



# The Impact of Switzerland's Participation in the EU Framework Programmes

2019 report



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,  
Education and Research EAER  
**State Secretariat for Education,  
Research and Innovation SERI**

Pictures: project Hyperbole (p.14), FEMTOprint SA (p.22), Olivier Bloch, Agroscope (p.30), Vincent Spano, Idiap (p.39), Boris Kolvenbach, School of Life Sciences FHNW (S.54), project Lifepath (p.62).

Cover picture: In this report, various project examples show Switzerland's participation in the European Framework Programmes for Research and Innovation. This includes, for example, the project "Femtoprint". The aim of this research project was to develop a 3D printer for miniature devices, so-called microdevices (see pages 22 and 23). Picture: FEMTOprint SA.

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## **Publishing details**

Publisher: State Secretariat for Education, Research and Innovation (SERI), © 2019  
Editorial team: EU Framework Programmes Unit  
Layout: Communication Unit, SERI  
Translation: Translation Service SERI and Federal Chancellery  
Printed by: FOBL  
Languages: German, French and English  
ISSN: 2296-3871

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# Summary

## Background to the report and methodology

Since 2009, the State Secretariat for Education, Research and Innovation SERI has been commissioned by the Swiss parliament to carry out controlling processes to ascertain the cost-effectiveness and impact of Switzerland's participation in the European Union's Framework Programmes for Research and Innovation (EU framework programmes, FPs).

This report is the third of its kind, previous reports having appeared in 2009<sup>1</sup> and 2014<sup>2</sup>. It complements SERI's regular publication Facts and Figures on Switzerland's participation in the European Framework Programmes, which provides a snapshot in figures of Swiss participation for a given period.<sup>3</sup>

The impact analysis methodology applied in this report is based on a system of indicators developed and applied in the two previous impact reports. In this issue, the indicator system and the data collection survey have been expanded and further developed. A total of 878 participants from Switzerland who took part in a project in FP6, FP7 or FP8 (Horizon 2020)<sup>4</sup> answered questions on both their general experiences of taking part in the FPs and on their experiences in the projects in which they participated.

Chapters 1 to 5 of the report present specific aspects on the basis of indicators, while Chapter 6 elaborates on methodological issues. The report also contains case studies of actual FP projects and interviews with representatives of the national research and innovation funding institutions (Swiss National Science Foundation and Innosuisse).

## Key findings

The investigation of specific impacts of the participation to the FP by means of various indicators produces a fundamentally positive picture despite the limitations of the used methodology: Investments in FP participation are shown both to be necessary and to generate benefits for research and innovation in Switzerland. The findings are in line with those of the previous reports.

The findings show that the FPs are an integral part of the Swiss Research and Innovation (R&I) landscape and that their significance far exceeds purely monetary considerations. In particular, it is the integration into the international competitive R&I environment that makes the FPs so attractive for Switzerland. This is beneficial for Switzerland's competitiveness in this field.

<sup>1</sup> Effects of Swiss participation in EU Framework Programmes, SERI [SERI], 2009

<sup>2</sup> Auswirkungen der Beteiligung der Schweiz an den Europäischen Forschungsrahmenprogrammen SERI 2014

<sup>3</sup> Most recent report: Swiss Participation in the European Research Framework Programmes, SERI, 2018.

<sup>4</sup> For FP8, only participants whose projects were launched between 2014 and 2016 were surveyed

The key findings of this report can be summarised as follows:

**Switzerland's participation in the FPs is a substantial and integral complementary element of the R&I funding instruments available in Switzerland.**

- The survey on which this report is based suggests that the FPs are one of the most popular funding sources for R&I projects after the Swiss National Science Foundation SNSF (SNSF: 40%, FPs: 35% of respondents).
- The FPs provide considerable funding for multilateral international cooperation for which the Swiss R&I funding institutions (SNSF and Innosuisse) do not have appropriate funding instruments.
- For FP participants from Switzerland, access to funding is an important reason for taking part in FP projects, but not necessarily the most critical one. Just as important are the opportunity to cooperate with European partners, the increased competitiveness and the gain of international prestige.
- A positive side-effect is a possible net flow of funds from the FPs into Switzerland, but this is certainly not the most important argument in favour of Switzerland's participation in the FPs.

**Switzerland's participation in the FPs boosts the country's economic competitiveness and leads to the creation of new jobs.**

- Participation in FP projects frequently leads to greater turnover (approx. 30% of all project participations by corporations and SMEs), and to business start-ups (approx. 10% of all project participations).
- Each FP project participation leads on average to the creation of one new job in Switzerland.
- FP projects with an innovation focus generate patent activity (on average nearly one in two project participations by Swiss companies leads to a new patent) and innovative products close to marketability (in the case of two thirds of project participations by companies in Switzerland).

**Switzerland's participation in the FPs fosters knowledge generation and stimulates exchange and competition, in particular among higher education institutions.**

- Participation in FP projects generates a considerable number of academic publications (around five publications per project). In particular collaborative projects frequently result in publications by participants from Switzerland with co-authors from other countries.
- The FPs play an important role in the training of young researchers in the Swiss R&I sector. On average, each Swiss project participation results in a Master's and a Doctorate degree.
- Participants from higher education institutions report that cooperating in an FP project has a very positive effect on their career. Participants from the private sector experience this to a lesser extent. Further, the survey results suggest that individual grants have a greater impact on careers.

**Participation in the FPs has a positive impact on society in Switzerland.**

- Not all societal impacts of FP participations are direct and quantifiable. Participants were therefore asked to give a qualitative assessment of the (long-term) effects of their FP participation on society.
- FP project participations can indeed lead to findings which are of direct relevance to society, such as the development of products based on new technologies (e.g. 5G, Internet of Things, quantum computing), or provide the basis for policy decisions (e.g. climate scenarios or natural hazard mapping).

## **Methodology**

Chapter 6 describes the methodology applied in the impact analysis and explains the terms used, in particular the term 'impact', which in recent years has been increasingly used in the strategic planning of research programmes.

- An examination of the causal relationship between Switzerland's participation in the FPs and the impact of this participation reveals a highly complex chain of effects, which cannot be fully depicted within the scope of this study.
- For practical reasons, the findings of this report cannot claim to be completely representative of the influence of the FPs on the Swiss socio-economic reality.

# Introduction

As part of the approval of the credit for Switzerland's participation in the 7th EU Research Framework Programme (FP7, 2007–2013), Parliament gave the SBFI the following mandate: "With the allocation of the first framework credit amounts, a controlling system shall be introduced that contains indicators to determine the cost-effectiveness and the concrete positive effects of Swiss participation in the various programmes and projects."<sup>5</sup> In its first report on the issue<sup>6</sup> SERI thus developed a system of indicators to assess the impact of Swiss participation in the FPs. The report set out in detail the fundamental methodological aspects of measuring 'impact' in complex socio-economic systems. The subsequent report in 2014<sup>7</sup> covered the period of FP6 (2003–2006) and part of FP7 (2007–2013), and presented results on the basis of the indicators developed in the first report. The current report, the third of its kind, continues to build on the methodology applied in the first two reports and may be seen as a continuation of these. The European Commission also assesses the impact of the FPs and regularly publishes reports to this effect.<sup>8</sup> Their findings are congruent to those presented here, but they relate to the impact in the EU rather than to the specific impact in Switzerland. However, it is the impacts in Switzerland that are relevant for the fulfilment of the mandate of the Swiss Parliament.

The results presented in this report are based on a survey conducted among Swiss participants in the sixth and seventh framework programmes and the first three years of the eighth programme (Horizon 2020). The market research institute Ipsos AG (formerly GfK AG) was commissioned by SERI to conduct the survey. The questionnaire was developed jointly by SERI and Ipsos AG, who invited 4,425 Swiss FP project participants to take part in the questionnaire via a link sent by email. The questionnaire could be completed between 21 November 2018 and 27 January 2019, and the data collected was then passed on to SERI for analysis. The response rate was just under 20%: 878 responses were received to the general part of the questionnaire, and 959 to the project-specific part. As the response rate for the various project participant categories was similar, it was not necessary to weight the answers. The European Commission eCORDA database and SERI's own ProFund project database were also important sources of data.

This report provides a comprehensive picture of the impact of FP6 and FP7 and identifies initial trends in FP8. The survey gives an idea of the various effects of participation in an FP project. Specifically, it looks at the impact of Swiss FP participation on research promotion (Chapter 1), on the Swiss economy and employment (Chapter 2), on the formation of networks (Chapter 3) and on the production of knowledge and skills (Chapter 4). Further data allow analyses to be conducted of the societal impact of FP projects and the transfer of research results (Chapter 5).

The limitations of measuring the impacts resulting from research activities must be borne in mind throughout. Although research can have an effect in the short, medium or long term, it per se has no stringency towards usable results (see also information on methodology in Chapter 6).

<sup>5</sup> Federal Decree of 14 December 2006 on the Funding of Switzerland's Participation in the EU Programmes on Research, Technological Development and Demonstration in the years 2007–2013 (BBI 2006-1628, pp. 9843–9844), Art. 1 para. 5.

<sup>6</sup> Effects of Swiss participation in EU Framework Programmes, SERI, 2009, ISSN 1424-3342.

<sup>7</sup> Auswirkungen der Beteiligung der Schweiz am 7. europäischen Forschungsrahmenprogramm, SBFI, 2014.

<sup>8</sup> European Added Value of EU Science, Technology and Innovation Actions and EU-Member State Partnership in International Cooperation, European Commission, 2017; Commitment and Coherence – Ex-Post-Evaluation of the Seventh EU Framework Programme (2007–2013), European Commission, 2015

## Impact of Swiss association to the FPs

### Switzerland's participation in the FPs

Researchers from Swiss institutions have been taking part in EU Framework Programmes since 1987, the first programme generation (FP1, 1984–1988). Over the years the conditions for participation have changed several times (see table below).

- Up to the end of 2003 (FPs 1–6), researchers from Switzerland had few opportunities to take part in projects, as Switzerland had third-country status. Funding initially had to be provided by the project participants themselves, and from 1992 onwards was provided by the Confederation (participation per project).
- From 2004 to 2013 (FP6 and FP7), Switzerland had the status of an associated country in the FPs, thanks to one of the seven sectoral agreements in the Bilateral Agreements I package between Switzerland and the EU. This agreement was renewed with each programme generation. Association guarantees participants from Switzerland similar rights and obligations as participants from EU member states, in particular direct EU funding and the possibility of being project coordinator.
- The political events following the popular vote in Switzerland in favour of the 'mass immigration initiative' in early 2014 initially blocked Switzerland's association in FP8 (Horizon 2020). During the first half of 2014, the country's status in FP8 was unclear, and Swiss researchers could not take part in some of the calls during this time. It was not until September of that year that Switzerland and the EU agreed on Switzerland's partial association from 2014 to 2016.

Switzerland took part in only about a third of FP8 as an associated country, and in other areas had the status of a third country. In these parts of the programme, researchers from Switzerland were able to join collaborative projects with partners from other participating states, but did not receive any funding from the EU. Instead, the Swiss government funded Swiss partners in approved collaborative projects directly (in the same way as participation was funded per project prior to 2004).

- As a result of the decisions taken by Parliament in December 2016 regarding the implementation of the mass immigration initiative, Switzerland again obtained full association for the remaining of FP8 from the beginning of 2017, i.e. until the end of 2020.

### Overview of Switzerland's participation status in the FPs

1987–2003	FPs 1–6	Third country	Self-funding or direct government funding (from 1992)
2004–2013	FP6 and FP7	Full association	EU funding
2014–2016	FP8 (Horizon 2020)	Partial association	partly EU funding, partly Swiss government
2017–2020	FP8 (Horizon 2020)	Full association	EU funding

## Various conditions for participation from the researchers' point of view

The survey upon which this report is based allows us to draw conclusions about how the various conditions of participation in the FPs were perceived and experienced by researchers in Switzerland.

Around three quarters (73%) of the respondents said that they had already been active participants in the FPs prior to 2014. 39% said that, between 2014 and 2016, they participated in projects in FP8 with direct funding from SERI under Switzerland's status as a third country. During the same period, 38% received EU funding in associated status. Since 2017, i.e. since Switzerland has again enjoyed full association to FP8, 38% of respondents have submitted a project proposal.

When asked about their participation during Switzerland's partial association between 2014 and 2016, the majority of respondents (64%) replied that it was initially not clear what the funding conditions were and whether participation in an FP8 project was actually open to them as a Swiss partner (49%). Moreover, 43% of those taking part in a project during that period felt that the other consortium partners initially viewed the inclusion of Swiss partners as disadvantageous to their project proposal.

Overall, the responses highlight the considerable uncertainty posed by the political situation at the beginning of FP8 both for participants in Switzerland and for their international partners. At the same time, a large majority of those participating in an FP project at the time reported that helpful information on Switzerland's status in FP8 was available if needed (69%), and that the information provided on how to correctly apply to participate was useful and comprehensive (71%). The coordinated information and replacement financing measures of the responsible bodies (including SERI, Euresearch and SNSF) have apparently been implemented efficiently and have taken effect quickly.

The interim direct funding of Swiss FP projects during partial association led to an additional administrative burden for the institutions and companies involved in the projects as well as for the Confederation and the SNSF. Swiss project partners had to submit an application both to the EU and to the Swiss authorities, conclude a funding agreement and account for the use of the funds. For its part, the Confederation had to set up the necessary operational processes.

Swiss project participants seem to have had very good experiences with direct funding through SERI. Almost 80% of those surveyed believe that applying for funding from SERI was an uncomplicated process, and 82% stated that SERI handled administrative processes quickly, cooperatively and satisfactorily<sup>9</sup>. Only one fifth of the respondents (20%) stated that reporting on the use of funds to SERI was a considerable additional effort compared to financial reporting to the EU. This share is lower for higher education institutions, but somewhat higher among companies. Depending on the size of the company, between a quarter and a third of the respondents felt that the process of reporting to SERI was an additional effort.

Overall, Switzerland's association in the FPs – whether from 2004 or from 2017 onwards was left open – is viewed positively in the survey. 46% believe that, with association, it has become easier for Swiss partners to join a project consortium (14% think otherwise and 41% did not respond to this particular question). Furthermore, 57% stated that association has had positive overall effects for their institution.

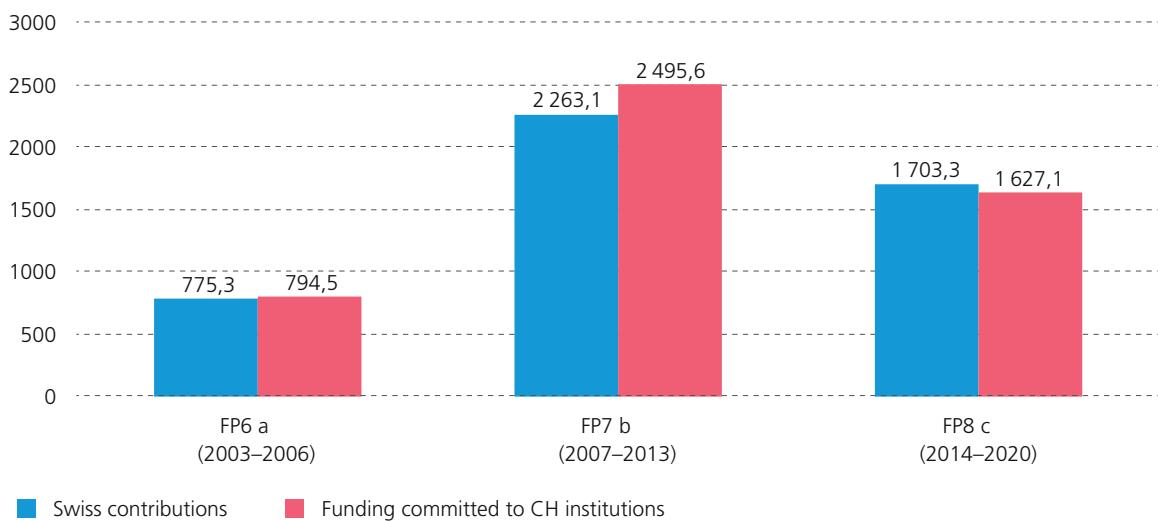
<sup>9</sup> Although this survey was conducted online, a positive bias due to social desirability cannot be completely ruled out.

# 1 Impact on research funding

Participation in the FPs has opened up an additional source of funding for research and innovation in Switzerland that complements national funding instruments. The financial return from the FPs has been positive for Switzerland so far. Participation in the FPs also leads to considerable additional investment in research and innovation in Switzerland by the participants themselves. The survey results indicate that the FPs are the preferred source of funding for Swiss research and innovation players after the Swiss National Science Foundation (SNSF). For many researchers, access to funding is a key motive for participating in the FPs, but it is not only monetary factors that play a role. For a clear majority of respondents, the FPs offer opportunities for international cooperation that do not exist with national funding instruments. This is also suggested by the fact that there appears to be little permeability between national and European funding programmes: national funding apparently does not appear to motivate researchers to apply for EU projects and vice versa, and rejected EU project proposals are rarely implemented by means of national funding instruments.

## 1.1 Financial return

Figure 1.1 Financial return (in CHF m)



a Not including INTAS contributions (International Association for the promotion of cooperation with scientists from the New Independent States of the former Soviet Union)

b Not including 'Fusion' by Euratom and ITER.

c Provisional estimate by SERI as at end of 2018, excluding Euratom and ITER.

Sources: European Commission, SERI

Since the beginning of FP3 (1991–1994), the Swiss research community has received approximately CHF 5.9 billion in funding from the framework programmes. From FP3 to FP5, Swiss participations in European projects were directly funded by the Swiss government. Since 2004 (the second year of FP6), Switzerland has taken part in the FPs as an associated or partially associated state (the latter between 2014 and 2016). Association allows researchers in Switzerland to receive funding directly from the EU in a competitive process. To this end, the Confederation makes compulsory contributions to the FP budget calculated according to the ratio of the Swiss GDP to the sum of the

GDP of all EU member states. This funding mechanism enabled net financial returns. Figure 1.1 shows a comparison between the contributions made by the Swiss government to the framework programmes and the funds raised by Swiss institutions since FP6.

The Confederation contributed a total of CHF 775.3 million to FP6 (2003–2006). Some of these funds were used in the form of project funding for the so-called “project-based participation” before 2004, the other part in the form of compulsory contributions to the EU for participation as an associated state from 2004 onwards. Swiss participants in FP6 received total funding of CHF 794.5 million, representing a positive net return of CHF 19.2 million from the EU to Switzerland for this programme generation.

In FP7 (2007–2013), the Swiss government made compulsory payments of CHF 2,263.1 million to the programme’s budget. Meanwhile, Swiss researchers were able to secure European funding totalling CHF 2,495.6 million – three times the amount received in FP6, and this represents a positive net return of CHF 232.5 million for Switzerland.<sup>10</sup>

In the current programme, Horizon 2020 (FP8), Switzerland participated as a partially associated state from 2014 to 2016. During these years, a mix of Swiss direct funding (“project-based participation”) and funding as an associated state was used. Since the beginning of 2017, Switzerland has participated in all parts of the programme as an associated state. As FP8 runs until the end of 2020, it is not yet possible to draw a final financial balance. However, the figures currently available show that the Swiss government has directly committed funding to Swiss participants in FP8 of CHF 481.9 million. In addition, Switzerland contributed CHF 1,221.4 million to the budget of FP8 until the end of 2018, while Swiss research institutions secured CHF 1,145.1 million in EU funds.<sup>11</sup> This corresponds to a provisional net outflow of CHF 76.3 million. The more difficult conditions for participation resulting from the political situation in the first years of FP8 (2014–2016) coupled with uncertainties among Swiss R&D actors about the participation opportunities in this period seem to have impaired Swiss participation and thus the net return.

