From the complete publication:

RIO Country Report 2015: Finland

Chapter:

4. Quality of science base and priorities of the European Research Area

Kimmo Halme
Veli-Pekka Saarnivaara
Jessica Mitchell

2016
The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.
4. Quality of science base and priorities of the European Research Area

The Finnish R&I system is active and has a long track record in addressing ERA priorities as discussed in connection with the national challenges. However, there also is a clear need for further development. For a small country with limited resources, the European dimension is seen as a logical extension of the national policy. In its recommendations for 2015–2020, the Research and Innovation Policy Council stated that Finland is a proactive partner in the European research and innovation policy.

4.1 Quality of the science base

The Academy of Finland publishes every few years a thorough assessment of the state of scientific research in Finland. The latest report, *The State of Scientific Research 2014* concludes that Finland’s position in the scientific world community has remained fairly unchanged throughout the 2000s. At the same time, however, many other countries have picked up speed and are now making strides forward. Finland ranks just above the average but is behind the other Nordic countries, and the gap to the top performers seems to be growing. According to the report, Finnish science is in danger of falling further behind. It notes that Finnish universities and research organisations will have to make an increasing number of strategic choices, focus on their strengths and step up collaboration, and invest in new initiatives that might emerge thereafter. The disciplines hosted by Finnish universities are often quite small, and the same disciplines may be represented at several universities at the same time. The number of publications in Finland grew steadily in the 2000s. During the years 2009–2012 the number of publications grew up to 28,000 (publications by researchers working in Finland). The Web of Science (WoS) top 10 index is 1.04. The number of researchers at the very top of their field remains low in Finland. Finland needs more high-quality, leading-edge research. Regarding the importance of internationalising research, it is important to note that according to the bibliometric results of the Academy’s report international cooperation increased the impact of the research significantly.

Finnish universities in general do not fare so well in international comparisons. The only Finnish university ranked in the top-100 of the Shanghai ranking in 2014 was the University of Helsinki (67th). In 2015, Helsinki University was for the first time ranked amongst the 100 best universities (73rd) also in the Times Higher Education World University Ranking. Also OECD STI Outlook ranks Finland among the top-5 based on the top-500 universities (per GDP). However, most Finnish universities reach a mid-table ranking in the international university rankings partly due to international excellence being focused on few fields, and also due to the small size of universities. The regional policies of Finland may have also affected the level of science in several Finnish universities: several are established in remote locations based more on equal regional policy than actual demand. Student–teacher ratios are lower in Finland than in the top universities of the world. Finally, Finnish universities used to offer only few regular postdoc vacancies but the new tenure track system will probably change this.

The quality of research and its efficient use in society is linked with the structure of the research system. According to the international evaluation of the Finnish research and innovation system (MEE & MEC, 2009) the Finnish higher education and public research system is fragmented, which makes it more difficult to focus resources and to provide high-level research. According to the evaluation the system can be seen as fragmented in three dimensions. Firstly, resources are scattered in three different types of organisations with overlapping tasks – universities, polytechnics and public research organisations (PROs).

---

1 During 2000-2012 the report was published every third year, and since 2014 every second year.
Secondly, these institutions are scattered around the country with several rather small units. Thirdly, the universities have been internally fragmented in several rather small units.

In total, there are 14 universities in Finland that conduct research in 54 fields of science that further are divided into 297 units. From these 54 fields 27 are represented in six or more universities. The level of research was not clearly above the world average in any of these 27 fields (top 10 index > 1.15). Therefore, there is a clear need to prioritise and make strong strategic choices to decrease fragmentation and aim at increasing the critical mass. There are 26 polytechnics (also known as Universities of Applied Sciences), and 12 public research institutes, which also have several regional extents.

According to a recent study by the Ministry of Education and Science, the Finnish universities produced on average 37,000 publications between 2011 and 2012, generating 51,400 publication scores. Altogether 19,800 authors were involved in producing these publications, resulting in an average publication score of 2.6 per author. The volume of World of Science publications in universities has increased from just over 14,000 between 2000 and 2003 to 18,400 between 2009 and 2012. The citation index rate is back to the same level as in the early 2000s (1.08). Despite the rise in the citation index, Finland’s ranking between the OECD countries has deteriorated.²

<table>
<thead>
<tr>
<th>Table 1 Basic indicators for the scientific performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
</tr>
<tr>
<td>Number of publications per thousand of population (2013)</td>
</tr>
<tr>
<td>Share of international co-publications (2013)</td>
</tr>
<tr>
<td>Number of international publications per thousand of population (2013)</td>
</tr>
<tr>
<td>Percentage of publications in the top 10% most cited publications (2000)</td>
</tr>
<tr>
<td>Share of public-private co-publications (2011-2013)</td>
</tr>
</tbody>
</table>

Although the Finnish universities’ ranking is fairly low, the position of Finnish research in international comparison is reasonably good and stable. At the same time, Finland has a strong history in investing into education and science, which should also be reflected in these numbers. Finnish contribution to world science remains limited simply due to the small size of its population and research community. There are also a number of areas in the Finnish research system that would require further development and strengthening. Typical challenges are those related to fragmentation into many small universities and research units that lack sharp focus and benefits of scale. Recently introduced government budget cuts to higher education and research raise many concerns about the future trends of Finnish research.

