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RIO Country Report 2017: Finland

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Halme, K.
Saarnivaara, V-P.
Mitchell, J.

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Contact information: JRC-B7-NETWORK@ec.europa.eu

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RIO Country Report 2017

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

Summary

Challenges for R&I policy-making in Finland

Enhancing the commitment to R&D, innovation and skills. The main policy responses in 2017 are the new vision and roadmap of the Research and Innovation Council, the Vision for higher education and research in 2030, and the Government, in its mid-term review, updated action plan 2017-2019 thus making decisions related to operationalize the Key project program. A practical response is the establishment of a new technical network-university, Finnish Institute of Technology in Southwest Finland are to be started in autumn 2017. The Government also decided additional capitalisation of universities. However, Finland's R&D intensity has decreased following R&D funding cuts of recent years.

New measures and resource allocation to exploit knowledge and competence for economic and societal renewal. In 2017, funding increase for business capital markets is announced (Ministry of Finance 2017, Prime Minister's Office 2017b). As part of the Government's Key projects, investments in new growth sectors are planned, including in the bioeconomy, clean and green technologies, healthcare, and digitalisation, which cuts across these areas. There will be measures to boost experimentation, ecosystem development, as well as deregulation. However incentives for business R&D and funding for strategic applied research remain low.

Improving implementation and collaboration within the innovation system. The new vision and roadmap of the Research and Innovation Council, as well as the Vision for higher education and research in 2030, aim at intensifying cooperation. The Government's action plan 2017-2019 also includes activities to improve collaboration. The merger of Finpro and Tekes into *Business Finland*, as well as its new funding criteria may also intensify collaboration.

Strengthening quality, relevance and internationalisation of science & research: There are a number of measures, which are aimed at increasing the quality of the science base through structural changes, improving financial incentives and reforming the financing models, including the further University funding model (2017). The Ministry of Education and Culture (MEC) prepared new guidelines for internationalisation of higher education and research, and a Vision for higher education and research in 2030, continuing by preparing a roadmap. The Government, in its mid-term review, made decisions to operationalize the Key project programme. Business Finland will start in 2018 boosting promotion of Finnish companies access to markets abroad, and bringing together all state-funded actors and the services they offer, to promote internationalisation and attract foreign investments to Finland.

Smart specialisation

In Finland, smart specialisation is tightly linked with smart regions. The Government's vision for 2025 is that regions will have created growth based on high-quality competence and sustainable development, and that smart specialisation based on regional strengths, active renewal of business structures, and a better basis for entrepreneurship and business operations have created economic prosperity. The Government plans on establishing a centre of excellence during spring 2018 to enhance innovative procurements, which especially concerns municipalities. Finland aims for every region to formulate a Research and Innovation Strategy for Smart Specialisation (RIS3), which are set and overseen by the Regional Councils. In addition to smart regions, the national smart specialisation strategy of Finland focuses on developing smart cities. An analysis of regional strengths has been conducted to support the Government's efforts to enhance growth and employment through regional specialisation and to provide information for the ongoing regional development efforts.

Foreword

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

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Authors

Kimmo Halme, 4FRONT OY (Helsinki, Finland)
Veli-Pekka Saarnivaara, VPSolutio (Helsinki, Finland)
Jessica Mitchell, European Commission, Directorate-General Joint Research Centre,
(Brussels, Belgium)

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1 Economic context for R&I

After several years of contraction, Finnish economy is growing again. Preliminary data shows that economic growth (volume of GDP) in 2016 was 1.9 % and in the first quarter of 2017 1.2% over the previous three months and 2.7% year-on-year. Respectively, the figures for the second quarter were 0.4% and 3.0% ([Statistics Finland, 2017a](#)). Hence, during the first half of 2017, most growth forecasts have been revised upwards. The growth has been triggered by positive developments in exports, which have quickly intensified and broadened. According to the preliminary statistics of Finnish Customs, exports increased by 15% since the beginning of 2017 ([Indicator, 2017](#)). Private investments have been pulled particularly by construction.

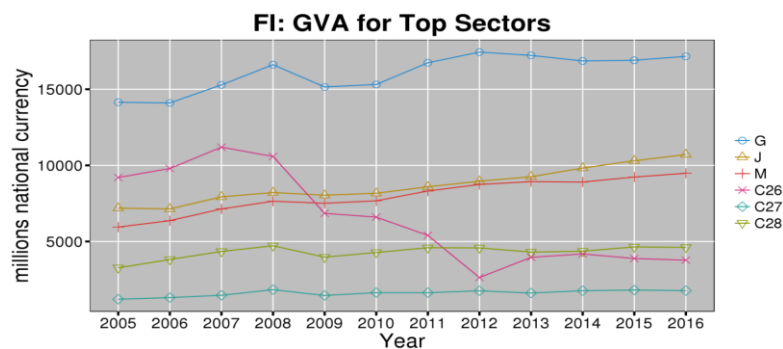
The European Commission expects real GDP growth to climb to 3.3% in 2017 and remain above the EU average in both 2018 and 2019, at 2.7% and 2.4% respectively (EC 2017a). However, put in perspective, this means in 2019 the GDP will only reach the same level it was in 2008 ([Bank of Finland, 2017](#)).

Employment is equally expected to continue growing, but this is likely to be hindered by labour market mismatch and constraints in labour supply (including demographic change). The emphasis of economic growth is slowly expected to be shifting towards less labour-intensive sectors, when exports assume a greater role as the engine of growth. At the same time, productivity growth should improve ([Bank of Finland, 2017](#)).

1.1 Structure of the economy

Manufacturing is the biggest single contributor by a clear margin to Gross Value Added (GVA) in Finland accounting for 16.9% in 2016. However, the share of manufacturing GVA decreased significantly over the recent years, down from 23.3% in 2007. Part of this decline is due to the contraction of the manufacture of computer, electronic and optical products sector where the value-added declined from over €8 billion in 2007 to less than €800 million in 2012. The largest R&D performer in Finland - computer manufacturing, electronic and optical products (sector C26 below) - not only dramatically decreased in R&D intensity but also lost 90% of its Added Value in the period 2007-2012. The increasing share in the export-market of competing products in this sector (e.g. smart phones) from emerging players, along with the weakening cost competitiveness, e.g. high cost of labour helps explain the trends during this period. Employment in this sector follows a similar trend with losses of about 35% between 2008 and 2013. Value added by industries as a proportion of GVA (at basic prices) in 2017 were: Primary production (agriculture, forestry, fishing) 2.7%; Secondary production (manufacturing, construction) 27.1%; and Services 70.2% ([Statistics Finland, 2017b](#)).

Figure 1: Gross Value Added for Top Sectors



Data: Eurostat, graph by European Commission JRC 2017

(ISIC Classification: G = Human health and social work activities; J = Information and communication, M = Professional, scientific and technical activities; C26 = Manufacture of computer, electronic and optical products; C27 = Manufacture of electrical equipment; C28 = Manufacture of machinery and equipment n.e.c.)

Exports of services have continued to increase for over 10 years, but exports of goods, which represent 70% of the foreign trade, are still more than 10% below their pre-crisis level. The export market share losses since 2008 are largely explained by the rapid decline of nominal cost competitiveness (in 2015, Finland's cost competitiveness was still weaker than 10 years earlier). Despite some recent positive signs of economic recovery (e.g. exports growth), many of these structural challenges of Finnish economy remain. Finland has not yet properly recovered from the industrial decline and led to a loss of an important part of the country's economic base, and challenges in productivity growth.

1.2 Business environment

The 2018 Doing Business report ranks Finland 13th in 2017. Although it drops three places on 2015 (10th), and stood at 8th in 2014, it is still the fifth highest of other EU Countries (World Bank, 2018).

Finland also performs well on the WEF Global Competitiveness Index 2017-18 (WEF 2017), although it has slipped in the overall rankings at 10th in 2017 from 8th in 2015. It is among the top 5 performers in institutions, and health and primary education (1st), higher education and training (2nd), innovation (4th). It scores lowest in market size (60th) macroeconomic environment (33rd), labour market efficiency (23rd) and – due to indexes like fixed-telephone lines per population - infrastructure (26th). Global innovation Index GII (Cornell University, INSEAD, and WIPO 2017) ranks Finland 8th. It dropped 3 places since 2015. Finland ranks best in Human capital and research (1st), well in Institutions (4th) and Business sophistication (6th), but not as well in outputs: in Knowledge & technology outputs (10th) and in Creative outputs (18th). According to the European Innovation Scoreboard 2017, Finland is among the Innovation Leaders but the performance has declined by 5.1 % relative to that of the EU in 2010 (EC 2017b).