When interpreting the return, it should be noted that part of the FP budget is earmarked for the funding of the EU Joint Research Centre (JRC), for the evaluation of the submitted research proposals and for the general management and implementation of research projects and framework programmes (administrative costs amounting to approximately 5% of the total budget). Moreover, some projects and project calls are directly managed by organisations other than the European Commission (EC). In these cases, the corresponding contributions are first paid to the responsible organisation and are then forwarded by it to the researchers. In such cases, the EC database on which the figures presented here are based does not contain any information on the final beneficiaries and the amount of funding paid to them.

To summarise, the overall positive net return of FP funds testifies to the excellence and competitiveness of research and innovation in Switzerland. It has also had a leverage effect, as additional funds for research and innovation in Switzerland were generated in addition to the federal investments for Swiss participation in FPs.

<sup>10</sup> These figures only reflect payments to and from FP7 and the ‘Fission’ part of the Euratom programme. Payments to and from Euratom’s ‘Fusion’ programme and the ITER project are calculated differently, and this makes it difficult to ascertain the financial return.

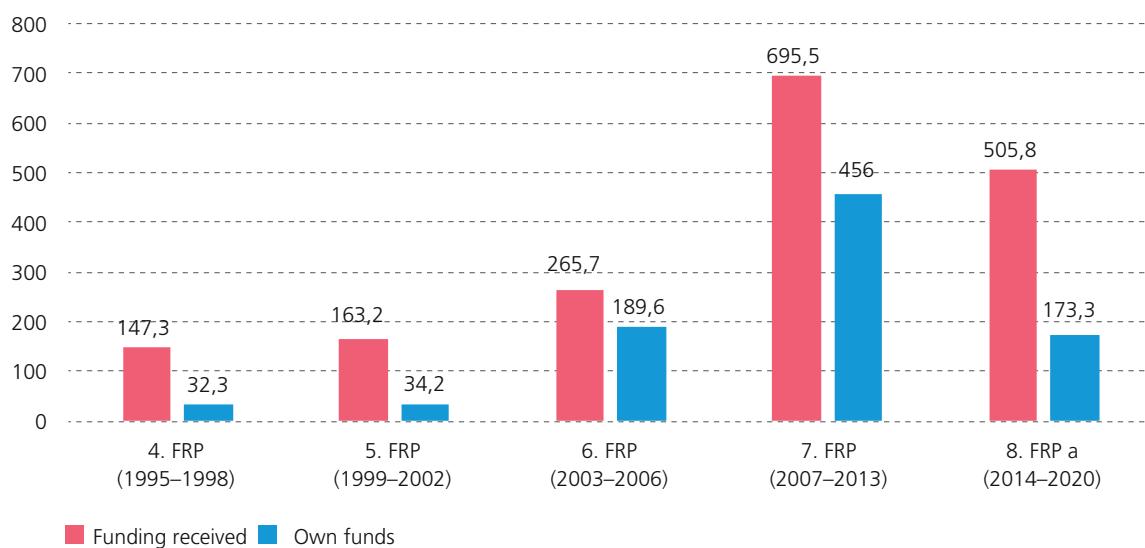
<sup>11</sup> These figures only reflect payments to and from Horizon 2020, not including Euratom and ITER.

## 1.2 Own funds

The FPs have a further leverage effect for research and innovation in Switzerland: the costs of FP projects are not always fully met by the framework programmes, so in some cases participants must provide their own funds or find third-party funding in order to carry out their projects. From FP4 to FP8, private-sector participants (companies and non-profit organisations contributed an additional CHF 885.3 million to the EU and federal funding of CHF 1777.5 million until March 2019 to finance their research projects.<sup>12</sup> The funding of a research project thus generates on average additional investments of just under 50% (CHF 885.3 / 1,777.5 million) of the allocated funds on the part of the companies and non-profit organizations involved in the projects.

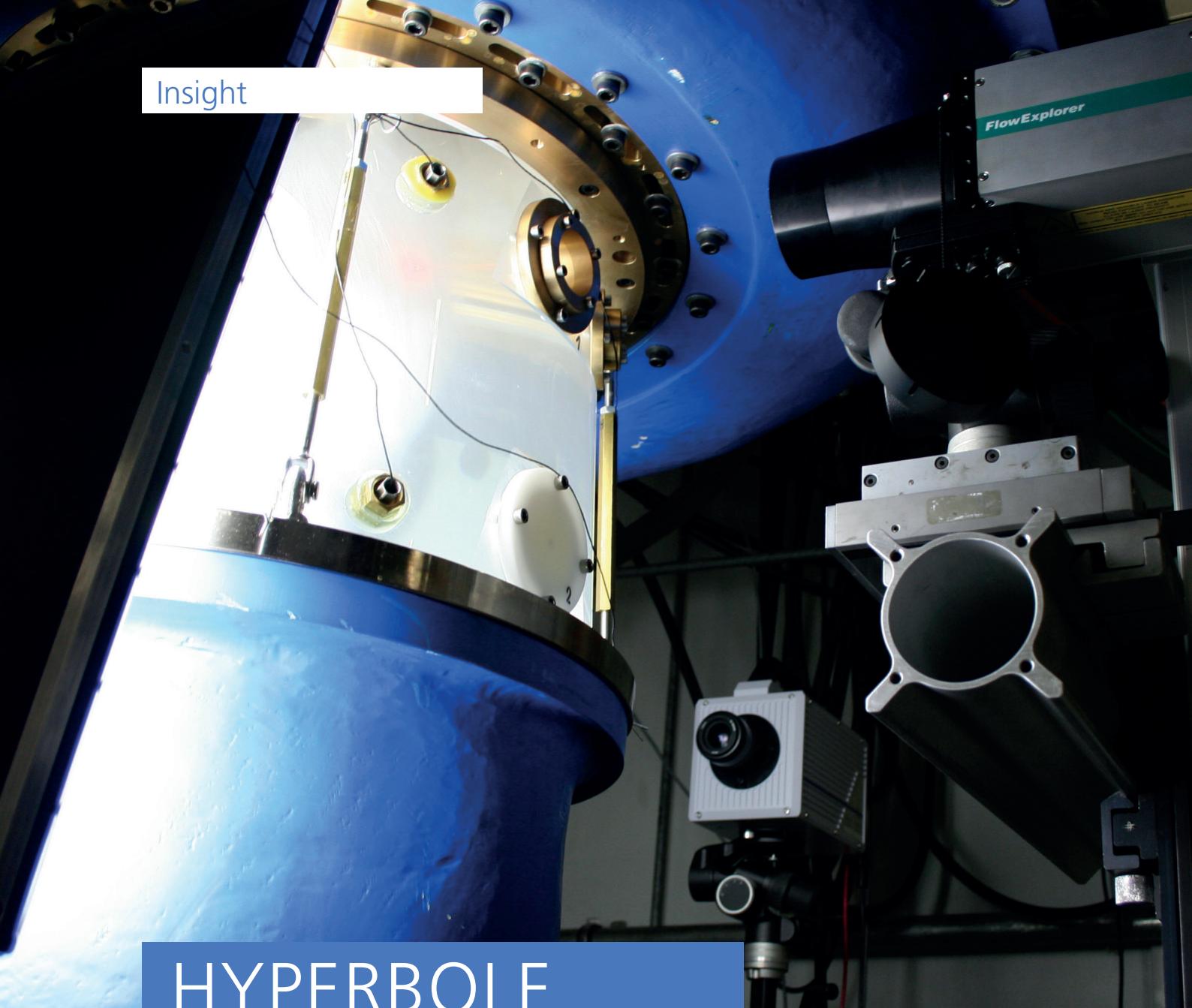
Figure 1.2 shows the amount of funding received and the funds contributed by participants from the Swiss private sector for each FP. The figures cannot be directly compared, as each FP had a different budget and different rules regarding the own resources shares to be contributed. However, there is a marked rise in the volume of own funds committed over time. Not only does the trend reflect the greater numbers of participations by Swiss companies and other private players in the FPs also the increasing orientation of FPs towards innovation promotion, which specifically targets companies. Innovation promotion instruments generally require a greater proportion of own funds to be committed, and this is frequently set out in the participation regulations

**Figure 1.2 Funding received and own funds used per FP by Swiss participants from the private sector (in CHF m)**



a Provisional data (as at 13 March 2019)  
Sources: European Commission, SERI

<sup>12</sup> Figures from the EU project database eCORDA (as at 13 March 2019). No reliable data on own funds is available for FP3 (1991–1994).



## HYPERBOLE

Using an ancient force  
more efficiently



Hydropower plants PERformance  
and flexiBle Operation towards  
Lean integration of new renewable  
Energies



Project duration  
09/2013 – 02/2017



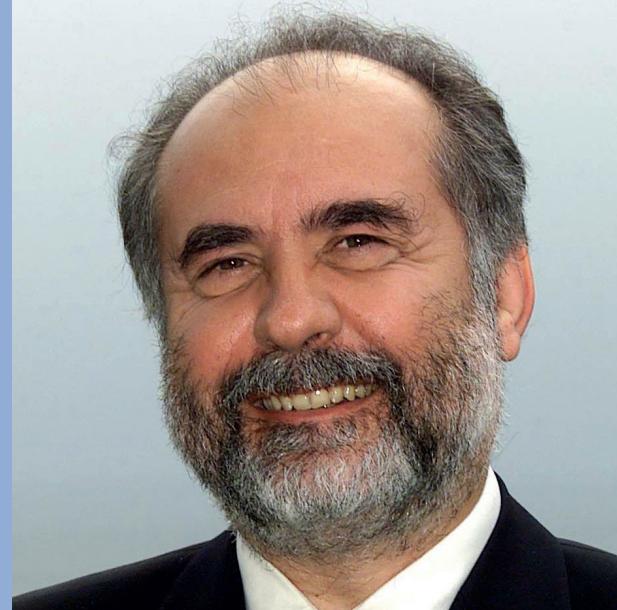
Number of project partners: 10  
Number of countries: 6



Total budget: € 6 294 644  
Budget of Swiss Partner: € 1 628 270

„Thanks to EU funding, it has been possible to establish international collaboration between key players.“

Prof. François Avellan of the EPFL Lausanne



The history of hydropower goes back a long way. Historians estimate that it was used in China 5000 years ago. In 1866, Werner von Siemens succeeded for the first time in converting hydropower into electricity. This was followed in 1880 by the first commissioning of a hydroelectric power plant in Great Britain. Since then, hydroelectric power has become increasingly important as a source of electricity, not least because of its inexhaustible potential as a renewable energy source. Recently, the EU issued a directive that dictates a massive increase in the use of renewable energy sources. Hydropower plants will have to play a major role in achieving these ambitious targets.

This is where the “Hyperbole” project comes in. Its aim was to increase the efficiency of hydroelectric power plants and improve their long-term viability. To this end, the dynamics of the various hydroelectric machine sets in these hydroelectric power plants were to be optimised in their hydraulic, mechanical and electrical properties. Under the coordination of Prof. François Avellan of the EPFL Lausanne, a consortium of universities, leading hydropower turbine manufacturers and an SME was formed. The consortium carried out tests on site and on a miniaturised model to optimise the functioning of the hydroelectric turbines and also used digital simulations of real hydroelectric turbines.

The Hyperbole project delivered an impressive scientific performance in the form of publications and doctoral theses. At EPFL, for example, four PhD theses were realised, fulfilling the task of training the scientific and technical staff needed by industry and the public sector. In addition, the project has produced the first economic study showing how to ensure the profitability of pumped storage power plants by extending their operating range. According to Prof. François Avellan,

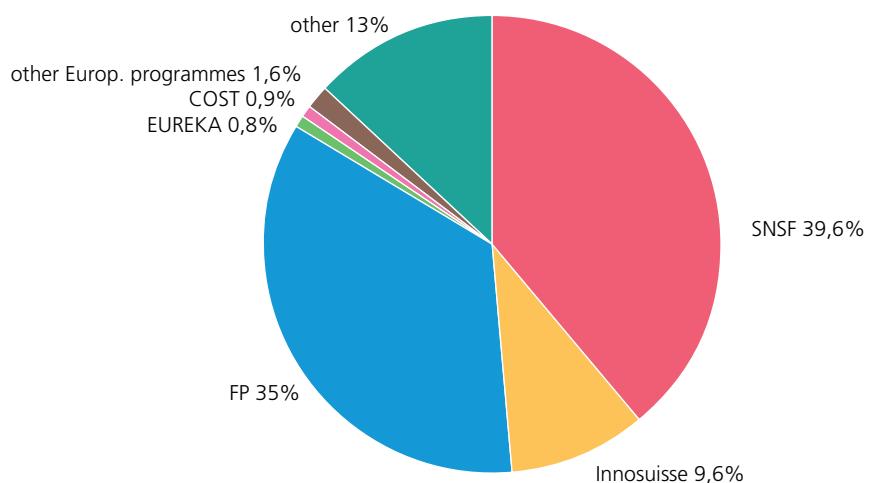
the Hyperbole project has contributed significantly to the development and integration of renewable energy sources. It thus contributes to achieving the EU's strategic goals in its agenda 2020. In addition, the machines and processes developed in the project represent a decisive competitive advantage for European suppliers of hydroelectric equipment. They enable the industrial partners in the project to defend or even increase their share of the world market. The installation of new and refurbished hydropower plants and the development of renewable energy sources have a very interesting business potential.

From a Swiss point of view, the project has strengthened the visibility of Prof. François Avellan's EPFL laboratory as one of the world's leading research laboratories in the field of turbines and pump turbines for hydropower plants. Moreover, through the knowledge they gained during the project, the Hydraulic Machinery Laboratory of the two Swiss Centres of Excellence in Energy Research, SCCER SoE and Furies will also contribute to the implementation of the Confederation's Energy Strategy 2050.

### 1.3 Comparison and complementarity of sources of funding

The survey conducted for this study suggests that the SNSF is the preferred funding source overall for researchers in Switzerland, cited by 40% of all respondents (see Figure 1.3a). In second place comes the EU framework programmes: 35% of all respondents said this was their preferred source of funding.<sup>13</sup> This highlights the importance of the FPs in the Swiss R&I funding landscape. Innosuisse, the Swiss Innovation Agency, was mentioned by 10% of respondents, while the remaining replies were split between other sources including, in very few cases, other European programmes such as COST or EUREKA.

**Figure 1.3a Preferred funding sources among Swiss FP participants**



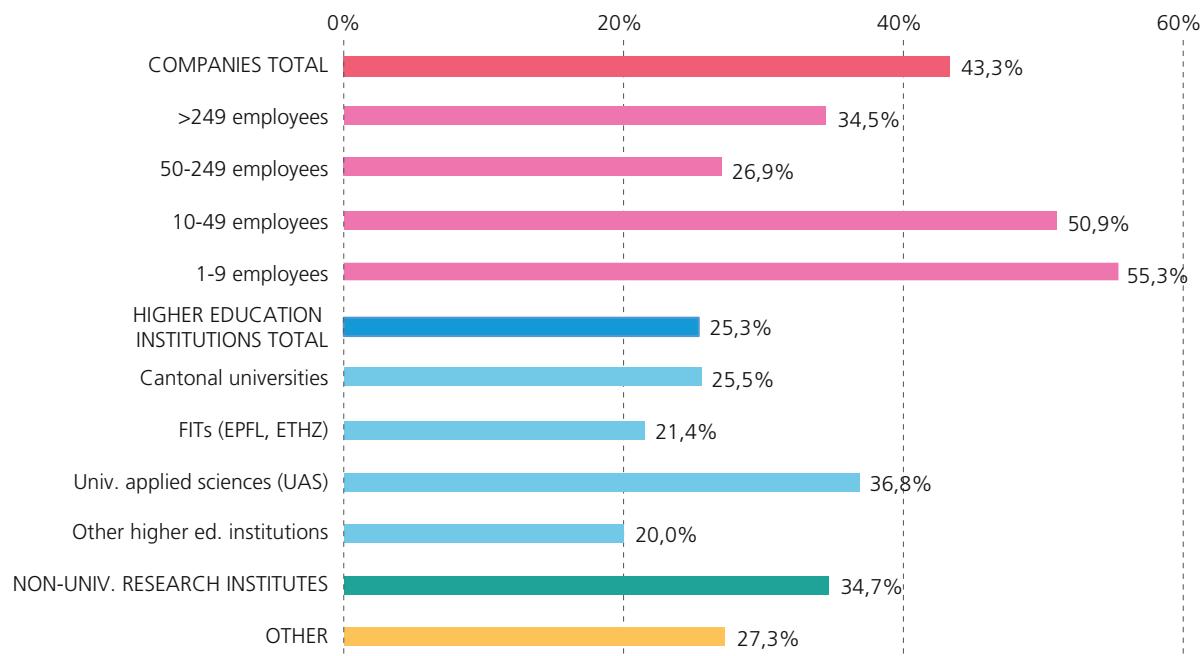
Source: SERI/Ipsos (GfK) survey (Sample size: 763)

As Figure 1.3b shows, the importance of the EU FPs varies depending on the participant category. By their very nature, the FPs are more important for companies than for higher education institutions, as the Swiss government – that is to say, the federal funding agencies (SNSF, Innosuisse) – does not grant funding directly to private businesses. The FPs play a particularly important role for smaller businesses with up to 50 employees. More than half of the survey respondents in this category stated that the FPs were their preferred source of funding, in contrast to only around a quarter of higher education institutions. In the latter group, the universities of applied sciences (UASs) were the largest group to cite the importance of the FPs as a funding source, at 37% of those surveyed. This is presumably due to the fact that, as their name suggests, the UAS's focus is applied science and they rarely attract funding from the SNSF, which primarily funds basic research.

These findings suggest that both national funding instruments and the EU framework programmes are similarly appreciated by research and innovation players in Switzerland, but their importance is weighted differently depending on the group of participants.

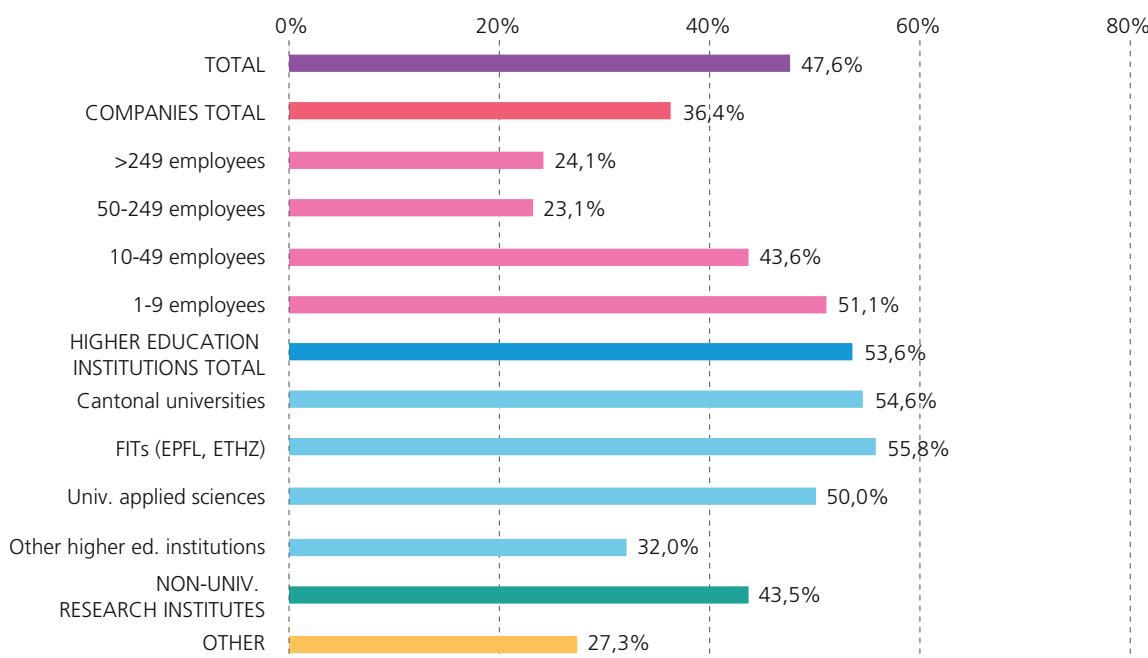
<sup>13</sup> As only researchers who have actually taken part in an FP project were surveyed, the results may be distorted. Overall, researchers in Switzerland may actually have different preferences.