² Productivity and impact of Finnish university research, Ministry of Education and Culture, 2015:5
4.2 Optimal transnational cooperation and competition

Given that Finland is a relatively small country, participation in cross-border joint initiatives has typically been valued high on the R&I agenda. Finland has participated in 45 ERA-NET networks as of 2013. Although there is no overarching legislation governing Finland’s participation in European research, the strategies of the main actors (funding organisations, HEIs, PROs) support selectively joint projects with partners in the other Member States.

The research agendas of EC and those of the other countries are taken into account when new programmes are prepared in Finland. In the case of Tekes and SHOK programmes also global market studies are made. Typically, Tekes programmes have a direct connection to European programmes and they prepare and support the programme participants to take part also in European programmes. Ex-post evaluation procedures are implemented in major programmes. Tekes implements both mid-term and ex-post evaluation processes in all of its programmes, funding instruments and funding concepts.

The new recommendation by the RIC recognises that Finland has not utilised the opportunities offered by European and other international research funding to a sufficient degree. It recommends increasing the participation in the EU Framework Programme by 50 % and creating a special funding instrument for planning international projects and preparing for FP projects.

Finland is well represented in the European cooperative research landscape, being a member of all major pan-European research organisations and infrastructures (like European Organisation for Nuclear Research CERN, European Molecular Biology Laboratory EMBL, European Space Agency ESA, European Organisation for Astronomical Research in the Southern Hemisphere, European Synchrotron Radiation Facility ESRF, ITER – International Thermonuclear Experimental Reactor, European Southern Observatory ESO, and GSI/FAIR – Facility for Antiproton and Ion Research).

4.2.1 Joint programming, research agendas and calls

At the European level, Joint Programming aims at building a common approach for addressing major societal challenges or opportunities through strengthening collaborative research and its funding amongst interested countries. Jointly coordinated actions are funded by pooling of national resources. Finland is currently participating in the following nine of the ten European Joint Programming Initiatives (JIs); of which the Academy of Finland is coordinating the Water JPI.

- Neurodegenerative Disease Research (JPND)
- Agriculture, food security and climate change (FACCE JPI)
- Healthy diet for a healthy life (JPI HDHL)
- More years, better lives (JPI MYBL)
- Connecting Climate Knowledge for Europe (JPI-Climate)
- Urban Europe: global changes – local solutions (JPI UE)
- Water challenges (Water JPI)
- Healthy and productive seas and oceans (JPI Oceans)
- Antimicrobials resistance (JPI-AMR)

Aside from European JPIs, the national research and innovation funding agencies have cooperation agreements with corresponding organisations in other countries: Tekes with Sweden, China, India, Russia and the US; the Academy of Finland with 16 countries. Moreover the funding agencies have launched focused initiatives to boost international cooperation. The funding criteria of Tekes and the Academy as well as HEI’s institutional
funding reward international cooperation. The Academy has earmarked funding for international projects whereas Tekes has not. The principle of Tekes has been that all the project applications compete against each other, and international projects have to succeed in this competition. However the funding criteria still reward for cooperative international projects.

Furthermore, R&I cooperation is intensive between Nordic countries. As an example Tekes co-funds innovation research with its Swedish sister organization VINNOVA under a joint programme.

According to statistics, the share of joint initiatives in Finland has been below the EU average. The latest available Eurostat data for Finland, however, shows an increase in the share of the public funding invested in transnational activities between 2010 and 2011: the amount of coordinated funding (which includes ESA contribution) more than doubled (EU, JRC 2013, ERA Communication Synthesis report).

The mandate for activating HEIs, PROs and enterprises to participate in international initiatives has been given to the funding agencies. Top-down joint calls and programmes are more common in scientific research but usually cooperative innovation is a bottom-up process that should not be dictated by external limitations.

Also the Finnish Strategic Centres for Science, Technology and Innovation (SHOKs) represent a kind of public-private joint programming approach led by the industry (see Chapter 1.2). The SHOKs have all a number of targeted collaborative research programmes including international cooperation. The mid-term evaluation of SHOKs in 2013 highlighted some programmes with very intense international collaboration.