Finland has one of the most competitive Small Business Act profiles in the EU. It surpasses the EU average in seven out of nine SBA principle areas. Only in State aid & public procurement and Internationalisation does it trail behind the EU average. However, Finland has not significantly improved its position in any of the SBA areas since 2008, with the exception of the Single market (EC 2016). Despite a sluggish economic environment, access to finance for SME's in Finland has remained easy compared to most other European countries since the 2008 financial crisis, although it has become more difficult for small firms in the very recent past. According to the EIB Investment Survey, the share of finance-constrained firms in Finland is among the lowest (4th lowest), as well as the perceived investment gap (6th lowest), but the share of investments in new products is not high (3rd lowest) (EIB 2017). Private equity investment (as a share of GDP) is one of the highest in Europe. The OECD Review also states that, on average, Finnish firms do not face financial constraints (OECD 2017a).

Finland is among the most advanced digital economies in the EU (2nd) according to The Digital Economy and Society Index DESI 2017 (EC 2017c). Digi barometer 2017 shows that Finland's excellent preconditions for digitalisation have been realised reasonably well. Although on some essential areas, like on the international e-commerce, Finland's rank still is poor (ETLA 2017).

2 Main R&I actors

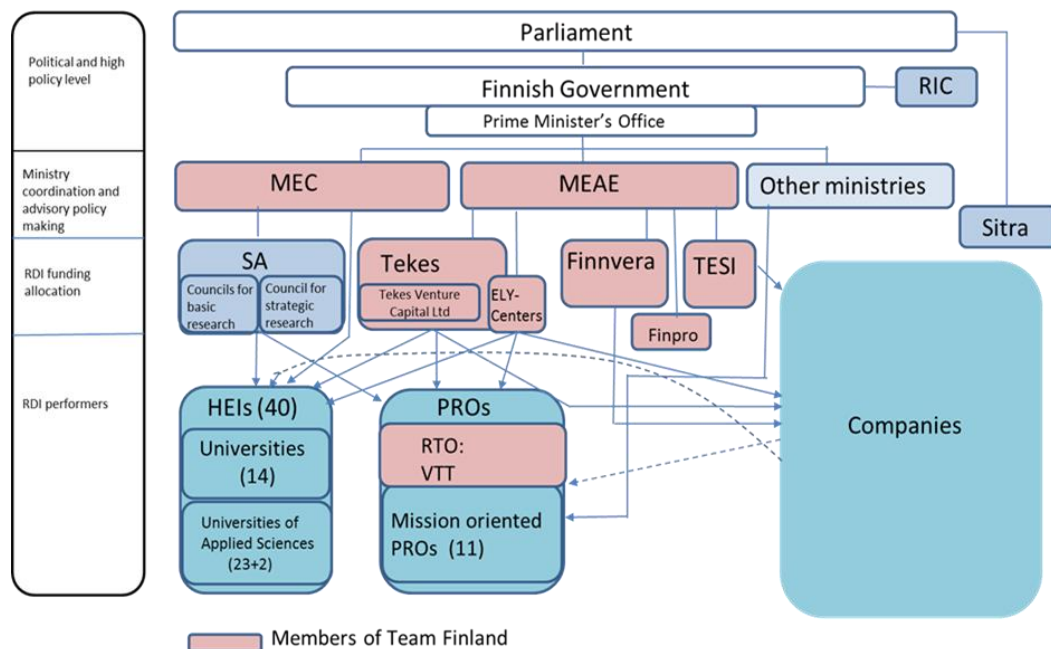
The R&I governance system is centralised in terms of national guidelines, strategies and funding, but a mix of national and local administration gives regions a relatively high degree of autonomy in the design and implementation of regional policies. Regional autonomy will be further strengthened, because of the planned administrative reform.

The R&I system is divided into four strategic and operational levels. Innovation policies and strategies are led by the Finnish government, which decides on national development goals and sets the general guidelines. The Research and Innovation Council (RIC) has been reorganised, and its role is not as well-established as in the past. A 2014 evaluation

of the RIC stated that its influence had declined since 2005. The start of the new RIC has been slow, and it's too early to say how strong its role will become (see Chapter 3). Funding agencies, universities and research institutes have substantial freedom of creating and implementing their strategies. R&I policy has been increasingly connected with societal issues (e.g. globalisation, ageing, the environment and public health) that pose a challenge to growth and well-being. Such challenges can be tackled with public incentives for private innovation, public sector innovation (or public procurement), growth entrepreneurship, service innovation as well as user and demand-driven innovation. This policy framework also aims to support collaboration and engagement between the public and private sectors on these issues.

National funds are mainly allocated through the Ministry of Education and Culture (MEC, 60%) and the Ministry of Economic Affairs and Employment (MEAE, 27%), and their agencies Academy of Finland and Tekes ([Statistics Finland 2017c](#)). Regional activities are mainly based on EU structural funds (combined with the national counter funds) which are very modest in Finland.

Figure 2: Finland's R&I system



- [RIC](http://valtioneuvosto.fi/tin) Research and Innovation Policy Council (<http://valtioneuvosto.fi/tin>)
- [MEC](http://minedu.fi/en/frontpage), Ministry of Education and Culture (<http://minedu.fi/en/frontpage>)
- [MEAE](https://tem.fi/en/frontpage), Ministry of Employment and the Economy (<https://tem.fi/en/frontpage>)
- [SA](http://www.aka.fi/en/), Academy of Finland (<http://www.aka.fi/en/>)
- [Tekes](https://www.tekes.fi/en/), Finnish funding agency for innovation (<https://www.tekes.fi/en/>)
- [Sitra](https://www.sitra.fi/en/#), the Finnish Innovation Fund (<https://www.sitra.fi/en/#>)
- [Finnvera](https://www.finnvera.fi/eng/) Ltd, a specialised financing company owned by the State of Finland and it is the official Export Credit Agency (ECA) of Finland (<https://www.finnvera.fi/eng/>)
- [TESI](http://www.industryinvestment.com/), FII, Finnish Industry Investment Ltd, a government-owned investment company (<http://www.industryinvestment.com/>)
- [ELY Centres](https://www.ely-keskus.fi/en/web/ely-en/), Centres for Economic Development, Transport and the Environment are responsible for the regional implementation and development tasks of the central government (<https://www.ely-keskus.fi/en/web/ely-en/>)
- [Finpro](http://www.finpro.fi/web/finpro-eng) helps Finnish SMEs go international, encourages foreign direct investment in Finland and promotes tourism (<http://www.finpro.fi/web/finpro-eng>)
- [VTT](http://www.vttresearch.com/), Technical Research Centre of Finland (<http://www.vttresearch.com/>)
- HEI, Higher Education Institutions ([Universities](http://minedu.fi/en/heis-and-science-agencies), Universities of applied sciences, <http://minedu.fi/en/heis-and-science-agencies>)
- PRO, Public Research Organisations (<http://minedu.fi/en/science-agencies-research-institutes-and-scientific-organisations-in-finland>)

Source: Veli-Pekka Saarnivaara, 2017

Further changes to the Finnish higher education system continuing major reforms since 2009, include renewed funding models – the latest in 2017. The reform of the universities was followed by a corresponding reform of the polytechnics (UAS) in 2011 and 2015. (OECD 2017a). The Government has put forward a bill to merge two universities (University of Tampere and Tampere University of Technology) and a university of applied sciences (Tampere University of Applied Sciences) ([Prime Minister's Office 2017a](#)). The Government also allocated resources for a new technical network-university FITech (Finnish Institute of Technology) to be started in autumn 2017. The network includes 7 universities, and Technology Industries of Finland as well as the association of Academic Engineers and Architects in Finland TEK have sign the letter of intent ([MEC 2017a](#)). FITech is intended to get more engineers in Southwest Finland, especially to serve shipbuilding and automotive industries.

Reforms have significantly changed the funding and structure of the country's public research institutes over the past decade. The number of national research institutes

declined to 12 in 2016 from 19 in 2009 after several mergers and other measures. While many of the changes referred above took place only in 2015 and later, it is hard to gauge the effects of the institute reform on PRIs and on Finland's innovation system more generally. The Finnish Food Safety Authority Evira, National Land Survey of Finland NLS, and parts of the centre for ICT services of the National Land Survey of Finland NLS will be merged in 2019.

