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The Dutch science system in the European Research Area

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In this publication the Rathenau Instituut provides factual information on the importance of European research policy, in particular the European Research Area, for scientific research in the Netherlands.

Introduction

Since the launch of the European Framework Programme (FP) Horizon 2020, the significance of Europe as a funder of research is greater than ever. Horizon 2020 has a budget of € 78.6 billion and runs from 2014 to 2020; participants from the Netherlands are relatively successful in acquiring FP support. Europe has become an important source of funding for researchers in the Netherlands.¹

However, Europe provides more than just an extra funding opportunity for researchers. It has become more influential in agenda-setting, programming, organising, implementing and valorising scientific research. Societal challenges have, for example, been formulated in Horizon 2020, that orient research agendas across Europe. The European Research Council (ERC) stimulates 'excellence' in science by organising competitive funding on a European scale. And a pan-European research infrastructure has been developed, guided by the European Strategy Forum on Infrastructures (ESFRI).

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The Rathenau Instituut promotes the formation of political and public opinion on science and technology. To this end, the institute studies the organization and development of science systems, publishes about social impact of new technologies, and organizes debates on issues and dilemmas in science and technology.

¹ As well as through the FP, research is funded at European level by Structural Funds such as the European Regional Development Fund (ERDF). This fund is outside the scope of this publication. See Appendix 1.

2 The Dutch science system in the European Research Area

Science policy has long been primarily a matter for national governments, but the European policy level has become more relevant in the governance of scientific research. The European goal of establishing a European Research Area (ERA) in which research and researchers can freely circulate plays a central role in this development.

This publication is a first attempt to provide an overview of facts and figures on the importance of European research policy and the ERA to scientific research in the Netherlands.

The first chapter provides a historical overview of European research policy and outlines the ERA's most important policy instruments. It shows how the scope and financial impact of European research policy have increased over time.

The second chapter describes how the Horizon 2020 budget is divided into several pillars and various instruments. It illustrates the broadened scope of EU research policy, demonstrating that the research budget supports three main goals: 1) excellent science, 2) industrial leadership, and 3) tackling societal challenges.

In Chapter 3, we provide facts and figures on Dutch participation in Horizon 2020 and in the ERA, including participation in FP projects, funding received from the FP (also in comparison with the Dutch contribution towards it), the participation of Dutch partners in large-scale European initiatives and platforms, and lastly, Dutch participation in pan-European research infrastructures and the ESFRI Roadmap.

Chapter 4 provides an analysis of international collaboration between researchers in the ERA. We look at the degree to which Dutch partners collaborate with partners from other EU countries in FP projects. We also examine the international collaboration of Dutch researchers in international co-publications. Finally, we show the relative preference that Dutch researchers have for collaborating with partners from different countries, both in FP7 projects and co-publications.

In Chapter 5, we discuss the international mobility of researchers, examining countries of origin of researchers in the Netherlands, and the destinations of those who originated in the Netherlands. Subsequently we provide an overview of the various EU policy instruments designed to promote inter-EU mobility.

1 Developments in European science policy: the creation of the ERA

The European Commission has actively stimulated collaboration in research since the 1950s². In its early days, the focus was on industrial research and technological development, to promote Europe's economic growth. The Treaty of Rome, which established the European Economic Community (EEC) in 1957, laid the groundwork for research programmes in fields such as energy, environment and biotechnology.

In 1983, prompted by concerns that technological knowledge in Europe was lagging behind that of Japan and the US, the European Strategic Programme on Research in Information Technology (ESPRIT) was launched. The following year saw the introduction of the first FP (FP1) as an umbrella framework for most European research subsidies. The emphasis of FP1 was on biotechnology, telecommunications and industrial technology. In 1986, research became an official EEC policy area,

² The treaties of the European Coal and Steel Community (ECSC) and the European Atomic Energy Community (Euratom) included provisions for research. See European Commission (2014) for a short historical overview.

with its own chapter in the Single European Act. The goal was to reinforce the scientific and technological base of European industry and to strengthen its international competitiveness.

Intergovernmental collaboration between European countries in large-scale research facilities developed in parallel to this community-based research policy. In 1945, CERN (the European Organisation for Nuclear Research) was created to organise structural research on particle physics on an international scale. Other examples of intergovernmental collaboration are the European Southern Observatory (ESO, 1962), the European Space Agency (ESA, 1975)³ and the European Molecular Biology Laboratory (EMBL, 1974).

Intergovernmental initiatives were also implemented to foster European research cooperation, such as COST (1971), the European organisation for collaboration in science and technology, and EUREKA (1985), a European network for industrial research and development.

European research policy between the post-war period and 2000 was characterised by a focus on applied research and technological development, and on European cooperation and coordination between researchers and between research funders.

Around the turn of the century, the EU broadened the scope of its research policy. Scientific excellence became an explicit goal. In addition to boosting industrial competitiveness, innovative solutions to tackle societal challenges were also encouraged. Since 2000, the EU has also worked towards the alignment and integration of national research systems into one open European Research Area (ERA). The Netherlands is part of the ERA, together with the other EU member states and thirteen associated states.

The Treaty of Lisbon (2007) gives the European Commission the capacity to initiate programmes in the policy area of research and technological development. Research policy is characterised as a 'shared competence' of the Commission and member states.⁴

Large-scale research facilities have become a European policy theme. In 2006 the European Commission set up a European Strategy Forum on Research Infrastructures (ESFRI) Roadmap to integrate national research facilities and provide access for all researchers within the ERA. The Roadmap includes start-up research infrastructures and those under construction.

Upon the foundation of the European Research Council (ERC) in 2007, the EU began for the first time to fund basic research and individual researchers directly. The ERC is committed to supporting ground-breaking research in all scientific areas, funding the most talented researchers and their teams. Transnational collaboration is not a prerequisite. The ERC was the first to create competition for research funding at the European level, to stimulate the quality of scientific research.

A year after the founding of the ERC, the European Institute of Innovation and Technology (EIT) was established in Budapest, to bring together higher education, research and business through support for so-called Knowledge and Innovation Communities (KICs).

³ The ESA evolved from the European Space Research Organisation (ESRO) and the European Launcher Development Organisation (ELDO) in 1975.

⁴ The Treaty on the Functioning of the EU (2007, see <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E%2FTXT> for details) states that "In the areas of research, technological development and space, the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being prevented from exercising theirs."

4 The Dutch science system in the European Research Area

In 2010, the EU launched the Innovation Union, an initiative to improve the conditions and funding for research and innovation in Europe. The Innovation Union is one of the seven flagship initiatives of Europe 2020, the EU's overarching ten-year plan for economic growth and employment.⁵ The ERA is an important building block within it. In 2012, the European Commission formulated five ERA priorities:⁶

1. More effective national research systems – including increased competition within national borders and sustained or greater investment in research;
2. Optimal transnational cooperation and competition: common research agendas for societal challenges, increased quality of research through inter-EU competition, and shared large-scale European research infrastructure;
3. An open labour market for researchers: fewer barriers to mobility, education and attractive careers;
4. Gender equality and mainstreaming in research: no more waste of talent, diversification of views and approaches in research, and increased expertise;
5. Optimal circulation of, access to, and transfer of scientific knowledge, including via the digital ERA, so everyone has access to knowledge and is able to use it.

1.1 Summary

Since 2000 the European Commission has striven to establish a European Research Area (ERA) in which researchers and research institutions can collaborate and compete internationally without barriers. The goals of the ERA go further than traditional EU research policy, which promoted cooperation in application oriented research and technological development and coordination between EU member states. Goals central to the ERA include common research agendas across member states, an increase in the quality of research stimulated by pan-European competition for funding, and the construction and management of large-scale European research infrastructures.

2 Horizon 2020

One of the most important means to fund the Innovation Union – and the ERA – is Horizon 2020, the eighth Framework Programme. With a budget of € 78.6 billion, running from 2014 to 2020, it is the largest FP so far.⁷ Figure 1 shows the growth of the FP budget since FP1 in 1984. In practice, the FPs' financial impact is even larger, because EU funding often requires co-funding from public and private sources.⁸

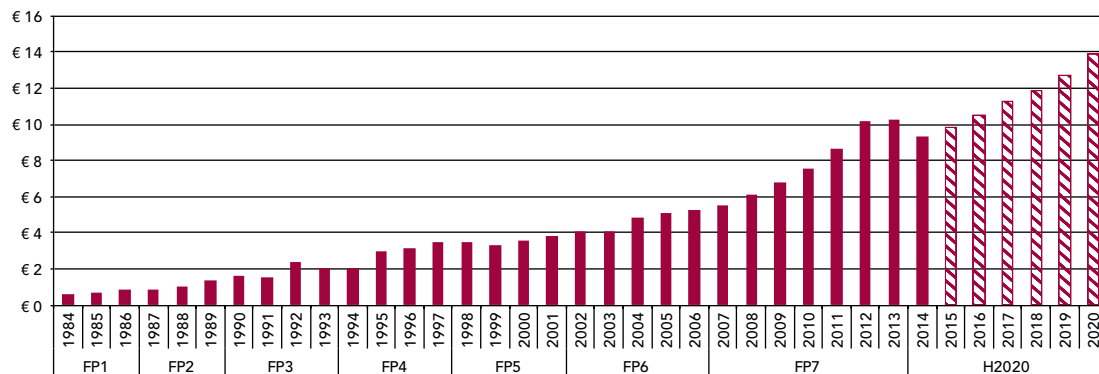
5 For more details on the Innovation Union, see http://ec.europa.eu/europe2020/index_en.htm.

