programmes does not always produce the same results due to the structure of the research projects or due to national rules on PhDs and post-degree training.
- The special opportunity the EU FPs supply in comparison with other existing funding schemes at national level is the possibility to build networks that can include different types of actors from different countries and even non-European countries. This possibility of having a wide European participation is not generally assured by the national project funding schemes.
- Bureaucratic requirements are generally considered the most important obstacle to participation in the sample of top research universities, the second being the probability to failure that is judged too high considering the application costs in terms of time and resources mobilized. The mentioned problems discourage the participation when the uncertainties and the shortcomings of the evaluation process combine with the presence of other funding schemes at national or international level that can be used to pursue the same research objective, have simpler processes for proposals submission than EU FPs, and are characterised by evaluation processes perceived as more transparent and reliable. There is a clear convergence of top research universities and other universities in the sample on this remark.
- The picture the universities provided in the interviews, as to the obstacles to participation, is mostly related to the heavy bulk of duties that goes with the proposal submission and – in case the proposal succeeds, its implementation. This fact has been negatively reported also because the bureaucratic workload required is the same whatever the size of the project (providing a very large funding or a relatively small one). Again we find a large convergence with other universities in the sample on this issue.

### 7.1.3 Results of the analysis of non-participation

- The main reasons for rejecting the proposals are related to the scientific and technological contents of the projects in approx. 77% of the cases. In these cases, the "impact of the project" was considered unsatisfactory by the reviewers or, alternatively, the project was considered too ambitious given the time, resources and existing knowledge. Administrative issues follow in terms of importance and concern approx. 11% of the applications.
- Approximately half of the applicants believe that the feedback received was clear and exhaustive. The other half, on the contrary, is very unsatisfied. The reasons for being unsatisfied are that comments on the projects are very brief and superficial, considering the great deal of work that the majority of respondents had to do to put the bid together. The comments are considered generic also as regards quality and efficiency of the implementation and management systems.
- The selection process would benefit from some improvements suggested by the majority of respondents: more transparency, full reviews made available, availability of information on background of reviewers. A greater detail in the provided feedback or less superficiality is equally

important. This is a necessary condition for learning and improving the success rate of applicants. In addition, a greater interaction with the Commission is considered essential for both learning and transparency.

- 61% of applicants disagree with the final evaluation, a result which is clearly closely linked with the inadequacy of the feedback. In general, applicants claim that the assessment should be much more based on facts and requires specific competences that are not clearly demonstrated through the project evaluation.
- There is a multitude of reasons behind this disagreement. Some of the flaws (e.g. need for completing the team with some experts/competences; spreading the funding more evenly among the partners; lack of detail on one budget item) seem minor and could be positively addressed and fixed by the applicants, if they had a chance to do so, while should not lead to a rejection. Often, too much attention is given to some peculiar aspects while the novelty of the proposed project is not been properly valued in their opinion. Lack of interaction with the policy maker is also considered an important constraint for learning and improving the quality.
- Overall, the applicants disagree, on average, that the evaluation was instrumental to improving the proposal of the newly submitted project, mostly for the shortcomings of the feedback which were previously underlined and which greatly constraint its utility.
- Approx. 35% of the projects, were abandoned following the negative assessment within FP7, while the large majority, about 65%, were re-used. In about 42% of the cases the project was submitted in full or in part to another call or self-financed. Within this group, approx. 20% of applicants have already submitted the project to another call and 16% of them re-used parts of the project for other applications. Finally nearly 6% were auto-financed, by the university or privately. In nearly 24% of the cases, the applicants claim that they intend to submit them to future calls but they are still unsure on which and when.
- Most of the successfully re-used projects were submitted to Horizon 2020 (50%), followed by national and regional calls (35.7%). Finally, approx. 14% of the projects were successfully re-submitted to the FP7.
- The main changes or amendments to the original proposal that were carried out before submitting the project to another call or scheme are the scientific and technical contents of the proposal (35%). In 30% of the cases, the revision concerned the scope of the project and in particular its financial size or the amount of requested public resources. The types of revision (scientific contents vs. financial size) are obviously not exclusive but can and should be related, meaning that the same project can be subject to multiple revisions. In nearly 25% of the cases, the main changes concerned the composition of the project team with the integration of specific competences and professional profiles, both as regards scientific areas as well as management and organisational skills. Sometimes changes are neither related to comments or wanted choices concerning science and technology issues or organisational arrangements but are forced. Indeed, some technological solutions and innovations risk of becoming obsolete while partnerships change if some key people are not anymore available.
- There are alternative schemes "on the market" often more generous or less strict in terms of requirements that seem to reward high risk innovation. This fact was highlighted and documented also by the case studies which include some examples, where available, of equivalent instruments available for the universities at national or regional level which can have displacement effects on FPs.
- In general, applicants believe that alternative support schemes which financed their proposals are characterised by some advantages in comparison with FP7. It is often highlighted that the new scheme ensured a transparent evaluation process with adequate feedback and the possibility of adjusting the project. Other advantages are: simpler procedure with less bureaucratic requirements; lower co-financing required; less strict eligibility rules.

- Rejected proposals which are re-used are not necessarily downscaled in terms of costs but, on the contrary, their scope and size is often increased and this seems to be unrelated to the feedback received from FP7 reviewers, as the latter is considered of limited value. This fact, together with the "competition" of alternative schemes and the dissatisfaction with the selection process which could have negative impacts on propensity to participate, urges to improve the FP procedures in order to minimise the loss of potentially worth and innovative projects.