**Figure 1.3b FPs as preferred funding source by participant category**



Source: SERI/Ipsos (GfK) survey (Sample size: 870)

**Figure 1.4a Access to funding as a reason for participating in FPs**



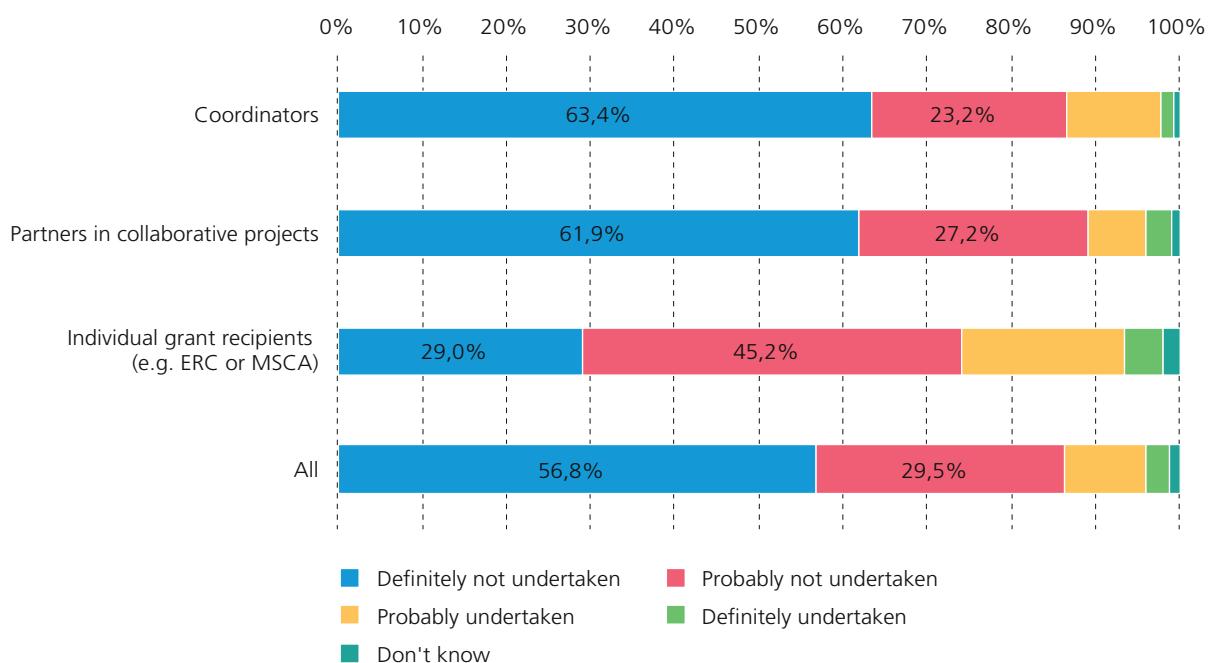
Source: SERI/Ipsos (GfK) survey (Sample size: 870)

## 1.4 Motivating factors and importance of FP participation

An analysis of the reasons for FP participation shows that access to funding is one of the main motivating factor for 48% of respondents and is indeed the most frequently cited reason for participation (see Figure 1.4a). The proportion is even higher among nearly all types of higher education institution and among smaller companies with fewer than 50 employees. For larger companies with more than 50 employees, however, access to subsidies plays a lesser role. For the latter category, the opportunity to form international networks and to develop products plays a greater role (see Chapter 3).

A very clear indication of the importance and complementarity of the FPs for research and innovation in Switzerland is the fact that, of the projects recorded in the survey, 86% would definitely or probably not have been carried out without EU funding. As Figure 1.4b shows, this clear result applies in particular to participations in or coordination of international collaborative projects, but interestingly also to almost three quarters of individual grantees (e.g. in the programme areas of the European Research Council (ERC) or the career-promoting Marie Skłodowska-Curie Actions (MSCAs)). There are only minor differences among the different institutions in their responses to this question. A somewhat higher proportion of funding recipients from companies than their counterparts in higher education institutions state that EU funding has been crucial to the implementation of their project.

**Figure 1.4b Course of the project without EU funding**



Source: SERI/Ipsos (GfK) survey

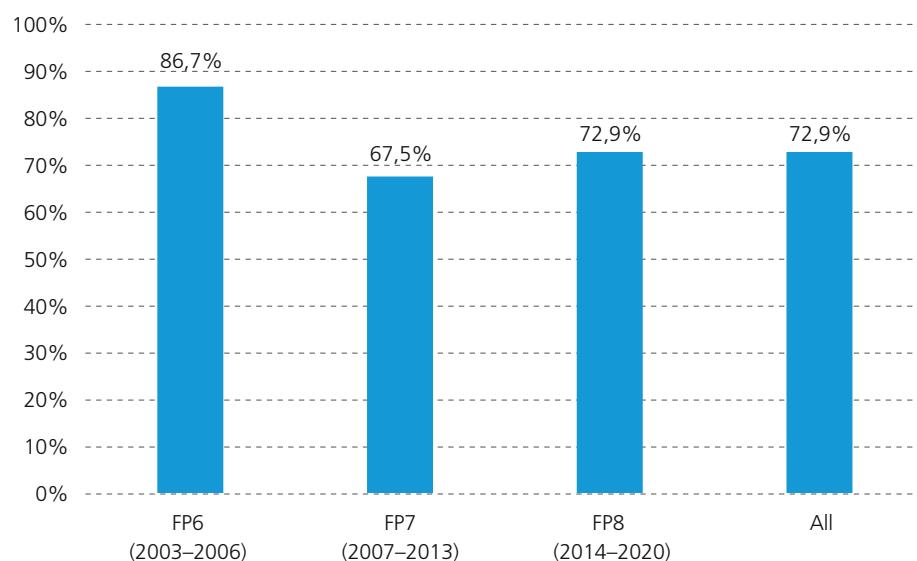
(Sample size: Total = 959 / Coordinators = 142 / Partners = 662 / Individual grants = 155)

ERC: European Research Council

MSCA: Marie Skłodowska-Curie Actions

Similar observations can be made in the response to whether projects could have been carried out on a national basis if appropriate funding had been available. In 73% of all cases this statement was denied. This opinion was more pronounced among experienced FP participants, and was also generally reflected in responses to several of the questions discussed above. It seems that researchers (at least those consulted in the survey) with greater experience in the EU framework programmes tend to specialise on specific funding instruments, have a more international focus and consider national funding opportunities to be less appropriate for their purposes. Moreover, it was stated that comparatively more projects could not be undertaken only at national level in FP6 compared to projects in FP7 and Horizon 2020 (see Figure 1.4c). This could be due to a change in Swiss R&I promotion: in recent years more opportunities for cross-border cooperation were created at national level, which were not yet available during the FP6 period.

**Figure 1.4c Project could not have been undertaken at national level (% agreement)**



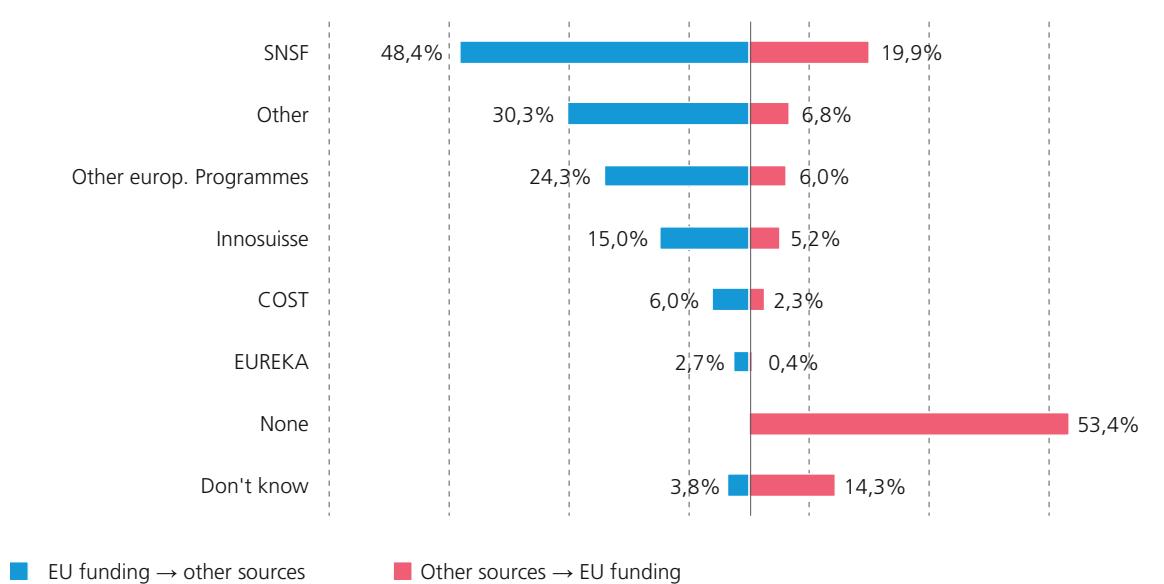
Source: SERI/Ipsos (GfK) survey  
(Sample size: Total = 959 / FP6 = 211 / FP7 = 538 / Horizon 2020 = 210)

Overall, the results presented in this section indicate that for researchers in Switzerland attracting funds is a major motivation to participate in the FPs. In many cases, however, the possibility of carrying out and establishing cross-border research projects and alliances, which would not be possible or would be much more difficult to set up with national funding instruments, seems to be an even greater motivating factor.

## 1.5 Links between European and national funding schemes

There is no clear evidence from the survey results that FP project funding facilitates the acquisition of third-party funding from other sources. 43% gave a negative response when asked if this was the case; 38% said FP funding did make it easier to access third-party funding. The latter were also asked which sources of funding became easier to tap as a result of FP participation. As Figure 1.5a shows, the SNSF was cited most frequently as a funding source (48%<sup>14</sup>), followed by other sources (30%), other European funding programmes (24%) and Innosuisse (15%).

**Figure 1.5a Links between funding sources: EU funding has facilitated the acquisition of other funding vs. other funding sources have facilitated the acquisition of EU funding**



Source: SERI/Ipsos (GfK) survey

Remarks: Figure left side (blue): Positive responses in percent to the question "Has EU funding for your project made it easier to attract funding from other public sources, and if yes, from which sources?" The sub-question was only addressed at those who answered 'yes' to the main question; there were therefore no responses in the 'None' category. Figure right side (red): Positive responses in percent to the question "Has funding from one or more of the following public funding sources facilitated the acquisition of EU funding?"

Similarly, receiving funding from other public funding sources does not seem to greatly affect success in the competition for EU funding. In 68% of the projects, no other source of funding was mentioned or no answer given. However, in 20% of the cases, prior funding by the SNSF had made it easier to access FP funding. Innosuisse, other European programmes and other sources were mentioned less frequently (see Figure 1.5a).

<sup>14</sup> This percentage is considerably higher for individual grantees. In two thirds of cases, it was stated that FP funding made it easier to attract SNSF project funding.

**Table 1.5b Further course of the last rejected FP project application**

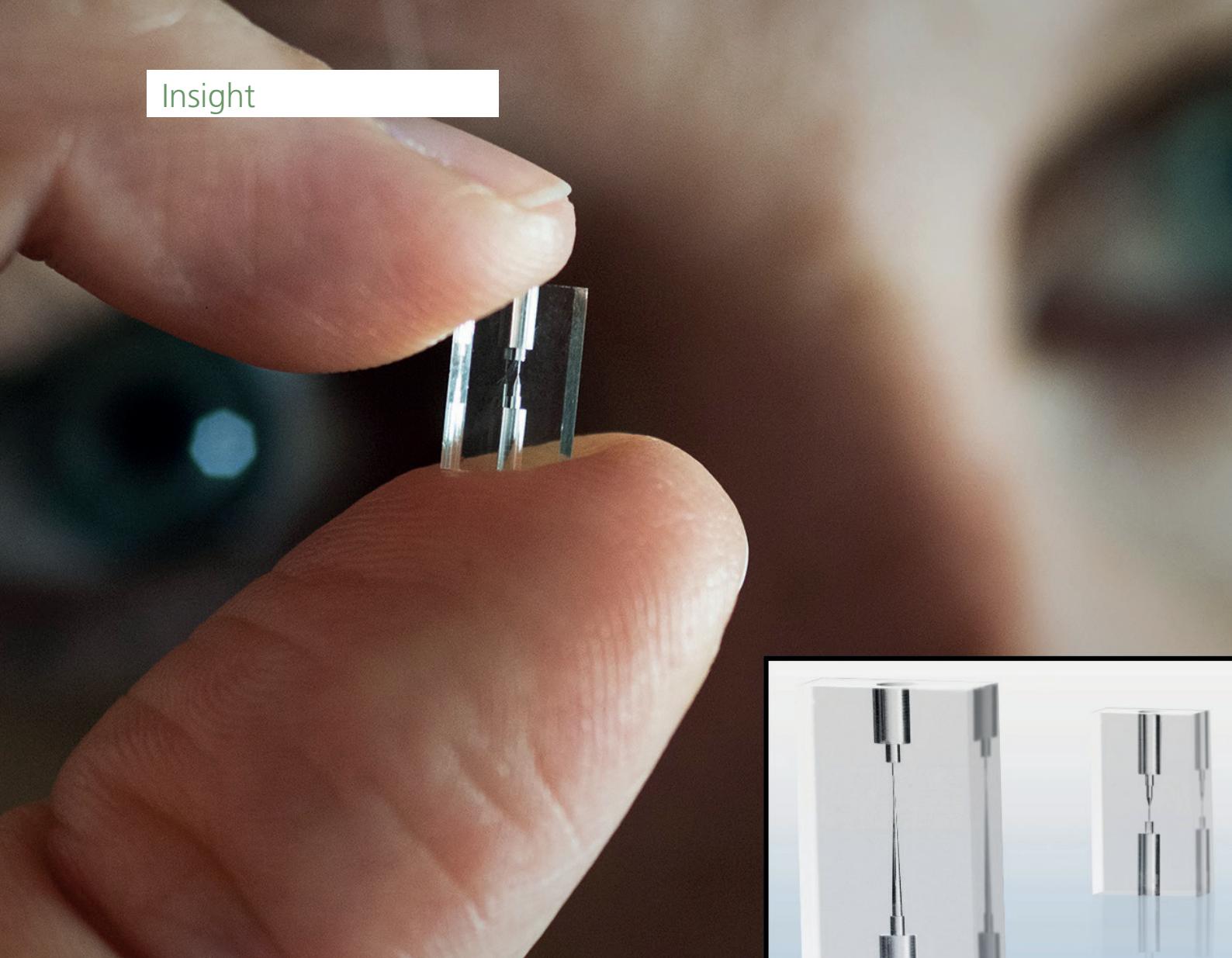
	Total	Degree of experience			FP6	FP7	FP8
		High	Average	Low			
Not carried out	58.4%	58.2%	58.3%	60.0%	49.5%	57.2%	66.2%
Carried out in another FP call	15.2%	14.5%	18.8%	3.6%	17.5%	14.8%	12.9%
Other	8.0%	7.7%	8.0%	9.1%	9.7%	8.2%	6.5%
Carried out with own funds	6.4%	5.9%	6.5%	5.5%	12.6%	5.9%	2.9%
Carried out as SNSF project	2.8%	2.7%	1.4%	10.9%	1.9%	4.3%	0.7%
Carried out as project in another EU funding programme	1.6%	1.4%	1.4%	1.8%	1.0%	1.6%	2.2%
Carried out as an Innosuisse project	1.1%	0.9%	1.1%	1.8%	1.0%	1.3%	0.0%
Carried out as a EUREKA project	0.7%	1.4%	0.4%	0.0%	1.0%	1.0%	0.0%
Carried out as part of a COST action	0.4%	0.0%	0.7%	0.0%	0.0%	0.7%	0.0%
Don't know	5.5%	7.3%	3.3%	7.3%	4.9%	4.6%	7.9%
(n)	565	220	276	55	102	303	138

Source: SERI/Ipsos (GfK) survey

In view of these findings, it is not surprising that around 60% of respondents stated that their most recently rejected FP project proposal had not been realised.<sup>15</sup> The figures in Table 1.5b show that 15% were able to carry out their project in another call for proposals in the EU framework programmes and 14% were able to do so with their own or other undetermined means. The specific source of these funds was rarely stated. This may be because FP projects are frequently cooperation projects. There are differences according to degree of experience: experienced FP participants tended to resubmit applications in the FPs, with success, while inexperienced participants placed more emphasis on the SNSF. Moreover, the percentage of projects that were not carried out was higher among participants in Horizon 2020 (66%) than among those in FP6 (50%). For the latter, their project proposal was rejected longer ago, and so they have had more time to find an alternative source of funding.

These results suggest that the link between different research and innovation funding schemes at European and national level is not very strong. This is a further indication of their complementarity.

<sup>15</sup> However, this may also be because the proposals were rejected relatively recently..



## FEMTOPRINT

The 3D laser printer no bigger than a shoebox



Femtosecond laser printer  
for glass microsystems with  
nanoscale features



Project duration  
05/2010 – 04/2013



Number of project partners: 9  
Number of countries: 5



Total budget: € 3 391 780  
Budget of Swiss Partner: € 161 699

„The success of FEMTOprint is an incentive for companies from Ticino to participate and apply for FP projects. In doing so they are supported by regional institutions in Ticino.“

Nicoletta Casanova, co-founder and CEO of FEMTOprint SA



“I am grateful to the EU framework programme. Without it, our company FEMTOprint would not exist.” These are the words of Nicoletta Casanova, co-founder and CEO of FEMTOprint SA, a high-tech company in Ticino which has won several awards. The company continues to expand and currently employs around twenty specialists.

The Femtoprint research project was set up to develop a 3D printer designed to create miniature glass devices called microdevices. The aim was to allow a wide range of users in research centres, small businesses and higher education institutions to create their own microdevices very quickly, without the need for expensive infrastructure or specific expertise.

“The technology developed at FEMTOprint is constantly being improved, and there are new and interesting prospects for developing a multitude of microdevices with resolutions down to the nanometre,” explains Casanova. The Femtoprinter works with ultra-short laser pulses, in the femtosecond range, to “print” monolithic pieces with specific mechanical, fluid or optical properties. Such a printer has a huge range of applications, since it uses glass, a material with numerous useful properties: for example, it is biocompatible, very stable, insensitive to electromagnetic fields, transparent and even flexible at micrometric dimensions. The Femtoprinter can produce a variety of precise forms for a range of industries including watchmaking, biotechnology, optics and telecommunications. It is not only highly effective, it is also very compact: the original version of its laser was no bigger than a shoebox.

Besides technological development, another objective of the three-year project was to develop a solid business plan to market the Femtoprint technology. The

issue of intellectual property often represents a major obstacle when a spin-off is created to implement project results, in part because the various partners from different countries all have rights to the project results. The Femtoprint project consortium solved this dilemma by running a competition among the project partners to find the best business idea. “The winner of the competition would receive exclusive rights to use the technology developed,” says Casanova, explaining the agreement reached at the time. As an entrepreneur with start-up experience, she played an important role in the winning team.

Although developing the Femtoprinter was the main aim of the project, the new technology has also given rise to other commercial products. These are distributed by other project participants or licensed to European companies.

The FEMTOprint company’s voyage also continues, as Casanova explains: “We would like to continue to develop the Femtoprint technology platform, so we regularly respond to calls for European projects and are often contacted by higher education institutions or businesses asking if we would like to take part in collaborative EU research projects.”