6 European Commission (2012).

7 The Horizon 2020 budget is not definitive; fluctuations may occur.

8 The majority of Horizon 2020 projects require co-funding (of on average 25%). In the national budget for 2015, € 100 million was made available for co-funding and matching. Half of this was available through the SEO-scheme ('Stimuleren Europees Onderzoek': Stimulation of European Research) for co-funding of European programmes by the Dutch government. A quarter of the total budget, € 25 million, was to be used for matching, if individual researchers or consortia were required to match funding when they joined a project. The other € 25 million was available via NWO on the basis of open competition (Ministry of Education, Culture and Science, 2014a).

Figure 1 Framework Programme budgets, in billion €



Source: European Commission (2015a, d).

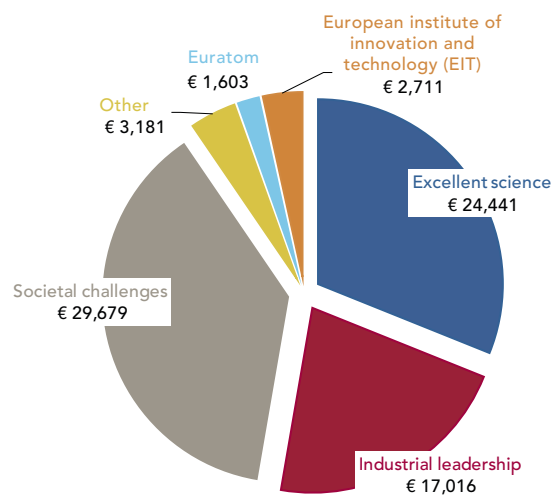
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Horizon 2020 is built around three pillars:

1. Excellent Science: to ensure that European scientific research is of the best possible quality, attracting world-class researchers, by, for instance, offering access to the best research infrastructure.
2. Industrial Leadership: to make investment in European research and innovation more attractive to business.
3. Societal Challenges: to encourage an integral, multidisciplinary approach to finding solutions for grand societal challenges.

Figure 2 shows the financial share of the Horizon 2020 components. The various goals into which they have been divided are explained in Table 1.

Figure 2 Division of Horizon 2020 budget, in million €



Source: European Commission (2013).

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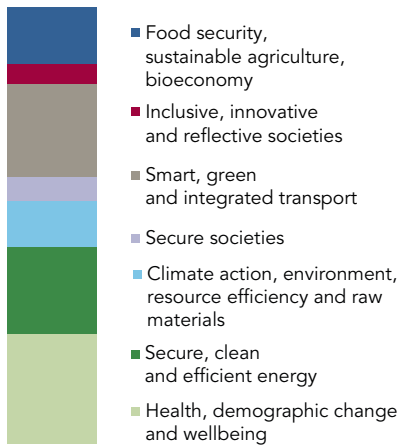
Table 1 Horizon 2020 pillars

<p>Excellent Science is about scientific talent, ‘frontier research’ and collaboration in research infrastructure.</p>	 <ul style="list-style-type: none"> ■ European research council ■ Marie Skłodowska-Curie actions ■ Future and emerging technologies ■ European research infrastructures 	<p>The European Research Council (ERC) for excellent, ground-breaking research. Funding via four types of ERC grant:</p> <ul style="list-style-type: none"> - Starting Grant - Consolidator Grant - Advanced Grant - Proof of Concept (to support ERC-grantees in bridging the gap between their research and marketable innovations) <p>€ 13.1 billion</p>
<p>The Marie Skłodowska-Curie Actions (MSCA) scheme to promote researcher training and mobility. Funding via diverse ‘MSCA actions’ and ‘MSCA co-fund actions’ (see Table 2).</p>	<p>€ 6.2 billion</p>	<p>The Future and Emerging Technologies (FET) programme for collaboration in promising new fields. This programme consists of three components: FET-Open (calls with free choice of topics); FET-Proactive (calls with predetermined topics); FET-Flagships (large-scale multi-year research projects).⁹</p> <p>€ 2.7 billion</p>
<p>Research infrastructures accessible to all European researchers, including e-infrastructures. An ESFRI Roadmap has been established to construct and join up national facilities into shared European infrastructures.</p>	<p>€ 2.5 billion</p>	
<p>Industrial Leadership is about facilitating business investments in research and innovation in Europe.</p>	 <ul style="list-style-type: none"> ■ Leadership in enabling and industrial technologies ■ Access to risk finance ■ Innovations in SME's 	<p>Leadership in key technologies, in particular ICT, aero-space, nanotechnologies, new materials, new production technologies and processes, and biotechnology. Funding via diverse calls and Joint Technology Initiatives (JTIs).</p> <p>€ 13.6 billion</p>
<p>Access to risk capital for innovative ventures, through loan facilities and risk capital.</p>	<p>€ 2.8 billion</p>	<p>Innovation by SMEs, via:</p> <ul style="list-style-type: none"> - A special SME instrument - Eurostars for hightech SMEs - Support for the innovation capacity of SMEs. <p>€ 0.6 billion</p>

⁹ For the two FET-Flagships, an ERA-NET (a type of collaborative network, see Table 2) has been founded, FLAG-ERA, in which national governments collaborate for transnational calls.

Societal Challenges

is about finding resolutions to grand societal challenges, by taking a multidisciplinary and integral approach.



The societal challenges are:

- Food security, sustainable agriculture, marine and maritime research and bio-economy
€ 3.8 billion
- Inclusive, innovative and reflective societies
€ 1.3 billion
- Smart, green and integrated transport
€ 6.3 billion
- Secure societies
€ 1.7 billion
- Climate action, environment, resource efficiency and raw materials
€ 3.1 billion
- Secure, clean and efficient energy
€ 5.9 billion
- Health, demographic change and wellbeing
€ 7.5 billion

Part of the Horizon 2020 budget goes to *Euratom* (€ 1.6 billion), the European Atomic Energy Community that was established in 1957 (together with the European Economic Community (EEC)), and the *European Institute of Innovation and Technology* (EIT) (€ 2.7 billion), founded in 2008 to drive innovation and to integrate the triple helix (education, science and business) through thematic Knowledge and Innovation Communities (KICs).

Other



In addition to Euratom, the EIT and the three main programme components, there are specific schemes for:

- The *Joint Research Centre* (JRC), the research centre that supports and advises the EU on scientific grounds
€ 1,9 billion
- Spreading Excellence and Widening Participation
€ 816 million
- Science with and for Society
€ 462 million
- Fast Track to Innovation Pilot, used in, and funded through, various Horizon 2020 schemes

Opportunities for Horizon 2020 funding are established in multi-year work programmes per programme component.¹⁰ Regular Horizon 2020 funding runs through various ‘actions’ aimed at researchers and ‘co-fund actions’ aimed at government bodies, research funding organisations, programme managers and others (see Table 2). Regional, national and international research programmes are co-funded by the European Commission.¹¹

Table 2 Horizon 2020 actions en cofund actions

Actions for researchers	Co-fund actions for policy makers, research financiers, programme managers etc
<i>Research & innovation actions</i> aimed at research projects by multinational consortia.	<i>MSCA cofund actions</i> for co-funding fellowships or doctoral programmes that include transnational mobility
<i>Innovation actions</i> for innovation projects by multinational consortia.	<i>ERA-NETs</i> for public-public partnerships, such as <i>Joint Programming Initiatives</i> (JPI's), with co-funding by the European Commission for transnational calls for proposals. Additionally, although not technically co-fund actions, Article 185 initiatives enable the EU to join existing transnational public-public partnerships.
<i>Coordination & Support actions</i> for other projects in the areas of standardisation, dis-semination, awareness and communication, networking, coordination and support services, policy dialogue and activities and studies geared towards sharing knowledge and expertise.	
<i>Marie Skłodowska-Curie actions</i> (MSCA) aimed at promoting researcher mobility in the context of career and training.	
<i>ERC grants</i> to support excellent researchers who conduct ground-breaking research.	
<i>Prizes</i> for innovative solutions.	

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The EU has a specific instrument for the implementation and funding of strategic research and innovation in areas of importance to the competitiveness of European industry, and for issues of greater societal concern: Joint Technology Initiatives (JTIs).¹² JTIs are long-term, public-private partnerships with the status of a Joint Undertaking. This means they function as independent legal entities with their own budget and staff. They can manage integral research projects and provide a framework for the collaboration of public and private parties.

2.1 Summary

Horizon 2020 is the most important source of funding in the ERA. With a budget of € 78.6 billion, it is the largest FP to date. Horizon 2020 has three main pillars: Excellent Science, Industrial Leadership and Societal Challenges. Funding mainly runs via various types of ‘actions’ and ‘co-fund actions’.

¹⁰ See <http://ec.europa.eu/programmes/horizon2020/en/h2020-sections> for the corresponding work programmes.

¹¹ In addition to the actions named in Table 2, there is also an SME instrument aimed at individual innovative SMEs and a Fast Track to Innovation Pilot for promoting innovations in products, processes or services by consortia of three to five companies. Co-fund actions include Pre-Commercial Procurement co-fund actions for stimulating public tenders for research, development and validation, and Public Procurement of Innovative Solutions aimed at stimulating contracting parties to share risks in innovation-friendly tenders. These are all actions geared towards innovation and R&D in the private sector.