## 7.2 Supporting cross-country knowledge diffusion and integration

- The contribution to the creation of an effective European Research Area is one of the key objectives of EU FPs. In this regard the collaborative nature of most the projects is meant to improve knowledge circulation between institutions, firms and across countries. This is turn is expected to lower entry barriers into specific technological and scientific domains, especially for countries with a relatively less developed scientific systems or lacking a critical mass of research infrastructures. About this specific goal, the analyses conducted in this report on the subset of projects granted to Universities in the context of FP7 and FP6 reveals a mixed situation.
- First, aggregated data for FP7 highlight that a large number of academic institutions in the EU countries benefited from the EC funding, more than 1,200 single Universities have at least one granted project. Moreover, the overall EC funding to universities has significantly increased between the past two FPs, at rate of 219%, reaching about € 18,900 million in FP7. The analysis of international collaborations reveals that the largest part of project involved cross-border partnerships, with remarkable variations. The most internationally oriented countries are small and belonging to EU13: their project portfolios show a higher incidence of projects with large international networks. This seems to suggest that indeed for EU13 countries FP projects can have provided a channel to reach knowledge sources and research infrastructures located abroad.
- Second, the previous point is somehow contrasted by the data on the overall geographical concentration of projects and EC funding. In terms of geographical distribution of the EC funding, Universities based in EU15 countries have received about 85% of the EC total financial contribution in FP7. Also, the three extra EU countries analysed in the report (Israel, Norway and Switzerland) have shown a significantly higher incidence of EC funding (about 11%) compared to the incidence of participant Universities from EU13 countries (3%). In the last two FPs there has been a 164% increase in the number of projects granted to at least one university. If we focus on the subset of projects with a university coordinator, we observe an increase of 220% between FP6 and FP7 suggesting an increase in the centrality of universities in FP7. The decomposition of these growth rates across countries reveals that, among larger countries, Germany, the UK and Switzerland experienced higher growth rates, while a more moderate increase has been recorded for Italy, France and Spain. In general, all the analyses conducted in this study on the country-level distribution of projects and funding appear to point to a significant geographical concentration. To a large extent this evidence clearly mirrors structural differences among analysed countries. Still, the comparison between the data from FP6 and FP7 does not support the presence of a trend towards a less concentrated geographic distributions of funds. The data seem to suggest that the concentration pattern is significantly driven by the presence of an uneven distribution of top universities across EU countries. Indeed, the top ten universities get around the 16% of the total EC funding in FP7, while the top 20 universities receive one fourth of the total EC funding. Such polarisation is also well reflected by the distribution of participant Universities in FP7 by size classes of total funding. 43% of universities has received a total amount of EU funding lower than € 1 million. About 32% of universities has received between € 1

and 10 million. Only 1% of universities has been granted a total amount of EU funding greater than € 15 million while 24% are included in the range € 10-15 million.

- Third, the country level breakdowns presented in section 3 clearly indicate the persistence of structural difference in the competitiveness of EU countries systems in obtaining and leading FP projects. The average success rates for projects with EU15 Universities is 19.1%, it shifts to 16% for EU13 countries while it is equal to 21.9% for the three extra EU countries analysed in the study (CH, IL, NO). The data reveals, as expected, also large differences across countries in the share of projects with a national coordinator. Such incidence is larger than 50% in the case of UK and Israel, while it is below 25% for many EU13 countries.
- Fourth, when moving to an observation of the links set up through FP projects at the level of specific institutions by means of social network analysis we obtain differentiated evidence about the capability of top performing EU Universities to act as knowledge bridges towards more peripheral academic institutions. Key results on the university network show strong collaboration links between some central players, many of them located in the UK, and important "gatekeeper" universities or knowledge hubs (e.g., KU Leuven, TU Delft). The core university network does not seem to follow a particular geographical logic, i.e. country clusters or explicit clusters of neighbouring countries are not observable. The UK constitutes the most central country in the FP7 UNI network. Southern European and Benelux countries are more intensively connected than Northern European countries. The collaboration within Southern European countries is much more intensive than between Scandinavian ones.
- The joint consideration of the above points support the view that despite a non-negligible role of FPs in favouring knowledge circulation and the integration of European research infrastructures, there is still considerable space for improvement. Some countries keep lagging behind and the structure of the networks, either when observed at country level or at single university level, suggest the presence of a dense interflow mostly between more advanced scientific systems. This situation clearly poses relevant challenges for the future design and management of funding schemes that explicitly aims at addressing a further integration of national research systems.
- This type of intervention should aim at increasing the number of European elite universities that effectively play a role of knowledge hubs, thus connecting the core of the network of high performing universities with more peripheral nodes. In sum, the data on the concentration of resources call for a policy approach that, while preserving the fundamental driving role of the key players and the value of their networks of collaboration, guarantee sufficient entry opportunities for lagging regions and institutions. In this regard, entry barriers might be lower for projects of relatively smaller size, focused on capacity building and/or addressing more incremental types of research and innovation activities.