### Interaction between national research funding and the FPs: View of the two main national funding agencies, the SNSF and Innosuisse



**Interview with Jean-Luc Barras,  
Head of International Cooperation, SNSF**

*What is the impact of Switzerland's participation in the EU framework programmes (FPs) on Swiss R&I? And on the SNSF's tasks and instruments?*

Switzerland makes an active contribution to the development of the European Research Area. 65% of all international collaborations in projects funded by the SNSF involve collaborations with research groups in the European Union; 42% of young researchers choose to go to an EU member state in the mobility grant programme, and many excellent scientists from the EU come to Switzerland to conduct research. This encourages the circulation and exchange of talent and ideas.

Switzerland's participation in the FPs allows us to compete internationally with the best scientists in the world, and this is vitally important for the Swiss scientific community. Switzerland's association to the EU framework programmes also offers funding opportunities and facilitated access to large-scale projects such as the Future Emerging Technologies (FET) Flagships and large research infrastructures, and allows us to be fully integrated in European networks.

In Switzerland, the SNSF is commissioned by the government to support research and to foster a new generation of scientists using public funds. This mandate also includes the mission to guarantee competitiveness and international networking of Swiss research, which involves the responsibility to ensure the alignment and complementarity of national funding instruments with European ones. The series of agreements that the SNSF

forges with research funding agencies in European countries serves to complement the cooperation area created by the EU framework programmes. Both national funding and European funding are necessary; they are mutually reinforcing and ensure Switzerland's competitiveness in research and innovation.

*If you could make changes to the framework programmes, what would they be?*

The EU should continue to concentrate on the instruments and activities which clearly bring added value to Europe, while maintaining a balance between basic research and innovation, and creating firm links between basic research, applied research and innovation funding.

Only activities that cannot be successfully carried out, or are not carried out as well, by countries or national organisations should be supported by the EU. There should be a range of flexible funding instruments adapted to researchers' needs, which encourage a free choice of research topics, and which are backed up by adequate funds. Reasonable success rates are important to ensure a good balance between the high standard of selection and the efforts made by the scientific community in preparing project proposals.

Finally, it is essential to support countries which are underrepresented and have lower performance levels. Participation needs to be broadened without, however, compromising the principle of excellence upon which

## Point of view

research projects are selected. Specific measures such as the Spreading Excellence and Widening Participation programme can certainly play a role in reducing the scientific divide in Europe, but seeds of excellence need a good ecosystem in order to germinate: European added value should be considered as complementary to national funding and not as a substitute.

*What are the main challenges facing basic research today?*

Basic research, being research whose primary aim is to acquire new knowledge, regularly has to justify the investments made in terms of impact and benefits. Experience shows, however, that it is difficult to identify the direct impact of basic research in the form of technological advances, economic benefits or developments in society, and in most cases such impacts are not foreseeable. Moreover, basic research increasingly needs to have access to large and expensive infrastructures, and these are subject to economic and political constraints.



*What is the impact of Switzerland's participation in the EU framework programmes (FPs) on Swiss R&I? And on Innosuisse's tasks and instruments?*

Europe is Switzerland's most important trading partner. Many innovative Swiss companies are therefore closely linked to the value chains in the European economic area. It is essential for these companies to be able to take part in the initiatives in the EU programmes. Swiss players are highly valued partners and perform very well in the competitive process to obtain European funding. Companies in Switzerland can benefit from funding

*From the SNSF's point of view, what is the primary positive impact of international collaboration in R&I?*

Cross-border cooperation creates real added value to projects, which can benefit from the mutual exchange of ideas, people and resources. Researchers from different regions (including beyond Europe's borders), from different disciplines and backgrounds (public and private) work together and can thus address issues that could not otherwise be addressed, for example owing to a lack of expertise, infrastructure or access to relevant data. As a result, we certainly have more ambitious projects, which have more visible results and which boost Switzerland's international influence as a country at the forefront of research and innovation

.

**Interview with Marc Pauchard,  
head of Knowledge Transfer &  
International Cooperation, Innosuisse**

conditions in the FPs that Innosuisse cannot offer at national level. For example, they can obtain direct grants through the Eurostars, ECSEL and AAL partnerships, or the Horizon 2020 SME instruments. In particular in the case of high-risk innovative projects, this puts companies in a better position compared to foreign competitors and means they have a higher chance of success on international markets or of working with strategic partners. In some parts of Horizon 2020 (e.g. the SME instrument), companies also receive support from a network of international coaches. Innosuisse tries to exploit these synergies fully and offers complementary support

so as to create the ideal conditions for these companies. Actual examples show that a combination of different support measures provide the best basis for success.

As the framework programmes develop, innovation is taking on an ever more important role. This means that it is all the more important for Switzerland to have access to the programmes, which ideally complement Innosuisse's own innovation promotion activities.

*If you could make changes to the framework programmes, what would they be?*

Because the range of opportunities and different funding instruments is so wide, companies often find it difficult to identify how they can benefit best from the programmes. Simplifying access and improving communication are a constant concern. Fortunately in Switzerland we have a very competent organisation in Euresearch, which provides support to SMEs (and all other researchers) on behalf of SERI.

Furthermore, the relevance of the funding instruments to companies could be considerably increased if the success rate of all instruments were significantly above 10%.

*What are the main challenges facing applied research today?*

I think it's a shame that basic research and applied research are often played off against one another. The priorities and conditions necessary to conduct these two types of research may be different, but both pursue the aim of contributing something to society and the economy. The huge challenges that we currently face as a society are best met by standing shoulder-to-shoulder. The greatest challenge in applied research is to bridge the gap between basic research and practical application, and to work with both on finding solutions. To do this, we need to bring together different systems, cultures and interests.

*From Innosuisse's point of view, what is the primary positive impact of international collaboration in R&I?*

Switzerland's success depends on international cooperation. Only by cooperating with the best and by positioning ourselves on international markets will we man-

age to remain competitive and uphold Switzerland's attractiveness as a business location. Innosuisse also has to operate and compete internationally in order to create ideal conditions for Switzerland. Fortunately we are very well connected and are in frequent contact with our partner organisations throughout the world. Switzerland has a very special innovation ecosystem, so it's not often possible to directly adopt approaches from other countries. However, we can benefit from each other's experiences and inspire each other, and there's always something new to be learned.

*Note: The two interviews were conducted within the preparation of the present report. They represent the position of the two national funding agencies (Swiss National Science Foundation and Innosuisse) with regard to Swiss participation in the FPs. These statements are not necessarily the opinion of the SERI.*

## 2 Impact on the economy and employment

**The FPs have a wide range of impacts, in large part because of the many different funding instruments they involve. An important factor is the impact on the economy and employment. Both the private and the public sector benefit from the programmes. Firstly, FP participations create jobs, on average one permanent and two temporary jobs per project. Secondly, participating in an FP can help a company to increase turnover or develop marketable products. Switzerland has benefited greatly in this regard, in a number of ways. Participations in the FPs have resulted in a range of start-ups and SMEs being founded and new jobs created both at universities and in the private sector.**

The FPs cover the entire innovation chain from basic research through to applied product development. They therefore play an important role in the research and innovation process in Switzerland too. The creation of a programme area specifically for SMEs<sup>16</sup> in the Horizon 2020 second pillar 'Industrial Leadership' has highlighted the strong focus that the FPs now place on applied research and support for SMEs in particular.

The European Commission (EC) states that FP7 had a huge economic impact on research and development in Europe. Directly or indirectly, each euro invested generated an economic effect of eleven euros. It is estimated that the EU can expect to add EUR 20 billion to its GDP over a 25-year period thanks to the investments made in FP7 (Fresco et al., 2015).<sup>17</sup> The programme had a rather limited impact on job creation in the EU. By definition, however, the FPs are not job-creation programmes.<sup>18</sup> That said, by the end of FP7 in 2013, a total of 217,000 jobs had been created thanks to the programme (EC, 2017).<sup>19</sup>

The financial crisis of 2008 meant that the economic objectives for FP8 had to be adjusted. Horizon 2020 has much more modest aims in terms of its economic impact than the preceding programme, FP7. In essence, they involve support for the Europe 2020 strategy and the establishment of the European Research and Innovation Area (ERA). The Europe 2020 strategy envisages an investment in R&I of 3% of European GDP and 75% of the working-age population in gainful employment. A further aim formulated by the European Commission for FP8 is for as many fast-growing innovative companies as possible to be established.

<sup>16</sup> SECO's definition of an SME (small or medium-sized enterprise): 1–249 employees. This definition is used in both Switzerland and the EU (Source: <https://www.kmu.admin.ch/kmu/de/home/kmu-politik/kmu-politik-zahlen-und-fakten.html>).

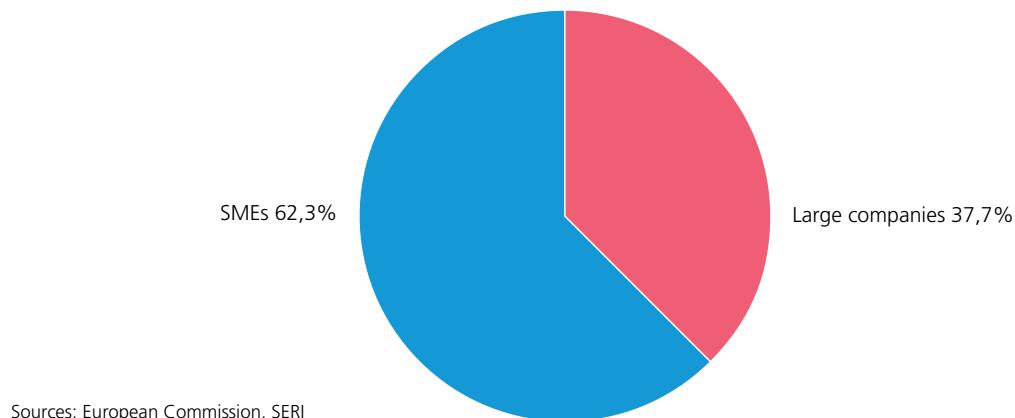
<sup>17</sup> Assessment of the Union Added Value and the economic impact of the EU Framework Programmes (FP7, Horizon 2020), European Commission, 2017: <https://publications.europa.eu/en/publication-detail/-/publication/7e74df87-ebb0-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-80689114>

<sup>18</sup> Both the international financial crisis in 2008 and the euro crisis of 2010 occurred during FP7. These two events had a major impact on employment.

<sup>19</sup> Assessment of the Union Added Value and the economic impact of the EU Framework Programmes (FP7, Horizon 2020), European Commission, 2017 <https://publications.europa.eu/en/publication-detail/-/publication/af103c38-250d-11e9-8d04-01aa75ed71a1/language-en>

## 2.1 Profile of companies participating in the FPs

**Figure 2.1a Profile of companies participating in the FPs (FP6–8, as at 13 March 2019)**



During the FPs covered by this report, Swiss companies participating in the FPs comprised 62% SMEs and 38% large corporations.

More than 99% of all businesses in Switzerland are SMEs; they employ around two thirds of all employees. We can compare this figure with the proportion of SMEs in the overall number of Swiss companies taking part in an FP, which stands at close to two thirds. This is remarkably high, considering that many of the large Swiss corporations participating in the FPs are among the most research-intensive companies in the world, and are involved in many different projects. SME participations in FP8 have risen slightly over FP7. SME participation in FP8 stands at around 20% of all participations.<sup>20</sup> A funding instrument specially for SMEs has existed in both FP7 and FP8. However, during Switzerland's partial association to FP8 (2014–2016), Swiss SMEs were not entitled to take part in these. The situation changed when Switzerland attained full association to FP8 at the beginning of 2017. Since then, Swiss SMEs have been able to participate regularly in these tenders; in 2018, a total of 61 SMEs did so. The figure for 2019 up to mid-March stands at 24.

Besides being able to participate in the SME instrument described above, small businesses can take part in framework programme collaborative projects as project partners. In FP6, 562 project participations by Swiss companies received funding. In FP7, this figure was 1,352, of which 823 were SMEs. In FP8, the number up to mid-March 2019 stands at 2,739 project participations by Swiss companies. As a proportion of all Swiss participations, these figures for Swiss businesses correspond to 30% in FP6, 32% in FP7 and 37% in FP8. Participation by the private sector has, therefore, increased over the programme generations, both in absolute and relative terms.

To provide a comparison: in 2017 the Commission for Technology and Innovation (CTI)<sup>21</sup> provided funding to 414 projects.<sup>22</sup> However, the federal contributions did not flow directly to the companies, but was paid exclusively to non-profit research institutions. In CTI projects, at least one economic partner and one not-for-profit research institute were required to take part.<sup>23</sup>

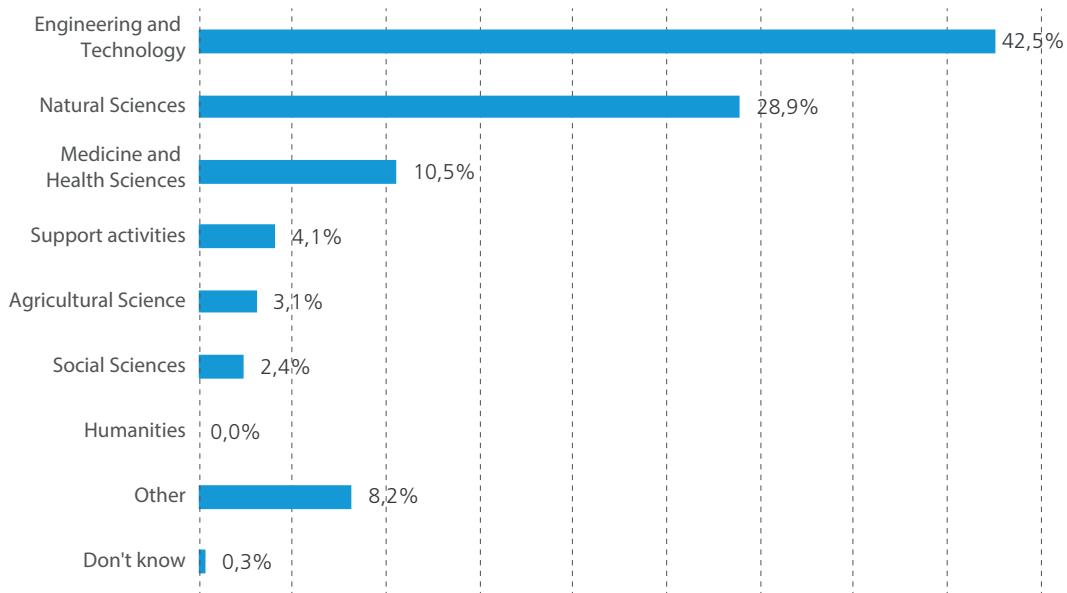
<sup>20</sup> Swiss Participation in the European Research Framework Programmes, SERI, 2018.

<sup>21</sup> The CTI became the Innosuisse innovation promotion agency in 2018.

<sup>22</sup> Activity Report 2017

<sup>23</sup> KTI Förderung - Grundsätze, Finanzierungskriterien und Saläransätze für Forschungs- und Wirtschaftspartner

**Figure 2.1b: Company participations in FP projects by research area**

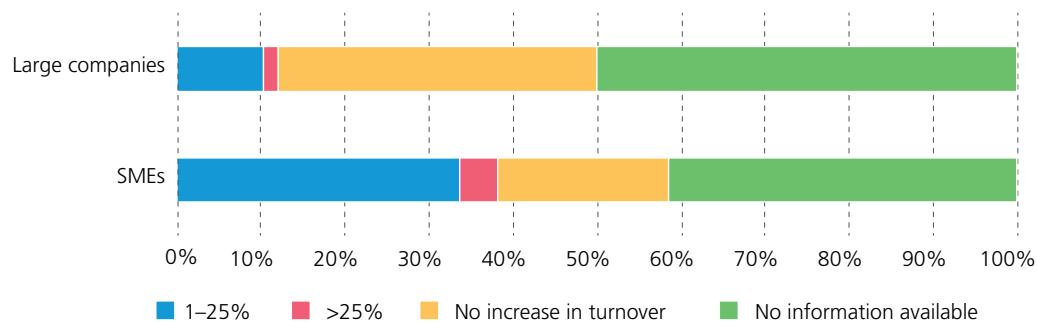


Source: SERI/Ipsos (GfK) survey

The companies which took part in the survey are primarily active in the following research areas (see Figure 2.1b): Engineering and Technology (42.5%), Natural Sciences (28.9%) and Medicine and Health Sciences (10.5%).<sup>24</sup>

## 2.2 Turnover of companies participating in the FPs

**Figure 2.2a Percentage of companies with increase in turnover thanks to FP participation**



Source: SERI/Ipsos (GfK) survey

31% of the private-sector companies surveyed stated that they had increased their turnover thanks to the FPs. Of these, 88% experienced an increase in turnover of up to 25%, and the remaining 12% saw increased turnover of more than 25%. More than one third of all SMEs surveyed stated that they had experienced a direct increase in turnover, while only one in ten large companies said they had been able to increase turnover as the result of an FP participation (see Figure 2.2a).

<sup>24</sup> The companies were not asked their precise area of activity in this survey. However, the research areas give an indication of the sectors in which the companies operate.



## LEGUME PLUS

Native fodder plants reduce nitrogen emissions



Optimising plant polyphenols in LEGUMES for ruminant nutrition  
PLUS health PLUS environmental sustainability



Project duration  
01/2012 – 12/2015



Number of project partners: 8  
Number of countries: 6



Total budget: € 4 097 982  
Budget of Swiss Partner: € 751 172

„Such a project offers an ideal platform for international, intersectoral and interdisciplinary collaboration.“

Dr Frigga Dohme-Meier, head of the research group at the Agroscope research institute



Global challenges such as climate change and rapid population growth pose a threat to our food security on the long term. One way of dealing with such threats is to improve the efficiency of ruminant fodder production and use. But there is no need to reinvent the wheel, as the LegumePlus project, launched in 2012 under the EU framework programme, shows.

“The project helped us to rediscover the potential for animal production of fodder legumes containing condensed tannins, such as sainfoin,” explains Dr Frigga Dohme-Meier, head of the research group at the Agroscope research institute. Sainfoin is a native legume which captures nitrogen from the air and can therefore be used in place of artificial fertilisers. It is also a protein-rich source of raw fodder and contains tannins. However, it is now rarely used in farming. The researchers were able to show that growing sainfoin reduces levels of nitrogen in the environment. Fed to ruminants, it also improves the composition of milk and meat for human consumption. As legumes help to prevent bloat in animals’ digestive tracts, they contribute to reducing greenhouse gas emissions; along with their environmental benefits, they provide a sustainable, native source of protein-rich fodder. Based on these project results, Agroscope has developed a new sainfoin seed mix, which is now available to farmers to be grown as fodder.

According to Dohme-Meier, the strong network built up by the researchers and the trans- and interdisciplinary approach were key to the success of the project. Thanks to these elements, it was possible to view the problem and the potential solution from a global perspective. The project was funded via the Marie-Skłodowska-Curie Actions, a funding instrument in the EU framework programmes which is specifically aimed at promoting the younger generation of scientists. “Giving oppor-

tunities to young researchers was a very stimulating experience for the mentors,” explains Dohme-Meier. The PhD students received generous funding and high-quality support. They were also able to take part in international project meetings and to gain experience in a range of disciplines, working with various research groups throughout Europe over a period of six months.

The positive experiences have not come to an end with the conclusion of the project. The research network continues to grow. As the then PhD students now have new post-doctoral positions in European research groups, they can form interesting new contacts and opportunities for working together. Furthermore, sainfoin is now being studied further in an Agroscope research programme (REDYMO), which is looking in greater detail at the interaction between tannins and the gut microbiome, and how the anti-bacterial effect of these substances can be exploited to reduce antibiotics use in animals.