¹² JTIs are established on the basis of Article 187 of the Treaty on the Functioning of the EU: “the Community may set up joint undertakings or any other structure necessary for the efficient execution of Community research, technological development and demonstration programmes.” JTIs are based on ETPs (European Technology Platforms) that have grown so large that coordination by ETPs and support by regular FP means have become insufficient. ETPs are platforms for European industry, which are acknowledged by the EU as important players in stimulating innovation, knowledge transfer and European competitiveness. ETPs draft research, innovation agendas and roadmaps, at national as well as EU level, supported by public and private funding. They seek to further the participation of industry in Horizon 2020 projects. ETPs are independent and take care of their own funding. The European Commission provides limited support for ETPs, through the organisation of contact points within the Commission, for example, and of cross-ETP workshops.

Actions are aimed at individual researchers and international collaboration between researchers. Co-fund actions are for collaboration between policy actors in different member states. European funding often requires co-funding by governments, the private sector and other funding applicants. In this way, EU funding influences the allocation of national budgets for scientific research.

3 Participation of the Netherlands in the ERA

This chapter describes four dimensions of the Netherlands' participation in the ERA. First, we take an overview of Dutch participation in Framework Programme projects. Then, we focus on the financial impact of that participation. Third, we examine the extent of Dutch involvement in several specific ERA instruments. Finally, we zoom in on Dutch participation in European initiatives which involve large-scale international research infrastructures.

3.1 Dutch participation in Framework Programmes

Table 3 shows general information on the FPs from FP1 onwards, and figures on Dutch participation in consecutive FPs. To better interpret the development of Dutch FP participation, the evolution of the FPs must be taken into account. The total budget has increased (sometimes steeply) with each new FP. This increase reflects in part the gradual expansion of the EU from 12 member states in 1986 to 28 member states in 2013.

The available budgets are divided over an increasing number of projects, leading to a decreasing budget per FP project. In FP6, the budget is divided over fewer projects, leading to an increased average budget per project. On average, FP7 provided the highest budget per project.

The share of FP projects involving a Dutch participant fluctuates around 20% through consecutive FPs. In the final two FPs, this share drops below 20%. The share of FP projects with a Dutch coordinator varies from 5% (in FP7) to 10% (in FP3).

Table 3 Dutch participation in European Framework Programmes

	FP1	FP2	FP3	FP4	FP5	FP6	FP7	Horizon 2020 ^{a)}
Total FP budget (billion €)	3.8	5.4	6.6	13.2	15	17.9	53.2	78.6
Duration of FPs (years)	3	3	4	4	4	5	7	7
Total number of projects per FP	3282	3884	5527	14567	17202	10075	25653	4987
Average budget per project (k€)	1158	1390	1194	906	872	1777	2074	1158
Number of projects per year	1094	1295	1382	3642	4301	2015	3665	712
Number of EU member states at start of or during FP	12	12	12	15	15	25	28	28
FP budget per member state per year (million € in current prices)	106	150	138	220	250	143	271	401
Number of projects with Dutch partners	448	1037	1620	3343	3434	2485	4476	885
Projects with a Dutch partner as percentage of all FP projects	14%	27%	29%	23%	20%	25%	17%	18%
Number of projects with a Dutch coordinator	225	366	529	1211	1253	668	1206	388
Projects with a Dutch coordinator as percentage of all FP projects	7%	9%	10%	8%	7%	7%	5%	8%
Projects with a Dutch coordinator as percentage of all projects with a Dutch partner	50%	35%	33%	36%	36%	27%	27%	44%

Source: CORDIS Database, http://cordis.europa.eu/projects/home_en.html.

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Note: ^{a)} As the eighth Framework Programme, Horizon 2020, is still running, these figures represent projects to date.

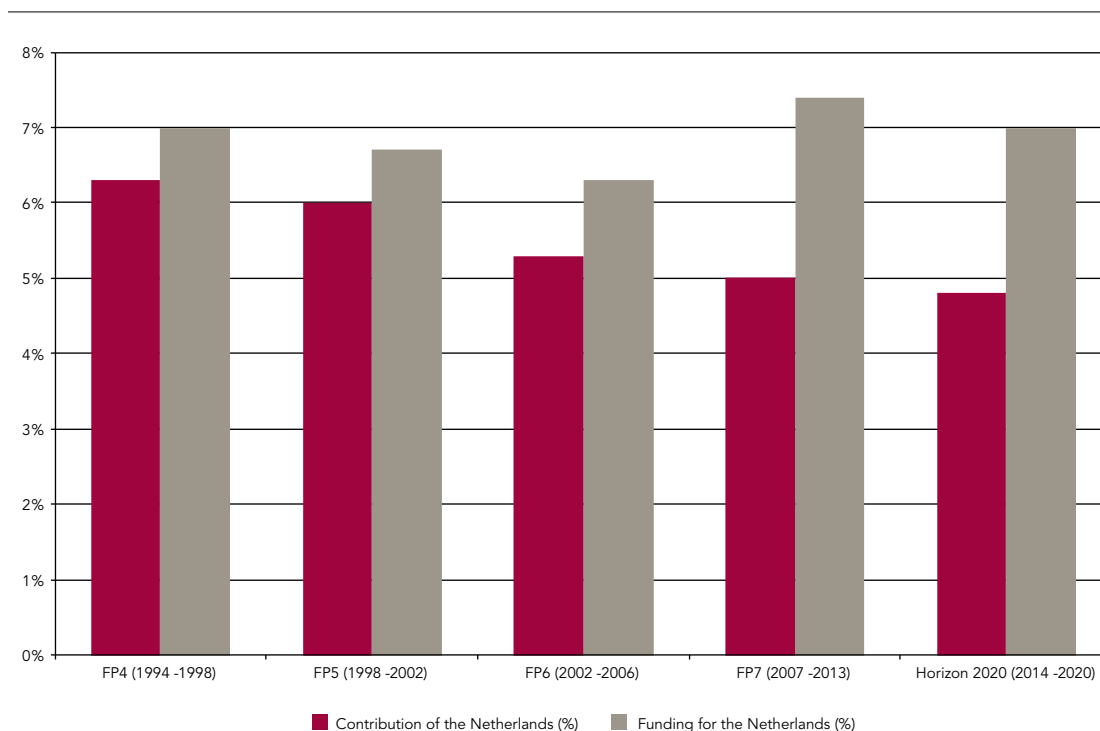
3.2 Dutch income from and contribution to European research funding

Active participation of the Netherlands in FP projects results in a funding stream from Europe to the Netherlands. Figure 3 shows what the Netherlands has contributed – via the EU-budget – to the FP budgets, and its share of income out of these budgets. The Dutch contribution to the FP budgets as a percentage of the total gradually decreases due to the expansion of the EU to 28 member states. Figure 3 also shows that the country’s share of income from the FP budget is higher than its contribution to it. In the period from FP4 to FP6, that income decreases in relative terms, but increases substantially in FP7. Dutch applicants are allocated an estimated € 3.4 billion from FP7, which is 7.4% of the total FP budget.¹³

The share of funding received by the Netherlands from Europe during FP7 is 1.5 times higher than its contribution. More than half of this (51%) goes to universities and other higher education institutions, 21% to research institutions, 22% to the private sector and 6% to other parties.¹⁴

Dutch researchers have been relatively successful in FP7. From the submitted applications, the success rate of 25.5% is higher than the EU average of 20.5%. The remuneration of 23.7% of the requested budget is also higher than the EU average of 19.2%.¹⁵

Figure 3 Dutch contribution to and allocated funding from the Framework Programmes



Source: Senter (2003), SenterNovem (2006), Van Steen (2015).

Note: The percentages of the Dutch contribution are those of the contribution to the EU budget. The percentage of the share in Horizon 2020 is, from 2015 onwards, based on estimates.

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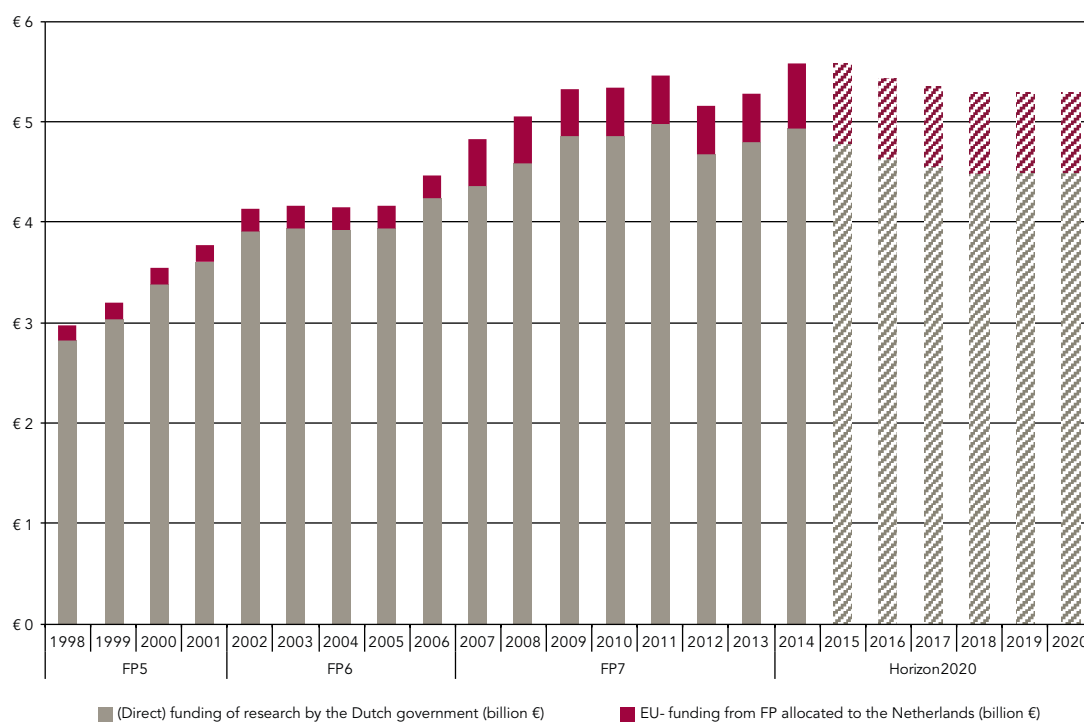
13 Ministry of Education, Culture and Science (2014b).