## 7.3 Supporting cooperation between industry and academia

### 7.3.1 Evidence on collaboration patterns from the statistical analysis

- A fundamental objective of EU sponsored FPs is to foster the cooperation between firms, universities and other institutions at both national and international level.
- The economic literature has revealed that participation of universities in collaborative projects with other universities and with public or private research centres increased over time. Available evidence indicates that EU sponsored FPs have made an important contribution to the development of cooperation between firms and universities and the formation of research networks. Empirical results show that research networks funded by FPs are characterised by a significant degree of institutional and international diversity, are facilitated by prior acquaintance,

thematic and geographical proximity. However, the strength of the collaborative linkages may depend upon the conditions of the local economy, the funding scheme that backs their formation and the geographical distance. Interestingly, the literature also reveals that universities tend to have a more active and prominent role in the networks examined and that the introduction of new instruments in both FP6 and FP7 has considerably increased interconnectivity compared with the previous FPs.

- On this point, the data indicate that although in the analysed projects, universities establish partnerships mainly with other universities, private companies also play a significant role. Indeed, across the full sample of FP7 analysed university projects more than 60% have collaborated with at least one private company. Among EU countries, such incidence ranges between 44.5% for projects involving a UK university to 71.8% in the case of Romanian university projects.
- The social network analysis confirms the high intensity of interactions between firms and universities in both FP7 and FP6.
- Collaboration with firms is obviously very important in relation to patenting. Cooperation, which accounts for most of the public-private partnerships, is the programme with the highest share of projects reporting patents as outcomes of the funded activities. Only 22.6% of the total number of patents associated with university projects result from UNIV projects that do not involve a firm.
- This evidence is consistent with the FP7 objective of setting up long term public private partnerships in order to accelerate the transition towards a competitive knowledge-based economy. Yet, the evaluation of the long-term economic impact of university-industry collaborations is a complex task due to the difficulties in measuring the intangible outcomes of funded projects.

### 7.3.2 Evidence from case studies

- In approximately half of the cases studies there are academia-industry mobility programmes in place (financed by the government, the EU or with own resources) aiming at increasing the mobility of students or researchers. The individual cases provide examples of these schemes.
- In nearly all universities, companies participate in curricula design and training of PhDs mostly by: supporting individual researchers through grants; providing training on the job; participating in education and training courses. Often, though less frequently, companies contribute to design PhD courses and fund training abroad.
- In 22 cases universities could provide at least one example of laboratory which is permanently financed by industry. Six universities, from Austria, Germany, Italy, UK, Poland and Cyprus, are able to indicate two examples of laboratories. Three universities from Austria, Italy and Cyprus list 3 examples.
- Industry-university cooperation activities established thanks to the EU programmes are medium-long term on average as they tend to continue after the duration of the project financing in the large majority of cases.
- In nearly all cases, the university participates as institution in collaborations, programmes, events etc. promoted by national or local industry and clusters. The universities also contribute to innovation policy making. For instance, approximately 60% of respondents confirm that the universities participated in the development of the Smart Specialisation Strategy, an ex-ante conditionality of the Cohesion Policy 2014-2020 and an important tool for promoting coherence between EU and regional policy and contributing to achieve EU2020. They did so to a varying degree: by producing preparatory studies, assisting the public administrations in drafting the strategy, taking part in *ad hoc* working groups etc.

- Apart from cooperation with industry, the cases studies emphasised that participation in FPs facilitated research cooperation with other universities, other research organisations or regions in all cases, according to respondents. Cooperation is mostly international/cross border, involving organisation from different regions. In a considerable number of cases the universities highlight that this cross border cooperation is long term.

### 7.3.3 Evidence from the analysis of top universities

- The top research universities of the sample pointed out some differences which affect the collaboration with other research organization and the collaboration with industry. In the former case (collaboration with other research organisation) the advantages are positively perceived by all the universities; in the latter case, the possibility to identify other funding schemes that are similar or even more suitable was reported in the interviews, especially as regards transnational research programmes funded by EU.
- Most of the time, collaborations with external partners within the EU FPs facilitate cross border cooperation activities with other universities. The cooperation with other research institutions or regions is facilitated as well but for only half of the universities in the sample; in the other cases, the EU FPs have a positive effect on cooperation only occasionally. No university reports any effects of the EU FPs on collaboration with external partners other than universities.
- EU FPs have some effects on the internal organization of the university, which let emerge trans-disciplinary research groups composed by researchers belonging to different Faculties, continuing to work and to apply for funding even after the EU FP project completion. This event has always an impact on teaching activities when the topic has a potential for educational purposes (as in the case of emerging fields like biotechnology or nanotech).
- The university-industry cooperation is not a central motivation for participation. In other words, EU FPs are not perceived as funding instruments leading to innovation although there are several very good examples of projects developed in cooperation with industry and the contribution to EU FPs to innovation outcomes is perceived to be positive. To this respect the change produced by Horizon 2020 universities are fully aware of the change produced by Horizon 2020, which is correctly perceived as much more related to innovation than on research; this fact confirms the attention that top research universities play to the EU FPs rationales and objectives.
- The universities indicated some academia-industry mobility programmes in place aiming at increasing the mobility of students and researchers; these programmes were mainly based on Marie Curie Actions, which in fact is one of the actions recalled as strategic by the top research universities for training PhD students and early researchers through mobility within different academic, non-academic and private organizations within Europe.
- The assessment the respondents of the role of the universities in the national innovation system shows how the top research universities are aware of their role and capability to participate and influence other institutions through collaborations, events promoted by national or local industrial partners; the same is true for the systematic participation of the universities in national level policy making, and in the debate and definition of EU FPs.
- Institutional and national conditions are relevant elements that impact EU FP participation. Size, funding, reputation are features of those universities able to provide services and support – also financial, for the project submission, empowering the proponents and the internal research groups. The latter provides external conditions for universities through rules and regulations, special incentives, quality standards and evaluation criteria.