**Table 2.2b: Expected increase in turnover in the next three years following participation in an FP project**

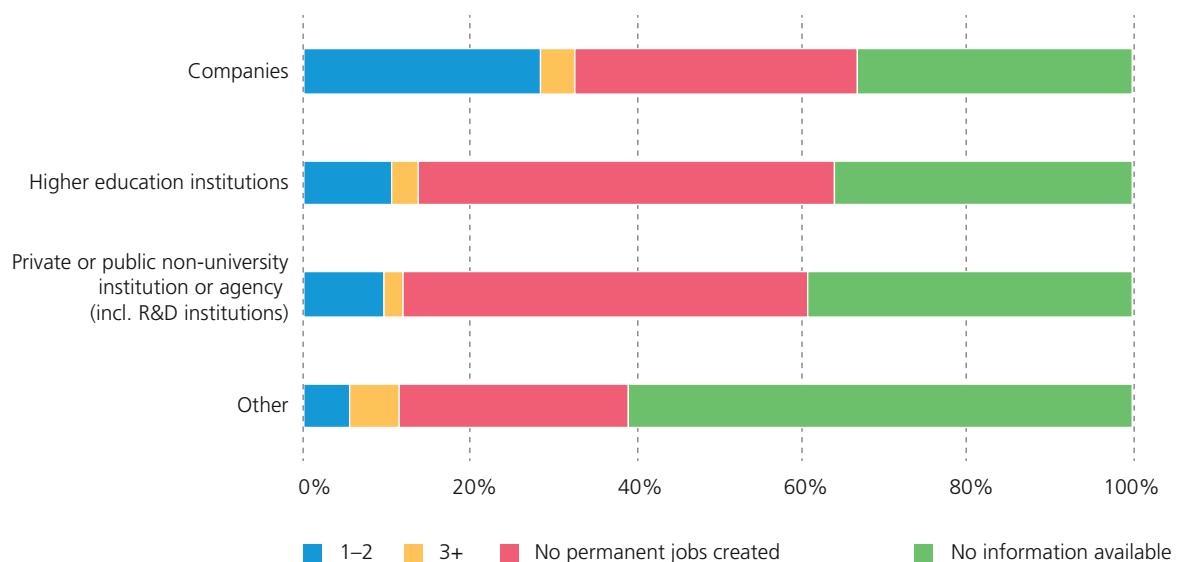
Expected increase in turnover	SMEs (n=157)	Large companies (n=58)
1–25%	17.2%	17.2%
>25%	3.8%	0.0%
No increase in turnover	21.7%	15.5%
No information available	57.3%	67.2%

Source: SERI/Ipsos (GfK) survey

Of the surveyed companies, 17% expect to be able to increase their turnover by up to 25% over the next three years thanks to participation in an FP project.

## 2.3 Direct employment growth

**Figure 2.3a Permanent jobs created as a result of FP participation**



Source: SERI/Ipsos (GfK) survey

As EU funding is primarily used to hire researchers, project participation has a direct impact on the creation and preservation of jobs. In our previous report<sup>25</sup> it was stated that each project creates an average of three jobs, although only one of these is permanent (see Figure 2.3a).

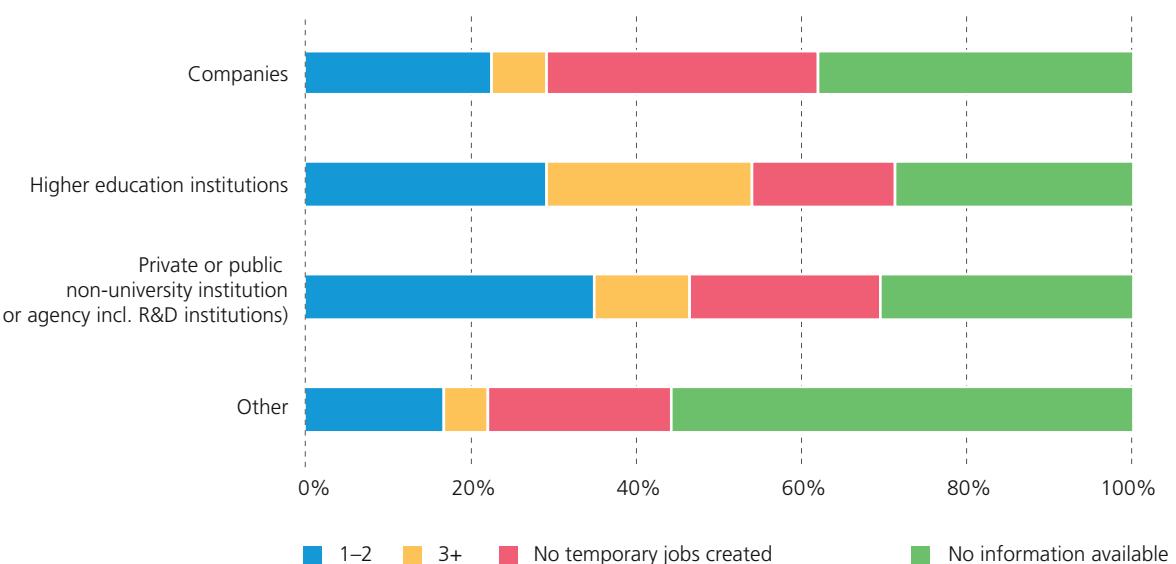
**Table 2.3b: Permanent jobs created thanks to FP participation, by company type**

	SMEs (n=157)	Large companies (n=58)
1–2	32.5%	17.2%
3+	5.1%	1.7%
No permanent jobs created	28.7%	48.3%
No figures available	33.8%	32.8%

Source: SERI/Ipsos (GfK) survey

The survey conducted for this study shows that it is primarily SMEs that are able to create permanent jobs as a result of FP participation. One third stated that they were able to create at least one new permanent position (see Table 2.3b).

**Figure 2.3c Temporary jobs created thanks to FP participation**



Source: SERI/Ipsos (GfK) survey

Higher education institutions mainly employ assistant staff, PhD students and post-doc researchers, who are generally employed on a temporary, project-related basis. This is also confirmed by the survey. More than half of them stated that they created one or more temporary posts thanks to FP project participation. Almost a quarter of the FP participants from higher education institutions were even able to create more than three temporary posts thanks to FP participation.<sup>26</sup> (see Figure 2.3c). On average, two new temporary positions were created per project.

<sup>26</sup> It can be assumed from the survey results that participants who stated that more than five temporary jobs had been created gave the total number of jobs created in several projects

**Table 2.3d: Temporary jobs created thanks to FP participation, by type of higher education institution**

Number of jobs created	Cantonal university (n=233)	ETHZ, EPFL (n=251)	University of applied sciences (n=71)	Other (n=27)
1–2	27.0%	26.7%	47.9%	18.5%
3+	30.5%	23.5%	14.1%	14.8%
No temporary jobs created	16.7%	18.7%	11.3%	18.5%
No information given	25.8%	31.1%	26.8%	48.2%

Source: SERI/Ipsos (GfK) survey

## 2.4 Start-ups and spin-offs

New long-term jobs can also be created in new companies founded as a result of an FP project. Earlier studies showed<sup>27</sup> that 10% of project participations led to the creation of a start-up or spin-off. Extrapolated, this suggests 190 new businesses were founded as a result of participation in FP6.

**Table 2.4b: Projection of number of spin-offs and start-offs arising from FP participations**

Already founded	118
Expected in the next 3 years	40

Source: SERI/Ipsos (GfK) survey

**Table 2.4b: Projection of number of spin-offs and start-offs arising from FP participations**

Already founded	118
Average (n=959)	0.12
Total project participations	8,181
Extrapolation	1,006.63

Source: SERI/Ipsos (GfK) survey

The survey respondents also stated that, over all three FPs under review, about one in ten projects generated a new spin-off or start-up (118 in total in the survey). Moreover, 40 further spin-offs or start-ups generated in an FP project are planned in the next three years. Extrapolated to all projects of the three FPs examined here (cut-off date: 13 March 2019), this results in more than 1000 start-ups or spin-offs already realised by project participants in Switzerland (see Table 2.4b).

## 2.5 Direct research findings

The framework programmes cover a wide range of R&D activities. The results of the EU FP projects thus span a correspondingly large spectrum, from basic research to patented prototypes and marketable products

**Table 2.5a Direct research results from FP participation**

	Marketable products (n=959)	New services (n=959)	New technological skills in an emerging research area (n=959)
Results achieved	17.5%	22.4%	50.7%
No results	50.2%	41.8%	21.3%
Don't know	32.3%	35.8%	28.1%

Source: SERI/Ipsos (GfK) survey

Survey participants were asked about the direct results of FP project participations. More than half of the respondents stated that they had developed new technological skills in an emerging research area.<sup>28</sup> Over a third of all private-sector companies stated that they had been able to develop a marketable product thanks to a project participation, while just under a third believe that they will be producing a new marketable product in the next three years. The values are inevitably somewhat lower among higher education institutions, although here too 13% stated that they have already produced a marketable product and a further 13% that they expect to be able to do so in the next three years (see Table 2.5c). Overall, 284 products were created from the projects surveyed, and a further 141 are expected over the next three years (see Table 2.5b).

**Table 2.5b: Number of marketable products arising from FP projects**

Already produced	284
Expected in the next three years	141

Source: SERI/Ipsos (GfK) survey

**Table 2.5c: Marketable products expected in the next three years**

	Companies (n=215)	Higher education institutions (n=589)	Private or public non-university institution or agency (incl. R&D institutions) (n=135)	Other (n=18)
Results expected	27.9%	12.7%	14.1%	22.2%
No results	21.9%	34.3%	37.0%	16.7%
Don't know	50.2%	53.0%	48.9%	61.1%

Source: SERI/Ipsos (GfK) survey

<sup>28</sup> This is discussed in further detail in Chapter 4, 'Impact on knowledge and skills production'

**Table 2.6a: Patents resulting from FP participation**

	Companies	Higher education institutions	Private or public non-university institution or agency (incl. R&D institutions)
No of patents	98	131	6
Average	0.46	0.22	0.04
No of participants	215	589	135

Source: SERI/Ipsos (GfK) survey

Patents<sup>29</sup> are an important objective and potential source of income, and producing one is of particular interest to companies. There is therefore little surprise that, in relative terms, private-sector companies file patents resulting from FP participation more frequently than higher education institutions. According to the survey, companies file almost one patent per two projects (46%), for higher education institutions the figure is one in five (22%) (see Table 2.6a).

When these figures are extrapolated, we obtain 518 patents for FP6, 1,358 for FP7 and 388 so far for FP8 (see Table 2.6b).<sup>30</sup>

**Table 2.6b: Patents by FP**

	FP6	FP7	FP8
No of patents, survey	57	169	42
No of participants, survey	211	538	210
Average	0.27	0.31	0.2
Total no of projects	1916	4323	1942
Extrapolation	517.59	1357.97	388.4

Source: SERI/Ipsos (GfK) survey

As a comparison: According to the OECD (2019)<sup>31</sup> a total of 1,206 patents were filed in Switzerland in 2015. Switzerland has among the highest numbers of patent applications in the world.

<sup>29</sup> Patent registrations are just one of several ways of protecting potentially marketable results. Others (such as copyright for software, trademark registration, trade secret, licence, private contract) were used three to four times more frequently than patents in FP projects to protect commercially marketable results. This is known from earlier studies on the FPs.

No distinction is made between the different offices (Swiss Federal Institute of Intellectual Property, European Patent Office, United States Patent and Trademark Office, Japan Patent Office) at which a patent was filed.

<sup>30</sup> The extrapolation of data from only part of the respondents to all Swiss FP participants is subject to uncertainties.

# 3 Impact on scientific cooperation networks

The FPs contribute to the realisation of the European Research and Innovation Area ERA. By promoting the mobility of researchers and encouraging the cooperative design of research projects at European level, they also help to reduce the fragmentation of the ERA. Indeed all collaborative projects in the FPs are carried out by research consortia composed of research groups from different EU member states, FP-associated states, and in many cases other third countries (such as the US and China). Below, we discuss the impact of the FPs on the formation of networks and the integration of researchers in Switzerland in these networks. For researchers, the opportunity to network is one of the major motivations for participating in FP projects. Furthermore, the results suggest that the FPs foster the formation of networks that endure beyond the completion of the project. This underlines the importance of the FPs for international cooperation in R&I.

## 3.1 Public-private partnerships

The conditions for participating in an FP collaborative project state that research consortia must include partners from different countries. In most cases, consortia are formed between public research institutions and private-sector companies. In FP6, around one third of research collaborations involving Swiss partners in EU projects took place between a higher education institution and a company. In FP7, as in the current FP8, this proportion increased to almost 50% (see Table 3.1). These collaborations offer both the opportunity to align research agendas and to exchange knowledge and experience between the public and private sectors.

**Table 3.1 Percentage of collaborative projects involving collaboration between Swiss higher education institutions (cantonal universities, institutes in the ETH Domain, universities of applied sciences) and Swiss companies**

Time period	Percentage of public-private partnerships
FP6 (2003-2006)	33%
FP7 (2007-2013)	48%
FP8 (2014-2020)*	44%

The figures show projects with at least one Swiss partner.

\* As at 13 March 2019

Sources: European Commission, SERI

The importance and use of these partnerships is underlined by the growing calls for 'open innovation': the notion that academic institutions, industrial partners, administrative agencies and ordinary citizens should work together (more) closely in innovation processes, not only to increase the innovation potential, but also to make processes more efficient.



## TABULA RASA

Tabula rasa in the world of biometric systems



Trusted Biometrics under Spoofing Attacks



Project duration  
11/2010 – 04/2014



Number of project partners: 12  
Number of countries: 7



Total budget: € 5 567 257  
Budget of Swiss Partner: € 737 886

„TABULA RASA has given rise to a number of spin-off projects funded under FP7 and Horizon 2020 and by national promotion agencies throughout Europe.“

Dr. Sébastien Marcel from the Idiap research institute in Martigny (VS)



A technique which featured only in sci-fi films a few years ago is now an integral part of real life: machines equipped with facial and vocal recognition software are now widespread. Smartphones, tablets and passports – all contain personal and confidential information that can be protected by a biometric system. But biometric sensors still have some weaknesses. This makes deceptive attacks possible while concealing one's own identity (so-called spoofing attacks). For example, scammers can try to bypass the facial recognition system by using other people's photos or masks.

The aims of the TABULA RASA project coordinated by Sébastien Marcel from the Idiap research institute in Martigny (VS) was to identify as many weak points as possible in these biometric systems and then to develop corrective measures such as combining biometric characteristics for data access. The goal was to develop a new generation of reliable biometric technologies that are capable of withstanding direct attempts to steal a person's identity. To this aim the researchers studied biometric data rarely used previously, such as a person's gait, their veins, or electrophysiological signals such as heartbeat. They then analysed the advantages and disadvantages of using the various data.

The very first harmonised evaluation systems and methods were developed in the TABULA RASA project. They are now being used by many biometric researchers and have also been used to define standards such as ISO / IEC 30107.

Publications, data sets, algorithms and evaluation methods from the project have changed the way the sector thinks. A better understanding of identity theft has allowed European businesses to strengthen their dominant position by improving the design of the next generation of identity theft-resistant biometric sensors

and exploiting the enormous potential of biometric technology. The project has also had a world-wide impact: Apple has developed a more secure version of its facial recognition system (iPhone X FaceID) based on the project results.

The improved systems not only provide more secure devices and information, they also mean faster connections to computer terminals or faster and more accurate border controls. "We believe that many different organisations will be interested in our research, including tech companies, postal operators, banks, mobile device manufacturers and online service providers," explains Marcel. The Swiss industrial partner, KeyLemon, has drawn long-term benefit from the project in the form of know-how and job creation.

The TABULA RASA project opened further doors for Marcel's research group. "Following this project we received lots of other projects on identity theft. Our research group has also been involved in some confidential projects run by large corporations, and we have worked on improving and evaluating techniques which recognise when someone is trying to fake biometric data." The Canton of Valais and the town of Martigny supported the establishment of the Swiss Centre for Research and Evaluation in Biometric Security (Centre suisse de recherche et d'évaluation en sécurité biométrique), whose aim is to develop biometric test activities and establish certification methods for them. Meanwhile, the Idiap Biometrics Security and Privacy research group has made a name for itself globally with its pioneering activities in detecting biometric attacks.

### 3.2 Knowledge transfer and researcher mobility

In the FPs, grants are available which are expressly intended to promote the flow of knowledge between the public and private sector. Such grants are awarded to institutions that would like to take on experienced researchers in order to boost or expand their research skills. This represents an opportunity both for companies and for researchers from academia, who are able to gain experience in the industrial environment and become familiar with its needs. The Marie Skłodowska Curie Actions (MSCAs) are an example of the EU's efforts to promote such knowledge sharing. The Marie Curie Industry-Academia Strategic Partnership Scheme (TOK-IPA) in FP6 and the Marie Curie Industry-Academia Partnerships and Pathways (IAPP) in FP7 exclusively funded exchanges between higher education institutions and businesses in Europe. Marie Skłodowska Curie Research and Innovation Staff Exchange (RISE), a programme in FP8, enables and promotes exchanges between academic and non-academic institutions and between Europe and third countries.

While researchers in Switzerland were able to secure a total of eight TOK-IAP fellowships in FP6, the number in FP7 rose to 40 IAPP fellowships. In the current FP8, 39 RISE projects involving researchers from Switzerland were carried out until March 2019. There is now a greater amount of funding available for these types of grant, hence the rise in these figures; at the same time, they demonstrate the increased international exchange in the field of R&I in the sense of 'brain circulation', as promoted by Switzerland. The rise in the figures is an indication of the increased importance of this form of scientific exchange.

In general, the framework programmes offer a wide range of exchange grants and scholarships that promote the mobility of researchers within Europe and between European and third countries. This exchange allows participants and host institutions to learn equally from each other. It also encourages cross-cultural dialogue and European integration. Participation figures on researcher exchange between Switzerland and abroad can be found in a study by SERI.<sup>32</sup>

### 3.3 Forming and maintaining networks

Switzerland's participation in the FPs is very important for the formation of networks. The data currently available confirm the findings of previous studies: the opportunity to form networks by initiating a research and innovation collaboration is what motivates researchers to take part in an FP project. 39% of respondents stated that this was one of their three main reasons for participating in an FP. Around half of all respondents from non-university research institutions and from the private sector (SMEs and large companies) stated that this was a major factor for them. In contrast, only around one third of respondents from the higher education sector gave this as a reason; for them, access to funding is often of greater interest. The opportunity to form cooperative networks is more important to universities of applied sciences than to cantonal universities and the federal institutes of technology. Indeed, having been in existence for a much longer time and having a stronger international focus, the latter can already claim well-established networks. Thus, for participants from this institutional category, other motivational reasons predominate, such as the financing possibilities.

The opportunity to develop existing or new commercial partnerships is of particular interest to private-sector companies. For 32% of respondents in this category, developing existing or new business partnerships is one of the three main reasons for participating in an FP project. By contrast, for participants from higher education institutions the possibility of developing commercial partnerships is of minor interest.

Scientific cooperation networks help researchers become more established in their specialist communities. On a broader scale, they help to knit together the European Research Area. However, this assumes that the networks will be long-lasting; this seems to be the case regarding Swiss participation in FP6, FP7 and Horizon 2020. The survey results suggest that about a third of project consortia were newly created for the FP participation, while only very few consortia (approx. 6%) were formed prior to the project (see Table 3.2).

**Table 3.2 Share of project consortia that already existed before the project idea or project submission**

Time period	Did the project consortium already exist before the project idea or submission?				
	No	In part	Yes	Other*	
FP6 (2003–2006) (n=211)	30.80%	58.30%	6.20%	4.70%	
FP7 (2007–2013) (n=538)	31.20%	43.90%	5.20%	19.70%	
FP8 (2014–2020) (n=210)	36.70%	46.70%	6.70%	10%	

\* 'The project did not take place within a research consortium' and 'don't know'

Source: SERI/Ipsos (GfK) survey

However, a majority of consortia (58%) existed in part before the project, which can be explained by the fact that part of the members of these consortia had already worked together in the past. This is consistent with the finding that research consortia formed in an FP project definitely continue to exist in 51% of cases, and will probably continue to exist in 36% of cases (see Table 3.3).