14 Van Steen (2015).

15 European Commission (2015e).

It can be deduced from Figure 4 that income from the FPs has risen; as a percentage of the total public research budget in the Netherlands it increased from 5.5% in 1998 to 14% in 2014. The EU has thus become more important to Dutch research funding.

Figure 4 Dutch public research funding: national from the EU



Source: Senter (2003), SenterNovem (2006), Van Steen (2015), TWIN-databases at <http://www.denederlandsewetenschap.nl/web-specials/de-nederlandse-wetenschap/cijfers/cijfermateriaal/achtergrondcijfers-feiten-cijfers.html> and earlier Totale Onderzoek Financiering (TOF/ 'Total Research Funding') overviews of the Ministry of Economic Affairs.

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Note: Figures from 2015 onwards are based on estimates.

In practice, the EU's impact is even greater due to its influence on the allocation of national research funding budgets. Part of the national budget for research is used to co-fund European projects, stimulating European collaboration¹⁶ and funding international research infrastructures.

3.3 Dutch participation in ERA instruments

Table 4 shows prominent ERA instruments and the extent to which Dutch participants partake in these programmes and initiatives. The Netherlands is shown to be a very active participant, represented in a large share of public-public partnerships such as ERA-NETs, Article 185 Initiatives and JPIs. This also holds true for public-private partnerships, JTIs and ETPs. The ERC also proves to be a significant source of income for researchers in the Netherlands, who receive 9% of all ERC grants. By

¹⁶ The ERA Facts and Figures 2014 overview by the European Commission gives indications for the share of the Dutch budget allocated to international initiatives. According to the survey on which this part of the overview is based, 11.3% of Dutch research funds go to programmes for transnationally coordinated R&D (including the 'LEAD Agency Procedure', 'Money Follows Transnational Co-operation Line' and 'Money Follows Researchers' schemes – all of which foster international mobility, see Chapter 5). 9.2% of funding is allocated to joint research programmes, and 2.1% is spent on international collaboration with countries outside the EU. Dutch research funders allocate more than the EU average (4.1% and 1.7% respectively) to the first two types of collaboration, both inter-EU. The last type, international collaboration with countries outside the EU, receives less than the EU average (which is 2.4%) from Dutch research funders (European Commission, 2014b).

way of illustration, Textbox 1 shows a comparison of ERC grants and their Dutch equivalent, the 'Vernieuwingsimpuls' (VI) grants. This shows that the budget allocated to Dutch researchers by the ERC has, since 2013, outgrown that of the VI grants.

Table 4 Dutch participation in ERA instruments

Instrument	Dutch participation ^{a)}
ERC	Since the start of the ERC in 2007, 496 of the +5,400 ERC grants have been awarded to Dutch researchers. This amounts to 9% of the available ERC budget, circa € 700 million. In the Netherlands, 0.5% of all researchers received an ERC grant. This puts the Netherlands in the highest ranking category.
MSCA actions	Of the 52,639 researchers that were supported with a MSCA action during FP7, 1128 (2%) were from the Netherlands. These grants are also rewarded to researchers outside the EU.
FET programme	Of the 64 FET projects currently running, the Netherlands participates in: <ul style="list-style-type: none"> - 5 projects in FET-open, of which the Netherlands coordinates two - 8 projects in FET-proactive, of which the Netherlands coordinates one - both FET Flagship projects: Graphene and Human Brain
COST	The Netherlands participates in 700 out of 1172 COST projects currently running (60%), and coordinates 39 of these.
EUREKA	The Netherlands currently participates in: <ul style="list-style-type: none"> - 661 out of 3557 EUREKA projects (18.6%) - 6 out of 8 EUREKA clusters - 1 out of 4 EUREKA umbrellas - Eurostars, a JPI of EUREKA and the EU
KIC's of the EIT	The Netherlands participates in all 5 KICs: Climate, Digital, InnoEnergy, Health and Raw Materials.
Joint Technology Initiatives (JTI)	The Netherlands participates in all 6 JTIs: Biobased Industries, Clean Sky 2, ECSEL, Hydrogen and Fuel Cells, Innovative Medicines Initiative and Shift2Rail.
European Technology Platforms (ETP)	The Netherlands participates in at least 37 of the 41 ETPs ^{b)} .
Public-public partnerships	The Netherlands participates in: <ul style="list-style-type: none"> - 137 out of 192 ERA-NETs (over 70%) - 8 out of 9 Article 185 initiatives - all 10 Joint Programming Initiatives (JPIs), of which the Netherlands coordinates 1

Source: Ministry of Education, Culture and Science (2014b), European Commission (2015b), Nether (2015), Marie Skłodowska-Curie Country factsheets (European Commission, 2014c), CORDIS database, COST Country Info.

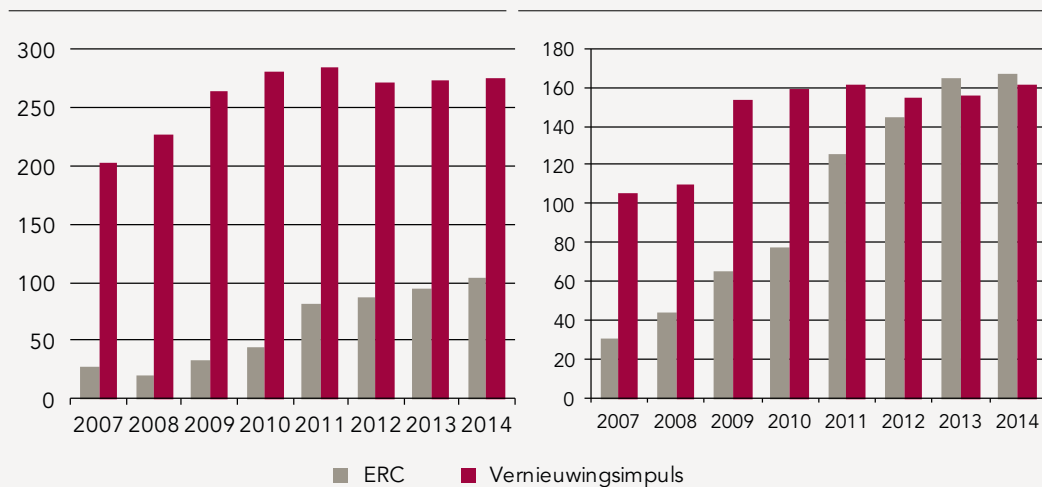
Note: a) 'The Netherlands' here means the participation of Dutch partners in projects, or in the case of grants, individual Dutch researchers. b) Estimate based on the various ETP websites.

Textbox 1 Funding from ERC and *Vernieuwingsimpuls* grants for Dutch researchers

In Figures 5.1 and 5.2 the ERC grants are compared, in budget and number, to their Dutch equivalent, the *Vernieuwingsimpuls* (VI) grants from Dutch science financier NWO. Three things become apparent. Firstly, the number of ERC grants has increased relative to the number of VI grants – 8 VI grants to 1 ERC grant in 2007, compared with 2.5 VI grants to 1 ERC grant in 2014. Secondly, the budget allocated to Dutch researchers by the ERC has grown considerably. Thirdly, the budget allocated to Dutch researchers by the ERC has outgrown that of the VI grants since 2013.

Figure 5.1 Number of ERC and VI grants for Dutch researchers

Figure 5.2 Budget of ERC and VI grants allocated to Dutch researchers, in million €



Source: ERC (2015), NWO (2015b).

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3.4 European research infrastructures

Shared large-scale research infrastructures are a central component of the ERA. In 2006, the European Commission started the European Strategy Forum on Research Infrastructures (ESFRI) Roadmap to integrate national research facilities and make them openly accessible to all researchers within the ERA.¹⁷ Facilities are featured on the Roadmap which are still under construction or in the start-up phase. In addition, several intergovernmental initiatives for internationally shared research infrastructures already exist, such as CERN, the ESA (European Space Agency), ESO (European Southern Observatory), EMBL (European Molecular Biology Laboratory) and ESRF (European Synchrotron Radiation Facility).

¹⁷ In addition to the ESFRI Roadmap, 65 Dutch research facilities are funded by the European Commission for the purpose of making them accessible to all European researchers. For a map of these facilities, see http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=mapri.

Large-scale research facilities

The Netherlands plays an active part in European research infrastructures, including CERN, ESA, ESO, EMBL and ESRF. This participation is funded mainly through the budgets of the Ministry of Education, Culture and Science and the Ministry of Economic Affairs. The Netherlands also partakes in Euratom (including EUROfusion, the European Consortium for the Development of Fusion Energy) and the EU's Joint Research Centre (JRC). These are directly funded from the Framework Programme. The most important facilities, in terms of budget, in which the Netherlands is involved are shown in Table 5.