## 7.4 Fostering research excellence

### 7.4.1 Output publications, Ideas-ERC

- One of the main pillars of the EC Framework Programme is to reinforce and extend the excellence of the Union's science base in order to make the Union's research and innovation system more competitive on a global scale. The main reason for governments to be concerned about research excellence is the need to maximize efficiency when allocating resources to research organizations through various schemes. A key dimension of research excellence is the quality of research outputs in both basic and applied research. Within this pillar the IDEAS programme, implemented through the European Research Council (ERC), has the aim of providing funding to enable the most talented and creative scientists to pursue high-impact research.
- The economic literature has analysed the relationship between the levels of funding and the scientific productivity of academic researchers using both quantitative and qualitative approaches. It is generally believed that participation in EU-funded research projects may have an important impact on the future research potential of the participants, by enhancing researcher productivity. Empirical studies at the individual level of analysis, reveal a positive effect of research grants on individual productivity, although the intensity of this impact varies depending on the stage of the career, on the amount of funding and on the past research performance. The positive relationship between funding and scientific output is also confirmed at the macro-level of analysis, although it seems that different countries, characterized by different competitive funding environment, reveal different levels of efficiency in publication output. Finally, studies on the linkage between public funding, research collaborations and scientific productivity have found contrasting results concerning the impact of funded collaboration on research productivity.
- In this report we showed the results of a statistical analysis of publications associated with UNIV projects funded within the FP7. We disaggregated data by different Specific Programmes, Funding Schemes, size of the EC financial contribution and number and type of partners. In addition to basic counts of publications, we also provided details on the quality of publications and related scientific journals using standard bibliometric approaches. In order to do this we have matched the data on scientific publications made available by the European Commission and included in the SESAM database with data from the proprietary databases SCImago and Web of Science (WOS). Moreover, in we provided aggregated statistics for the publications related to IDEAS projects using the data made available by the EC. As the information available for each publication does not allow the matching with external bibliometric databases, in order to provide descriptive evidence on the quality of publications related to IDEAS projects we identified a subset of high-impact publications (those that have appeared in the top 5 journals by scientific field) from IDEAS projects.
- Our findings reveal that in terms of scientific output universities exert a relevant role in FP7. Indeed, a high percentage (87.1%) of scientific publications refers to UNIV projects. Furthermore, the large majority of FP7 projects that report at least one publication is represented by UNIV projects (76.9%). However, our findings show that there is a high degree of concentration in terms of projects and resources in a relatively limited number of countries and organisations.
- Moreover, projects vary considerably in terms of scientific productivity. The overall evidence from the analysis of publications across projects confirms the presence of a significantly skewed distribution with a median of 4 publications per project and a $90^{th}$ percentile of 25 publications.
- As far as the scientific specialization is concerned, publications are distributed in the macro areas as follows: 49.4% of publications refer to Life Sciences and Biomedicine, 28.3% to Physical

Sciences and 20.0% to the Technology field while Social Sciences and Arts and Humanities account for less than 3%.

- For what concern the quality of projects outputs, our findings suggest the presence of a remarkable above average scientific standing of the publications stemming from the analysed projects, as captured by the number of citations received and the impact factor of the scientific journal in which they have been published.
- Data also indicate that publications from projects of larger size (> € 5 million) have on average a higher quality.
- On average the analysis of co-authorships confirm the presence of significant inter organizational research collaborations in the context of FP projects. Indeed, more than 80% of UNIV publications involve collaboration across different institutions. In most of the cases such collaboration involved 2 to 5 organizations, although we observe a non-negligible incidence of papers co-authored by researchers affiliated to more than 10 organizations.
- As far as the IDEAS programme is concerned, in this report we also analysed a sample of 37,169 publications related to projects started between 2008 and 2013. The analysis reveals that a non-negligible fraction of IDEAS projects (12.6%) reports a very high number of declared publications. Yet, within this programme, UNIV projects present a significant variance in terms of productivity. This may be partly due to the specificities of the different scientific fields.
- Finally, data seem to suggest a higher average number of publications for larger projects, although the increase in the number of publications per funding size is not particularly sharp. In terms of quality, the data reveal the presence of a significant number of publications in leading international journals. This result is consistent with the objective of the IDEAS programme to support academic excellence. In particular, the IDEAS programme gives a significant contribution to the advancement of scientific knowledge across different areas of natural science and engineering.
- All in all, the evidence on scientific publications is consistent with the FP7 objective to develop and enhance the excellence of European universities in order to make the European Union the most competitive and dynamic knowledge-based economy in the world. However, while targeting excellence in research is undoubtedly a perquisite for keeping in a highly competitive position the European scientific system, the presence of self-reinforcing mechanisms in the structures of the research collaboration networks among top performing institutions and countries might have negative implications for cohesion at European level. In this regard, it is advisable to carry out policy initiatives that allow pursuing excellence and at the same time facilitating the collaborations with countries with a relatively less developed scientific and innovation system.