The Government has also decided to merge Tekes (the Finnish Funding Agency for Innovation) and Finpro (a provider of internationalisation advisory services). Abroad, co-operation with the Ministry for Foreign Affairs will also be intensified. The process started by integrating Tekes and Finpro programmes in 2017, and the merged *Business Finland* should begin its operations at the beginning of 2018 ([MEAE 2017a](#)). The Government bill states that the merge clarifies and simplifies the public business service system, internationalises the national innovation system, increases sme's exports, supports regional growth services, and creates preconditions for more dynamic allocation of human resources for customer interface and activities abroad ([MEAE 2017b](#)). Tekes' research funding will be modernised to Business Finland research funding (Tekes 2017b).

3 R&I policies, funding trends and human resources

The main R&I policy developments in 2017 are mostly guidelines, reports and studies. Principal proposals for new laws are included in the Government Programme and the Governments action plan, some of which will be realised by the forthcoming State Budget 2018 ([Ministry of Finance 2017a](#)).

Table 1: Main R&I policy developments in 2017

English review of the Government budget proposal for 2018. Ministry of Finance publications – 33c/2017.	The Government of Finland submitted its proposal to the parliament regarding 2018 budget. The proposal includes a section on research and development, outlining the key government actions and allocations for the coming year.
Ministry for Foreign Affairs of Finland, Press Release 29 November 2017.	The Government of Finland agreed the establishment of UN Technology and Innovation Lab (UNTIL) at the Aalto University Campus in 2018.
Government proposal HE 158/2017 for the law concerning Business Finland. (In Finnish)	The Government proposal 26 October 2017 for the law concerning Business Finland Agency and the Business Finland Ltd. This law sets the legal framework for the merger of Tekes and Finpro into Business Finland at the beginning of 2018
Solutions for Finland. Midterm overview. Governments action plan for 2017-	The midterm review of the Government examines the state of affairs of Finland and Government's activities. Next steps and new

<p>2019. Government's publication series 5/2017. 28 April 2017 (in Finnish)</p>	<p>openings are presented in a form of an updated action plan for the remaining Government term 2017–2019.</p>
<p>Europe 2020 Strategy. Finland's National Reform Programme, Spring 2017. Ministry of Finance publications – 18c/2017</p>	<p>The report describes the measures that the Government has initiated in order to achieve the national targets of the Europe 2020 Programme and how the country-specific recommendations given by the EU have been taken into consideration. The information provided in the programme will facilitate a more detailed examination of Finland's situation at the EU level.</p>
<p>RIC vision and roadmap. Finnish Government Press Release 447 / 2017</p>	<p><i>Making Finland the most attractive and competent environment for the experiment and innovation</i> - the vision and roadmap of the Research and Innovation Council</p>
<p>OECD Innovation Policy Review of Finland, 2017</p>	<p>The OECD Review of Finland's Innovation Policy is part of a series of OECD country reviews of innovation policy. The review highlights number of development issues in Finnish RDI policy and gives recommendations accordingly.</p>
<p>Vision for the higher education and research in 2030. 'Proposal for Finland: Finland 100+' Ministry of Education and Culture 2017</p>	<p>The outcome of a collaborative vision process for the education and research in Finland 2030 by MEC and other stakeholders, including a parliamentary monitoring group.</p>
<p>Better together for a better world. Policies to promote internationalisation in Finnish higher education and research 2017–2025. The Report is in Finnish but a summary presentation in English is on the web sites of the MEC Ministry of Education and Culture 2017</p>	<p>The Ministry of Education and Culture appointed a steering group to prepare an international higher education and research policy for 2025. In its proposal, the steering group took into account the global development of higher education and science, possibilities of strengthening the visibility of Finnish higher education and research in Europe and globally, and streamlining the integration of foreign students and scientists in the Finnish higher education and research community and society. It also identified the roles of different ministries and other stakeholders and their possibilities of developing joint actions in international cooperation.</p>
<p>Civil servant study on the impacts of business subsidies. MEAE publication 22/2017. Ministry on Economic Affairs and Employment 5 May 2017 (in Finnish)</p>	<p>The study commissioned by the Economic Policy Committee of the Government on the impacts of business subsidies (incl. tax concessions) to the economic growth.</p>
<p>Economic survey, Summer 2017. Ministry of finance publication 28a/2017. Ministry of Finance, June 2017</p>	<p>Economic Survey provides a concise outlook for the immediate future. The Survey also provides a medium term estimate of development.</p>
<p>Use and impacts of open data. Publications of the Government's analysis, assessment and research activities 40/2017. Prime Minister's Office, 16 March 2017 (in Finnish)</p>	<p>This report sheds light on the openness of major data resources maintained by the public administration and on means to assess the economic impacts of open data in Finland. It further studies the relationship between firms' use of open data and their innovation production and growth. Furthermore, this report proposes concrete means how to enhance the impact of open data in our society.</p>
<p>Benchmarking of operational models for promoting exports and internationalisation. Publications of the Government's analysis, assessment and research activities 8/2017. Prime Minister's Office, March 2017 (in Finnish)</p>	<p>The purpose of this international comparison is to assess the network-based Team Finland model against export promotion and internationalisation (EPI) measures in place in the Netherlands, Sweden and Denmark and to determine good practices and possibilities for further development of Team Finland based on comparison data.</p>
<p>Competences and employment in digital transformation. Publications of the Government's analysis, assessment and research activities 24/2017. Prime Minister's Office, 20 February 2017 (in Finnish)</p>	<p>The document presents views on future changes caused by digital transformation to needed competences, employment and jobs based on literature study. The changes mentioned frequently in the literature include growing inequality and differences in salaries, scattering of work and that people may have several jobs at a time.</p>

<p>Innovation ecosystems as drivers of research–industry cooperation. Publications of the Government’s analysis, assessment and research activities 28/2017. (in Finnish) Prime Minister’s Office, 15 2 2017</p>	<p>The development and internal dynamics of ecosystems are examined in this report based on four case subjects, all of which are ecosystems of national economic importance (Forestry, Digital Business, Healthcare, and CleanTech). The report examines the role of different types of enterprise services from the point of view of the development of ecosystems through national and international case studies.</p>
<p>Cooperation between higher education institutions, research institutes and the business sector: the impacts of differences in legal status. Publications of the Government’s analysis, assessment and research activities 34/2017 Prime Minister’s Office, 9.3.2017 (in Finnish)</p>	<p>The report examines what impacts the legal status has on cooperation between research and the business sector and how cooperation could be enhanced.</p>
<p>Business taxation, investments and productivity. Publications of the Government’s analysis, assessment and research activities 6/2017. Prime Minister’s Office, 11 January 2017</p>	<p>The report evaluates the problems and reform options for Finland’s current business and capital income taxation from the perspective of investment incentives, economic efficiency and productivity. The objective is to provide information to support decision-making, the aim being to achieve a tax system that supports growth and investments.</p>
<p>Ecosystems as a target of the new economic and innovation policy, March 2017, Ministry on Economic Affairs and Employment (in Finnish)</p>	<p>The report combines and summarises the research papers produced for and presented at the international research workshop on “Industrial Policy for New Growth Areas and Entrepreneurial Ecosystems” organised by MEAE, Tekes and Sitra. The report provides a framework for studying an ecosystem policy and findings on the role of the public sector in the development of ecosystems.</p>
<p>Entrepreneurial policy for education 2017, Ministry of Education and Culture (in Finnish)</p>	<p>The aim of the entrepreneurial policy for education is to direct, develop and guide the measures taken at different levels of education to provide education in entrepreneurship.</p>
<p>Impact goals of Tekes for the longer term, Tekes Review 337/2017 (in Finnish)</p>	<p>Aim of this study was to develop a framework for measuring business sector’s structural changes in a long-term as well as to study possibilities of Tekes to enhance the impact of its activities to boost renewal.</p>
<p>Evaluating the impact of Sitra: well-being accelerator and pioneer of economic change</p>	<p>Two parallel impact evaluations of Sitra’s activities. One focusing on the well-being, another on the economic impact. Evaluations highlight Sitra’s role as a change-agent in the Finnish society.</p>

The Government presented the ninth Europe 2020 National Reform Programme in April 2017 ([Ministry of Finance, 2017b](#)). Related to research and innovation, the main objectives of the research and innovation policy are: improving the quality and effectiveness of research activity, reforming public sector research structurally and operationally, and diversifying the structure of business and industry. Of the Government’s 26 key projects, around 10 are more closely linked to research and innovation policy.