Table 5 Highlighted large-scale research infrastructures in which the Netherlands participates

Name	Discipline	Annual budget, in million €	Role of the Netherlands	Contribution by the Netherlands, in million €		Number of participating countries (of which EU member states)
				One-off (via NWO Roadmap)	Annual	
ESA (European Space Agency)	Astronomy	4400	Its largest site, ESTEC (European Space Research and Technology Centre), is based in Noordwijk		121	22 (20)
EURATOM	Physics	1600	The shared research centre has a facility in Petten	Funded by FP		EU consortium
CERN (European Organisation for Nuclear Research)	Physics	1053	Cofounder	15,2 (for CERN component LHC) (2014)	40.5	20 (17)
JRC (Joint Research Centre)	Various	330	The JRC Institute for Energy and Transport has a facility in Petten	Funded by FP		EU consortium
EMBL (European Molecular Biology Laboratory)	Molecular biology	181	Member		4.8	21 (17)
ESO (European Southern Observatory)	Astronomy	141	Cofounder		8.5	15 (14)
ESRF (European Synchrotron Radiation Facility)	Physics	80	Member		9.6	21 (16)
EMBC (European Molecular Biology Conference)	Molecular biology	18 ^{a)}	Cofounder		0.8	27 (22)
SHARE (Survey of Ageing, Health and Retirement)	Soial sciences	11	Cofounder	Partially funded by FP	0.01	20 (19)
ESS (European Social Survey)	Soial sciences	N/A	Member	4 (2008)	0.08	15 (14)

Source: Ministry of Finance (2015), consortia websites.

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Note: ^{a)} Estimate.

De ESFRI Roadmap

A large share of the research infrastructures in Table 5 started out as intergovernmental facilities. However, the EU has listed the construction and reinforcement of internationally shared European infrastructures as one of its top priorities, and to this end has tightened its grip on them with the establishment of the ESFRI Roadmap in 2006.

The ESFRI Roadmap is a strategic instrument for directing member states' national funding of research facilities towards those which the EU considers internationally important. Those countries which join ESFRI projects pay an annual contribution once they are up and running.

Once constructed, ESFRI facilities can become a European Research Infrastructure (ERIC). When a consortium has this status, it is a recognised legal entity in all EU member states.

The Dutch Roadmap, drafted by NWO, largely follows the ESFRI Roadmap. Every two years, NWO allocates funding to projects on the national Roadmap. These budgets run alongside the annual subsidies for large-scale research facilities in the Netherlands.¹⁸ In 2014, NWO allocated € 80 million to six Roadmap projects, five of which are part of a broader European infrastructure: BBMRI, CLARIAH, EMFL, CERN and SKA. The project NanoLabNL is the only facility independent of the European context that received NWO funding through the 2014 Roadmap.¹⁹

Of those ESFRI projects in the preparatory phase which involve the Netherlands, four were coordinated by the Netherlands: CLARIN, DARIAH, EATRIS and LIFEWATCH. Three European research facilities have their headquarters in the Netherlands: CLARIN, EATRIS and KM3NET.

The following table highlights some of the ESFRI projects in which the Netherlands plays a role.

18 In 2013, NWO allocated € 62 million to national large-scale research infrastructure, but this budget is expected to decline to around € 55 million (see the database of Totale overheidsinvesteringen in wetenschap en innovatie (TWIN) 2013-2019 (Total government investments in science and innovation) at <http://www.denederlandsewetenschap.nl/web-specials/de-nederlandse-wetenschap/cijfers/cijfermateriaal/achtergrondcijfers-feiten-cijfers.html>).

19 NWO (2015a).

Table 6 Highlighted ESFRI projects

Name	Discipline	Budget, in million €		Role of the Netherlands	Dutch branch	Contribution via NWO Roadmap (2008-2014), in million €	Number of member states
		Construction costs	Annual operational costs				
BBMRI (Biobanking and Biomolecular Resources Research Infrastructure)	Biomedical sciences	170	3	Facility in the Netherlands	BBMRI-NL	33.3	13
CLARIN (Common Language Resources and Technology Infrastructure)	Humanities	104	7.6	Co-ordinator, headquarters in the Netherlands	CLARIAH (Common Lab Research Infrastructure for the Arts And Humanities)	22 ^{a)}	13
DARIAH (Digital Research Infrastructure for the Arts and Humanities)	Humanities	20	2.4	Co-ordinator	CLARIAH	22 ^{a)}	15
EATRIS (European Advanced Translational Research Infrastructure)	Biomedical sciences	20-100	3-8	Co-ordinator, headquarters in the Netherlands	N/A ^{c)}		10
EMFL (European Magnetic Field Laboratory)	Physics	115	8	Facility in the Netherlands	HFML (High Field Magnetic Laboratory)	25.9	3
INFRAFRONTIER	Biomedical sciences	180	80	Facility in the Netherlands	MCCA (Mouse Clinic for Cancer and Ageing research)	18,6	16
INSTRUCT	Biomedical sciences	300	25	Facility in the Netherlands	Proteins@Work, uNMR-NL (Ultra-High Field Magnetic Laboratory), NeCEN (Netherlands Center for Nanoscopy)	32	27
KM3NET (KilometreCube Neutron Telescope)	Astronomy	220	4-6	Headquarters in the Netherlands	N/A ^{c)}	8,8	12
LIFEWATCH	Biology	225	35.5	Co-ordinator	N/A ^{c)}		3 ^{b)}
SKA (Square Kilometer Array)	Astronomy	1500	100-150	Lid	N/A ^{c)}	12	11

Source: ESFRI (2011), NWO annual reports 2006-2010, consortia websites.

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Note: ^{a)} Budget is for CLARIN and DARIAH together. ^{b)} Estimate. ^{c)} This consortium has no separate Dutch branch.

3.5 Summary

The share of funding contributed by the Netherlands via the EU budget to FPs has decreased over time, while the share of income from the FPs remained at the same level. As a percentage of total public research funding in the Netherlands, the share of EU funding increased from 5.5% in 1998 (start of FP5) to 14% in 2014 (start Horizon 2020). In general terms, the financial significance of Europe for the Dutch science system has grown, not only because of the increased EU budget, but also because Dutch applicants have proven to be effective in making use of European funding opportunities. The success rates of Dutch applicants were above the EU average in FP7. With the increases in EU research budgets and Dutch participation in the FPs, the impact of the EU on the allocation of the national research budget increases, due to co-funding requirements and policy coordination at the EU level.

Dutch researchers participate actively in a broad range of ERA instruments. They are especially well represented in public-public partnerships, such as ERA-NETs, JPIs and Article 185 initiatives, and they also participate in several public-private partnerships, such as JTIs and ETPs. The ERC is another relatively large source of funding for Dutch research. In addition, the Netherlands is involved in various multi-national research facilities and ESFRI projects. The Dutch Roadmap for research infrastructures largely follows the European (ESFRI) Roadmap.

4 Collaboration between researchers in Europe

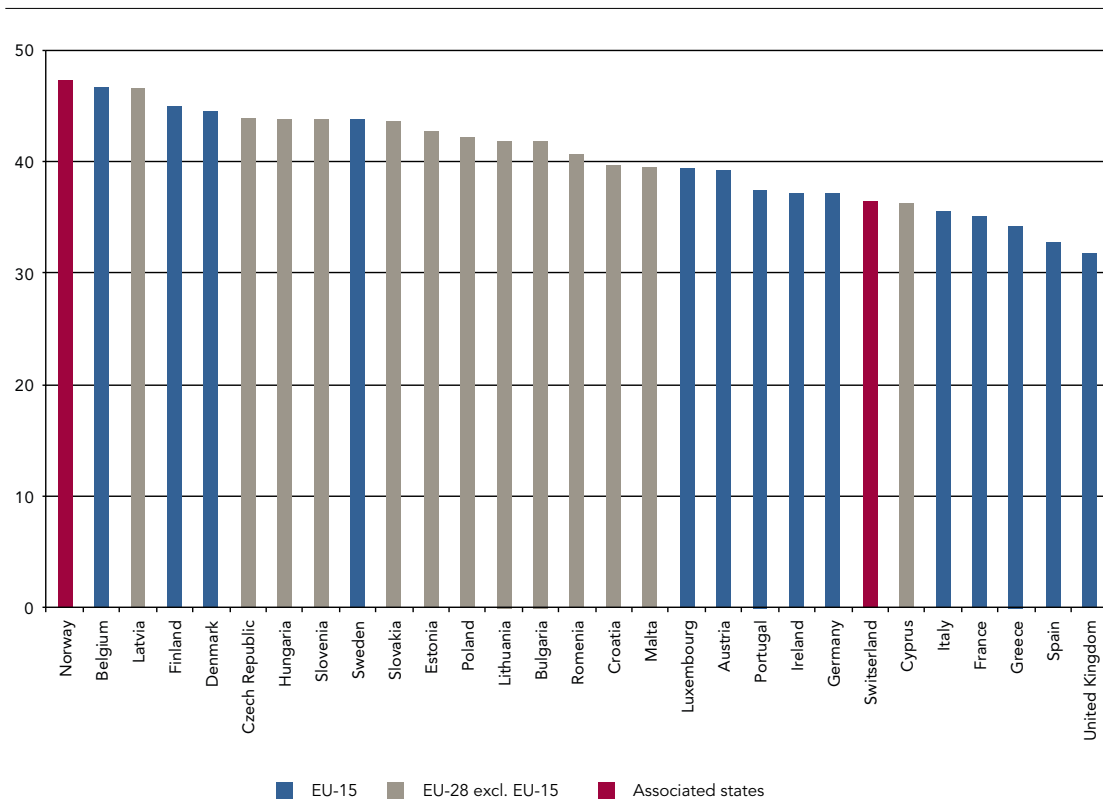
In the previous chapter we demonstrated the ways in which the Netherlands participates in European partnerships and initiatives. In this chapter we look at the partners with which Dutch participants collaborate in FPs. This gives an image of the extent to which, from a Dutch perspective, the ERA provides a common area for European research in which researchers can circulate (and compete) freely. We then take a look at the international co-authors with whom Dutch scientists publish scientific work.