In spring 2015, Team Finland launched its first cross-ministerial innovation programme, Business with Impact – BEAM. The programme is jointly funded by Tekes and Ministry for Foreign Affairs of Finland, with other Team Finland operators (such as Finnvera and Finpro) providing complementary services. With regard to the increasing the efficiency, performance and effectiveness of Team Finland, joint operations, such as common client process and coordinated evaluation system is being planned.

Finland is especially active in the Nordic research cooperation, now expanding to the Baltic States, and arctic research. Tekes is also involved in FIT (Finnish Israeli Technology), a joint programme between Finland and Israel for technology applications in different technology areas.

**4.2.2 RI roadmaps and ESFRI**

The first Finnish research infrastructure roadmap was published in 2009. A total of 24 major research infrastructure projects by national actors were selected for this roadmap. Of these, 13 formed part of European roadmap projects under the European Strategy Forum on Research Infrastructures (ESFRI). The 2009 roadmap and its recommendations resulted in a broader discussion of Finland’s research infrastructures.

The Finnish Research Infrastructure Committee (FIRI Committee) was appointed in 2012 by the Academy of Finland. FIRI Committee is in charge of developing Finnish research infrastructures and decides annually the allocation (approximately €18.5m in 2015) of governmental investments into national and international research infrastructures.

The committee made also recommendations on how Finland’s research infrastructure policy could be developed. Its key observations concerned the achievement of greater consensus and closer cooperation between ministries, funding agencies, universities and other research infrastructure host organisations, and the scientific community. Another important area of development was the opening up of national materials and registers for wider international use, for example, by stepping up the digitalisation of materials.

In March 2014, the FIRI Committee published Finland’s national research infrastructure strategy as well as the infrastructure roadmap for the years of 2014–2020 (FIRI Roadmap 2014-2017). The roadmap is a plan for key research infrastructures in Finland
that are either under development or that will be newly required over the next 10–15 years. The goal is to update the roadmap every five years. As regards the alignment of Finnish roadmap with the ESFRI process, the draft contribution is anticipated for spring 2016.

The FIRI research infrastructure strategy lays out a vision for Finland in 2020. By then, the strategy says, Finland will have gained further recognition for its world-class science and top-tier research, facilitating the regeneration of education, society and the business sector.

The FIRI strategy and roadmap do not automatically ensure financial commitments to research infrastructures, while some indication of the volume is given by the Academy of Finland’s budget allocation for research infrastructures which in 2015 was €19.3m and included 48 investments along the lines of FIRI strategy

In 2015, the Ministry of Education and Science commissioned a survey amongst Finnish research organisations reflecting the current situation of FIRI roadmap implementation. The study showed that the majority of higher education and research institutions incorporate research infrastructures in their organisational strategy or other programme. Higher education and research institutions also see the roadmap for national research infrastructures as an important tool in the development of the infrastructures. The goals of the roadmap, as regards developing research infrastructures, are also evident at the operational level. In most organisations, the focus points of research infrastructures are their profile fields. The national development needs are especially connected to supporting the open access and joint use of research infrastructures (Strategic development of research infrastructures).

Also included in the FIRI roadmap are significant international infrastructures such as CERN, the European Organisation for Nuclear Research, and BBMRI, the Biobanking and Biomolecular Resources Research Infrastructure, which are of key importance to Finnish research.

The roadmap includes a total of 31 research infrastructures as well as two projects with the potential to become significant infrastructures. Of the projects selected for the Finnish research infrastructure roadmap 2014–2020, 15 were also on the latest ESFRI roadmap, whereas 13 ESFRI projects appeared on Finland’s national roadmap in 2009. The current projects fall under the following scientific fields:

- Social Sciences and humanities (7)
- Environmental Sciences (6)
- Energy (0)
- Biological and Medical sciences (10)
- Material Science and Analytics (3)
- Natural Sciences and Technology (4)
- e-Science and Mathematics (3)

The research infrastructures were selected in a two-stage international review using three main criteria: the project’s significance to the Finnish scientific community as well as to the research strategy of the host organisations; the quality and scope of the potential user community; and the commitment by the participating organisations to the project. All of these criteria were interpreted from Finland’s perspective.

The Finnish roadmap includes five sets of measures to realise the infrastructure strategy. These are:

---

3 Communication of the Academy of Finland, 16 January 2015.
1. Long-term development of all research infrastructures
2. Improvements of access to and collaborative use of research infrastructures
3. Shoring up of the funding base of research infrastructures
4. Provision of a firm basis, by the roadmap, for the methodical development of research infrastructures
5. Evaluation of the impact and significance of research infrastructures.

