

The Dutch science system in the European Research Area *Or: the Europeanization of the Dutch science system?*

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Abstract

This paper assesses the significance of EU science policy for the Dutch science system, with a special focus on the European Research Area and the EU Framework Programmes. The Dutch science system is increasingly intertwined with that of the EU. The EU has become more than just a funding opportunity for researchers: it is now gaining influence in agenda-setting, organizing and valorizing research as well. As the EU science policy budget and the Dutch share in it continue to grow, so too does the impact of EU research policy on Dutch choices in policy and allocation of funding.

Introduction

Over the last decades, the practice of science has become an international affair. Science policy and funding has nevertheless long been a matter for national governments. In the Netherlands the national government is still the main funder of scientific research. However, the EU is increasingly active in this area, and with the newest Framework Programme (FP) Horizon 2020 the European budget for research steadily grows.

But Europe is more than just an extra funding opportunity for researchers. It is gaining influence in agenda-setting, programming, organizing, implementing and valorising research as well. An increasing number of policy instruments is aimed at strengthening Europe’s science base, through inter-European competition and cooperation. The EU’s goal of a unified European Research Area in which researchers and knowledge can circulate freely is central to this development.

The main question I will investigate in this paper is: how does the changing European science policy affect the Dutch science system? Or: is the Dutch science system ‘Europeanizing’?

In order to compose an answer to this question, literature on the development of the European Research Area (ERA), documents on different collaboration types and European policy and quantitative data on publications and ERA-networks have been analysed.¹

In this paper, I will first touch briefly on the formation of the ERA. In the subsequent section two dimensions of the Dutch participation in the international context of the ERA are examined: firstly, the involvement of the Netherlands in the Framework Programmes and several ERA instruments and secondly, the international collaborative links between Dutch and European researchers in FP networks and co-publications.

The development of a European Research Area

The development of European science policy was fuelled by the need for renewed, large(r) research facilities and the overall European integration after the devastation of the Second World War. Early on, the focus lay on industrial research and technical development, to promote economic growth and to compete with economically strong regions like the United States and Japan. Co-ordinating the cooperation between member states was a second focus, rooted in the European principle of subsidiarity, which states that the EU only acts in areas where actions on a national scale would be insufficient. Responsibility for fundamental science lay with nation states (Nedeva & Stampfer, 2012).

Simultaneously, multinational agreements were made on large-scale, field-specific research infrastructures (Chou & Gornitzka, 2014; Nedeva & Stampfer, 2012). In 1945, CERN (the European Organisation for Nuclear Research) was created to organise structural research on an international scale. Other examples on intergovernmental research facilities or organisations aimed at specific scientific fields were the European Southern Observatory (ESO, est. 1962), the European Molecular Biology Laboratory (EMBL, est. 1974) and the European Space Agency (ESA, est. 1975).

In addition several organisations aimed at intergovernmental research cooperation were initiated, such as COST (est. 1971), the European organisation for science and technology, and EUREKA (est. 1985), a European network for industrial research and development.

A shift in the European organisation of science took place towards the end of the 20th century. The notion of the value of inter-EU competition to spur on research excellence surfaced, and was incorporated in EU science policy. In addition, the idea of a unified, open market place for research within Europe, to further integration and enhance quality and the competitiveness of Europe as a whole entered EU science policy (Nedeva & Stampfer, 2012). In 2000 the European Research Area (ERA) was founded, comprising all EU member states and thirteen associated countries (European Commission, 2014a).

With the founding of the ERA, the European research policy focus broadened from boosting applied science and setting the stage for nations to carry out their research policies, to include advancing fundamental science and excellence, improving quality and excellence through competition, and enhancing integration by encouraging networked projects of several member states. Besides this,

¹ This paper is based on research on the connections between the Dutch science system and the ERA conducted over the last year at the Rathenau Institute by Jasper Deuten, Edwin Horlings and me (Dorst, Deuten, & Horlings, 2016). Many of the research results mentioned in this paper thus originate from this publication.

policy emphasis shifted from coordinating intergovernmental cooperation to promoting the adjustment of national policies to a European research agenda (Chou, 2014).