### 7.4.2 Evidence from the analysis of top universities

- The global ranking, such as the ARWU, confirms the presence of a small number of universities positioned very high in the scale, and other universities that position themselves at a very high level as well. The former group of universities shows a tendency toward maintaining their outstanding positioning; the same is true for the second group, and the possibility of other universities to gain the same positioning does not emerge as an easy objective.
- The Leiden ranking allows further considerations as to the capability of the universities to produce high-quality research, and to have effective research collaboration. The impact indicator shows a significant differentiation between the selected universities, with few of them ranking very high, which continue to grow; the collaboration indicator shows how international collaboration is diffused and effective within the universities of the selected sample, although few high-performing universities still emerge.

- There is a clear indication that the countries where the universities are located play a significant role, a fact that has been also reported in the interviews. This evidence confirms what literature recalls on the influence of the geographical localisation and national conditions as determinants of the success in public grant allocation and in European programmes participation.
- Cumulative and self-reinforcing mechanisms affecting participation in FPs and more generally, public grant allocation, is confirmed by the data on the high performance in the European programmes and on scientists productivity.
- A small group of outstanding universities, which is composed by both technical universities and generalist universities, of different size and different age, is characterized by stability in the ranking positioning -eventually getting higher along the years, with a very high performance in all the indicators on scientific productivity, excellence, and collaboration in knowledge production, and a strategy of networking aimed at joining similar high-level performers.
- Another group of universities whose performance in EU FPs participation ranks 1st at the national level show a common tendency toward reinforcing the international standing in terms of top-cited publication, international networking, and EU FPs participation. Nonetheless, the distance from the outstanding universities make them very different players despite the good performance in EU FPs participation.
- All the top universities have a strategy to facilitate the participation in EU FPs; the strategy is generally included in one official document such as the multi-year planning or in the annual Report. However, the strategy is part of a more general attention of the organizations towards improving the internationalisation of the research activities, to achieving and maintaining reputation and prestige worldwide, joining new high-performing research groups and consolidating the existing ones. This result is coherent with the main motivations to participate in EU FPs, and with the special advantages the top research universities attribute to the participation in European programmes with respect to other existing funding schemes.
- The main strategic aims for high-ranked universities are more circumscribed: quality and excellence, with ERC funding as the true strategic action. The aims are also to positioning the university to compete successfully for funding from Europe and beyond, including by influencing and engaging with EU priorities for Horizon 2020, professionalising the approach to securing EU funding, and supporting the staff to be successful consortium leaders. In this respect the strategies might include the improvement of the specialised internal structures for participating to international and national tenders and to foster the coordination of research projects.
- The strategies are put into action by facilitating the work for the researchers in order to enlarge the number of applicants and to foster the assumption of a leading role within the research consortia.
- Most of the top research universities are also proactive actors in the European scene, activating contacts and inter-personal exchanges in Brussels, encouraging researchers to be involved in the evaluation or peer review processes of the EU FPs, whose advantage is perceived very high since it allows understanding more concretely the mistakes to avoid writing the proposals.
- Some universities report that recruitment of talents is a strategic aim, together with the use of EU FPs as a means to send talented people abroad for a period of time. Participation in EU FP also represents a way to recruit or to promote careers. Holding an ERC or a Marie Curie grant at the start of the career can help build individual and also university reputation in academic world. However the impact of EU FPs on rankings and quality standards, at least formally, is difficult to assess.
- Integration as a policy objective is not perceived by the top research universities; the main interest is to build stable trans-national high-ranked research groups able to persist along the time trusting each other and able to apply successfully to project funding competition within Europe. This result is fully consistent with the evidences on trans-national research based on joint

programmes (Lepori, Reale, Laredo, 2014), where the value of cooperation built in among different players in different countries is a key component of the ERA dynamics.

## 7.5 Impact on innovation

### 7.5.1 Output in terms of IPR

- Innovation is one of the main targets of EU Framework Programmes which aim create a more competitive economy and to promote new job creation. The goal is to foster a virtuous circle leading from R&D investment to new jobs creation via innovation. A key dimension of this innovation process is the generation of commercial and valuable innovation in the form of Intellectual Property Rights.
- While the economic literature has widely examined how changes to university IPR regulations in Europe (and abroad) have affected academic patenting and technology transfer, the issue whether and to what extent public funding affects innovation of beneficiaries is still poorly debated. From a macro-economic perspective, the empirical literature has found that the participation in European scientific networks supported by FPs is positively related with the production of knowledge. It also seems that the involvement into formal networking programs enables participants to achieve innovation outcomes. Moreover, recent literature has found some evidence in favour of a positive impact of public funding on technology and knowledge transfer activities, especially for high levels of contract funding.
- In this report we analysed scientific outputs in terms of IPRs associated with FP7 UNIV projects, taking into account the EC financial contribution, the number of partners in the projects, the Specific Programmes and the Funding Schemes. The information and data needed to carry out the analysis of the scientific outputs come from multiple sources. As mentioned, to organise the dataset including information on projects' outputs we have used information on sampled projects' IPRs made available by the European Commission and included in the SESAM database.
- The analysis of IPRs reveals that the patenting output of the funded FP7 projects appears to be quite low, especially taking into consideration the aggregated financial support by the EC. It is important to recall that such evidence might be partly due to an underestimation of the actual number of patents stemming from the projects for two reasons: first, beneficiaries might have not reported patent applications; second, at the moment of the analysis not all FP7 projects were closed.
- Descriptive evidence shows that in terms of IPRs, universities exert a leading role in FP7. Indeed, 1,516 IPRs, 87.8% of a total of 1,726, refer to UNIV projects and a total of 572 UNIV projects have at least one IPR.
- The analysis also reveals that the incidence of UNIV projects with patents increases with size of the EC financial contribution. The highest number of projects with patents results from interactions with companies: only 22.6% of the total number of patents associated with UNIV projects is the result of UNIV projects that do not involve a company. Consistently with this result, COOPERATION is the Specific Programme with the highest number of projects with patents (328) and the highest number of patents (842). Similarly, CP (Collaborative projects) is the Funding Scheme with the highest number of projects with patents (335) and the highest number of patents (883). This result is consistent with the objective of the Framework Programme to support university-industry collaboration for the generation of new technological knowledge and technology transfer.