In addition to ESFRI infrastructures, the FIFI Roadmap lists altogether 344 local research infrastructures, of which the majority are in universities (195) and in research institutes (107). Finland is also a member of 18 international research infrastructures, through various treaties and other agreements. In 2013, those membership fees totalled around €40m (see Table 3, in FIFI Roadmap).

4.3 International cooperation with third countries

According to the latest guidelines set by the research and innovation council (RIC) the priority countries for internationalisation of science and technology are the EU area, countries that have bilateral agreements with Finland, countries with FinNode cooperation (South Korea, Japan, China, Russia, United States) as well as emerging economies in Asia, the Americas and Africa, such as India, Vietnam, Bhutan, Brazil, Chile, Tanzania and South Africa.

According to ERA Survey 2014, the share of Finnish R&D budget allocated to collaboration programmes carried out with third countries was around 1.5 % of funders’ budgets, which was below the EU average (2.4 %). Finland was also one of the Member States with no specific measure or strategy to this end (ERA Progress Report 2014).

Finnish funding agencies for research and innovation have established cooperation agreements with corresponding organisations in countries outside of the EU. For example, the Academy of Finland has bilateral agreements with 16 countries. Most of the agreements deal with mobility, while there are also joint research activities. The international strategy of the Academy of Finland states that the Academy will create strategic partnerships with foreign funding organisations to create opportunities for researchers to engage in joint projects, as well as enhance the impact of international activities in general. Tekes has established cooperation agreements with funding agencies in other countries, such as USA, Japan, China, Canada, Israel, Singapore and South Korea.

The Academy provides funding for international joint projects through various targeted calls, often as part of its research programmes or in the context of bilateral or multilateral agreements with China (Cas Fellowship to China), India, Japan (JSPS Fellowship to Japan) and Russia. The FinNode Centres (global network of Finnish innovation organisations operating via nodes in global innovation activity) in China, India, Japan, Russia and the USA are also valuable instruments for international cooperation. There are some field specific contracts also, e.g. Tekes cooperation with Canadian Institutes of Health Research (CIHR), but most instruments cover all areas.

Over the past decade or so, the Ministry for Foreign Affairs of Finland (MFA) has conducted with developing countries a number (12) of collaborative programmes that have focused on innovation system development at large. The latest ones include Vietnam-Finland Innovation Partnership Programme (IPP), the Information Society and ICT sector development project in Tanzania (TANZICT) and Southern Africa Innovation Support Programme (SAIS).

The establishment of Team Finland approach (Team Finland) has to some extent impact the coordination of international R&D cooperation. This is in particular relevant to Tekes, Finpro’s and Ministry for Foreign Affairs of Finland’s joint efforts for promoting
international innovation activities of Finnish companies. For example, in 2015 Tekes and MFA launched a joint Team Finland BEAM – Business with Impact Programme (BEAM). The aim of BEAM is to assist Finnish enterprises and other actors in addressing global development challenges by converting such challenges into successful and sustainable business. The programme supports Finnish companies, NGOs, research organisations, universities, universities of applied sciences and others in developing, piloting and demonstrating innovations that improve wellbeing in poor countries, while giving rise to international business opportunities for Finnish companies. BEAM is a five-year programme with a total volume of €50m, about 50 % of which is financed by Tekes and the Ministry for Foreign Affairs.

The programme is not restricted to particular sectors, and the target countries can be any of the developing countries listed as eligible for official development assistance by the OECD/DAC (Development Assistance Committee), except China.

4.4 An open labour market for researchers.

4.4.1 Introduction

The main trend in this ERA priority in Finland is that institutional autonomy is common but funding incentives are used for facilitating researcher mobility. Many Universities (Including University of Tampere, University of Jyväskylä and University of Aalto) have launched new tenure track systems and increased the recruitment of foreign researchers and professors recently.

Considering the statistics, in 2011 the number of researchers per 1,000 active labour force was 21.5 (EU average 10.6) and new doctoral graduates per thousand population aged 25–34 was 2.71 in 2012 (EU average 1.81). The share of non-EU doctorate students as a % of all doctorate students was 6.8 % in 2011 (EU average 24.2 %), which is alarmingly low (EC 2014, Research and Innovation performance in Finland; Country Profile 2014 and ERA Progress Report 2014, Country snapshots).