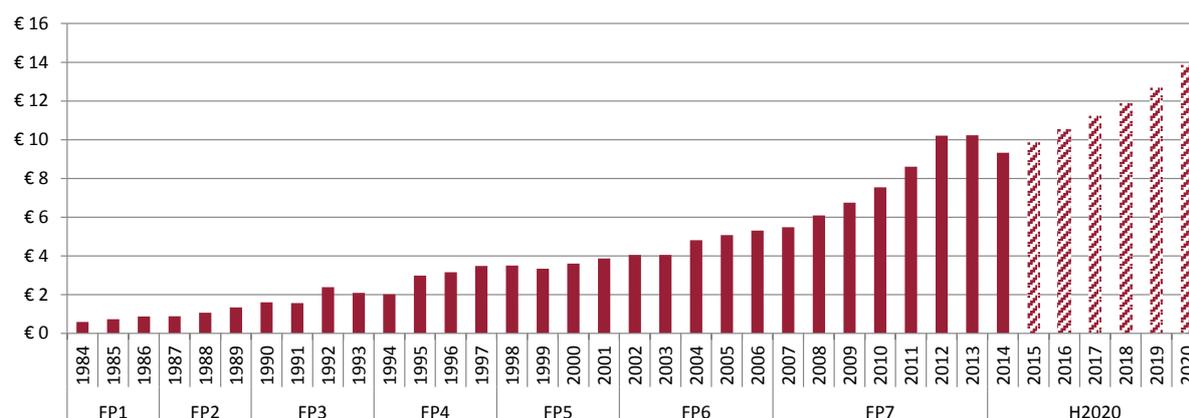
The main EU instrument to fund research is the Framework Programme (FP). The first FP was initiated in 1984. The current version, running from 2014 to 2020 is called Horizon 2020. However, after the founding of the ERA several EU research policy instruments followed to accompany the Framework Programme. Some examples:

- Instruments were put in place to promote partnerships on specific research areas, both public-public (ERA-NETS (in 2002), Joint Programming Initiatives (in 2006) and Article 185 (in 2003) Initiatives) and public-private (European Technology Platforms (2005) and Joint Technology Initiatives (in 2007)).
- In 2006 the ESFRI Roadmap was launched, which the EU uses to support the prioritization of national science funds for designated large-scale research infrastructures (ESFRI, 2011).
- A year later, in 2007, the European Research Council (ERC) was founded. Through this council, the EU for the first time started funding basic, ‘frontier’ research done by individual researchers directly, through various types of grants (Nedeva & Stampfer, 2012).
- Future and Emerging Technologies (FETs) were also founded in 2007 to support “frontier research and innovation with a high potential impact on technology” through open calls, thematic calls and multi-year, large-scale themed projects (European Commission, 2015c).
- In 2008 the European Institute of Innovation and Technology (EIT) was established, aiming to bring together higher education, research and business by supporting thematic Knowledge and Innovation Communities (KICs).

Horizon 2020

Horizon 2020, has a budget of nearly €80 billion and a time span of seven years stretching to 2020. As can be seen in Figure 1, FP budgets have grown steadily throughout the decades.

Figure 1 Framework Programme budgets, in billion €



Source: (European Commission, 2015a; d)

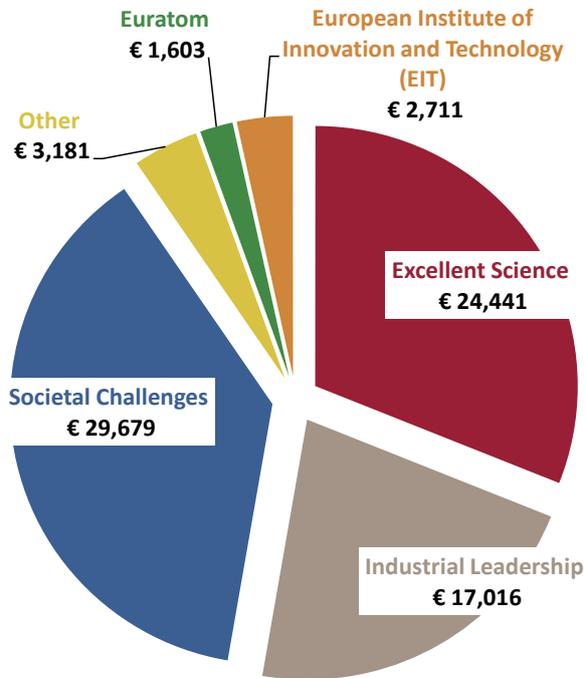
The Horizon 2020 budget is mainly divided over three pillars (see Figure 2), in which the focal points of EU policy are visible:

- *Excellent science*, to ensure that European scientific research is world-class, attracts the best researchers and offers access to high quality research infrastructure
- *Industrial leadership*, to attract business investments in European research and innovation

- *Societal challenges*, to encourage an integral, multidisciplinary approach to finding solutions for societal challenges

The remaining funding goes to the EIT, Euratom, the EU's Joint Research Centre (JRC) and a few smaller research policy goals.²

Figure 2 Division of Horizon 2020 budget, in million €



Source: (European Commission, 2013)

The budget is disseminated chiefly via competition through various so-called ‘actions’. These actions are aimed either at individual researchers and research groups or at multinational consortia of researchers, policy makers and industry (often but not always combined). Table 1 gives insight into the differences between these actions (the list is not exhaustive, and action types change throughout FPs).

² A more extensive overview of the various program sections of Horizon 2020 can be found at <https://ec.europa.eu/programmes/horizon2020/en/h2020-sections>.

Table 1 Horizon 2020 actions and co-fund actions

Actions for researchers	Co-fund actions for policy makers, research financiers, programme managers et cetera
<i>Research & Innovation actions</i> for research projects by multinational consortia.	<i>MSCA co-fund actions</i> for co-funding fellowships or doctoral programmes that include transnational mobility.
<i>Innovation actions</i> for innovation projects by multinational consortia.	Public-public partnerships, such as <i>ERA-NET co-funds</i> and <i>Joint Programming Initiatives (JPIs)</i> , with co-funding by the European Commission for transnational calls for proposals. Additionally, although not technically co-fund actions, <i>Article 185 initiatives</i> enable the EU to join existing multinational public-public partnerships.
<i>Coordination & Support actions</i> for other projects in the areas of standardisation, dissemination, awareness and communication, networking, coordination and support services, policy dialogue and activities and studies geared towards sharing knowledge and expertise.	Public-private partnerships, such as <i>Joint Technology Initiatives (JTIs)</i> , long-term partnerships with the status of Joint Undertaking, meaning they function as independent legal entities with their own staff and budget.
<i>Marie Skłodowska-Curie actions (MSCA)</i> to promote researcher mobility in the context of career and training.	
<i>ERC grants</i> to support excellent researchers who conduct ground-breaking research.	

Source: (European Commission, 2014; 2016)

The Netherlands in the European Research Area

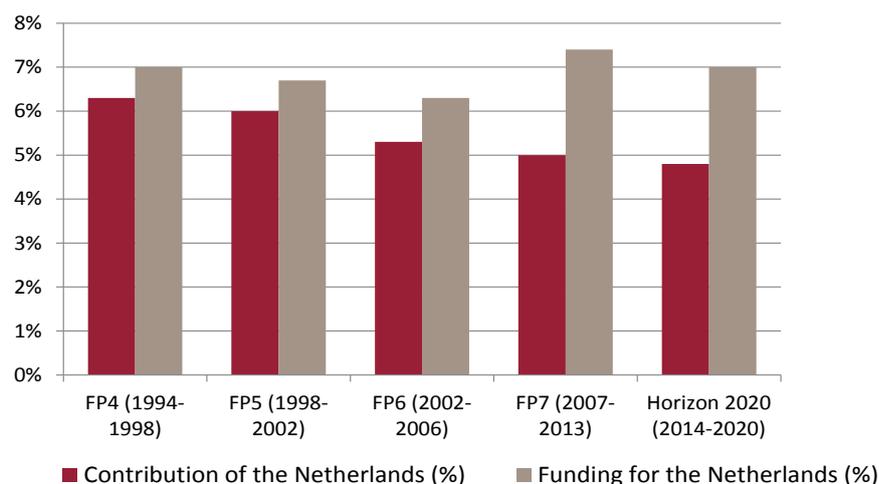
The following section describes to what extent Dutch participants (researchers, policy makers or companies) are involved in Horizon 2020 and in important ERA instruments.

The Netherlands' share in Horizon 2020

The budget of the eight FPs has been steadily increasing, and the number of participating member states has also grown during these years. The percentage of FP-projects with Dutch participants fluctuated around 20% during the consecutive FPs. The share of FP-projects with a Dutch coordinator also kept steady, between 5% and 10% (Dorst, Deuten, & Horlings, 2016).