**Table 3.3 Percentage of research consortia wishing to maintain cooperation (between at least two of the partners involved) after completion of an FP project**

Time period	Are further collaborations planned following completion of project?					
	No	Probably no	Probably yes	Yes	Don't know	
FP6 (2003–2006) (n=201)	9.00%	12%	25.90%	55.20%	4%	
FP7 (2007–2013) (n=432)	5.30%	7.40%	25.70%	56.30%	5.30%	
FP8 (2014–2020) (n=189)	2.10%	3.20%	36.50%	50.80%	7.40%	

Source: SERI/Ipsos (GfK) survey

These figures suggest that not only do the FPs foster the formation of new consortia, partnerships frequently continue to exist after completion of a project. Interestingly, the respondents primarily intend to continue working with their international project partners rather than with partners from Switzerland (see Table 3.4). This underlines the importance of the FPs for international R&I cooperation.

**Table 3.4 Percentage of project partners intending to continue working with a national or international project partner following completion of an FP project**

		Are further cooperations planned with national or international project partners following completion of project?			
Time period		Yes, with a national partner	Yes, with an international partner	No	Other*
FP6 (2003-2006) (n=163)		18.40%	82.20%	7.40%	8.60%
FP7 (2007-2013) (n=354)		17.80%	77.70%	10.70%	8.20%
FP8 (2014-2020) (n=166)		17.50%	87.30%	3.00%	7.80%

\* Other = "No response" and "don't know"

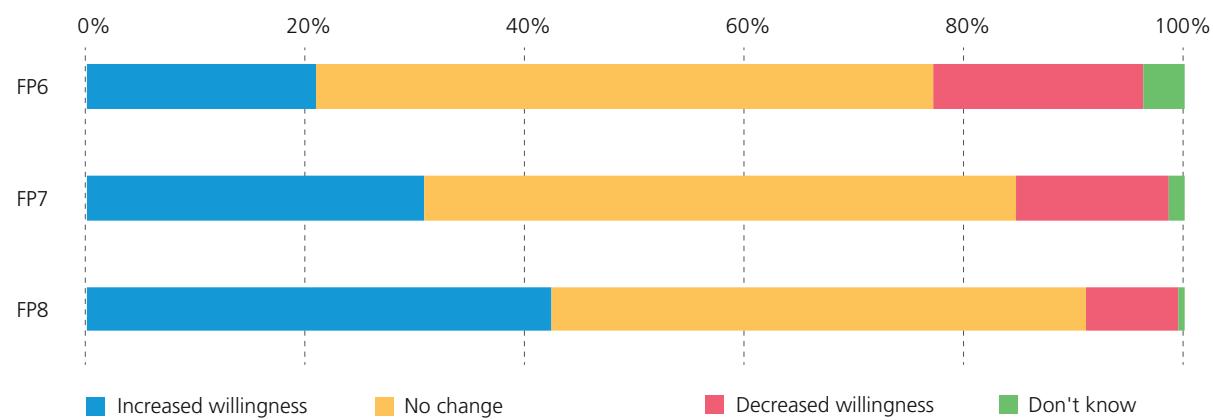
NB: It was possible to give several answers; the total percentage is therefore greater than 100.

Source: SERI/Ipsos (GfK) survey

One major reason why project consortia and networks are preserved is their quality. Around one sixth of the respondents stated that an unsuccessful project submission was due to the insufficient quality of the consortium. Even fewer of the respondents cited the lack of partners from the private sector as a reason why their project was not considered. The high degree of satisfaction with the consortium composition means that various partners are considering joint cooperation for further project applications despite the rejection of a project application. Meanwhile, the following three main reasons were given for why a project application was rejected: 1) project application not innovative enough, 2) scientific quality of the project application unsatisfactory and 3) application does not sufficiently meet the criteria of the call for proposals. Furthermore, many researchers cited the relatively low success rate in the individual calls to explain why their project was rejected. In general, the success rates in the FPs are well below the SNSF's funding rates. However, the SERI report published in 2018 showed that the success rate of researchers from Switzerland is above the European average, which demonstrates the excellent quality of research proposals with Swiss participation.

For the vast majority of respondents, collaboration in consortia is a positive experience. Between 80 and 90% of the respondents stated that their willingness to continue working together was the same or even greater (Figure 3.5). This willingness also increases continuously over the project generations. This can be seen as an indication of how well the FPs have established themselves as a funding instrument in Switzerland.

**Figure 3.5: Willingness to further continue international cooperation on the basis of experience in EU Research Framework Programmes**



Source: SERI/Ipsos (GfK) survey

# 4 Impact on knowledge and skills production

The primary aim of research is to acquire new knowledge. That said, it is difficult to measure new knowledge or the acquisition of new skills. This chapter looks at the scientific dissemination activities of FP participants, their publications in academic journals and books, and conference presentations. It also considers indicators such as the number of academic degrees acquired as a result of an FP project, or the impact of FP participation on individual careers. According to the results, almost all FP participants generated one or more publications as the result of their project participation. Furthermore, one master's degree and one PhD resulted on average from a Swiss participation in an FP project. Researchers from higher education institutions, in particular, rate the benefits of participating in FPs for their own careers as high.

## 4.1 Publications

### 4.1.1 The role played by publications when assessing scientific success

In general, scientific findings are published in specialist journals once they have undergone a comprehensive peer review. These publications are a way of sharing findings in the research community, allowing them to be discussed and validated. The widespread practice of measuring the success of scientific activities by the number of publications is based implicitly on the premise that all research activities result in the publication of articles or books. However, this is not true of all scientific work: if research findings may shortly lead to a product being commercially marketed, it is advisable to keep the findings confidential, or even to protect them (see patent findings, 2.6). Therefore, in view of the fact that broad areas of the framework programmes are application-oriented, to produce a scientific publication is not necessarily a primary objective, and applying classical bibliometric analysis to measure academic productivity is not always suitable in the case of marketable research results. Such limitations do not apply to basic research projects. Publishing scientific findings is part of the daily business of researchers in the academic field. It can be said, therefore, that bibliometric assessment methods are more suitable for projects which are at the beginning of the R&I value chain and for participants operating in the academic field than for those from the private sector.

### 4.1.2 Publications in scientific journals and books and presentations at science conferences

Over 90% of survey respondents stated that, as a result of their project in FP6, FP7 or FP8, they published one or more articles in scientific journals or books. Furthermore, 87% stated that their FP project led to publications co-authored with colleagues from abroad. Participation in FP projects, therefore, often leads to publications, primarily in conjunction with foreign partners. A bibliometric study by SERI<sup>34</sup> has shown that the share of the publications co-authored by researchers from Switzerland and researchers from abroad is very high. FP projects, in particular cooperation projects, often not only bring together researchers from different countries, but also project partners from the public and private sectors. This is also reflected in the publications resulting from these projects. According to the results of this survey, almost all publications by Swiss companies resulting from an FP project are co-authored with partners from academia. From among higher education institutions, researchers from universities of applied sciences (UASs) tend to publish more frequently with private-sector partners than researchers from the cantonal universities and federal institutes of technology. Over 80% of respondents from UASs and between 60 and 70%

of those from the cantonal universities and federal institutes of technology stated that they had co-authored a publication with a private-sector partner. This difference is unsurprising, considering the practical orientation of the UASs (see Table 4.1).

**Table 4.1 Publications in scientific journals and books co-authored by academic and private-sector partners**

Institution (n)	Private sector (215)	Cantonal universities (233)	FITs (ETHZ, EPFL) (251)	Univ. applied sciences (UAS) (71)	Private or public non-university institution or agency (incl. R&D institutions) (135)	Other (18)
Co-publication(s) published or expected	33.5%	20.6%	19.9%	42.3%	21.5%	5.6%
No co-publication	11.6%	33.0%	31.1%	16.9%	33.3%	11.1%
Not possible to estimate number of co-publications	54.9%	46.4%	49.0%	40.8%	45.2%	83.3%

Source: SERI/Ipsos (GfK) survey

The survey results indicate that participation in an FP6 project generated a median number of four publications, rising to five in FP7. A further publication on average is still expected for projects in FP7, whereas no further publications are expected for FP6 projects. In FP8, an average of three publications per project is already realized, with a further three expected at a later stage. Even using a conservative extrapolation,<sup>35</sup> it can be assumed that, for each year of the FP, several thousand publications are co-authored by project participants from Switzerland (see Table 4.3).

<sup>35</sup> Median values multiplied by the total number of Swiss FP participations (Table 4.2) registered in the European Commission's eCORDA database.



## WELFAREPRIORITIES

Welfare state priorities – helping to find compromises



Welfare state politics under pressure:  
Identifying priorities, trade-offs and  
reform opportunities among citizens,  
political and economic elites



Project duration  
09/2017 – 08/2022



Number of project partners: 1  
Number of countries: 1



Total budget: € 1 474 133  
Budget of Swiss Partner: € 1 474 133

„Right from the start, the project attracted a lot of interest among political parties, decision-makers and the media.“

Professor Silja Häusermann of the University of Zurich



When cuts need to be made, countries are faced with making difficult decisions and compromises in their welfare policies. When resources are tight, whose risks should the social security system safeguard? Should the welfare state give priority to the needs of older or younger people? Of workers or the unemployed? Of the country's nationals or immigrants?

The way in which countries decide to answer these questions depends on the priorities of its citizens, and of its political class and economic decision-makers. But little is known about these priorities and the factors that influence them, and even less about the mechanisms that promote a sense of social solidarity and favour compromise beyond personal interest.

This is where the Welfarepriorities project comes in. Funded by the European Research Council (ERC) and headed by Professor Silja Häusermann of the University of Zurich, it applies innovative theoretical and methodical approaches to gain new insights into the political coalitions and lines of conflict that influence social policy in the 21st century. It also aims to develop and validate new empirical methods to measure the preferences and priorities of the various stakeholders, and so build up a body of data on the priorities of the public and political parties. Such information can provide a solid basis for assessing the feasibility of particular reforms, such as the promotion of early childhood education or the protection of retirement pensions. It will also provide information on the type of social policy that is welcomed by specific groups of voters. Overall, it is hoped that the findings will foster compromise that is politically acceptable throughout society.

“Thanks to the widespread visibility of an ERC grant both within one's own university and in the research community in general, the research comes to the at-

tention of many people who might not otherwise have been aware of it,” explains Häusermann. In her case, she was able to present the project at several conferences both in Switzerland and abroad, and was invited to take part in a number of joint research applications by national and international consortia. She was also invited to sit on various academic committees and to take on tasks outside academia, for example for the advisory bodies of think tanks and social insurance organisations. Although the project was only launched in the autumn of 2017, initial findings have already been discussed by the media, public, political parties and policymakers, e.g. at a meeting of German-speaking ministers for social affairs. In addition to the academic findings and their significance for welfare policy, Häusermann believes that an ERC project offers only benefits: “An ERC grant provides the time and resources to address all the scientific endeavours one wishes to pursue. It's like swimming in a perfect pond.”

**Table 4.2 Number of Swiss participations in the FPs**

Year	FP6	FP7	FP8
2003	22		
2004	614		
2005	491		
2006	579		
2007	200	10	
2008	1	605	
2009		560	
2010		688	
2011		658	
2012		691	
2013		761	
2014		311	17
2015		39	474
2016			649
2017			626
2018			680
Total:	1'907	4'323	2'446

Sources: European Commission / SERI

**Table 4.3 Projection of the number of publications**

Year	FP6	FP7	FP8
2003	88		
2004	2'456		
2005	1'964		
2006	2'316		
2007	800	50	
2008	4	3'025	
2009		2'800	
2010		3'440	
2011		3'290	
2012		3'455	
2013		3'805	
2014		1'555	51
2015		195	1'422
2016			1'947
2017			1'878
2018			2'040
Total:	7'628	21'615	3'420

Notes:

- 1) The figures actually correspond to authorship rather than publications. A single article may have two or more researchers from Switzerland listed as authors.
- 2) The researchers only listed publications that have already been published. On average, three further publications are expected per participation in FP8, and one additional publication per participation in FP7.
- 3) Based on figures given by respondents. Median figures used: 4 publications for FP6, 5 for FP7 and 3 for FP8.

Source: European Commission / SERI

The number of publications generated per project participation varies according to the discipline: natural sciences (5),<sup>36</sup> technical sciences (4), medicine and health sciences (4), agricultural sciences (3), social sciences (3) and humanities (3). The institution type also plays a role (see Table 4.4). Participants from academia did not produce a publication in only approx. 5% of their FP projects, whereas this figure was three times higher for project partners from the private sector. This is unsurprising: as already mentioned above, publishing research findings is less important, the closer the findings are to market readiness. The role played in the project also has an influence on publication activity. Researchers who are holders of an individual grant are the most productive when it comes to publications (median: 7.5). Project coordinators also produce more publications (median: 6) than other partners in a collaborative project (median: 3) (see Table 4.5).

**Table 4.4 Number of publications generated in an FP project, by participants' institution**

Institution (n)	Private sector (215)	Cantonal universities (233)	FITs (ETHZ, EPFL) (251)	Univ. applied sciences (UAS) (71)	Private or public non-university institution or agency (incl. R&D institutions) (135)	Other (18)
Publications	3	5	5	4	2	2.5

Source: SERI/Ipsos (GfK) survey

**Table 4.5 Number of publications generated in an FP project, by participants' role**

Role	Publications
Individual grant recipient	7.5
Project coordinator	6
Project partner	3

Source: SERI/Ipsos (GfK) survey

Interestingly, the opportunity to publish scientific articles is not one of the main motivating factors in FP participation. Only 10% of survey respondents from the academic field cited publication as one of their three main reasons for participating in an FP project. For participants from the private sector, publications are even less important: a mere 1% stated that the opportunity to publish was one of their three most important motivating factors.

<sup>36</sup> The median values for each discipline are given in brackets

Besides publications, scientific conferences, at which the latest research results are presented and can be discussed with experts in the field, also play an important role in the dissemination of research findings (see Table 4.6). The survey showed that the median number of oral presentations of FP projects given at conferences was five, and the median number of poster presentations three. As in the case of publications, oral and poster presentations at conferences are given about twice as frequently by project coordinators and individual grant holders as by 'simple' project partners. Furthermore, participants from higher education present more frequently than their colleagues from the private sector.

**Table 4.6 Overview of scientific dissemination activities linked to FP participation**

Programme		Publications	Conference presentations	Conference posters
FP6	Median	4	5	3
	(n)	134	141	211
FP7	Median	5	5	3
	(n)	418	415	538
FP8	Median	3	5	2
	(n)	148	169	210

Source: SERI/Ipsos (GfK) survey

The dissemination of research findings via scientific publications and presentations at congresses and conferences is aimed at specialists and primarily at researchers from the same or related subject area. Dissemination to a broad public is also an important aspect, and one that is addressed in Chapter 5.

## 4.2 New technological skills in emerging research areas

On average, participation in an FP project leads to the acquisition of a new technological skill in an emerging research area. The understanding of the term 'skill' varies widely according to specialist area and personal opinion, and was therefore not defined further in the survey. The survey results differed according to the type of institution to which the respondents are affiliated. Participants from the private sector and from universities of applied sciences stated more frequently that they had gained or expect to gain new technological skills in an emerging field from their participation (60% of participants from the private sector, 68% from UASs). This is compared to researchers from the cantonal universities (46%) and from the federal institutes of technology (45%, ETHZ and EPFL only; figure does not include other institutes in the ETH Domain). The average number of such acquired skills is also higher among participants from the private sector than among those from the field of higher education (see Table 4.7). It is not possible to say whether these differences are due to the nature of the projects in which the companies and UASs on the one hand and FITs and cantonal universities on the other prefer to take part, or whether the results are due to a difference in participants' perspective. It is possible that participants from the private sector and UASs are more sensitised to the issue and for this reason state more frequently that a new technological competence was acquired.

**Table 4.7 Number of new technological skills in an emerging area for FP participants from the private sector and higher education**

Institution	Number of new skills
Private-sector companies (103)	1.8
Higher education institutions (338)	1.14

Source: SERI/Ipsos (GfK) survey

The table shows the average figure

It can be assumed that participation in an FP project fosters the development of skills outside of the technical field, for example soft skills. Examples include skills in staff leadership or in intercultural cooperation. Around three quarters of the respondents stated that they had been able to improve their project management skills thanks to participation in an FP project.

### 4.3 Promoting early-career scientists

In many cases, master's and PhD students are involved in FP projects (see Table 4.8). The survey found that an FP project participation usually leads to one completed master's degree and one completed PhD. This varies, however, between the different types of institutions and applies most strongly to FP participants from the cantonal universities and FITs, where FP project participation leads to at least one successfully completed master's degree and one PhD. The figures are lower both for private-sector companies (18% of FP participations lead to at least one PhD, 13% to at least one master's degree) and for UASs (16% lead to at least one PhD, 39% to at least one master's degree).

The completion of a master's dissertation or PhD thesis as part of an FP project is also more widespread in the natural sciences and medical and health sciences than in other fields.

**Table 4.8 Number of completed degrees (average) by participants' type of institution**

Degree and answers (n)	Private sector	Cantonal universities	FITs	UASs	Private or public non-university institution or agency (incl. R&D institutions)	Other
PhD (average)	0.91	1.98	2.14	0.38	0.72	2.25
(n)	129	173	186	42	88	8
Master's (average)	0.80	2.18	3.21	1.00	0.79	1.63
(n)	123	165	165	46	81	8

The number of answers (n) is also given.

Source: SERI/Ipsos (GfK) survey

FP projects thus play an important role in the training of young scientists. PhD students and master's students are interested in participation in an FP project not only because of the subject matter, but also because these projects provide opportunities for forming international networks (see Chapter 3).

#### 4.4 Impact on careers

When asked about the personal benefits that can be drawn from FP participation, the respondents named an increase in specialist knowledge first (63% - great benefit, 25% - medium benefit). International recognition of methodologies and ideas is also classed highly (52%: great benefit, 28%: medium benefit). Both of these aspects – greater specialist knowledge and greater international recognition – are important in a scientific career. Thus, the majority of the respondents agreed that FP participation was of great benefit (31%) or medium benefit (26%) for their own career. In this area, there was a marked difference between participants from academia and those from the private sector (see Table 4.9). For 41% of participants from a higher education institution, FP participation was of great benefit for their personal career and for 23% it was of medium benefit. By contrast, only 11% of participants from the private sector felt that FP participation was of great benefit to their career, and 29% that it was of medium benefit. Almost a third stated that it had not benefited their career at all.

**Table 4.9 Benefit of FP project participation for one's own career, by participants' institution**

Participants' institution	No benefit	Slight benefit	Medium benefit	Great benefit	Don't know
Private-sector company	28.8%	23.7%	28.8%	10.7%	7.9%
Higher education institution	13.9%	14.6%	23.1%	41.4%	7.0%

Source: SERI/Ipsos (GfK) survey

With regard to their own careers, recipients of individual grants in particular benefit greatly from FP participation. 68% of this group stated that the FPs benefited their careers greatly, 15% that the benefit was a medium one. Project coordination is also seen as very useful in this respect: 42% of the project coordinators stated that FP participation was of great benefit to their career, 32% of medium benefit. Participation as a project partner meant a considerable boost to the career of 20% of participants in this group, and a medium benefit for 28% (see Table 4.10).