The Research and Innovation Council (RIC), was established in a revised form in spring 2016 (Research and Innovation Council 2017). During the spring and autumn of 2017, the Council defined its work plan, carried out a vision work and prepared a roadmap of key actions. These actions are largely based on the Government programme and its Key projects ([Prime Minister’s Office 2017b](#)) and the National Reform Programme ([Ministry of Finance 2017b](#)). The ultimate objective of the new vision **making Finland the most attractive and competent environment for experiment and innovation by 2030**. Council’s vision and roadmap define a common direction for Finnish research,

development and innovation policies for the coming years in Finland. They call for both short-term and long-term measures, as well as for more flexibility, to ensure that the vision is achieved even when the operating environment changes. The Council highlights the importance of Finnish research, development and innovation in aiming to solve global problems and respond to international demand. The four key objectives of the RIC vision are 1) *ensuring the competence base*, 2) *the development of platforms for competence and growth*, 3) *internationalisation as a prerequisite for quality and impact*, and 4) *clear processes for strategic decision-making*. Each of these objectives include a number of measures or statements in the vision. The vision and its road map essentially build on activities which are dedicated to a certain ministry or to several actors by the Government. Some activities are already ongoing as part of the Government Key Projects ([Prime Minister's Office 2017c](#))

In parallel to the above, the MEC carried out its own vision process with universities and other stakeholders to define the targets of the higher education and research until 2030 ([MEC 2017b](#)). The Government decided that the vision work should consider comprehensive needs of the research and innovation system ([Prime Minister's Office 2017b](#)). The vision 2030 was published in October 2017 and it will also be complemented with a road map and development programmes. ([MEC 2017b](#))

R&I funding trends

Finland's gross domestic expenditure on R&D (GERD) fell to 2.75% in 2016, having peaked in 2009, at 3.75%. The declining trend is mainly due to the significant fall in R&D investments by Nokia. Despite the decline, the level remains among the highest in the EU and globally among advanced economies. R&D expenditure is estimated to grow in 2017 by around €100m to slightly over €6bn. Growth is anticipated mainly for business enterprises. The GDP share estimate for the year 2017 is 2,7%. There are four main sources of R&D funding: the domestic business sector (€3.25bn, 55%), the public sector (€1.84bn, 31%), foreign sources (€718m, 12%) and non-profit (€94m, 1.6%). The decline in business sector funding since 2008 is clear but public funding has declined, too (see **Error! Reference source not found.**). (Statistics Finland 2017d).

3.1 Public allocation of R&D and R&D expenditure

Public R&D funding (GBAORD as % of GDP) decreased since 2010 from 1.1% to 0.85% in 2016. The fall is estimated to stop in 2017 ([Statistics Finland, 2017d](#)), and will remain above the EU average (EU28 average 0.65 in 2015). The funds are mainly allocated to two ministries: the Ministry of Education and Culture (MEC) and the Ministry of Economic Affairs and Employment (MEAE), and to their agencies. In 2017, the share of MEC is 63% while that of MEAE was 24%. The rest (11%) is allocated to several ministries. The share of MEC has increased during recent years mainly due to additional funding to the Academy of Finland, and cuts in funding of VTT, other PROs, and University hospitals and especially of Tekes ([Statistics Finland, 2017c](#)). Finland's government support for business R&D is among the lowest in the OECD ([OECD 2017b](#)), and no tax incentives are used. Reducing the degree of government support for business R&D bares the risk of reducing innovation opportunities for the Finnish industry, and in return can be expected to exacerbate the decline in BERD that may amplify the stagnation in productivity growth from which the Finnish industry is currently suffering ([OECD 2017b](#)).

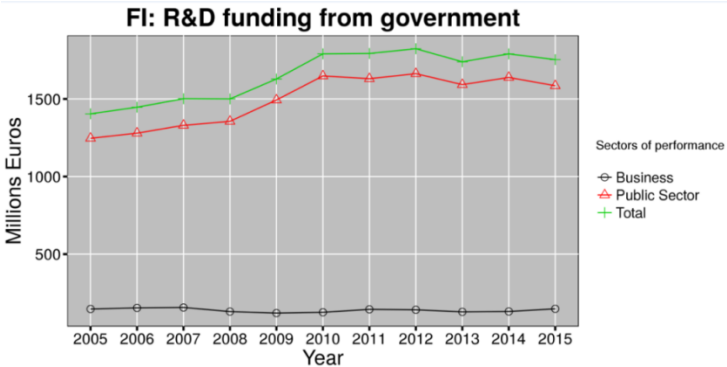
The major R&D funding agencies, Academy of Finland and Tekes - the Funding Agency for Innovation, are responsible for most of the competitive funding: in 2017, the Academy 25% (2.5% increase from 2016) and Tekes 18% (15.4% decrease from 2015) of public R&D funding ([Statistics Finland, 2017c](#)). The Academy provides funding for scientific research and researcher training, and aims at improving research capacities. Since 2014, The Academy runs the Council for Strategic Research (€55m) which includes societal impact criteria besides scientific quality. Tekes funds for applied research in universities, research institutes and large companies, provides competitive grants and

loans for development and innovation in SME's, grants and loans for YIC's (Young Innovative Companies) and start-ups, and VC-investments as a fund of funds. As a new measure, an innovation voucher was launched by Tekes in 2016. The innovation voucher is intended for SMEs engaged in well-established business, wishing to launch innovation activities. It may be used for purchasing expert services related to innovation activities ([Tekes 2017a](#)).

Public research is conducted by universities (14 in total), public research organisations (12) and universities of applied sciences (23+2). In research institutes and elsewhere in the government sector and in the higher education sector, R&D expenditure remained in 2016 on level with the previous year. Public research organisations (PRO) perform about 9% of all R&D activities. GERD as a % of GDP performed by PROs was 0.25% in 2016 (EU28 average 0.24 in 2015). The share of funding (for research) from outside sources was 55% in PRO's in 2016. The reform of central government research institutes and research funding has increased the share of competitive funding for PROs.

HEI's renewed funding model will emphasize scientific quality but incentives for cooperation and societal and economic impacts remain quite weak. Higher education institutions (HEI) perform around 25% of all R&D activities in 2016. Universities' share of the HEI R&D expenditures was 86%, universities of applied sciences' share 9.6% and university hospitals' share 4.5%. GERD as a % of GDP performed by HEIs was 0.69% in 2016 ([Statistics Finland, 2017d](#))(EU28 average 0.47 in 2015). The general trend in R&D funding from the Government is shown in the Figure 3

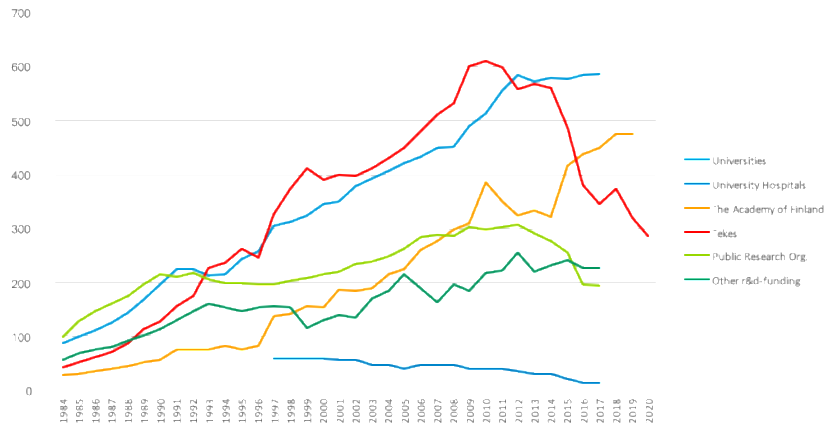
Figure 3: Trend in R&D funding from Government, Finland



Data: Eurostat

However, the overall funding trend doesn't reveal the sharply diverging trends across different types of public RDI funding, namely the steep decline of Tekes funding. Based on the Government decisions in 2016 and 2017, the cuts in Tekes awarding mandate in 2015-2017 (21% decrease; [Statistics Finland 2017c](#)) will be realised as paid funding after a couple of years. The long-term trend, including the latest years, is illustrated below. The Government R&D funding decreased in the state budget in 2017 by 2.5% from the year before. The Government's key projects may bring some compensation to the cuts.