The active participation in FP-projects is reflected in the flow of European funding to the Netherlands. The Dutch contribution to the EU-budget has become lower than its returns, as is seen in Figure 3. Dutch participants have a relatively high success rate in the European competition for research funding (European Commission, 2015e). In FP7, the Dutch received 7,4% of the EU budget, which is around €3.4 billion (Ministry of Education, Culture and Science, 2014). 51% of this budget was allocated to higher education institutions, 22% to private sector R&D, 21% to research institutes and 6% to other parties (Van Steen, 2015).

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



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.

Source: Senter, 2006; SenterNovem, 2006; Van Steen, 2015

In addition, EU funding for the Netherlands has risen relative to national funding – FP funding now accounts for 15% of the total of public research funding in the Netherlands, as can be deduced from Figure 4. The EU thus has become an increasingly significant funder of Dutch research.

Figure 4 Dutch public research funding: national from the EU



Note: Figures from 2015 onwards are based on estimates.

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.

In practice, the impact of EU funding is even greater due to its influence on the allocation of national research funding budgets. Co-funding of European FP-cooperation is often, if not always, obligated

and some multinational ERA-networks are meant to be funded entirely by participating nation states rather than the EU. Part of the Dutch research budget is thus used to co-fund European projects, but also to stimulate European collaboration³ and to fund international research infrastructures. As the Netherlands is often involved in EU-projects, the EU therefore more or less automatically gains a stronger hold on the thematic focus of Dutch research funding.

Dutch participants in ERA instruments

Public-public partnerships such as ERA-NETs, Joint Programming Initiatives (JPIs) and article 185 Initiatives are particularly popular with Dutch participants. Most public-private partnerships such as Joint Technology Initiatives (JTIs) and Knowledge and Innovation Clusters (KICs) from the European institute for Innovation and Technology (EIT) also have one or more Dutch partners. Table 2 gives an overview of Dutch participation in the various ERA instruments.

Table 2 Dutch participation in ERA instruments

Instrument	Dutch participation ⁴
ERC	Since the start of the ERC in 2007, 496 of the +5,400 ERC grants have been awarded to Dutch researchers. ⁵
MSCA	Of the 52,639 researchers that were supported with MSCA funding during FP7, 1,128 (2%) were from the Netherlands. ⁶
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 2 - 8 projects in FET-proactive, of which the Netherlands coordinates 1 - both FET Flagship projects
COST	The Netherlands participates in 700 out of 1,172 COST projects currently running (60%), and coordinates 39.
EUREKA	The Netherlands currently participates in: <ul style="list-style-type: none"> - 661 of 3557 EUREKA projects (18.6%) - 6 of 8 EUREKA clusters - 1 of 4 EUREKA umbrellas - Eurostars (a JPI of EUREKA and the EU)

³ According to the ERA Facts and Figures 2014 (European Commission, 2014), 11.3% of Dutch research funds are allocated to programmes for transnationally coordinated R&D, 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.

⁴ 'The Netherlands' here means the participation of Dutch partners in projects, or in the case of grants, individual Dutch researchers.

⁵ 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 (European Commission, 2015b).

⁶ These grants are also rewarded to researchers outside the EU.

EIT	The Netherlands participates in all 5 KICs
Public-public partnerships	The Netherlands participates in: <ul style="list-style-type: none"> - 137 of 192 ERA-NETs (over 70%) - 8 of 9 Article 185 initiatives - all 10 Joint Programming Initiatives (JPIs), and coordinates 1
Public-private partnerships	The Netherlands participates in: <ul style="list-style-type: none"> - all 6 Joint Technology Initiatives (JTIs) - at least 37 of the 41 European Technology Platforms (ETPs)

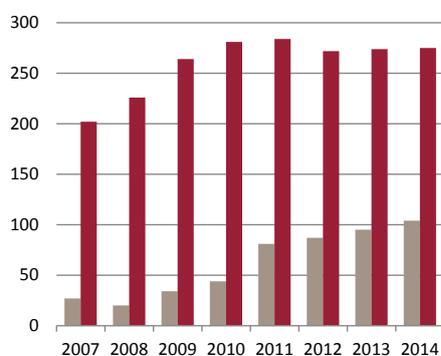
Source: European Commission, 2014b; Ministry of Education, Culture and Science, 2014; European Commission, 2015b; Nether, 2015; CORDIS database; COST Country Info