- In general, the data highlight significant opportunities for improvement in the industrial exploitation of projects outcomes. In this respect, an important effect might be exerted by funding schemes for university projects that include specific financial resources for enhancing technology transfer. In particular, we refer to the provision of complementary funding for covering the costs of downstream activities such as proof-of-concept, early prototyping, patent prosecution, technology landscaping and market analysis. Beside this policy suggestion we also stress that the currently available data does not allow a proper monitoring – on a comprehensive scale – of the actual impact of industry-university collaborations supported by FP projects. The focus on intellectual property rights is indeed likely to generate a biased view of the phenomenon and to overlook key dimensions of impact, related to the creation of intangible infrastructures and skills in beneficiary firms. The identification of indicators for capturing long-term effects of industry-university collaborations is still debated in the science policy literature.

### 7.5.2 Evidence from case studies

- As part of their current activities, 75% of the universities covered in Task 4 support spin-offs. They do so mostly by providing services or infrastructures and, to a lesser extent, by means of direct financial support. Support services mostly include: Information and advice such as specialized training and guidance on business planning and management, preparation of proposals; fund raising and negotiation with potential investors; IPR management and free licencing of IP; market research in cooperation with 3rd parties; technology reviews and assessment of market opportunities, proof of concept activities; search of external commercial expertise to develop ideas "from research to retail".
- Only a minor share of universities seems able to provide information on results in terms of creation of spin-offs and support to start ups, depending on their monitoring systems. The individual cases show that among the universities that monitor these features there is a strict relation between presence of an incubator (or an accelerator) and the results in terms of generation of spin-offs.
- While half of the universities covered in the case studies were able to provide some information on the spin-offs created in relation to FP7 projects carried out, only approx. 1/5th (26 institutes) were able to quantify the share of spin-offs emerging from the FP7 (as % of total spin-offs created by university researchers). For these universities, on average, 1 out of 7 spin-off created was somehow related to FP projects carried out since 2007.
- In the large majority of the cases, the universities provide knowledge and technology transfer services to industry. In most cases, there are specialised structures (e.g. knowledge transfer and liaison offices) in charge of providing these services, facilitating cooperation with industry and attracting private investments. In some cases, the universities rely on external providers.
- The individual cases include examples of knowledge diffusion and technology transfer structures. The services provided are mostly: IPR support (e.g. patents' applications, licencing, re-sale of licences), partners' search, market analysis and feasibility studies, technology audits, benchmarking services, support to internationalisation, tests and trials. Other typologies of services provided include: managing collaboration with local authorities, fund raising, organisation of workshops/events, administration of funds for early stage commercialisation activities, secondments to and from relevant partners, R&D project management, specialised training (e.g. to develop entrepreneurial skills).
- The large majority of universities covered in the case studies (83%) believe that, overall, participation in EU programmes had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge. This is because the FP7, in particular the

Cooperation and Capacities programmes, facilitated, as it is implicit in their mission, interaction and collaboration with firms.

- Universities are also very positive in relation to academia-industry mobility and post-degree training. Nearly all of them highlight that there was a positive effect of participation in this respect. Furthermore, 70% of respondents believe that participation in EU FPs had a positive effect on incubation of spin-offs.
- Much less positive is the assessment of the effect of participation in FPs on patenting activities, first of all because it is difficult, if at all possible for the universities, to link patenting outcomes with projects. In any case, it is worth noting that universities point out the lack of quantitative monitoring indicators on results and effects and hence the difficulty to go beyond perceptions and qualitative assessments.