Figure 4: Government R&D funding at current prices 1984-2020 (€ million)

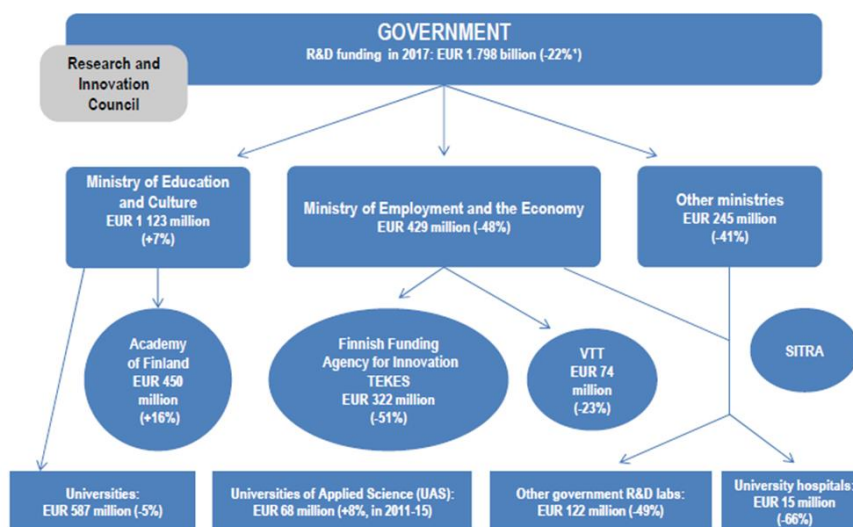


Source: Tekes 2017.

Estimations for 2016-2020 based on 2018 budget proposal and government allocation frame.

The main funding flows based on the state budget 2017, and percentage changes compared with 2011 are presented in the Figure 5. The priority in research has shifted towards scientific research, and public funding for Business Enterprise Sector (BES) has declined and shifted towards refundable instruments, nearer to markets. Therefore, funding for applied strategic research, radical innovations and any knowledge creation and competence building required by businesses is further weakening compared to leading OECD countries. There is an important, slightly positive, development in the new budget proposal for 2018. Some increases are proposed to Tekes (+8%), although minor cuts from others. These changes to the state R&D budget are marginal (+1%), but to a right direction. The budget explanation is more interesting: it appears that most concerns stated by the OECD Review are being addressed by the Government (Ministry of Finance 2017a).

Figure 5: Government R&D funding budget for 2017, main funding flows and percentage changes compared with 2011



Note: 1: Volume of government R&D funding in 2017 and the development of funding in 2011-2017 in real terms.
Source: Statistics Finland (2017).

Source: OECD, 2017

Public funding for research and especially incentives for innovation has been cut significantly in Finland over the last years. The long-term balance between bottom-up and top-down policies has shifted towards top-down policy, and the role of the MEC and basic research has been strengthened at the cost of the MEAE. MEAE's focus has shifted towards near-to-markets activities at the cost of strategic and applied research ([Statistics Finland 2017c](#)).

The Government programme ([Prime Minister's Office 2015](#)) with its Key projects ([Prime Minister's Office 2016](#)) include many reforms and activities – some of them (about 10 of 26) are linked to research and innovation policy. Of key project financing, a total of €59m has been allocated to Tekes and €30m to the Academy of Finland in 2016–2018 ([Ministry of Finance 2017b](#)). The mid-term review of the Government lists the achievements of the Government until now and defines next steps as well as new openings ([Prime Minister's Office 2017b](#)). The topics of the new openings, under the theme *Knowledge, growth, employment*, are: Employment package, Entrepreneur package's update, Circular economy, Business Finland, Innovative public procurement, Talent Boost, STI-reform, Creative economy, Artificial intelligence, Sustainable city development, and Labour from outside EU/EEA. The STI-reform includes a "principal decision" for additional investments in knowledge, growth and employment: capitalisation of vocational knowledge centres €80m, flagship institutes €60m and Tekes €60m, and focused funding mandates increase for 2018 and 2019 of the Academy of Finland (€50m) and Tekes (€60m) ([Sipilä, J. 2017](#)). Anyhow, compared to the previous cuts in funding mandates, the increase is marginal.

As a part of the above-mentioned reform of **the pooling of resources to the Prime Minister's Office (PMO)** and the **establishment of the Strategic Research Council (SRC)** at the Academy of Finland were attempts to strengthen knowledge- and evidence-based decision making, to train academics to carry out policy relevant analysis, and to target resources to solve societal challenges. The OECD Review states that the planned role of the PMO is ambitious and quite unique, at least among the Nordic countries. However, it is too early to tell what extent efforts to strengthen co-ordination have led to improved policy making and how the reports commissioned by the PMO will be used in

policy making and what impact they might have. Related to SRC, the OECD Review assess that, the research funded by the SRC might be considered to be “strategic” in the sense that it targets important questions in society. However, while systematic efforts to identify and support strategic research and innovation in the sense of investing in the development of “key enabling technologies”, or targeting areas identified by the government, such as “bio-economy”, “health” or “clean-tech” are under way, there is room for more significant support in these areas. Overall, further developing strategic research, including through adequate steering and funding of public research institutions, remains a challenge ([OECD 2017a](#)). The assessment may be interpreted that the share of the public R&D funding allocated to strategic research and innovation should be higher. It may also refer to the need to strengthen the role of businesses in strategy processes.

3.2 Private R&D expenditure

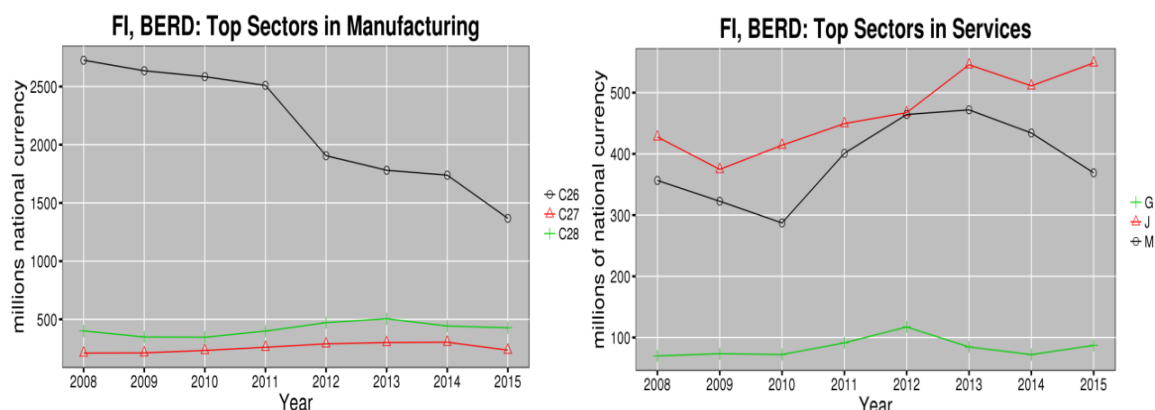
Business expenditure on R&D (BERD) stood at 1.81% of GDP in 2016, showing the strong role of the private sector in the Finnish R&I system (EU average 1.32% in 2016). The share of GERD performed by the Business enterprise sector (BES) was 66%, and 61% was funded by the BES (including from abroad) in 2016 ([Statistics Finland 2017d](#)).

However, private R&D intensity in Finland saw a general decrease since 2009, although it still is at a high level in comparison to other leading EU countries. Finland reported on a decline in the business sector's share of R&D expenditure from 74% to 66% in 2008 to 2016 ([Statistics Finland 2017d](#)). The decline is related to the severe drop in R&D expenditure in manufacturing and especially in ICT-manufacturing (See Figure 6 below). ICT-manufacturing is still the leading sector in terms of R&D expenditure (although not in terms of turnover or export) in Finland. It was dominant in R&D in 2008 (about 58% of BERD), and still in 2016 was large (35% of BERD – [Statistics Finland 2017d](#)). This is mostly due to the restructuring of Nokia. Nokia’s share of BERD peaked in 2009 (slightly above 50%), and has declined to less than 20% in 2014 (estimated by ETLA, [Ali-Yrkkö & al. 2017](#)). A small part of this decline in BERD was compensated for by an increase of R&D expenditure in services and other manufacturing. Manufacturing and services accounted for 93% of the BERD in 2016. In fact, BERD in manufacture went from 2.07% of GDP in 2010 to 1.2% in 2016 whereas BERD in the service sector increased from 0.46% to 0.53% of GDP during the same period ([Statistics Finland 2017d](#)). Equally, the share of services is high (up to 50% in many manufacturers) among manufacturing companies at present, and therefore a much greater share of BERD is focused on services than the statistics might imply.