Recent economic downturns and the structural reforms in HEIs have led to a growing number of highly educated people being unemployed. Considering different educational backgrounds, the proportion of the unemployment of the labour force aged 18 to 64 decreased in all categories until 2008. Unfortunately since 2012, the proportion of the unemployment has grown in all categories. According to Statistics Finland, however, the highly educated have been most affected. The proportion of the unemployed among the labour force grew for all levels of education. The number of the unemployed grew most among highly educated people; for persons with lowest level tertiary qualifications or lower university degrees, unemployment increased by 29 %, and for persons with higher university or doctorate level degrees, by 31 % compared to 2012. Many universities and PROs have been forced to lay off staff due to the decreased public and private funding. Some unemployed academics establish companies of their own; others re-educate themselves to better fit new prospects in the job market. Despite this, there is a need to attract more qualified researchers and labour in order to support and sustain the relatively high level of the Finnish research and innovation system. While the amount of researchers has decreased since 2008, the decrease has not been reflected neither in the share of foreign researchers or in the mobility of students and staff at Finnish HEIs. Both of the latter values have actually increased (Finnish National Board of Education (FNBE), Statistical services, in Finnish). Speaking of employment and labour force, in 2010–2013 altogether 1,219 new professors were recruited to Finnish universities and research institutes. 166 (14 %) of them were foreigners (Academy of Finland, The State of Scientific Research 2014, in Finnish). The share of foreigners among young researchers is higher than in other groups. Overall statistics is not available but for example at the biggest Finnish university (Helsinki University) the share of foreigners among young researchers is about 30 % while the average is about 8 %. This is a promising sign considering the low numbers otherwise.
One of the specific challenges related to the mobility of researcher and the deepening of research collaboration between universities and other research institutions has been the career aspects of researchers. In this regard, in June 2014 the Ministry of Education and Culture assigned a working group for the development of research careers in universities, universities of applied sciences and in research institutions, with a deadline of February 2016 for reporting.

Overall the deepening of the collaboration between universities and research institutions is a complex issue and a long-term development process has been initiated to that end (KOTUMO).

The main objective of the KOTUMO Roadmap for 2015 to 2017 is to create the best possible conditions for enhancing quality in research and innovations activities in Finland and to make the Finnish science community more visible internationally and strengthen its scientific impact by bringing together resources, stepping up cooperation and improving the division of labour. The roadmap gives a vision for collaboration for 2020 and lists key measures for reaching this vision. They encompass 1) steering and communication, 2) collaboration in education and research between higher education institutions and research institutes, 3) joint field stations and campuses, 4) common infrastructures in education and research and 5) more open and shared data repositories and research results.

4.4.2 Open, transparent and merit-based recruitment of researchers

High institutional autonomy affects recruitment and awarding positions of trust in Finland. The Strategy for the Internationalisation of Higher Education Institutions in Finland (2009–2015) calls for the principles of open, transparent and merit-based recruitment as laid down in the Charter and Code. UNIFI (the Rectors’ Council of the Finnish universities) and the Academy of Finland have signed up to the Charter and Code. The principles are being promoted through national higher education and research policy. Moreover, the funding models of HEIs, the 2012 agreement between national authorities and HEIs, and the new tenure track system adopted by the universities since 2010 support the principles of prioritising and focusing on improving research careers. A governmental programme was launched in 2007 to ensure that recruitment policies are developed in a way that makes research careers, both studying and working in Finnish universities and research institutes, more attractive. Moreover, measures such as RIC recommendations 2015–2020 and the FiDiPro programme further contribute to the opening up of the recruitment system and attracting foreign researchers.

The Finnish universities are fully autonomous under the Act on Universities (2010) and thus MEC cannot directly affect recruiting or the nature of the contracts of the academic personnel.

All Finnish universities post their open vacancies online although platforms may however vary between universities. Most institutions have a policy of publishing job vacancies also on relevant Europe-wide online platforms, including EURAXESS. Although, as discussed before, the institutions are highly independent, the practices in recruiting are quite similar. There are only some variations in details between individual institutions but the main principles are the same. This is elaborated below, considering the case of the biggest Finnish university, University of Helsinki. An open vacancy announcement is in use everywhere, but there may be exceptions for special reasons. Teaching and research positions are normally opened also for international applications.

Let us now consider the recruiting practices of University of Helsinki. The vacancy announcement always includes the job profile, skills and competences required, the eligibility criteria and the information about the selection process. The criteria used in evaluating the candidates are available for the candidates. The time period between publishing the open vacancy and deadline for application is defined but not included in the announcement - the information can be obtained by asking. Those applicants who have been selected on the short list of best applicants are able to get feedback from the
Some special reasons – like gender equality – give a right to appeal against the decision. Considering professorship, an appointment committee is established to prepare for the appointment process of a professorship, and information on the composition of the appointment committee is available for candidates. Selection committees are indeed the general rule here, although there may be exceptions and variations. Universities have instructions and guidelines for the composition of selection committees especially for tenure track recruitment. However, some guidelines are more generally valid for all academic recruitment. The composition of the selection committee is public information. The members of the selection committee are professionals from Finland (internal and/or external) but the assessors are international.