### 7.5.3 Evidence from the analysis of top universities

- Top research universities have a strong interest toward playing a leading role also in the development of innovative outputs and to generate an impact on the economy and society through, among others, spin-off and technology transfer. All the top research universities support spin-off creation, and most of the times provide infrastructure and equipment. Direct financial support is provided mainly by outstanding universities or by universities with a strong collaboration in research with industry.
- The most important service provided by the Technology transfer offices is the IPR support, more specifically the support to patenting and licensing. The assessment of the impact produced by the participation in EU research programmes on patenting received more positive answers by the respondents than spin offs. Half of the universities surveyed agree that the EU FPs have had a positive effect, although patenting is produced through converging research efforts coming from different sources of funding.
- All the top research universities have an incubator or an accelerator for spin-offs and start-ups; through the desk research we collect stories of excellent results in producing innovative outcomes.
- Another signal of effective collaborations between university and industry is the presence of university laboratories funded by industry on a permanent base and/or industry consortia.
- The universities always develop monitoring activities on spin-off created by the university and to start up supported, and this is a further example of the investment of this group of universities toward innovation.
- University-industry cooperation activities established thanks to the EU FPs participation are neither stable nor occasional; universities reported that sometimes they are short term ones and sometimes they continue after the end of the financial support of the EU project. Sometimes, collaborations occur because there are already relationships in place between the universities and the industry, but in some cases the relationships develop because of being part of the same consortium.
- Although the evidences of high-level realization in terms of impact on innovation, the linkages between them and the EU FP funding is not clear and the respondents outline concurring factors and funding sources. Moreover, the results come from long-term investment of the universities to consolidate expertise and gaining reputation within industrial partners.

## 7.6 Final remarks on fundamental questions and issues which deserve further analysis

This study powerfully remarked that university participation in European FPs and the corresponding funding is highly concentrated in a few countries and organisations and such concentration has increased.

There is stability in leadership, meaning that rankings did not change significantly over time. While motivations for participating are roughly comparable across countries, the reasons behind persistent success of some players are to be found mostly in accumulated experience, efficacy of support staff and quality of people, which are also linked to the wider national contexts (e.g. promotion systems affecting recruitment and careers, openness of the labour market).

Considering the quality of the projects' outcomes, we can be fairly certain that the FP7 objective to promote excellence and attractiveness was, to a varying degree, achieved. On the contrary, it is questionable whether a cohesive and inclusive ERA was promoted and whether the wide regional variation in research and innovation performance (European Commission, 2013)[22] was reduced, given the evidenced concentration patterns and the substantial exclusion of a large chunk of Member States from the beneficiaries.

For the same reasons, it is questionable that FPs facilitated freer circulation of knowledge outside the well-established, long standing linkages among strong research intensive universities.

This study provides some positive hints on the proactive contribution of universities to RDI policy development (e.g. as regards Smart Specialisation Strategies, local clusters' initiatives etc.), however, to what extent participation in FPs gave a positive impulse also to their engagement in policy remains an open issue to be further explored in following analyses; to those, this study provides a solid evidence base to start with.

Additional issues which deserve further analysis, in the view of the authors, are the following:

- After an adequate time lag, it would be important to analyse what the actual net flows of internationally mobile researchers across European Countries have been. This is fundamental to assess the EU internal brain drain and to measure the direct and indirect effects on sending and receiving countries. This would require the collection of individual data on mobility and careers of researchers supported by EU funds.
- An effective and comprehensive assessment of the quality of scientific and technological outputs generated by the granted projects would require a significant improvement in the data (on publications, patents, new products or know-how) collected from participants. The summary statistics presented in this report suggest that there is a positive link between EU funding and the quality of scientific publications. However, only the use of appropriate control samples would allow distinguishing the ex-ante selection effect and the true policy impact on the quality of scientific output.
- Given the complexity and heterogeneity of funding tools adopted by the FPs, it becomes difficult to provide a clear breakdown of financial resources by scientific field or industrial sector. In order to analyse the long-term impact of EU funds on European industry dynamics it would be important to design an appropriate methodology to map granted projects by scientific and technological domains. In this report we have provided a sectoral classification only for the scientific outputs of FP projects, but a more comprehensive assessment of the impact on specific EU industry and knowledge areas might significantly improve our understanding of the effects of

[22] As highlighted in the Sixth FP7 Monitoring Report: "ERA also aims at reducing brain drain, notably from weaker regions, and the wide regional variation in research and innovation performance".

FPs. It is worth noting that the existing classifications available in eCORDA do not allow to distinguish projects on the basis of their objectives, technological contents and actual innovation but rather on the basis of the calls which are not necessarily informative on technological features and actual sector of application.

- The results of the analysis and the workshop suggested the key importance of facilitating learning from best performers, in order to promote inclusion of less performing countries, regions and organisations, and hence also to contribute to reduce the wide regional variation in research and innovation performance. This would require mapping best practices (e.g. training, support services, infrastructures) for university success and identify measures which may facilitate entry of new players.
- The survey of non-participants conducted in this study highlighted that many improvements in the selection process are possible and provided some specific recommendations on how to go in relation to: quality of the feedback, interaction with applicants, effectiveness of the monitoring system etc. The risks of not improving selection practices are mostly related to potential loss of innovation, poor retention of applicants, lack of learning and therefore further exclusion of lagging organisations and regions. The workshop practitioners also emphasised that this analysis produced some new, non-existing, evidence on rejection and path of unsuccessful proposals; considering the paucity of data on these aspects it was also pointed out that it would be interesting to explore rejection motives further.
- Exploring alignment of EU-level and national policy was outside the scope of this study, however, recent developments suggest a growing coordination across Europe; for instance, the Smart Specialisation Strategies, an ex-ante conditionality for Cohesion Policy, provided a contribution towards more coordination of regional policy, including research and innovation, across Europe and alignment with the EU level policy for research and technological development. Nonetheless, understanding to what extent there are synergies or substitution effects and to what extent these depend on national policy contexts (e.g. existence of similar R&D support schemes and distribution of competences in relation to research policy) is to be further explored.