In individual competition for ERC grants the Dutch perform well, being awarded with 9% of the ERC-budget since the start of the ERC in 2007 (European Commission, 2015b). The Dutch science funding institute NWO⁷ also allocates grants at the national level through an equivalent instrument, the *Vernieuwingsimpuls* (VI). In Figures 5.1 and 5.2 these grants are compared in budget and number. Three things become apparent. First, the number of ERC grants has increased relative to the number of VI grants – from 8 VI grants for every ERC grant in 2007 to 2.5 VI grants for every ERC grant in 2014. Second, the total budget the ERC allocated to Dutch researchers grew considerably. And third, as of 2013 the budget allocated to Dutch researchers by the ERC has outgrown that of the VI.

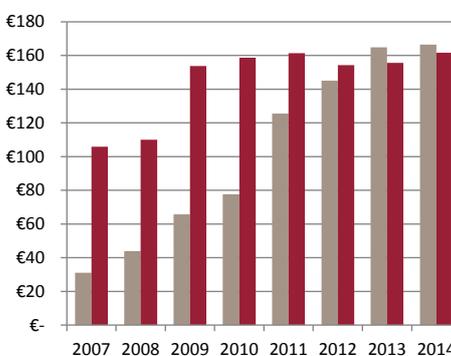
Figure 5.1 Number of ERC and VI grants

Figure 5.2 Budget of ERC and VI grants allocated

for Dutch researchers



to Dutch researchers, in million €



■ ERC ■ Vernieuwingsimpuls

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

In addition, Dutch researchers and research organizations are affiliated with many of the European large-scale research facilities, such as CERN, ESA and ESO. These large-scale research infrastructures originate from intergovernmental agreements, but as stated earlier, in 2006 the EU has started the promotion of EU-shared facilities by establishing a European Strategy Forum on Research Infrastructures (ESFRI) Roadmap (ESFRI, 2011). Through this Roadmap, national research funds are prioritized towards EU-defined infrastructure projects in the construction phase. The Dutch national

⁷ NWO (*Nederlandse Organisatie voor Wetenschappelijk Onderzoek* or The Netherlands Organisation for Scientific Research) is the main Dutch research funder, funded by the national government.

(NWO) roadmap, which prioritizes national funding for large-scale research infrastructures, largely follows the ESFRI Roadmap (NWO, 2015a).