The procedure varies depending on the level of the title (a four-level hierarchy for teaching and research staff is commonly used). In 2012, 56 % of university-based researchers were satisfied with the extent to which research job vacancies are publicly advertised and made known by their institution (EC, MORE2, 2013).

The share of researchers (post PhD) having spent a period of at least 3 months as researchers in another country was 57 % (EU average 48 %, 2012), the share of non-EU doctoral students was 6.8 % (EU average 24.2 % in 2011), doctoral candidates with citizenship of another EU member state was 7 % (EU average 8 % in 2011), work or internship in the non-academic sector during PhD was 26 % (EU average 23 % in 2012), and post PhD researchers with inter-sectorial mobility was 12 % (EU average 12 %). As a summary it can be stated that the outward flow of researchers is a bit above the EU average, the inward flow is clearly below the EU average. Most of the foreign researchers come from the EU countries, and the inter-sectorial mobility is about at the average level of the EU countries (EC, The Researchers’ Report 2014). The international mobility of the Finnish education and research labour increased by 19 % in 2010–2013 (FNBE, Statistical services).

It has been noted that a particular challenge for Finland in its efforts to attract foreign talents relates to the research and innovation environments and the non-competitive salary in the public and higher education sectors (Viljamaa et al., 2010). The situation might, however, have changed since 2010. Today, there are no legal limits for researcher salary. The salary, however, must be in a reasonable balance with salaries paid for Finnish researchers. According to an interview among university managers, there have been very few cases when the salary has been a deal breaker for recruitment. A researcher career is still quite attractive in Finland although the salaries are not high - they are a bit above the EU average – and the researcher labour market is strongly competitive. About one third of the contracts are permanent. The labour market has been quite unstable for the younger generations but the tenure track system adopted by the universities in 2010 now provides better opportunities for career development.

International evaluations and audits of staffing policies have been done in many universities but they have been for internal use only. Higher education and research institutes are autonomous to organise their activities in the areas of education, research and innovation, and according to the State of Scientific Research (2014) no alternative sources of funding for HR purposes are needed. There are no national accreditation mechanisms, institutional processes or informal barriers that hinder foreign researchers’ access to the scientific labour market. However, in some cases the Finnish language is essential which may discourage the access.

### 4.4.3 Access to and portability of grants

Grants are by and large open to foreign researchers and portable to other EU countries (e.g. Academy of Finland grants and fellowships), and the Academy of Finland has signed up to the Money Follows Researcher (MFR) agreement, the initiative of the European Heads of Research Councils (EUROHORCs). The Academy of Finland is committed to promote the internationalisation of Finnish science and research by establishing bilateral agreements with countries and regions. For instance, the Academy
of Finland provides funding for the Finnish Centres for Excellences (CoE) in order to support international cooperation in research. Financing to support the outflow of researchers is provided especially by the Academy of Finland and Tekes. Publicly funded grants or fellowships by the Academy of Finland are portable to other EU countries. However, administrative processes involved remain problematic, thus discouraging researchers from going abroad.

In case of Tekes, international researcher mobility involves performing part of the research work for the project in Finland and part of it abroad. Alternatively, a researcher can come from abroad to work in a research project carried out in Finland. Researcher mobility funded by Tekes involves research that genuinely adds value to the project. Tekes covers costs incurred by the recipient from researcher mobility. Tekes only provides funding for researcher mobility to the results for which the recipient receives at least access and utilisation rights for research and education purposes free of charge and globally (Tekes, General terms and conditions 2012, Funding for Public Research).

The FiDiPro programme of the Academy of Finland and Tekes is one of the tools established in Finland to tackle the issue of attracting talent from abroad. Additionally Joint Degree Programmes have been initiated in Finnish universities to target foreign students aiming at Master’s Degree level. Moreover, especially Tekes and the Academy of Finland promote the use of EU mobility schemes. So far the actions taken have improved the situation very slowly. To summarise, other policies or measures could perhaps be developed, as Finland is not considered a hotspot of scientific research and is unsuccessful in attracting foreign researchers on a larger scale.

Student allowances are partly restricted for Finnish students residing temporarily abroad and foreign students having “permission for municipality of residence” in Finland. A bill is ongoing in the Parliament to make the rules less restricted (Proposal of the government 6 October 2015).

4.4.4 Doctoral training

The ‘National Guidelines for the Development of Doctoral Training’ (2011) outlines the principles for doctoral training in universities. In the guidelines, the annual goal for new doctors graduated for the period of 2011–2016, is set to 1,600 per year. At the same time, the overall emphasis was moved from doctoral education more towards post-doctoral career development.