**Tabelle 4.10: Benefit of FP project participation to one's career, by participants' role**

Participant's role	No benefit	Slight benefit	Medium benefit	Great benefit	Don't know
Individual grant recipient	8.4%	4.5%	14.8%	68.4%	3.9%
Project coordinator	12.0%	7.0%	32.4%	42.3%	6.3%
Project partner	21.8%	21.6%	27.8%	20.4%	8.5%

Source: SERI/Ipsos (GfK) survey

# 5 Effects on society

This chapter looks at the extent of the social impact of research findings. It provides an overview of the various ways FP projects are linked to society and of their estimated corresponding social impact. The results indicate that there is a correlation between the technology readiness level of a project and its presumed social impact: as expected, as research and innovation activities approach market readiness, the presumed impact on society increases. The social impact can also be estimated in light of the presentation of project results to lay public. In this area, the private sector and universities of applied sciences tend to be more active. Participation in European research framework programmes (FPs) also has particularly interesting social repercussions by directly contributing to policymaking. According to respondents, over two thirds of the projects led to the implementation or elaboration of policy.

## 5.1 Social impact

The results presented in this chapter do not reflect 'visible' or 'quantifiable' social repercussions. Rather, they are based on a subjective appreciation that respondents have regarding the social impact of the projects that they were involved in.

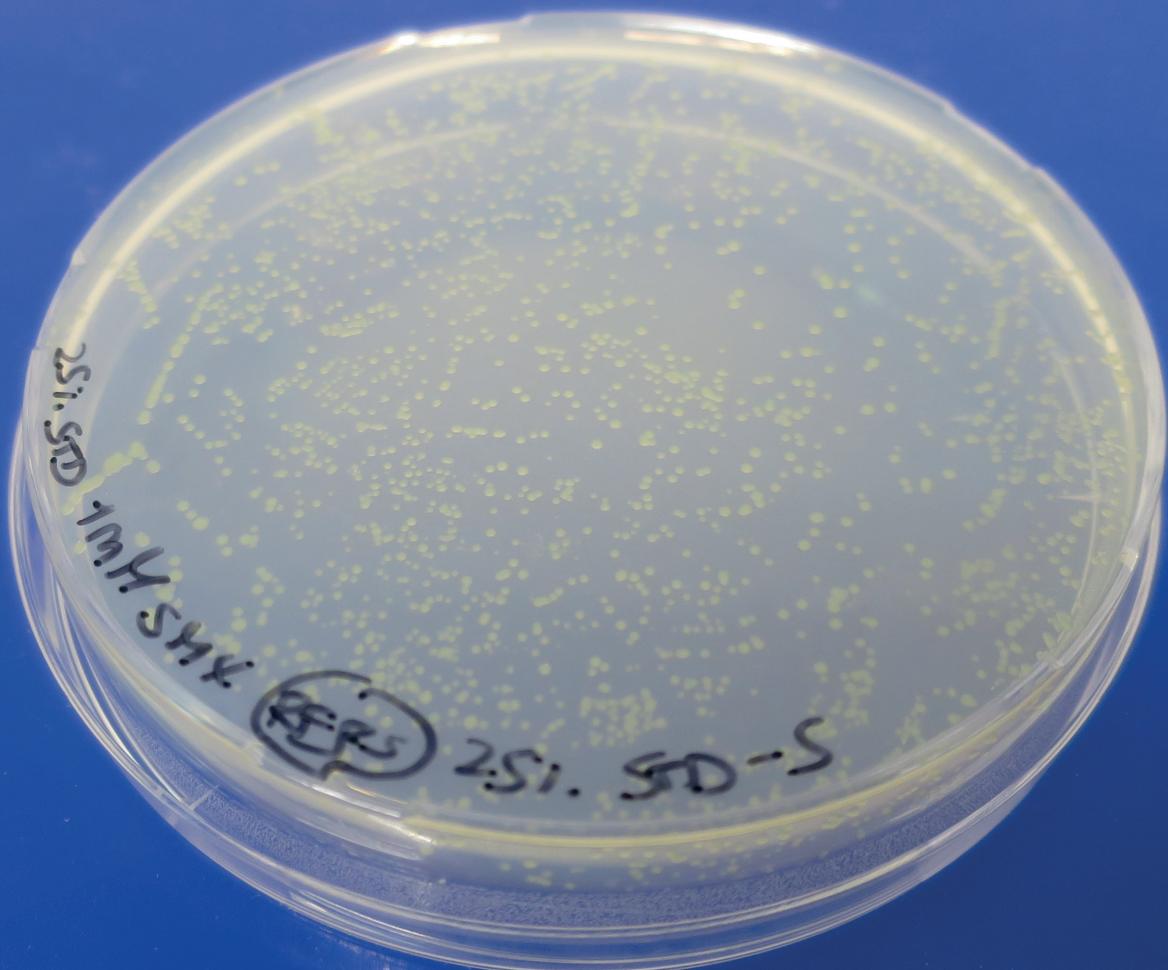
Over one third of respondents felt that their project had a rather high or (very) high social impact. In FP6, FP7 and FP8, the proportion of projects deemed as having a high social impact remained constant (see Table 5.1). the results vary according to the field of research to which the respondents belong.

**Table 5.1: Presumed social impact of research projects by FP**

	FP6	FP7	FP8	Total
(Very) high societal impact	23.2%	14.5%	20.0%	
Rather high	21.3%	17.3%	20.5%	
Middle	12.8%	17.8%	22.4%	
Rather low	12.3%	14.7%	11.9%	
(Very) low societal impact	17.5%	22.9%	15.7%	
Don't know	12.8%	12.8%	9.5%	
(n)	211	538	210	959

Source: SERI/Ipsos (GfK) survey

Compared to respondents from other disciplines, a higher proportion of respondents involved in research projects in health and medicine-related disciplines felt that the social impact of their projects was (very) high. 26% of them felt that their projects had a major social impact whereas only 13% of the researchers in human sciences, 16% of those in natural sciences and 17% of those in technical sciences felt this way (see Table 5.2).



## MINOTAURUS

New ways to address the problem of water pollution



Microorganism and enzyme Immobilization: NOvel Techniques and Approaches for Upgraded Remediation of Underground-, wastewater and Soil



Project duration  
01/2011 – 12/2013



Number of project partners: 16  
Number of countries: 8



Total budget: € 3 914 682  
Budget of Swiss Partner: € 494 137

„Participation in EU projects and coordination initiatives are an extremely useful means of improving the visibility of our research.“

Prof. Philippe Corvini, the University of Applied Sciences Northwestern Switzerland (FHNW)



Industry, agriculture and modern living standards leave their mark on the environment. For example, traces of industrial chemicals, drug residues and personal care products can be found almost everywhere in the water cycle. Wastewater from households and industry contains drugs such as antibiotics, hormones and organic compounds. This not only poses a threat to human and animal health, but also compromises the supply of clean drinking water in some parts of the world.

MINOTAURUS, a collaborative European project coordinated by Prof. Philippe Corvini and Prof. Thomas Wintgens at the University of Applied Sciences Northwestern Switzerland (FHNW), addressed this issue. Corvini, who has headed the Institute for Ecopreneurship at the FHNW School of Life Sciences since 2007, stresses the importance of taking part in EU FP projects for a relatively young institute like his: "These FP projects have given us national and international visibility. They have helped us to establish ourselves as a globally recognised institution in the field of environmental and water technologies."

The MINOTAURUS project showed that biological water treatment methods such as bioremediation are ideal for reducing the pollutant content of water. Bioremediation is a process in which microorganisms or other living organisms (e.g. plants or algae) are used to restore polluted water, soil and air to a healthy state. Either whole cells or cell enzymes can be used. An enzyme is a biological macromolecule that acts as a catalyst to accelerate a chemical reaction, for instance the degradation of a pollutant.

The MINOTAURUS project examined whether immobilising biocatalysts leads to a more rapid and effective biological degradation of pollutants. The researchers identified and isolated suitable biocatalysts (enzymes, bacteria or a mix of microorganisms) for different target compounds. For the first time, they were able to demonstrate

that bacteria feed on antibiotics under certain conditions and can therefore also be used to biodegrade them. This ground-breaking discovery opens up a completely new and promising perspective in the fight against the antibiotic resistance of bacteria, which is a major health risk today.

The identified biocatalysts were first tested in the laboratory and later in field experiments for their effectiveness in purifying polluted groundwater and wastewater biologically. But, the project did not end there. In addition to identifying and testing new biocatalysts, the researchers developed new reactor systems for immobilised biocatalysts, thereby creating a technology that is 'mobile', so to speak: the environmental technology can be brought to the polluted site, and the uncontrolled spread of polluted water prevented. Finally, the usability of the technology and the reactors were extensively tested to determine the effectiveness of the treatment, identify potential risks and establish compliance with EU directives in the water sector.

All in all, the MINOTAURUS project revealed that natural enzymes and microbes in remediation processes reduce overall energy and chemical use, lower costs and minimise the carbon footprint. In addition, the project led to the creation of a spin-off company from the FHNW's School of Life Sciences, INOFEA AG.

A key aspect of FP projects is the dissemination of research findings, which should not only be published in specialised journals, but also made available to the general public. The most important research findings from the MINOTAURUS project, for example, were published in a book. Corvini feels that policymakers in the EU should be better informed of the results of FP projects. This could improve the socio-economic benefits of FP projects further.

**Table 5.2: Presumed social impact of projects from each grouping of disciplines**

	Natural sciences	Engineering and technology	Medical and health sciences	Agricultural sciences	Social sciences	Humanities	Support activities
(Very) High societal impact	16.0%	16.8%	26.0%	19.6%	22.2%	13.3%	21.1%
Rather high	17.2%	19.6%	16.8%	31.4%	29.6%	26.7%	26.3%
Medium	18.0%	17.3%	17.9%	19.6%	19.8%	13.3%	2.6%
Rather low	16.3%	14.7%	12.1%	9.8%	9.9%	6.7%	13.2%
(Very) low societal impact	20.9%	18.7%	13.9%	13.7%	17.3%	33.3%	26.3%
Don't know	11.6%	12.9%	13.3%	5.9%	1.2%	6.7%	10.5%
Base (n)	545	434	173	51	81	15	38

Hinweis: Ein Projekt kann mehreren Kategorien zugeordnet sein.

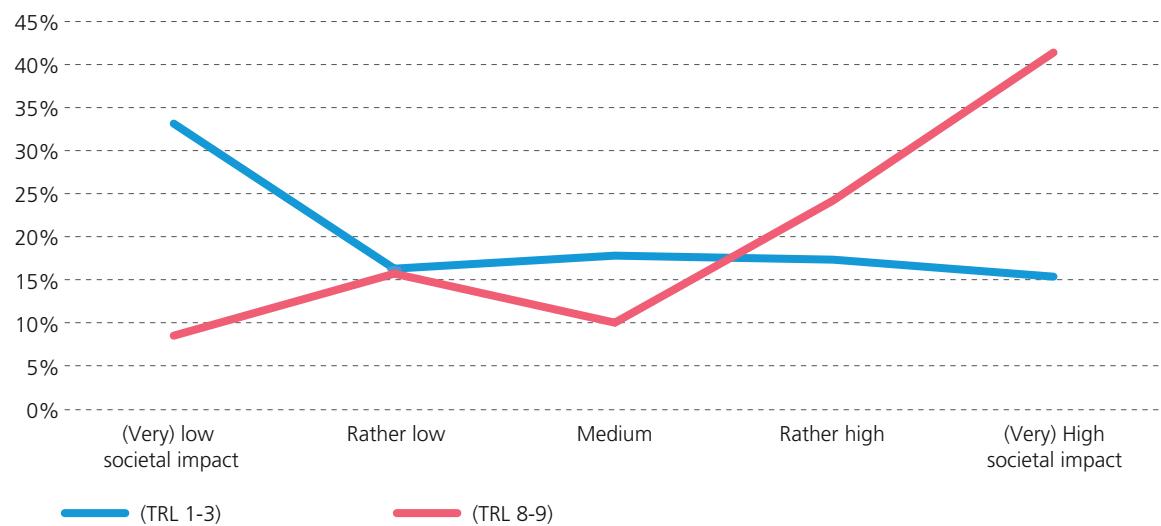
Source: SERI/Ipsos (GfK) survey

This result is rather surprising for technical sciences, since advances in this area, even if derived from basic research, can have undoubtable long-term effects on society. Smartphones, computers, internet, GPS, telecommunications and lasers are now an integral part of our daily lives and were all made possible thanks to advances in physics, for example. Apart from this, the differences are not very significant from one discipline to another. Overall, 37% of participants felt that their project has an average, high or very high social impact.

The presumed social impact of projects also varies according to the technology readiness level (TRL; see Annex 2). The TRL expresses how close research and innovation results are to the market and thus to society. As expected, the chart (Figure 5.3) shows that the more a project is at an early stage of development, the lower the proportion of respondents who feel that the social impact is high. In other words, the social impact attributed to projects increases in direct proportion to the increase in technology readiness level.

Among the projects at TRL 1-3, which includes the first R&D project stages: only 15% of the projects are considered to have a high impact. The opposite trend applies to TRL 8-9, which corresponds to the verification and validation stages of a complete system in an operational environment, 41% have a (very) high predicted social impact. Among the projects at TRL 1-3, 33% are considered to have a (very) low social impact, which is the case for only 8% of projects at TRL 8-9.

**Figure 5.3: Comparison of the proportion of research projects between levels TRL 1–3 and TRL 8–9, according to various degrees of presumed social impact**



Source: SERI/Ipsos (GfK) survey

## 5.2 Presentation of results to lay public

The scientific publications mentioned in Chapter 4 are not intended for the general public. Nevertheless, information about the results of FP-sponsored research projects reaches the general public when project results are presented in public presentations and when articles and interviews appear in the media. If the knowledge generated by a research project becomes part of the general knowledge, it may be considered as a social impact.

The results presented below reflect the dissemination of FP project results in society through three channels: media coverage of projects, interviews given about the projects and oral presentations to a lay public.

DFP6, FP7 and FP8 projects that respondents took part in generated over 5,000 contributions (interviews, media coverage, presentation of results to lay public, see Table 5.4).<sup>37</sup>

<sup>37</sup> This does not include replies from respondents who felt that their projects had been reported in the media, but who were unable to estimate the number of such contributions

**Table 5.4: Dissemination of results of research to society by dissemination channel**

	Contributions made			Total
	Presentation to lay public	Media reports	Media interviews about project	
FP6	622	439	166	1227
FP7	1319	990	446	2755
FP8	762	513	191	1466
Total	2703	1942	803	5448
(+)*	102	100	72	274

Note:

–No of respondents(\*) who indicated that project results had already been presented to a lay public (274). However, respondents did not indicate the number of contributions.

Source: SERI/Ipsos (GfK) survey

Half of these contributions are presentations to a lay public and over one third took the form of articles the media. On average, this corresponds to 1.4 interviews, 3.4 media articles and 4.5 presentations per project (see Table 5.5).

**Table 5.5: Number of contributions in average per project by dissemination channel and FP**

	Presentation to lay public	Media reports	Media interviews about project
FP6	5.7	4.1	1.6
FP7	3.9	3.0	1.4
FP8	5.1	3.9	1.6
Average	4.5	3.4	1.4

Source: SERI/Ipsos (GfK) survey

Respondents estimate that a total of 1,427 additional contributions are expected over the next three years. If these figures are applied linearly to all projects involving Swiss participants since FP6, then the total amounts to tens of thousands of contributions (interviews, coverage in the media and presentation of project results to lay public).

**Table 5.6: Number of interviews generated for each research project by type of participating institution.**

Number of interviews	Type of institution of participant					Total
	Private company	Public or private, non-university institution or agency (also R&D institutions)	Cantonal university	FITs	UASs	
0	45	56	65	90	19	275
1-2	31	18	53	37	22	161
3-5	14	5	26	21	3	69
6-10	2	1	5	4	2	14
11+			3	2		5
(+)*	39	8	15	5	2	69
Total	131	88	167	159	48	593

Note:

-312 respondents were unable to answer this question.

-69(\*) respondents indicated that at least one interview had been published but did not indicate the exact number.

Source: SERI/Ipsos (GfK) survey

Just over half of the projects gave rise to interviews (see Table 5.6). This figure is highest for the private sector (66% of projects) and cantonal universities (61% of projects)

**Table 5.7: Media coverage of research projects by type of participating institution**

Number of media reports	Type of institution of participant					Total
	Private company	Public or private, non-university institution or agency (also R&D institutions)	Cantonal university	FITs	UASs	
0	31	36	37	64	10	178
1-2	25	29	51	47	19	171
3-5	25	15	47	29	14	130
6-10	8	2	10	13	3	36
11+	3	3	10	7	3	26
(+)*	46	16	17	11	6	96
Total	138	101	172	171	55	637

Note:

- 268 respondents were unable to answer this question.
- 96(\*) respondents indicated that their project was covered by the media but did not indicate how many times this was the case.

Source: SERI/Ipsos (GfK) survey

According to the respondents, 72% of the projects were presented in the media (see Table 5.7). 82% of the projects in which universities of applied sciences took part and 79% of the projects in which cantonal universities took part received media coverage. It is worth noting that cantonal universities contribute more than the other types of institutions considered here to the production of knowledge in the social sciences and that the subjects they cover are therefore more likely to be disseminated to a lay public.

Finally, over three quarters of the projects were presented to a lay public (see Table 5.8). 88% of the projects in which universities of applied sciences took part and 83% of those in which the private sector took part were presented in this manner. Likewise, a large percentage (81%) of the projects in which cantonal universities took part were presented to a lay public. In contrast, projects in which the federal institutes of technology took part had the lowest percentage (66%) of projects presented to a lay public.

**Table 5.8: Presentation of project results to a non-academic audience by type of participating institution**

Number of presentations	Type of institution of participant					Total
	Private company	Public or private, non-university institution or agency (also R&D institutions)	Cantonal university	FITs	UASs	
0	26	24	34	60	7	151
1-2	27	24	48	48	14	161
3-5	32	18	61	42	12	165
6-10	13	11	7	14	10	55
11+	9	4	9	5	5	32
(+)*	43	19	20	9	8	99
Total	150	100	179	178	56	663

Note:

– 242 respondents were unable to answer this question.

– A total of 99(\*) respondents indicated that the results of their project were presented to a lay public but did not indicate how many times this was the case

Source: SERI/Ipsos (GfK) survey

### 5.3 From research to policy implementation

Some of the scientific projects are intended to create a scientific basis for policy development. Research results may also influence policymaking without this having been planned at the outset of a project.

According to the respondents, 62% of the projects had an impact on the creation or implementation of policy (see Figure 5.9).

<sup>38</sup> The social impact of these two projects was deemed to be high and very high, respectively.



## LIFEPATH

Health in old age  
for everyone



Lifecourse biological pathways  
underlying social differences in  
healthy ageing



Project duration  
05/2015 – 04/2019



Number of project partners: 17  
Number of countries: 11



Total budget: € 7 259 113.16  
Budget of Swiss Partner: € 841 525

„Lifepath has been one of the most enriching experiences in my career so far.“

Dr. Silvia Stringhini, from Vaud University Hospital (CHUV)



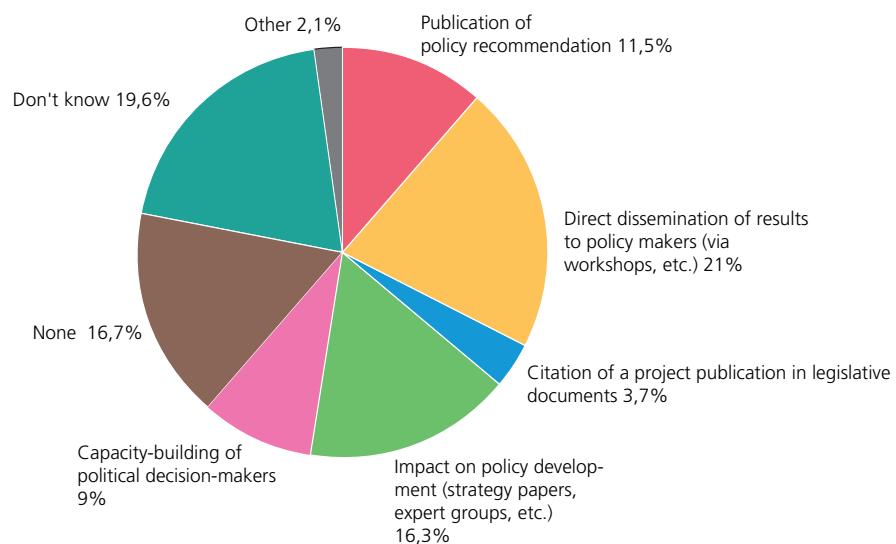
Various studies show that differences in social, economic and ecological conditions that people experience during their lives can lead to considerable differences in terms of their health. The disadvantaged are more likely to develop certain illnesses such as diabetes. This group also demonstrates a higher mortality rate and therefore also have shorter life expectancy.