Finland’s R&D is dominated by large companies (73% of R&D). The moderate role of the SMEs and especially of “mid-caps” is a challenge for Finland. Foreign affiliates in Finland covered only about 11% of the business sector R&D expenditures in 2016 ([Statistics Finland 2017d](#)). Related to innovation in general, 55% of companies (with more than 10 employees) reported innovation activity in 2012-2014 ([Statistics Finland, 2016b](#)), which is above the EU average. Although Finland ranks very high in the intensity and frequency of business-academia cooperation, the volume of BES funded research performed by HEI and PRO is low, and most of the BES’ R&D investments are focused on improvement of existing products and services ([Synergy Group Europe 2013](#), [EIB 2017](#), [Statistics Finland 2017d](#)). Therefore, BES R&D investments are not reaching for radical new to global markets innovations which may indicate weak incentives – both demand driven and funding incentives.

Finland has not been very successful in attracting FDI which net inflows were 3.9% of GDP (Finland’s rank 38th). Venture capital deals/bn PPP\$ 0.3 (Finland’s rank 5th), and Finland heads the charts in European venture capital investments in start-ups and early stage growth companies as percentage of GDP between 2012 and 2016, well above the OECD average, although it is far from the corresponding figure for Israel and the United States ([Cornell University, INSEAD, and WIPO 2017](#); [OECD 2017a](#) and [Finnish Venture](#)

Figure 6: Top sectors in manufacturing and service sectors



Data: Eurostat

Note: (C26=manufacture of computer, electronic and optical products; C27= manufacture of electrical equipment; C28=manufacture of machinery and equipment n.e.c)

J=information and communication, M=professional, scientific and technical activities, G=wholesale and retail trade; repair of motor vehicles and motorcycles

Table 2 lists top ten Finnish companies ranked by R&D. The trend causes some concern: the number of Finnish R&D-intensive “frontier” companies in the EU area has declined from 70 companies (in the top-1000 list of the EU Industrial R&D Investment Scoreboard) in the mid-2000s to slightly over 40 in the mid-2010s. Other countries and their companies have overtaken Finland ([OECD 2017a](#)).

Table 2: Top ten Finnish companies ranked by R&D

Global Rank	Name	Industrial sector	R&D 2015/16 (€mill)	R&D 1-year growth (%)	R&D 3-years growth (%)	R&D intensity (%)
16	NOKIA	Technology Hardware & Equipment	2502	-7.9	-15.6	18.4
190	WÄRTSILA	Industrial Engineering	138.0	-15.9	-13.3	2.7
207	STORA ENSO	Forestry & Paper	124.0	19.2	14.9	1.2
213	KONE	Industrial Engineering	121.7	18.0	12.2	1,4
235	ORION OYJ	Pharmaceuticals & Biotechnology	103.4	1.6	1.1	10.2
278	CARGOTEC	Industrial Engineering	79.6	33.3	4.4	2.1
281	AMER SPORTS	Leisure Goods	77.7	2.0	2.5	3,1
327	TIETO	Software & Computer Services	60.0	20.0	16.4	4.1
371	VALMET	Industrial Engineering	49.0	40.0	-4.9	1.7
373	OUTOTEC	Industrial Engineering	47.6	3.0	11.4	4.0

Source: (European Commission; the Economics of Industrial Research & Innovation (IRI 2016), EU – 1000

companies ranked by R&D¹. Note: The IRI scoreboard doesn't include the R&D expenditures of the Finnish affiliates of multinationals. For example, the R&D expenditures of ABB Finland were €129m in 2016.²

3.3 Supply of R&I human resources

Although there have been some cuts since 2010, Finland still invests significantly in education. The public expenditure on education (6.2% of GDP in 2015) is still amongst the highest in EU, second only to Denmark (7.0) and Sweden (6.5). In 2015, the total number of students in education leading to a qualification or degree remained on level with the previous year, at 1.27 million, although the *number of students in university education declined*. The new students totalled 283,100 and that of attainers of qualifications or degrees 223,500. A total of 52% of new students and 54% of attainers of qualifications or degrees were women. ([Statistics Finland, 2017e](#))

On the other hand, education leading to a *higher university of applied sciences degree* has increased by 8% in 2016. Nearly 130,000 students attended education leading to a university of applied sciences degree and 11,000 students education leading to a higher university of applied sciences degree in 2016. The number of university of applied sciences degrees completed was 23,200 and that of higher university of applied sciences degrees 2,500 ([Statistics Finland, 2017f](#)).

New graduates in science, maths, computing, engineering, manufacturing, construction is higher in Finland than the EU average (3.02 per 1000 population, 2016, vs 2.32 for EU-28, 2015). Finland also ranks above the EU average with regard to new doctorate graduates (1.27 per thousand population, 2016 vs 1.22, 2013) and the number of researchers (10.18 per thousand population in 2015 vs 5.61). However, the *share of female researchers* in Finland is below the EU average (32.29% vs 33.44%, 2015).

OECD PISA scores suggest that the quality of the Finnish secondary school system is still strong, although these scores have deteriorated in recent years. In the latest PISA survey Finland ranked sixth among in mathematics, fifth in problem solving, third in reading and second in science ([OECD 2016a](#)). Also in adult skills, Finland ranks among the best in the OECD (PIAAC) for literacy, numeracy and problem solving in technology-rich environments. Average proficiency in both literacy and numeracy are second highest in the OECD, and second only to Sweden for the proficiency in problem solving in technology-rich environments among adults ([OECD, 2016b](#)).

In particular the high level of ICT specialists is considered a strength of Finland ([DESI 2017](#)). In 2015 Finland had 6.5% of individuals with ICT skills (ranked #1), compared to EU average of 3.5%. Finland scores quite well also in STEM Graduates; amongst the EU countries, Finland ranks 4th with 22 graduates per 1000 individuals, when the EU average was 19 (2014). Altogether Finland maintained its top position in 2017 DESI Human Capital rankings (scored 0.76 vs EU 0.55).

On the downside, the employment of recent graduates continued weakening in 2015, and has weakened already for five years. Among those with qualifications from upper secondary vocational education, 65% were employed and among those with higher university degrees 80%. In 2015, 65% of all recent graduates were working, which is one percentage point lower than in the year before. In total, 50% of graduates were working full-time and 15% were working besides studies in 2015. The proportion of the unemployed was 14%.

Employment of men graduating from vocational education was particularly difficult. In 2015, *only 58% of men with vocation qualifications* and 71% of women were working.

¹ <http://iri.jrc.ec.europa.eu/scoreboard16.html>

² <http://new.abb.com/fi/abb-lyhyesti/suomessa>

Respective figures for university of applied sciences were 79% and 83%, as well as for university degrees 83% and 82% respectively. 90% of women and 85% of men with doctorate degrees were employed. ([Statistics Finland, 2017g](#))

Furthermore, with regard to *international linkages* in research and innovation, Finland underperforms in a number of dimensions. In terms of international co-inventions as reflected in patents, Finland is farther from the top performers than Sweden and Denmark, although it is doing better than the OECD average (with respect to the top performer). In regard to international co-operation in research as reflected in the number of international co-publications, Finland has been improving significantly, moving from 42.2% of total publications (involving co-authors located in a foreign country in total publications) in 2003 to 52.3% in 2012, which is above the OECD average. Yet most OECD countries, including the Nordic ones, have also increased this ratio significantly over the years (e.g. Denmark from 47% to 55% and Sweden from 45% to 56%).

Finland also underperforms in terms of *international mobility* of scientists and share of *foreign researchers* in the total number of doctorate holders, which suggest difficulties in attracting foreign talents and promoting the mobility of Finnish researchers abroad. According to the OECD Science, Technology and Industry Scoreboard ([2015](#)), in 2010- 11 only 7.1% of doctorates were of foreign origin whereas in Sweden and Norway this ratio was 20% and 32%. The figure for Denmark was 11%.