Until 2010, the Academy of Finland evaluated the applications of graduate schools for doctoral studies. The funding was part of the basic funding for universities through the Ministry of Education. All responsibilities regarding graduate schools have then been transferred to the universities. Since 2011, all Finnish universities have started the reform of the doctoral training system in line with the principles of innovative doctoral training. The Strategy for the Internationalisation of Higher Education Institutions in Finland (2009–2015) aims at improving the entry of foreign researchers and their access to research positions in Finland. Today, the doctoral trainings are primarily organised as full-time, four-year training periods and the training programmes form an integral part of universities research strategy. It is the task of the universities to gather doctoral training programmes into larger units for increasing their efficiency and quality.

At least some elements of IDT (Innovative Doctoral Training) are indeed fulfilled in projects funded by Tekes. Tekes does not fund individuals such as researcher. It instead funds research projects, although in the evaluation of the project applications also the skills and expertise of the applying researcher are considered. A significant number of academic degrees are achieved as a result of projects funded by Tekes. For example, 840 students graduated through the projects that ended in 2013, and 1,030 patents or patent applications were filed, as well as 1,270 new products, services or processes launched.

---

4.4.5 Gender equality and gender mainstreaming in research

In addition to the Equality Act, which supports gender equality in HEIs and PROs, Finland has also adopted measures to support gender equality when decisions on research positions and research funding are made (government Action Plan for Gender Equality (2012–2015) and Academy of Finland’s criteria for research funding decisions). As part of the steering of HEIs process and the 2012 agreement between national authorities and HEIs, the latter are required to report on the implementation of their gender equality strategies.

According to a study made in 2009, the government programmes and the government Action Plans for Gender Equality have incorporated ambitious objectives for the promotion of gender equality in higher education and in the field of science. During the period of review the objectives included dismantling segregation, reinforcing gender sensitivity in teacher education, promoting women’s research careers, and establishing the status of female students. Based on the results of the study, university and science policy had included relatively few concrete measures that enable the integration of gender equality into all actions regarding higher education and science.

The Gender equality index for Finland was 73.4 (EU27 54.0), and part index for knowledge 67.0 (EU27 48.9) of the European Institute for Gender Equality (Gender Equality Index Report 2013)\(^5\). The Guardian Gender Equality Report ranks Finland 2\(^{nd}\) in the Global Gender Gap Index\(^6\). The female to male ratio in tertiary educational attainment was 1.21, and in professional and technical workers 1.08 in 2014. ERA Snapshot Finland\(^7\) and OECD.Stat\(^8\) gives the following figures for gender equality:

- share of female researchers (2013) 32.5 %, EU 33.2 %
- share of female PhD graduates (2012) 50.9 %, EU 47 %
- share of female senior researchers (2010 or latest available data) 24 %, EU27 20 %
- proportion of female heads of institutions in HES (2010) 25.0 %, EU28 15.5 %

The long-standing gender equality work of the Academy of Finland has served as an example of how gender equality issues can be successfully integrated into activities. In 2011, more than 50 % of the public sector research and development personnel were women (Academy of Finland, 2012).

4.5 Optimal circulation and Open Access to scientific knowledge

Led by the Ministry of Finance, the Open Data Programme 2013–2015 has been put forward, aiming at eliminating obstacles in the re-use of public data and creating the preconditions for making public administration data open. Ministries, government agencies, municipalities, enterprises, NGOs, various organisations developing the sector and citizen bodies are collaborating in the implementation of the programme.

In 2014, the MEC launched an Open science and research roadmap 2014–2017. It is based on the work of the Open Science and Research Initiative (ATT), a cross-administrative initiative established by the Ministry of Education and Culture, with the goal of promoting open science and the availability of information. Open science means the promotion of an open operating model in scientific research. The key objective is, subject to the restrictions of research ethics and the juridical environment, to publish research results, research data and the methods used, so that they can be examined and used by any interested party.

---

Open science includes practices such as promoting open access publishing, openly publishing research materials, harnessing open-source software and open standards, and the public documentation of the research process through ‘memoing’.

4.5.1 e-Infrastructures and researchers electronic identity

The e-science research infrastructures identified in the FIRI Committee’s Roadmap include a range of services and supercomputers for use in computation and the management and archival of generated data, as well as open access to research results. Two major research infrastructures CSC and PRACE, were selected for the e-science (and mathematic) roadmap. The latter one is also on the ESFRI roadmap.

CSC - IT Centre for Science Ltd (CSC IT) is a state-owned non-profit limited company administered by the Ministry of Education, Science and Culture. It provides ICT services for the Finnish scientific community. It is one of Northern Europe’s largest super computing centres. CSC is a member in major European research e-infrastructures and a partner in several ESFRI projects. It has an important role in horizontal e-infrastructures that integrate scientific disciplines and organisations across the Europe.