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# 9 Annexes

## Annex 1 – 75 case studies of individual universities (submitted as separate file)

## Annex 2 – 25 case studies of Top European universities (submitted as separate file)

## Annex 3 - Protocol of the interviews of Top EU universities

**University participation in European Framework Programme for Research and Technological Development: motivations, collaborations with industry and innovation**

The **European Commission**, Directorate-General for Research and Innovation, has launched a study on the role and engagement of universities in the EU Framework Programmes for research and technological development. The results of this analysis will be used in the ex-post evaluation of the 7th Framework Programme for European Research and Technological Development (FP7) and will contribute to shape current and future EU policy and funding opportunities (Horizon 2020 and beyond). For more information, see the attached collaboration request from DG Research and Innovation.
The aim of this interview is to deepen information on **your university participation** in the EU Framework Programmes, with a focus on FP7. In particular, the interview wants to understand the motivation for participating (what kind of opportunities the university perceive from the EU FP participation) and the benefits coming from participation (how far the perceived opportunities have been realized, and what different/further opportunities have been mobilized)
Your university shows a high participation rate in EU FPs, so far your participation to this study, answering to this interview, is extremely valuable for the European Commission. Although questions are addressed to capture the university participation in the EU FP, please make reference to your personal experience in European FP programs providing examples of good practices or failures when possible.
Thank you for your collaboration in this important study.

***General information:***
***University of: .....***
***Person interviewed and position:*** *(this information is made anonymous)*
***Date: .....***

**Perceived opportunities**
*We focus on perceived opportunities about the participation to EU FP programmes. Think back to the application stage BEFORE funding.*

1. What are the main expected benefits that participation in EU FPs offer? Items to be checked:
   - MORE MONEY than other funding programme
   - A LONGER DURATION than other funding programme
   - Possibility to carry out HIGHER RISK research /FRONTIER research/ technology topics
   - Possibility to carry out CROSS-DISCIPLINARY topics no other funding programme would support
   - MORE OPPORTUNITIES FOR INDUSTRY-ACADEMIC collaboration than other funding programmes
   - JOINING new network of partners that other funding programmes would have not allowed
   - Possibility to access or develop more SPECIALISED RESEARCH EQUIPMENT than other programmes would allow
   - Possibility to TRAIN new PhDs / young researchers
   - Possibility to disseminate RESEARCH OUTCOMES or develop INTELLECTUAL PROPERTY
   - Possibility to ACCESS knowledge not available in your university
   - Possibility to IMPROVE scientific reputation and meet quality standards
2. Are there other programs that can provide University with same/similar benefits? (National/international programs. Please provide examples)
3. Do participation in EU FP represent a key element of your University research and innovation strategy?
4. If yes which one is the main strategic aim pursued (items to be checked):
   - Europeanization, integration within Europe

Quality/excellence of research
Breakthrough and innovation

**Mobilized opportunities**
*We focus now on mobilized opportunities. Think about the main benefits coming from participation to EU FP programmes (main focus on FP7).*

*1. In general, what benefits the participation to EU FPs provide to the University research? Items to be checked:*

EU FP funding AMOUNTS are sufficient to meet the research objectives
EU FP funding DURATION is sufficient to meet the research objectives
The research funding from the EU FP programmes was used to carry out HIGH-RISK RESEARCH / technology development or rather to penetrate a new research field / technology market
EU FPs are key instruments used to carry out CROSS-DISCIPLINARY RESEARCH / TECHNOLOGY DEVELOPMENT
Participation in EU FP allow starting NEW INDUSTRY-ACADEMIC COLLABORATIONS
Participation in EU FP allow to access or to develop more SPECIALISED RESEARCH EQUIPMENT
EU FP participation allow JOINING new network of partners
EU FP collaborations allow developing/access new knowledge
EU FP participation allow improving the University international standing and reputation

*2. Did participation in EU FP allow increasing the research team size of the University?*

*3. Are benefits from EU FP participation mostly long or short lasting benefits (e.g. commercialization and use of research outcomes beyond EU FP, networking capacity, training)?*

4. EU FP improve the most the possibility to produce valuable
- *research publications*
- *commercial research outcomes (e.g. patents)*
- *both*

*5. Beside the Marie Curie actions, participation in EU FPs are important to train new PhDs / young researchers?*

*6. Did EU FP participation improved your capacity to meet criteria for evaluation of research or quality assurance (e.g. improving internationalisation or international publications, contributing to the positioning in the rankings, improve the level of fund rising)*

*7. Can you provide one/two key examples of unintended and unexpected effects (positive or negative) that the participation to EU FPs produced?*

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The analysis is aimed at acquiring a better understanding of the motivations for university participation in the Framework Programmes for RTD, the patterns of cooperation that emerge and their effects, including differences across countries. The study provided evidence in the context of the ex post evaluation of the FP7. First, a literature review examines drivers of university participation, success rates, relationship between funding and scientific output, effects of participation on knowledge production and technology transfer. Secondly, the study provides an analysis of the patterns of university participation in several generations of FPs (FP4-FP7), a social network analysis as well as an analysis of outputs of funded projects. The study includes 100 case studies exploring motivations, collaborations, innovation pathways. 25 cases concern top European research universities. Finally, a survey of rejected proposals explores the issue of participation vs. non participation. The study highlights very positive results of the FPs but also a significant and persistent concentration of resources in few regions and organisations.

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