In terms of inflows of scientists (coming to Finland as a percentage of authors and based on the last recorded affiliation), the rate of incoming researchers was 4.2% (in 2013 according to Scopus data), which is lower than the OECD average (6%) and lower than Sweden (7.1%), Denmark (6.8%) and Norway (6.4%). Finland also lags behind its Nordic peers in terms of outflows: outflow rates reached 5.1% whereas in Sweden this ratio was 8% and in Denmark, 7.4%; the OECD average was 7.3%. ([OECD, 2017a](#))

4 Policies to address innovation challenges

4.1 Challenge 1: Enhancing the commitment to R&D, innovation and skills

Description

Finland still ranks well in most of the indicators related to the innovation policy but the development during the last years has been poorer than in many developed countries. Finland achieved a widely acclaimed transition from a largely resource-based to a leading knowledge-based economy shifting towards high-technology manufacturing and knowledge-based services. However, Finland was hit hard by the global economic crisis in 2009, and disruptive technological change contributed to the decline of Nokia's handset business and a sharp drop in exports of ICT goods. In the following years Finland lost ground vis-à-vis its peers in terms of productivity and competitiveness. Industrial restructuring entailed a steep decline in business R&D expenditure. The decline in central government and business R&D investments since 2010, are challenging the R&I landscape in Finland. The share of business-relevant research is low, and continued to decline in 2017. The impact of the budget cuts will further increase over the short-medium term. The commitment in Finland by stakeholders to a joint vision of a knowledge-based society with investments at the forefront of innovation is not evident anymore. R&D investments outside of the leading companies are just average, and below average for SMEs.

Policy response

The Government programme includes a number of Key Projects focusing on innovative procurement, piloting, experimentation, internationalisation, growth companies and near to markets incentives. The Key Projects to reform competencies and education mainly focus on education. Other changes in budget allocations for research emphasise curiosity driven research. However, there have also been significant funding allocation cuts, as set out in section 3. A number of reforms in the Finnish higher education system are continuing e.g. the merge of University of Tampere and Tampere University of Technology and Tampere University of Applied Sciences (Prime Minister's Office 2017a). Government resources towards a new technical network-university, Finnish Institute of Technology (FITech) in Southwest Finland were already started in October 2017. (MEC 2017a) The Government also decided additional capitalisation of universities (three times the private capital universities are able to collect in 2014-2017, at most €150m) and the universities have now succeeded in private capital rise. The reform of State Research Institutes and Research Funding (adopted in 2013) will continue, as detailed earlier, significantly changing the funding and structure of the country's public research institutes over the past decade. In terms of R&I support and coordination across Government, the RIC has decided its vision and roadmap until 2030 (Prime Minister's Office 2017c), and the MEC has launched a process for creating a vision for the Finnish higher education and research in 2030. The vision has been published, and the process continues for defining a roadmap (MEC 2017b).

Assessment

During the recession, the widely shared consensus on the role of science, technology and innovation (STI) epitomised by the renowned Research and Innovation Council (RIC) has weakened. Cuts in public spending on R&D, especially funding for applied research, have exacerbated the drop in business R&D. The innovation agency's budget has been cut severely. This, combined with cuts at VTT and other research institutes, has opened a gap in funding for technology development and innovation opportunities for the Finnish industry, and in return will amplify the stagnation in productivity growth from which the Finnish industry is currently suffering. It is obvious that the confidence in and understanding of the significance of knowledge, research, development, intangible investments and innovation for the national economy and productivity growth has very much disappeared.

The Government's recent policy plans and reforms signal some commitment to R&I, and the objectives of specific plans are very relevant from the R&I policy perspective. The initiatives related to innovative procurement, piloting, experimentation, internationalisation and growth companies are much welcomed. Policy programmes for new growth areas, such as clean technology, biotechnology and digitalisation are promising, although of relatively small-scale. The Government Key Projects introduce a genuinely new approach to R&I policy-making in Finland - precisely focused and resourced initiatives with specific targets and deadlines. They also focus on developing ecosystems which is positive. The Government has especially focused on solving short- and medium- term challenges, which is rational and crucial, but when it happens at the cost of the needs of long term development, Finland will lose opportunities to increase productivity, to create jobs, and thus raise standards of living.

Although there have been commendable initiatives (e.g. regarding start-ups and entrepreneurship), STI policy lacked coherence and orientation in recent years. Nevertheless, education, R&D and innovation remain paramount for Finland's future economic and broader social development and standards of living. While many of the changes referred above took place in 2015 and later, it is hard to gauge the effects of the institute reform on PRIs and on Finland's innovation system more generally (OECD 2017a). Nevertheless, the new vision and roadmap of RIC, and a vision and roadmap for

the Finnish higher education and research in 2030 by the MEC are encouraging policy signs.

4.2 Challenge 2: New measures and resource allocation to exploit knowledge and competence for economic and societal renewal

Description

Diversifying the economy remains a central issue. Finland has a narrow range of industries in which it enjoys comparative advantage and needs to build new export strengths, while established industries extend their capabilities to compete in high value-added segments on international markets. Company R&D funding has focused more on developing existing products and services than radical innovations compared to leading countries. At the same time, the long-term balance between bottom-up and top-down policies has shifted towards top-down policy, and the role of the MEC and basic research has been strengthened at the cost of the MEAE. MEAE's focus has been shifted towards near-to- markets activities at the cost of strategic and applied research.

Policy response

National innovation policies aim at diversifying the structure of business and industry, improving the level of research activity and reforming public sector research structures and operations aiming at sustainable growth and employment ([Prime Minister's Office 2017b](#)). The Government Programme 2015-2019 includes R&D policy objectives on university-business collaboration to utilise and commercialise research results. It also plans to support new skills based business activity by building growth environments as well as innovation and development platforms and ecosystems for digital business and providing open data resources. Funding increase for business capital markets is also announced ([Ministry of Finance 2017b](#), [Prime Minister's Office 2017b](#)). Investments in new growth sectors are planned, including in the bioeconomy, clean and green technologies, healthcare, and digitalisation, which cuts across these areas. There will be measures to boost experimentation, as well as deregulation. Public services will be digitalised. Tekes is running programmes related to digitalisation (5G, IoT, Smart City), and new programmes are under preparation. The digitalisation strategy of Tekes was widened to a national strategy Reboot Finland together with the MEAE and Finpro, with the Federation of Finnish Enterprises and the Confederation of Finnish Industries as partners ([Reboot Finland 2017](#)).

The mid-term review of the Government lists the achievements of the Government until now and defines next steps as well as new openings ([Prime Minister's Office 2017b](#)), with new openings, under the theme Knowledge, growth, employment, as detailed earlier. The STI-reform includes "a principal decision" for additional investments in knowledge, growth and employment: capitalisation of vocational knowledge centres €80m, flagship institutes €60m and Tekes €60m, and focused funding mandates increase for 2018 and 2019 of the Academy of Finland (€50m) and Tekes (€60m) ([Sipilä, J. 2017](#)). However, compared to the previous reductions of resources especially from applied research, business relevant research and companies R&D incentives, these additional investments are modest.

Assessment

There is still scope for Finland to improve its business environment and framework conditions for innovation and entrepreneurship, notably in the areas of competition and regulation, labour market flexibility, and tax policy. Among the most problematic factors for doing business in Finland are high tax rates and restrictive labour regulations, and

competition conditions in a number of sectors - e.g. gas, retail and transport, among others (OECD 2017).

The Government Programme's objectives aiming at diversifying the structure of business and industry, improving the level of research activity and enhancing the cooperation between industries, HEIs and PROs are rational. The targets and activities to speed up commercialisation of research results are welcomed, too. However, the introduced cuts are steering the focus of public research funding towards curiosity driven-research. At the same time, the incentives shift company research projects nearer to markets, which increases the imbalance of the allocation of R&I investments in Finland. Near-to-markets activities are not enough in a longer term – renewing the economy and society requires knowledge base for radical innovations. The imbalance of resource allocation, which has been a long lasting phenomenon in Finland, will continue and even worsen. Funding for applied research and “enabling technologies” (e.g. biotech, nanotech, advanced materials, advanced manufacturing) aimed at supporting innovation capacity to address both industrial and societal challenges needs to be further enhanced. Funding and novel (joint) operating models for VTT and other research institutes also need to be reinforced to maintain their quality and industrial impact, and address the “strategic research” needs of industry and intermediary stages of the innovation process. The new vision and roadmap of the RIC with the Government's commitment announcement implies that a change may be going on, but this commitment has not yet been reflected in budget allocations.