Partnership for Advanced Computing in Europe - PRACE (Finland) is a European research infrastructure offering high-performance computing resources (PRACE). The PRACE research infrastructure consists of national European computing centres functioning in collaboration with one another. It has 25 member countries from EU member states and collaborating countries. PRACE offers computing time on six Tier-0 and several Tier-1 national supercomputers. Its Tier-0 supercomputers are located in Germany, France, Italy and Spain. Finnish CSC has a Tier-1 supercomputer in PRACE, located in Kajaani.

No overarching policy on electronic identity for researchers in Finland has been identified, although electronic identity is being implemented. Finland participates in the following initiatives related to e-identity: GEANT and EduROAM (through Nordunet gathering Nordic regions), REFEDS (Research and Education Federations) and EDUGAIN through Haka. It is the identity federation for the Finnish higher-education and research institutions serving as a route to more than 160 services. It has 298,000 end users, which also is the total number of university and polytechnic students in Finland. Users log into Haka services over 11 million times per year. Haka is connected to the other identity federations of the Nordic higher-education institutions, giving users access to services throughout the Nordic region. FUNET is the Finnish National Research and Education Network (NREN), a specialised Internet service provider dedicated to supporting the needs of the research and education communities within the country. HAKA and FUNET are hosted by CSC that provides a computing environment and virtual computation services for R&D. Researchers can access the services through the FUNET network. Examples of the services that are available to researchers are:

**Funct Network Services**
- Eduroam Roaming Access Service
- Funet Boksi Cloud Storage Service
- Funet FileSender File Sharing Service
- Funet Tiimi Web Conferencing System

**Identity and Access Management**
- Haka Identity Federation
- Resource Entitlement Management System (REMS)

Consultation and Tailored Solutions

Training Services
**Education Management and Student Administration Services**

- Eduuni - e-Work and Collaboration Service Environment

**Scientific Computing and Software**

**Research Information Management**

- AVAA - Open-access publishing platform
- Etsin - research data finder
- IDA Storage Service
- Research Information Management

### 4.5.2 Open Access to publications and data

Although Open Access-related measures have been adopted as early as 2005, there is no overall legislation supporting Open Access to research publications and data. A national policy for the long-term storage of data is a broader initiative in Finland. The government Programme specifies that "opening the non-sensitive public databases will boost open science and create opportunities for new entrepreneurship and service innovations". Government’s objectives are implemented by the National Research Data Project (TTA). The first institute to open public databases was the National Land Survey of Finland (NLS). Open spatial data sets and interface services are available in Finland now free of charge. Coming back to the TTA project, it also includes measures like the Open Data Programme and the Working group on Open Access to publications and research data. Finland has adopted two overarching policy measures supporting the development of digital research services (i.e. ‘Putting data into use’ and ‘Roadmap for the utilisation of electronic data in research’)

The Ministry of Education and Culture of Finland has launched the Open Science and Research Initiative (ATT) for the promotion of research information availability and open science platform for the years 2014–2017. In 2014, the MEC released The Open Science and Research Roadmap 2014–2017. Finland' vision for 2017 is: "Open research leads to surprising discoveries and creative insights. This means a situation in which research data and materials move freely throughout society; from one researcher or research team to another, between disciplines, to innovative businesses, and to decision-makers and citizens. Information flow is facilitated by clear policies and best practices, and by providing services to safeguard the availability of scientific and research results. Openness is a joint operating model. Openness has given Finnish research an international competitive edge."

Open Access is not a mandatory funding criterion within the Academy of Finland funding programmes but the Academy recommends that Academy-funded researchers and research projects deposit their research data in open-access repositories, and that Academy-funded researchers investigate the possibility of long-term storage of their data. Recommendation is that research data is stored and made available through major national or international repositories, such as:

- Finnish Social Science Data Archive (FSD)
- FIN-CLARIN consortium
- CSC’s IDA Storage Service and its Kata metadata catalogue and AVAA open-access publishing platform
- CERN’s Zenodo service

---

9 [http://openscience.fi/](http://openscience.fi/)
The data should be delivered and deposited as soon as possible after Academy funding has ended. As for publishing, the Academy advises that researchers deposit their articles and other publications (as well as parallel copies) in high-quality open-access publication repositories, either provided or recommended by the host organisation. The Academy does not recommend so-called hybrid forms of open-access publishing.

The proportion of OA articles in Finland 2008–2013 was 55 % (adjusted 63 %), (Green 8.9 %, Gold 9.3 %, other 38 %); the total EU proportion was 51 %, (http://www.science-metrix.com/pdf/SM_EC_OA_Availability_2004-2011.pdfProportion of Open Access Papers, Science Metrix 2014).