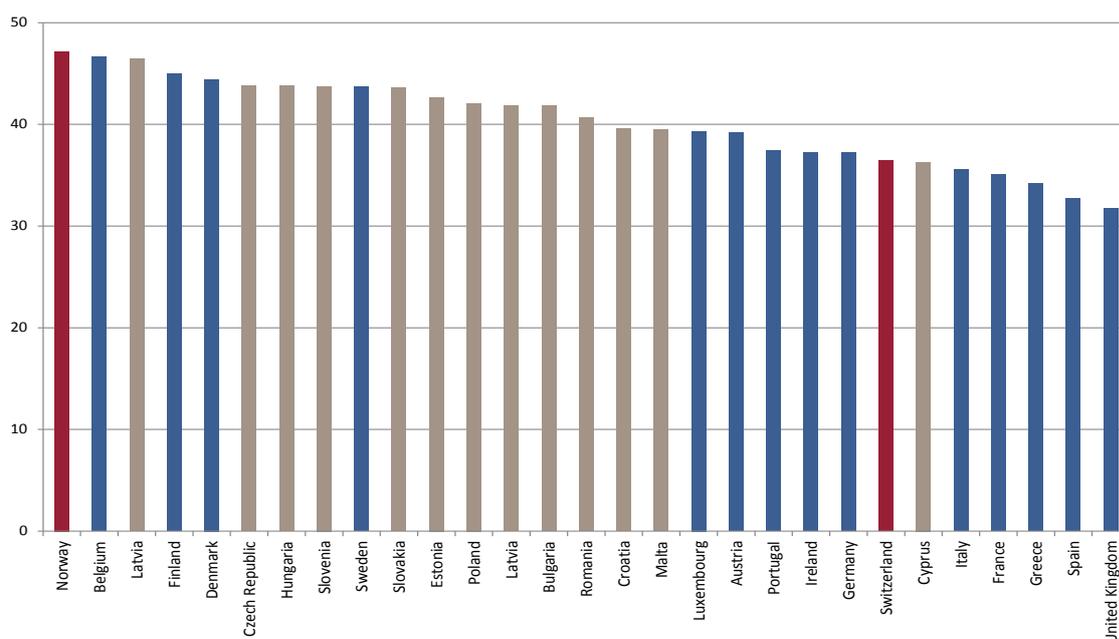
European collaboration

As shown in the previous section, Dutch participation in EU-projects has increased over the last decades. To give an impression of the progress in creating an actual integrated European Research Area, it has been analysed (by Edwin Horlings, in Dorst, Deuten and Horlings, 2016) with which European partners Dutch researchers work together and which partners they favour in FP-projects. To broaden that impression to a scope wider than Europe, collaborative links in international co-publications have also been analysed.

Collaboration in Framework programme networks

International cooperation in research is increasing across the EU, and likewise in the Netherlands. Figure 6 shows that in over 30% of the projects of each country participating in FP7, a Dutch partner is involved. Projects with partners from Scandinavian countries, Belgium, Germany and newer member states have the highest share of Dutch partners.

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



Note: Blue = EU-15, Grey = EU-28 excl. EU-15, Red = Associated states.

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

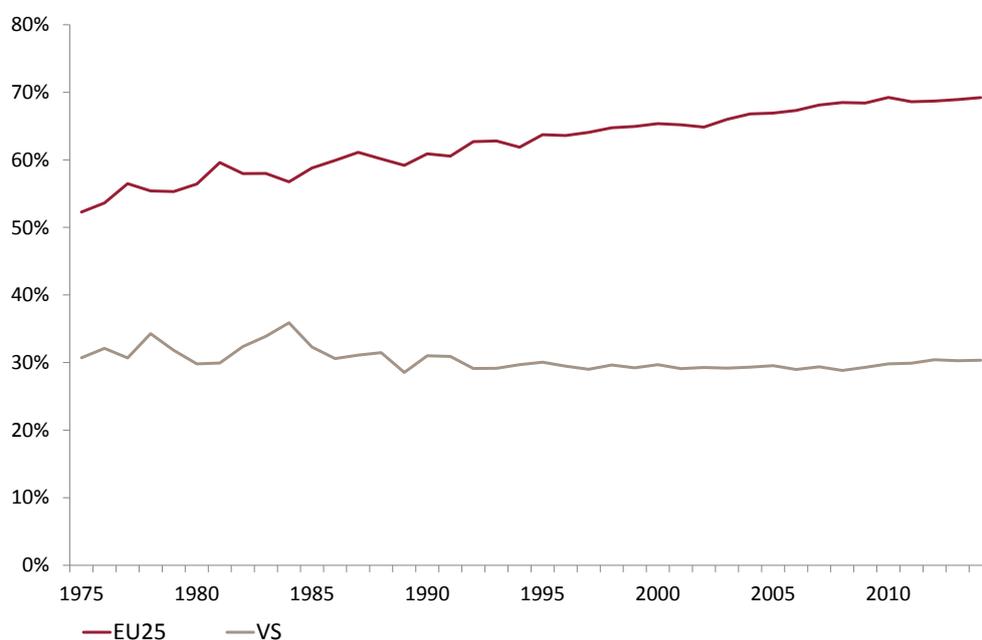
An analysis of the entire network of collaborative links in FP4 and FP7 projects shows the Netherlands to be in a core cluster with 14 of the EU-15 countries plus Norway and Switzerland in FP4 and in a smaller cluster with Germany, France, Italy, Belgium, Switzerland and Austria in FP7. With these countries the number of collaborative links is highest. This might have to do with the fact that these countries partake in the most FP-project compared to other EU countries. That would automatically lead to a higher number of projects with a Dutch partner. Corrected for the number of

projects each country participates in⁸, a different view is revealed. Dutch partners seem to favour working with their neighbours Belgium and Germany, and Scandinavian partners (Denmark, Norway, Sweden and Finland).