4.1 Collaboration with Dutch partners in the Framework Programmes

Figure 6 shows the proportion of FP7 projects for each country which also involved a Dutch participant. This chart demonstrates that for each of the countries in the ERA, the share of projects with at least one Dutch partner is more than 30% of the total number of projects in which that country was involved. The highest Dutch participation is seen in FP7 projects which also involve a partner from Norway, Belgium, Ireland, Finland, Denmark, Sweden, and a number of countries which became EU members after 2004. Dutch participation in projects with new member states is higher (circa 42%) than in projects with EU-15 countries (39%).

Overall, the extent of Dutch participation increases between FP4 and FP6. The increase in FP6 projects might be explained in part by the introduction of the instruments, 'Networks of Excellence' and 'Integrated Projects', designed explicitly to create large-scale European networks. In FP7 projects, the Dutch participation rate is lower than in FP6 projects. This might be explained by the introduction of the ERC, which allocates individual grants in the main, for which European collaboration is not a prerequisite.

Figure 6 Share of FP7 projects including one or more Dutch partners out of all projects of EU-28 member states, Norway and Switzerland (%)



Source: CORDIS database, http://cordis.europa.eu/projects/home_en.html.

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When the entire network of collaborative links at country level is mapped, clusters can be recognised.²⁰ From the analysis that formed the groundwork for Figure 6, it followed that international collaboration between countries partaking in the FPs has increased strongly. We have analysed the clustering of these countries, to assess the impact of this strong growth of international collaboration on the cohesion within the ERA and on the position of the Netherlands in the ERA.

For both FP4 and FP7, the analysis shows a distinction in the intensity of collaboration between the core countries (those which partake in the greatest number of projects, and are long-established EU members) and the countries that have become EU member at a later stage and are the periphery of the network and the EU. The Netherlands belongs to the core of this collaborative network. In FP4 the central network consisted of a cluster of 14 of the EU-15 member states, plus Norway and Switzerland. In FP7, this large cluster was scattered into three smaller clusters. The Netherlands is in a cluster with Germany, France, Italy, Belgium, Switzerland and Austria. Spain, Portugal and Ireland form a second cluster. The third cluster consists of the United Kingdom, Sweden, Denmark, Finland, Norway and Hungary.

²⁰ A project with three Dutch partners and two German partners, for instance, counts as one project link between the Netherlands and Germany. Clusters in the network are identified in Gephi with the Louvain algorithm at a resolution of 0.25.

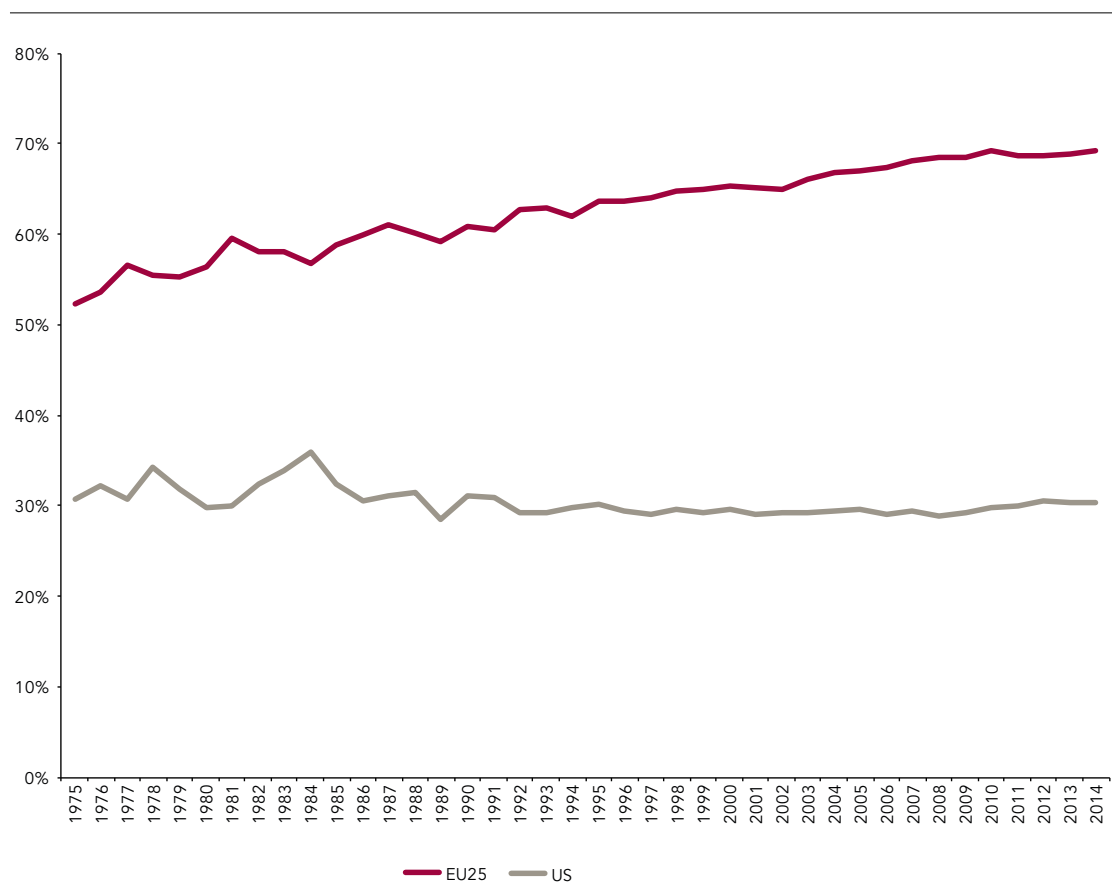
The rest of the network, outside the core, consists of two clusters, namely (1) countries in Eastern Europe, such as Poland, the Czech Republic, Slovakia and the Baltic States; and (2) countries from the Balkans and South-Eastern Europe, such as Greece, Romania, Bulgaria and Cyprus.

4.2 Collaboration in scientific publications

A growing percentage of Dutch scientific publications is written in collaboration with international partners. In 1975, 13% of all Dutch citable publications in the Web of Science were co-authored with international partners.²¹ By 2014 this percentage had risen to 58%.

Figure 7 shows that EU member states have become increasingly important co-publication partners for Dutch researchers. The United States, the largest producer of scientific publications in the world, remains an important partner, but the share of co-authors from the US in Dutch international publications stays constant at around 30%. The share of co-authors from EU-28 states in Dutch international publications is much higher, and increased from around 52% in 1975 to 69% in 2014.

Figure 7 Percentage of Dutch publications in international co-authorship with partners from EU-28 countries and the United States, 1975-2014 (%)



Source: Web of Science.

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Note: The figure is based on data on all citable publications (articles, proceedings papers, notes, letters, reviews) in five citation indexes of the Web of Science (see Note 21, p.19). This data is corrected for variations in the spelling of country names in the Web of Science. Figures from before 1991 include East Germany and Czechoslovakia, but exclude the Slovenian part of Yugoslavia.

21 The data cover all citable publications (articles, proceedings papers, notes, letters, reviews) in five citation indexes of the Web of Science: Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index – Science, and the Conference Proceedings Citation Index – Social Science & Humanities.

In Appendix 2 we include a table with more detailed figures of international co-authorship for Dutch researchers with partners from other EU-28 countries and four reference countries for the Programme periods of FP1 to FP7. What stands out is the increase in international collaboration in publications by Dutch researchers from 18% to 50% during this period. The overall increase in international collaboration applies to all EU countries. The degree of collaboration with the Netherlands is modest for the majority of countries. The United Kingdom leads the top 5 of Dutch collaboration partners in the EU with 24% during FP7, followed by Germany (24%), France (13%), Belgium (12%) and Italy (12%).

4.3 A comparison of collaboration in Framework Programmes and scientific publications

Figure 8 compares the revealed preference of Dutch researchers for collaboration with international partners in FP7 with their revealed preference for collaborating in scientific publications in the same period. If country size, in terms of the number of publications, is corrected for in the statistical analysis, the revealed preference for collaboration partners is demonstrated.²²

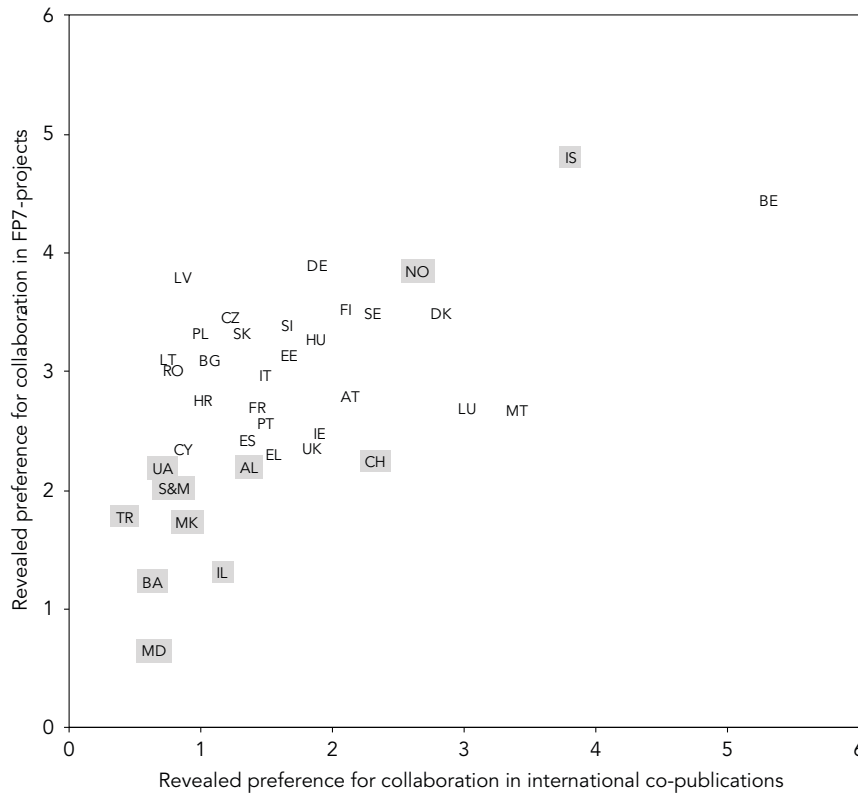
Dutch researchers have a low revealed preference for collaboration in both FP7 projects and co-publications with partners from associated states, such as Moldova, Albany and Turkey. Within the group of associated countries, Norway and Iceland are positive exceptions in both types of collaboration. While the revealed preference for collaboration with partners from Switzerland is relatively low in FP7 projects, it is relatively high in co-publications.