The aim of the Lifepath project was to identify the biological mechanisms that promote healthy aging and which are influenced by socio-economic conditions. Fifteen project teams with members from more than ten countries studied the biological traces which are present in the human body when this is exposed to certain socio-economic factors. Silvia Stringhini from Vaud University Hospital (Centre hospitalier universitaire vaudois, CHUV) was one of those taking part in the project. She and her colleagues collected data from more than 40 cohort studies involving almost two million participants from all over the world. The main objective of the study was to promote the idea of a balanced and fair approach to health based on empirical evidence, and to reduce the impact of socio-economic differences on health. For example, it was demonstrated that, besides material factors, psychosocial stress, in particular among children and vulnerable adults, may be a key factor in creating inequalities in health. Introducing suitable measures to improve a person's socio-economic conditions could therefore mean that they enjoy better health in old age. The Lifepath project came up with a range of proposals regarding the moment when these measures should be taken and the necessity of adopting an integrated approach so that everyone can enjoy good health as they grow old.

The results help to close the health gap between the different socio-economic groups in society. They are also being used to develop global health policies and strategies aimed at ensuring equal and universal access to health prevention and at improving health coverage as soon as possible.

The project has not only been cited in a large number of articles published in scientific journals, it has also been widely covered in the media. Silvia Stringhini mentions some other positive outcomes: "This project allowed us to create a major network in several countries and consolidate the importance of this discipline in Switzerland. This network will remain in place until the end of my academic career." Boosted by its success, the project consortium has already submitted other requests for collaborative research projects. As Silvia Stringhini explains, EU-funded research projects offer the possibility of working with researchers both in Europe and around the world. This is a huge advantage which enables issues to be put into proper perspective and creates scientific ties across national borders.

**Abbildung 5.9: Distribution of research projects according to policy implementation categories**



Source: SERI/Ipsos (GfK) survey

In 21% of cases, the results were directly made available to policymakers. 16% of the projects are estimated to have had an impact on policy development and 12% of the projects have resulted in the publication of policy recommendations. In one case, the project was aimed at promoting high ethical standards in research worldwide, while another contributed to development of the next generation of computer systems. The results of these two projects were shared with policymakers, notably through workshops. The second project also resulted in the publication of a policy recommendation.<sup>38</sup>

For 20% of the projects that they took part in, however, respondents did not know whether the projects had influenced policymaking. In this vein, it seems that 16.7% of the project participants felt that their project had not had any impact on policymaking.

Among the projects whose results were directly made available to policymakers, there were two projects that are considered to have had a (very) high social impact. One contributed to the drawing-up of legislation on sanitation and water protection, on river basin management and fishing elevators. The other project led to policy recommendations on biodiversity conservation in response to the effects of climate change.

# 6 Methodological aspects and challenges

**This report examines the impact of Switzerland's participation in EU framework programmes (FPs). The term 'impact' has been increasingly used in recent years, particularly in the context of strategic planning of research programmes. Research funding institutions, as well as policymakers worldwide, are increasingly beginning to understand and quantify impact not only as the number of quantifiable results, but also as the more general impact of their research funding. It is therefore worth defining the term in more detail and classifying this report within this conceptual framework. Published for the first time in 2009, the impact assessment of the FPs in Switzerland broke new ground. Although the methodology has been refined since then, measuring impact remains a complex challenge**

## 6.1 Clarification of the concept 'impact assessment'

In abstract terms, impact can be described as (OECD, 2019)<sup>39</sup> 'the volume of intended and unintended effects of targeted measures within and/or after a given period of time.'

In a scientific context, the term impact often refers to effects that go beyond the publication of specific research findings to have a more general impact on the economy and society.

Some other commonly used terms relating to impact analysis include the following:

- Input: Resources allocated to a given measure aimed at achieving a specific objective.
- Output: Results that can be attributed directly to a specific action taken as part of a given measure.
- Outcome: Results attributed to a given output at the level of the target audience.
- Indicators: Are derived from a set of measured variables that record action taken as part of a given measure. In a sense, indicators therefore enable to 'measure',<sup>40</sup> whether and to what extent the desired effects have been achieved, and hence their impact. Establishing an indicator value presupposes the availability of relevant data.

Impact assessments are based – at least implicitly – on a model<sup>41</sup> which establishes a link between the measures taken and the impact based on an idealised hypothetical chain of cause and effect. The simplistic linear impact chain in Figure 6.1 is the simplest possible model for impact assessment.

<sup>39</sup> OECD (2019), Reference framework for assessing the scientific and socio-economic impact of research infrastructures, OECD Science, Technology and Industry Policy Papers, No. 65, OECD Publishing, Paris, <https://doi.org/10.1787/3ffee43b-en>

<sup>40</sup> Talking about the „measurement of indicators“ is a common but actually imprecise way of expression in practice. In fact, only „measured variables“ can be measured. The values of measured variables obtained from the measurements then determine the value of the indicator. In this context, data collection can be understood as the measurement of measured variables

<sup>41</sup> In the social sciences and economics, the term 'logical model' is sometimes used in this context. However, the models used to assess impact are not 'logical' in an abstract or mathematical sense

**Abbildung 6.1: Linear impact chain as the simplest model for impact assessment using a scientific project as an example**

Input	⇒	Output	⇒	Outcome	⇒	Impact
Funding		Experimental equipment		Publications		Paradigm shift in the professional world, which has an effect on society as a whole
Team		Measured results		Follow-up projects		

However, even in the case of manageable issues such as the impact of a given teaching approach at a school, the idealised relationships are characterised by a multitude of interactions between activities and outcomes, which generate non-linear, complex behaviour through direct and indirect feedback.<sup>42</sup> In these models, which are closer to reality, the interpretation of indicators presupposes an understanding of the cause-and-effect relationships as well as a quantitative representation of these relationships as mathematical models.<sup>43</sup>

The challenge of assessing impact is that the more indirect the impact, the more difficult it is to measure it. While publication output or patents are relatively easy to quantify, the question of what impact research projects or entire research programmes have on the economy and society as a whole is far more difficult to measure.<sup>44</sup>

It is hardly disputed that universities and their basic research in all disciplines are important for the development of business and society and thus for the prosperity of a country. However, it is not easy to explain exactly how the mechanism works. Is the direct effect more relevant (e.g. by contributing research findings to innovations, by informing political decisions or by research institutions passing on their knowledge to qualified personnel during training) or is the indirect effect more important, i.e. the long-term effects of research on an innovative and critically reflexive environment?

## 6.2 Dimensions of impact and challenges

This difficulty in measuring impact should not lead to a situation in which impact measurement is dispensed with. Impact indicators provide important information on the effects of research funding. However, what is easy to measure does not cover all relevant aspects of impact. One should therefore not succumb to the temptation to describe only what is measurable as impact: Indicators represent only a part of reality. Certain effects are very difficult or even impossible to quantify.

<sup>42</sup> example retrieved from Wikipedia

<sup>43</sup> G. Mion & D. Ponattu (2019), Technical Appendix for Policy Paper 'Estimating economic benefits of the Single Market for European countries and regions', Bertelsmann January Stiftung (ed.), 2019, download

<sup>44</sup> B. Maegaard et al., Editor (2019). Stay tuned to the future. Impact of the Research Infrastructures for Social Sciences and Humanities. Proceedings of the International Conference on the Impact of Research Infrastructures for Social Sciences and Humanities organised by the ESFRI Strategic Working Group on Social and Cultural Innovation in collaboration with Fondazione per le scienze religiose Giovanni XXIII, Bologna, on 24-25 2018. [https://www.esfri.eu/sites/default/files/RI\\_SSH\\_Bologna\\_Conference\\_Proceedings.pdf](https://www.esfri.eu/sites/default/files/RI_SSH_Bologna_Conference_Proceedings.pdf)

This report focuses on various aspects of the impact of Switzerland's participation in FPs:

- Impact on the general performance of the research system: Since research funds have to be acquired competitively, FPs can contribute to improve competitiveness and thus also to the performance of Switzerland as a research location. Access to FPs makes Switzerland an attractive research location for top foreign researchers as well. Moreover, in many areas, research is not an individual achievement, but rather a collaborative effort of many researchers and research institutions across national borders. Cross-border research projects can therefore also improve the performance of Swiss research activities through cooperation and the creation and strengthening of networks. They also enable researchers and research institutions to become involved in important new initiatives and infrastructures outside of Switzerland.
- Impact on the economy and on society. Applied research projects, in particular, lead very directly to the creation of software programs or prototypes leading to the development of marketable products and services, or to the establishment of new companies. Many of the EU FP projects take place with the direct involvement of private companies. Research often also serves as a direct basis for policy decisions. Furthermore, research projects create jobs. Research thus generally has a positive effect on a country's economic performance.

The eighth FP generation (Horizon 2020) supports all research and development processes in the innovation chain from basic research (Excellent Science pillar) to market introduction (e.g. SME instrument, European Innovation Council pilot programmes).

Determining the longer-term socio-economic impact (i.e. 'impact') of Switzerland's participation in FPs is a conceptual challenge: there are interactions between a large number of individual and societal stakeholders in Switzerland, among European countries and within the EU institutions, at various levels ('scales'): individual researchers who produce ideas and receive FP funding; research groups and communities at laboratory, institute, enterprise, university, national and European levels; management bodies of institutes, companies, higher education institutions; as well as local, cantonal and federal authorities and institutions.

The interactions between the numerous stakeholders are also very diverse and in some cases much more difficult to grasp and quantify than the flows of funding. Interpersonal contacts, strategic and political advisory, negotiation and decision-making processes at all levels, in turn, determine a large number of interlinked results (outputs and outcomes), the totality of which, together with the quantifiable effects, produce the long-term impact of Switzerland's participation in FPs.

In light of the foregoing explanations, it is clear that a complete description of the overall social impact of Switzerland's participation in the FPs (in the strict sense of a complete impact assessment as described above) would be an extremely costly and complex (if not impossible) undertaking. Even a multi-year research project with this objective would only be able to cover partial aspects of the social impact of Switzerland's participation in the FPs, and even this would only be approximate.

For this reason, a pragmatic approach was chosen for the study: information was gathered to enable analysis of indicators deemed relevant under the terms of the SERI mandate, i.e. the outputs, outcomes and perceptions of Swiss researchers, institutions and companies that took part in EU framework programmes. We can therefore reasonably assume that the main aspects of the socio-economic impact of Switzerland's participation in FPs are adequately covered for the ERI sector in this report.

*Acknowledgements: we warmly thank Prof. Georg Lutz (FORS) for his advice for Chapter 6*

# Annex 1

## 1 Effects on research funding

### **Indicator 1.1 Financial return**

Ratio between the total amount of mandatory contributions paid by Switzerland to the budget of a given FP or directly committed funding ('project-based participation') and the total amount of committed FP funding secured by Swiss participants (international organisations based in Switzerland are not counted as Swiss participants).

### **Indicator 1.2 Own funds used**

Difference between the total cost of the research conducted by Swiss private-sector participants in all FP projects and total funding secured by them. The difference corresponds to the costs covered by the participants themselves.

### **Indicator 1.3 Comparison and complementarity of funding sources**

Percentage distribution of answers to the question 'What is your preferred source of funding?'

### **Indicator 1.4a Access to funding as a reason for participating in FPs**

Percentage of respondents who answered yes to the following question: 'In your experience, which are the main reasons for participating in the EU Framework Programmes – Access to financial means?

### **Indicator 1.4b Course of the project without EU funding**

Distribution of responses to the following question by role of the respondents in the given project: 'What would have happened to the project without FP funding?'

### **Indicator 1.4c National feasibility**

Percentage of respondents who agreed with the statement: 'The project could NOT have been carried out at a purely national level (i.e. by you alone or only with Swiss partners), even if national funding had been available'

### **Indicator 1.5 Links between European and national funding programmes**

1.5a: Percentage distribution of responses to the following questions:

1. "Did the EU funding for your project facilitate the securing of funding from another public research funding source, and if so, from which source(s)?"
2. "Did one or more of the following public research funding sources facilitate the securing of EU funding for your project?"

1.5b: Percentage distribution of answers to the question: 'What happened to your last rejected FP project proposal?'

## 2. Effects on the economy and employment

### **Indikator 2.1: Profil der Projektbeteiligungen von Unternehmen an den FRP**

- 2.1a Number of instances of participation by SMEs or large companies (>250 jobs)
- 2.1b Number of participations of companies by research area

### **Indicator 2.2: Immediate increase in turnover**

Increase in turnover achieved by companies participating as a result of their involvement in an FP research project.

### **Indicator 2.3: Jobs creation**

Number of jobs created as a result of participation in an FP research project.

### **Indicator 2.4: Business start-ups and spin-offs**

Number of newly established companies (start-ups, spin-offs) resulting from participation in an FP research project.

### **Indicator 2.5 Marketable products**

Number of commercially viable products developed within an FP project.

### **Indicator 2.6: Patents**

Number of patents filed or granted as a result of participation in an FP research project.

## 3. Effects on scientific cooperation networks

### **Indicator 3.1 Public-private partnerships**

Proportion of collaborative projects involving cooperation between Swiss universities (cantonal universities, institutions of the ETH Domain and universities of applied sciences) and Swiss companies. The number of projects with at least one Swiss partner serves as a basis.

### **Indicators 3.2 Knowledge transfer and researcher mobility**

Number of Marie Skłodowska-Curie fellowships awarded to Swiss researchers for the purpose of international knowledge transfer.

### **Indicator 3.3 Development and sustainability of networks**

- 3.3a Number of research consortia formed without prior cooperation between the project partners.
- 3.3b Number of research consortia continuing to collaborate (at least two of the partners involved) after completion of an FP project.
- 3.3c Number of project partners who wish to continue working with a national or foreign project partner after completion of an FP project.
- 3.3d Willingness to engage in further international collaborations as a result of the experience gained in EU framework programmes.



# SECURECLOUD

Data stored safely  
in the cloud



# Secure Big Data Processing in Untrusted Clouds



Project duration  
01/2016 – 12/2018



Number of project partners: 7  
Number of countries: 6



Total budget: € 2 285 37  
Budget of Swiss Partner: € 537 000

„In the medium term, the project could lead to legislative adjustments.“

Prof. Pascal Felber from the University of Neuchâtel



It is becoming increasingly common for data, including sensitive data such as banking details, to be stored not on a local server but in what is known as ‘the cloud’. Furthermore, it is becoming more common for businesses to offer their online services directly from a cloud. This is practical and reduces costs, but it also carries risks: in the cloud, data is more exposed to non-authorised persons than when it is kept locally. Large-scale cyber-attacks such as Petya in 2016 and WannaCry in 2017 can cause huge damage and completely paralyse entire businesses.

The SecureCloud project, in which Prof. Pascal Felber from the University of Neuchâtel was involved, aimed to make the cloud more secure. The promising approach adopted involved encrypting data so that it cannot be read, while offering the possibility of conducting calculations directly on encrypted data in a secure environment. Thanks to the technology developed in the project, cloud providers themselves can neither read nor use the stored data. Any data stored even in insecure cloud environments is therefore safe from intrusion.

The project has already borne fruit. A start-up has been founded to exploit the technology developed. The project is also a success on the intercultural front, with the team being made up of two Swiss, a German, a Brit, a Dane, an Italian, an Israeli and seven Brazilians project partners. Felber explains that “this type of collaborative project is enriching and impactful, although the distance and time differences have presented a challenge”.

For Felber and his team, the active involvement of industry has been a major motivating factor. This results in more applied research with results that could have a significant impact on industry and society. In the medium term, the project could even lead to legislative adjustments. Currently in Switzerland, for example,

patient data may not be stored anywhere other than within the national borders – i.e. it may not be stored in the cloud. If, thanks to the new technology, the cloud were to become more secure – perhaps even more secure than a local server – this restriction would have to be reviewed

## 4. Effects on the development of knowledge and skills

### **Indicator 4.1: Scientific publications**

Number of peer-reviewed articles published in specialised journals and books by FP participants based in Switzerland.

### **Indicator 4.2: Presentations at scientific conferences**

Number of presentations (oral or poster) of FP project results at scientific conferences.

### **Indicator 4.3: New technological skills in an emerging area**

Newly acquired technological skills in an emerging field of research within the framework of an FP project.

### **Indicator 4.4: Academic degrees**

Number of PhD and Master's Degrees awarded in connection with a participation in a FP project.

### **Indicator 4.5: Benefits of participating in an FP project for one's own career**

Benefits of participating in an FP project for one's own career based on personal appreciation of participants.

## 5. Effects on society

### **Indicator 5.1: Social impact**

Social impact that a project has or will have, according to the researcher involved in the project.

### **Indicator 5.2: Dissemination of results to lay public**

Estimation of the extent to which knowledge generated by research projects has been conveyed to a lay public. The following three variables are taken into account:

- Number of interviews generated by research projects.
- Number of media appearances generated by research projects.
- Number of presentations given to lay public in relation to research project.

### **Indicator 5.3: From research to policy implementation**

Estimation of the influence that research projects have had on policymaking and implementation based on 5 impact categories:

- Publication of policy recommendation
- Direct dissemination of results to policymakers
- Citation of a project publication in legislative documents
- Impact on policy development (strategy, papers, experts groups, etc.)
- Capacity-building of political decision-makers

# Annex 2

## Technology Readiness Level (TRL)

TRL	Description	IMPLEMENTATION (new interventions)	Change
TRL 9	Actual system proven in an operational environment		
TRL 8	System completed and qualified	DECISION MAKING	
TRL 7	System prototype demonstrated in an operational environment	Policy formulation and dissemination (advocacy!) (POLICY MAKING)	Policy
TRL 6	Technology demonstrated in a relevant environment		
TRL 5	Technology validated in a relevant environment		
TRL 4	Technology validated in the laboratory	Piloting, simulating, validating (EVIDENCE)	R&D SSH and transfer
TRL 3	Experimental Proof of concept	Proof of concept/idea/methodology	
TRL 2	Technology concept formulated	Idea formulated, methodology chosen	R&D SSH
TRL 1	Basic principles observed	IDEA	

## Grouping of disciplines:

### *Natural Sciences*

1. Mathematics
2. Computer sciences
3. Information sciences
4. Earth sciences
5. Biological sciences
6. Physical sciences
7. Chemical sciences

### *Engineering and Technology*

8. Civil
9. Electrical, electronic and information engineering
10. Mechanical engineering
11. Aerospace engineering
12. Chemical engineering
13. Materials engineering
14. Bioengineering and Biomedical engineering
15. Environmental engineering
16. Environmental biotechnology
17. Industrial biotechnology
18. Nano-technology

### *Medical and Health Sciences*

19. Basic medicine
20. Clinical medicine
21. Health sciences
22. Medical biotechnology

*Agricultural Sciences*

- 23. Agriculture, forestry and fisheries
- 24. Animal and dairy sciences
- 25. Veterinary sciences
- 26. Agricultural biotechnology

*Social Sciences*

- 27. Psychology
- 28. Economic, finance and business
- 29. Educational sciences
- 30. Sociology
- 31. Law
- 32. Political sciences
- 33. Social and economic geography
- 34. Media and communications

*Humanities*

- 35. History and Archaeology
- 36. Languages and literature
- 37. Philosophy, ethics and religion
- 38. Arts

*Support Activities*

- 39. Digital Archives
- 40. Infrastructure Development
- 41. Training/Demonstrations