Collaboration in publications

The analysis of cooperation in publications shows a similar story. Where the share of Dutch publications in international cooperation is 13% of all Dutch publications in 1975, this has grown to 58% in 2014.⁹ And although the United States has always been an important publication partner for Dutch researchers, the share of publications with US-authors stays stable around 30% throughout the last four decades. The share of publications with EU-member states, however, increases during these years, from around 50% to 70%. This comparison between the US and the EU is shown in Figure 7.

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



Note: The figure is based on data on all citable publications of the Web of Science (see Note 9, p.10).

Source: Web of Science.

If these numbers are once again corrected for the number of publications by researchers in these countries, a preference for EU-15 countries, Switzerland and Norway emerges.

A comparison of Dutch preferences

Both in FP-projects and in publications, Dutch partners display a preference for their neighbouring countries Germany, Belgium and Scandinavian countries. The revealed preference for other

⁸ This correction for the magnitude in terms of numbers of projects has been analysed with 'odds ratios', which show the revealed preference of two countries for working together.

⁹ Based on citable publications (articles, proceedings papers, notes, letters, reviews) in five citation indexes registered in the Web of Science. The 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.

countries in the core of the collaborative cluster - the United Kingdom, France, Spain, Portugal, Greece and Ireland - is remarkably lower.

Dutch partners show a low revealed preference for working with associated countries, except for Norway and Switzerland. For Norway, preferences are high both in FP networks as in publications, while for Switzerland this only holds for publications.

For Eastern European countries this works the other way around. There is no high preference for working together in publications, but there is for collaboration in FP projects: here the preference for working together is three to four times higher. This might be caused by the promotion of multinational collaboration by the FP programmes of the EU.

All in all, the ERA does not yet seem to be a tightly knit research system with evenly spread collaborative networks. But the higher number of collaborative links between Dutch researchers and newer member states relative to the preferences in publications seem to indicate the recent FPs' promotion of collaboration within the ERA has its effects.

Concluding remarks

Overall, from the Dutch perspective Europe seems to become an increasingly important context for the science system. The EU hopes to enhance an open, integrated European science system with the idea of the ERA, and within this system promotes competition (as a perceived way to boost quality) as well as cooperation (so as to intensify integration). The Dutch do relatively well in competing for EU- research funds and cooperation in ERA-networks, and following this track the Dutch research focus complies increasingly to European societal and economic research goals. This seems logical as not only EU science policy grows both in budget and substantial focus, therewith endeavouring to coordinate its member states, but the Dutch science system is becoming more and more entangled internationally and especially with its European neighbours.

Horizon 2020 is the most significant source of funding in the ERA and with a budget of € 78.6 billion, it is the largest FP to date. EU funding has also increased relative to Dutch national funding; it now represents 15% of public funding of Dutch research. In general, the financial significance of Europe for the Dutch science system has risen, 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 in FP7 were above EU average. As this growing European research budget requires co-funding by governments, the private sector and other funding applicants in almost all programmes, its impact on the allocation of national budgets for scientific research increases.

The Dutch actively participate in a wide range of ERA instruments. They are especially well represented in public-public partnerships, such as ERA-NETs, JPIs and Article 185 initiatives, and in several public-private partnerships, such as JTIs and ETPs. The ERC is another significant source of funding for Dutch research. ERC grants have now outgrown their Dutch equivalent (the *Vernieuwingsimpulsbeurzen*) in terms of budget allocated to Dutch researchers. In addition, the Netherlands is involved in various multi-national research facilities and European (ESFRI) projects. The Dutch Roadmap for research infrastructures largely follows the ESFRI Roadmap.

The analysis of international collaboration in FPs shows that the Netherlands is at the core of the EU collaborations network – the highest number of collaborative links are with several of the ‘oldest’ EU members and each country taking part in FP7 has at least one Dutch partner in over 30% of its projects. An analysis of international co-publications demonstrates that while the degree of collaboration with partners from the US has remained stable, the degree of international collaboration with EU partners has increased. When this analysis is corrected for country magnitude, it appears that the Dutch have a revealed preference for collaboration with partners from neighbouring countries Belgium and Germany and with Scandinavian countries both in FP7 projects and in international co-publications.

All in all, the ERA does not seem to be an evenly spread collaborative research system just yet, but the rise of EU research budget, number of European networking programmes and policy promotion of internationalisation certainly seem to encourage the Europeanisation of the Dutch science system.

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