In collaborations with partners from the EU, Dutch partners have a revealed preference for partners from Belgium, Germany and Scandinavian countries in FP projects and in publications. The revealed preference for collaboration with partners from France, Portugal, Spain, Greece, Ireland and the United Kingdom is remarkably lower in both types of collaboration.

Dutch researchers also show a relatively low revealed preference for collaborating with Eastern European partners in scientific publications. Their preference for collaborating with these partners in FP projects is three to four times higher. This could be explained by the stimulation of multinational collaboration within the EU by FP instruments.

²² Countries with many projects or international publications have more collaborative links than countries with fewer projects or publications. If the Netherlands and Germany work together often, this is caused by their magnitude in terms of number of projects and publications in general, as well as by preference. We have corrected statistically for the magnitude of countries by calculating an 'odds ratio'. An 'odds ratio' shows the revealed preference of two countries (Germany and the Netherlands for instance) for working together.

Figure 8 Revealed preference of Dutch researchers for international collaboration in FP7-projects and in co-publications during FP



Source: See Figure 6 and Table 8 (in Appendix 2).

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Note: The figure is based on data on all citable publications (articles, proceedings papers, notes, letters, reviews) in five citation indexes of the Web of Science (see Note 21, p.19).

4.4 Summary

The analysis of international collaboration in FPs shows that the Netherlands is at the core of the EU collaboration network. Each country taking part in FP7 has at least one Dutch partner in over 30% of its projects. Dutch collaboration is highest with partners from Norway, Belgium, Ireland, Finland, Denmark, Sweden and some new member states. A cluster analysis shows that the Netherlands is part of a cluster with Germany, France, Italy, Belgium, Switzerland and Austria.

An analysis of international co-publications demonstrates that the degree to which international collaboration with EU partners occurs has increased, while the degree of collaboration with partners from the US has remained stable.

When the analysis is corrected for the number of projects and publications of each country, it appears that the Netherlands has a revealed preference for collaboration with neighbouring countries, Belgium and Germany, and with Scandinavian countries both in FP7 projects and in international co-publications.

5 Mobility of researchers within the ERA

Many researchers working at Dutch universities and other research institutions were (partly) educated elsewhere in Europe, have spent a part of their career there, or will continue their career abroad. One of the priorities of the ERA is the free circulation of researchers, also known as the 'fifth freedom'.²³ The EU promotes intra-EU mobility with, among others, the Marie Skłodowska-Curie Actions and the Money Follows Researcher scheme, which enables researchers to bring their grant with them when they leave to work in other EU countries.

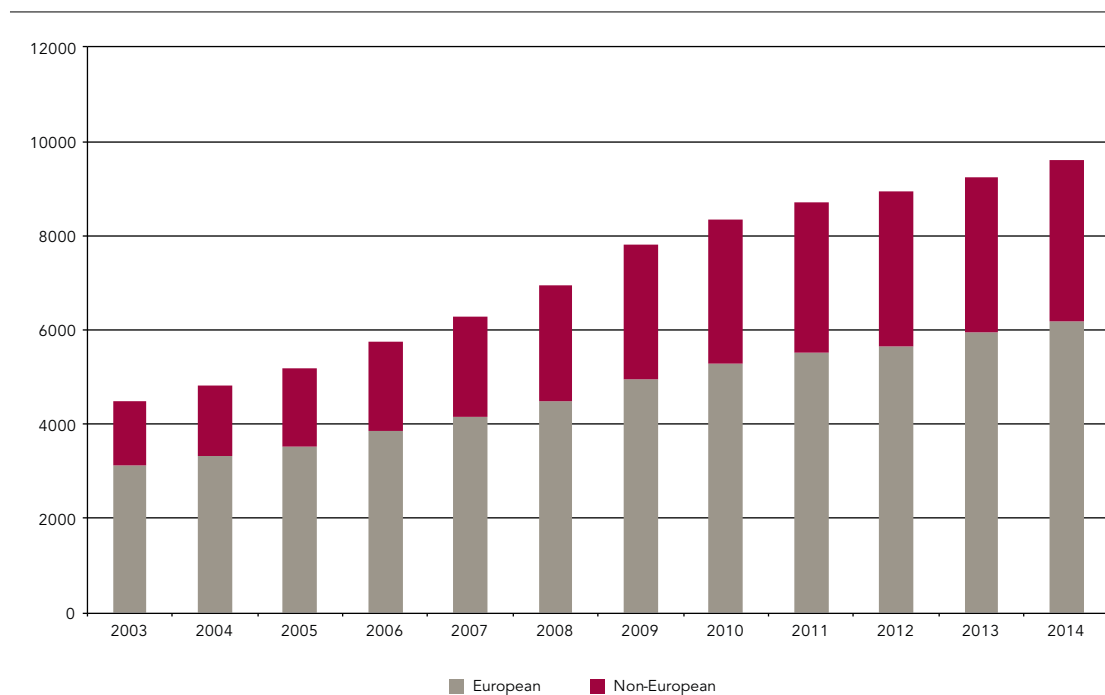
5.1 Researchers' mobility within and outside the EU

Before we zoom in on the various policy measures put in place by the EU to promote (intra-EU) mobility, we sketch an overall image of the mobility flows of researchers into and out of the Netherlands.

Academic personnel and PhDs

At Dutch universities, the share of international academic personnel is steadily growing. The number of European and non-European researchers working at Dutch universities has increased both in absolute terms, as well as relative to the number of researchers of Dutch origin.

Figure 9 Origin of international academic personnel at Dutch universities



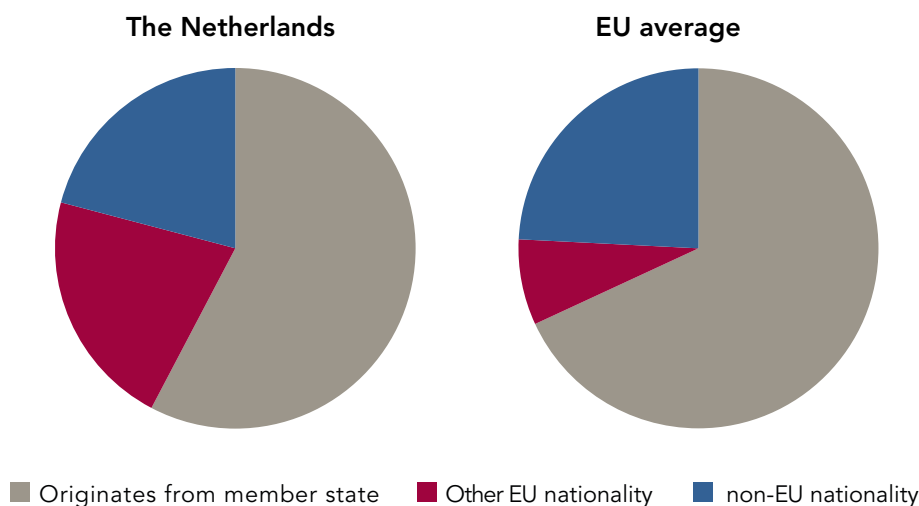
Source: WOPI Database, made available by VSNU.

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²³ In addition to freedom of people, goods, services and capital, circulation of knowledge is the fifth freedom within the EU.

The share of PhD students with non-Dutch nationality has grown to 45% in 2014, as a percentage of the total number of PhDs at Dutch universities. In 2006, this was 35%.²⁴ The share of PhDs at Dutch research institutions from other EU countries was, at 20.4%, much higher than the EU average of 7.7%. PhDs from outside the EU constituted 20.9% of all PhD candidates, lower than the EU average of 24.2%.²⁵ The Netherlands appears, compared with the EU average, to attract more PhDs from within the EU than from outside the EU.

Figure 10 Nationality of PhD candidates in the Netherlands and the EU



Source: European Commission (2014a)

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Origin and destination

Both the GlobSci survey and the MORE2 study²⁶ pinpoint Germany as the largest import country for researchers in the Netherlands. 14.6% of researchers working in the Netherlands, and 14% of those living here, are of German origin. In the GlobSci survey, Germany is followed by Italy. In the MORE2 study, Greece and Belgium are second and third. Throughout Europe, neighbouring countries are often found to be the main provider of foreign researchers for any country.

Dutch researchers seem to emigrate relatively often. After India and Switzerland, the Netherlands has the highest share of researchers travelling abroad for jobs: 26.4% of the GlobSci survey's respondents.²⁷ Popular countries include the United States, the United Kingdom and Germany. The MORE2 study sketches a similar view. Here, too, the Netherlands is third when it comes to emigration numbers of researchers, and again, the United States, the United Kingdom and Germany top the list of popular destinations.

²⁴ Data from before 2006 is not available.

²⁵ European Commission (2014b).

²⁶ Not all countries keep track of the nationalities of incoming scientific personnel and PhD candidates, so no clear image can be outlined for emigration from the Netherlands (Richters and Kolster, 2013). Some information can be deduced from the GlobSci and MORE2 studies. These are, as far as we know, the most comprehensive studies on both incoming and outgoing researchers in which the Netherlands is included. The survey on which the GlobSci study is based covers articles published in 2009 in four scientific fields, in 16 countries (Franzoni, Scellato and Stephan, 2012). The MORE2 study was based on a survey by the European Commission, held between 2011 and 2013 among 10,000 researchers working in the EU, and 4,000 outside the EU (MORE2, 2013).

²⁷ Franzoni, Scellato and Stephan (2012).

Table 7 Origin and destinations of researchers in or from the Netherlands

Source	Immigration <i>Top 3 countries of origin</i>			Emigration <i>Top 3 destinations</i>		
GlobSci survey	Germany (14,6%)	Italy (12,5%)	N/A	United States (22,9%)	United Kingdom (19,5%)	Germany (18,8%)
MORE2 study	Germany (11,3%)	Belgium (8,1%)	Greece (8,1%)	United States (24,5%)	United Kingdom (9,1%)	Germany (8,2%)
Marie Curie Actions	Italy (11,2%)	Germany (10,3%)	Spain (8,2%)	United Kingdom (24,6%)	Germany (10,5%)	Belgium (7,2%)

Source: GlobSci survey (Franzoni, Scellato & Stephan, 2012), MORE2 (2013), data Marie Curie Actions, made available by RVO National Contact Point Marie Skłodowska-Curie Actions.

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5.2 Policy instruments for inter-EU mobility

The European Charter for Researchers is a set of principles and requirements drafted by the EU, in which the value of researcher mobility is acknowledged, and instruments are promoted to achieve this goal. The Charter is signed by the Association of Universities in the Netherlands (VSNU) and other research institutions in the Netherlands.

The EU has three instruments to promote international collaboration and the mobility mentioned above: Money Follows Researcher, Money Follow Co-operation Line and the Lead Agency Procedure.²⁸ Through the Money Follows Researcher Scheme, researchers who have acquired a position at another European research institution can transfer what is left of their nationally awarded grants abroad. The Money Follows Co-operation Line scheme makes it possible for researchers to spend part of their grant on collaboration with researchers from other EU countries. The Lead Agency Procedure is designed to reduce bureaucracy, requiring only one of the countries in an international collaboration to perform the evaluation. ERC grants may also be taken to other EU countries.

The EU is also working towards greater clarity in migration conditions for researchers. A European visa for knowledge workers (the blue card) is in development, for example, as is a pan-European pension fund for researchers (RESAVER).²⁹

Euraxess, an online platform intended to foster mobility among researchers, is a European Commission initiative, part of the Horizon 2020 programme component 'Science with and for Society'. Using this platform, research institutions can publish their vacancies internationally, and researchers from all over Europe can search for jobs abroad. Support for, and information about a possible move abroad is also provided. The Netherlands is well represented here: in 2013, 153.3 vacancies were advertised per 1000 researchers, compared with a European average of 43.7.³⁰

Another Horizon 2020 initiative is ERA Chairs, under the programme component 'Spreading Excellence and Widening Participation'. ERA Chairs provides universities with the opportunity to invite highly regarded researchers from abroad to work on research projects for several months. This scheme is aimed only at countries which joined the EU after 2004. However, Dutch researchers are eligible to be invited abroad to collaborate on projects.³¹

Marie Skłodowska-Curie Actions

²⁸ Science Europe (2014).

²⁹ AWT (2011), European Commission (2014b).

³⁰ European Commission (2014b).

³¹ For more information on this arrangement, see http://ec.europa.eu/research/era/era-chairs_en.html.

In addition to these schemes, there are the Marie Skłodowska-Curie Actions (MSCA), promoting the exchange of researchers within Europe. During FP7, 1182 Dutch researchers were funded by the MSCA to the sum of € 319.9 million. 793 of these researchers received a grant, of which 629 used this grant to work abroad.³² 1,504 foreign researchers came to the Netherlands with a MSCA-grant. The largest share comes from Italy (186 researchers), followed by Germany (171) and Spain (136). Dutch researchers moving abroad went to the United Kingdom (195), Germany (83) and Belgium (57) (see also Table 10).

Textbox 2 National initiatives to promote mobility

There are also programmes at the national level to promote international mobility and collaboration among researchers, such as the NWO subsidies Rubicon and the Bezoekersbeurs ('Visitors Grant'). A Rubicon grant enables recently-promoted scientists to gain experience at a research institute abroad. The aim of the Bezoekersbeurs is to stimulate collaboration between Dutch and foreign researchers. Foreign researchers that can make a significant contribution to an existing research project are invited to join the project for several months.

Bilateral initiatives are also in place to promote exchange between Dutch researchers and those from other countries including Belgium, Germany, China, Japan, India and South Korea.

5.3 Summary

International mobility is on the increase in the world of science, both within the EU and beyond. Proximity is an important factor: for the Netherlands, neighbouring countries are both a main supplier and a favourite destination for researchers. To realise the ambition of free circulation of researchers within the ERA, the EU has introduced a diverse range of policy instruments. In addition, a pan-European visa and pension fund for researchers are in development.

³² Funding was spent on research grants but also on events for researchers. All researchers who benefitted from MSCA funding have been included in the total of 1,182 (European Commission, 2015c).

Appendix 1 Other European research funds

European Regional Development Fund (ERDF)

Besides the Framework Programmes, the EU has five structural and investment funds to promote intra-EU collaboration. The European Regional Development Fund (ERDF) is the largest in terms of budget and it is also the most important for research funding. The main goal of the ERDF is to level out the economic differences between European regions. The fund is aimed therefore mainly at the less well-developed regions in Europe. The more developed regions mostly use the fund to reinforce their competitiveness and employment. The ERDF has four priorities for the period 2014-2020:

1. Innovation and research
2. The digital agenda
3. Support for small and medium-sized enterprises (SMEs)
4. The low-carbon economy

For the implementation of the ERDF programmes, the Netherlands is in receipt of € 507 million for the period 2014-2020. The government and other parties involved are required to match this sum with co-funding. ERDF funding is allocated at the regional level (the North, West, East and South Netherlands).

European Fund for Strategic Investments (EFSI)

On 1 September 2015, the European Fund for Strategic Investments (EFSI) became operational. This fund's goal is to promote, by way of targeted investments, the structural economic growth of the EU. It is used for investments in the areas of infrastructure, research, sustainability and SMEs – sectors that are expected to fuel overall economic growth. The budget of over € 300 million is publicly funded in part, but the largest share will have to come from the private sector. A central role here is given to the European Investment Bank (EIB); the EFSI is not actually a fund, but rather a guarantee on funding given by the EIB.

Appendix 2 International collaboration of Dutch authors in scientific publications

Table 8 International collaboration of Dutch authors in scientific publications from FP1 until FP7

	FP1	FP2	FP3	FP4	FP5	FP6	FP7
Average annual publications of authors with Dutch affiliation according to the Web of Science	10,177	12,068	15,596	20,923	22,434	25,970	36,221
Dutch international co-publications (% of all publications)	18	21	24	29	37	43	50
Collaboration with EU28 member states (% of international publications)							
United Kingdom	16	16	17	18	20	21	24
Germany	17	17	18	18	19	21	24
France	10	10	11	12	11	12	13
Belgium	9	9	10	10	10	10	12
Italy	6	6	8	9	10	10	12
Spain	2	2	4	5	6	7	9
Sweden	4	4	4	5	5	5	7
Denmark	3	2	3	4	4	4	5
Austria	2	2	2	2	3	3	4
Finland	1	2	2	3	3	3	3
Poland	2	3	3	3	2	2	3
Greece	0	1	1	1	2	2	3
Ireland	1	1	1	1	1	2	2
Portugal	0	0	1	2	2	2	2
Czech Republic	1	1	1	2	2	2	2
Hungary	1	1	1	1	2	1	2
Romania	0	0	0	1	1	1	1
Slovenia	0	0	0	1	1	1	1
Slovakia	0	0	0	1	1	0	1
Croatia	0	0	0	0	0	0	1
Bulgaria	0	0	0	0	1	0	0
Estonia	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0
EU28	59	60	62	64	65	67	69
Collaboration with reference countries (% of international publications)							
Switzerland	5	5	6	6	6	6	7
Norway	1	1	2	2	2	3	4
United States	33	30	30	30	29	29	30
China	1	1	1	1	2	3	5

Source: Web of Science.

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Note: The figure is based on data on all citable publications (articles, proceedings papers, notes, letters, reviews) in five citation indexes of the Web of Science (see Note 21, p.19). This data is corrected for variations in spelling of country names in the Web of Science.

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Closing remarks

This sixteenth edition of the Rathenau Instituut series 'Facts & Figures' (*Feiten & Cijfers*) provides factual information on the position of scientific research in the Netherlands, in the European Research Area.

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Colophon

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March 2016

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Preferred citation:

Dorst, H., J. Deuten & E. Horlings, *The Dutch science system in the European Research Area*, The Hague, Rathenau Instituut, 2016

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