The Government's announcement of the STI-reform including increase in R&D funding, industry-academy cooperation and ecosystem development is a positive weak signal of changing the trend in public R&D funding but it doesn't solve the problem related to the lack of funding for strategic applied research, industry-academy cooperation and industry-relevant knowledge base creation without new resource allocation. The additions are small compared to cuts, and capitalisation does not incentivise these.

4.3 Challenge 3: Improving implementation and collaboration within the innovation system

Description

Finland provides generally favourable framework conditions that could facilitate the economy's renewal based on innovation and entrepreneurship. Recent reforms promote employment, entrepreneurship and economic growth and aim at reducing regulatory burdens for businesses ([OECD 2017a](#)). There is still scope for rendering business policies and product market regulation more competition-friendly by encouraging competition, firm entry and easing cumbersome regulations in certain sectors. Labour market flexibility could also be enhanced. However, cross-sectoral cooperation is still a challenge in Finland. Favourable framework conditions and demanding markets are strong incentives to companies and give motivation for innovation and cooperation. Business-research organisation cooperation has been very strong in Finland but has weakened during recent years, mainly due to lack of public incentives.

Policy response

The Government Key Projects focus on innovative procurement, piloting, experimentation, internationalisation, ecosystems, knowledge hubs, growth companies and near to markets incentives and deregulation. They also define cross sectoral responsibilities for objectives and activities, and R&D policy objectives on university-business collaboration to utilise and commercialise research results. In terms of R&I support the RIC defined a new vision and roadmap including objectives for cooperation.

As a part of the reform of the pooling of resources to the Prime Minister's Office (PMO) and the establishment of the Strategic Research Council (SRC) at the Academy of Finland are attempts to strengthen knowledge- and evidence-based decision making, to train academics to carry out policy relevant analysis, and to target resources to solve societal challenges.

The MEC has started a vision process to define the targets of the higher education and research until 2030 ([MEC 2017c](#)). The vision has been published, and the process will continue for defining a roadmap. The Government decided that the vision work should consider comprehensive needs of the research and innovation system ([Prime Minister's Office 2017b](#)).

Business with Impact ([BEAM](#)) – a joint five-year programme, started in 2015, by the MFA and Tekes aims to assist Finnish enterprises in addressing global development challenges and in creating sustainable business cooperation with local partners. The total budget of BEAM is €50m of which one half comes from private sector, another from public, the share being equally financed by MFA and Tekes.

The major R&I actors (Finpro, Finnvera, Tekes, TESI) have moved to the same premises (Team Finland house), and Tekes and Finpro have been merged to Business Finland to further intensify service providers' cooperation. A change in Tekes research funding (starting 1.1.2018 as Business Finland Funding) focusing on joint projects by research organisations and companies aims to boost the cooperation between parties.

Assessment

The Strategic Research Council, and the Prime Minister's Analysis Unit, represents an ambitious effort to strengthen knowledge-based decision making, particularly on societal challenges. To strengthen impact, Finland should consider encouraging close coordination with instruments and policies for the participation of innovation actors, including business enterprises, and more downstream innovation development. More attention should also be given to how research on societal challenges can be turned into concrete, viable and scalable solutions ([OECD 2017a](#)). It would be positive if the new RIC helps build consensus and commitment on a new national RDI strategy, and the Government creates conditions for a good balance between top-down and bottom-up policies.

The budget cuts in R&D funding that focused on the support to business R&D are having an impact. A study shows the effectiveness of the support ([MEAE 2017c](#)), with roughly half of University-business cooperation based on such incentives (Tekes Project database, and [Statistics Finland, 2015](#)). The Academy of Finland's Key Project funding aiming at strengthening the quality and impact of research will remain limited in light of the broader funding cuts.

The termination of public funding of the strategic centres for science, technology and innovation (the government's most ambitious effort to establish industry-academia linkages and industry-driven research agendas) has not been mitigated by other initiatives for more long-term platforms or strategies for industry-academia research and innovation co-operation. The cuts in Tekes' funding can be argued to have shifted resources away from long-term industry-academia collaboration (particularly with larger firms) and from commercialisation and technology transfer. The merge of Tekes and Finpro as well as the change in Tekes research funding focusing on joint projects by research organisations and companies boost the cooperation but the resourced are limited compared to previous incentives (Tekes 2017b).

The BEAM mid-term evaluation report compiles the results of the developmental evaluation process (since the start) and recommends stronger collaboration with Finnish embassies and external services present in target countries ([MFA 2017](#)). The move of the major R&I actors (Finpro, Finnvera, Tekes, TESI) to the same premises (Team Finland

house) as well as the merger of Tekes and Finpro to Business Finland could further intensify service providers' cooperation.

4.4 Challenge 4: Strengthening quality, relevance and internationalisation of science & research

Description

With regard to the quality and internationalisation of research, the performance of the Finnish innovation system is merely among the EU average level. Hence, strengthening of leading-edge research and internationalisation of R&I is needed. While overall the inputs to the science base remain strong, the scientific performance of Finnish research, measured by bibliometrics, including citation indicators, has remained flat since 2000. Despite high R&D investments and shares of new doctoral graduates, it is not matched with high quality scientific output. One explanation is that specialisations in key or strategic fields have not been sufficiently pursued, resulting in low numbers of researchers at the top of their field. Further internationalisation is critical for the performance of a small open economy and innovation system. The internationalisation of firms and access to global markets is paramount to enhance innovation activity and firm growth. There is a large gap between the ability of large firms and that of SMEs to access markets. New export niches require appropriate channels for innovative Finnish products and services to reach global markets. Maintaining a high level of global value-chain integration and attracting more foreign direct investment is critical, all the more so as the decline of large domestic firms in core industries has made it more difficult for many Finnish firms to access global markets. Both domestic and foreign-owned companies can play an important role in this regard.

Policy response

The current government is addressing the quality of research through the reform of the research system and by setting budget incentives of universities. The government budget cuts are aimed at encouraging stronger specialisation and strategic choices at universities and research institutions. The relevance of the scientific research for innovation and the economy of the country is not measured, although there is a strong evaluation culture. There are a number of measures, which are aimed at increasing the quality of the science base through structural changes, improving financial incentives and reforming the financing models. These include the new University funding model (2013, 2015 and 2017), the structural development scheme for universities of applied sciences implemented in 2014, the reform of research institutes and research funding (starting 2014) including the establishment of the Strategic Research Council (SRC) in 2014. These reforms are still going on. Specialisation of universities is catalysed by the MEC (Strategic development option of the funding model) and by funding incentives of the Academy of Finland (€50m). Universities Finland (UNIFI) is taking part in the process by negotiating to agree priorities and focus areas among universities. Some structural reforms are also fostering specialisation – a recent example is the establishment of the new technical network-university FITech (Finnish Institute of Technology).

The Government Programme outlines the Finnish education and culture policy and specifies the main objectives and tasks for this. According to the Programme, Finland will be further developed as one of the world leaders in education, knowledge and modern learning. The objective is to raise the level of competence and education. Six of the Government's Key Projects focus on promoting these objectives, with a total funding of €300m in 2016–2018. Most of this will be focused on education, some on working life and culture. One of the Key Projects is focused on cooperation between higher education institutions and business life allocating €30m to the Academy of Finland. Tekes has launched its own funding programmes in support of the key project.

The MEC has started a parallel process to the RIC vision process to define the targets of the higher education and research until 2030. The vision has been published in October 2017, and a roadmap definition is underway (MEC 2017c).

Finland is committed to addressing the weak internationalisation of its science base. MEC prepared new guidelines for internationalisation of higher education and research (MEC 2017a), and the Government, in its mid-term review, has made decisions related to operationalize the Key project programme. The Team Finland network's strategy was renewed in 2015, and Business Finland will start in 2018 boosting promotion of Finnish companies' access to markets abroad, and bringing together all state-funded actors and the services they offer to promote internationalisation and attract foreign investments to Finland.

Assessment

An evaluation of the university reforms in 2016 found that universities have started to think more strategically about where they should be headed and what they should be doing. At the same time, it is still too early to discern how this increased strategic thinking has been transformed into action, decision making and prioritisation or "re-prioritisation" in terms of recruitment and the allocation of basic funding. Thus, the evaluators found that "while the increased autonomy has improved the universities' preconditions for profiling, structural reforms have progressed rather slowly" ([MEC & Owl Group, 2016](#)). A challenge with evaluating the effects of the university reforms is that many other changes have occurred at the same time, all of which affect universities, such as funding cuts, university mergers, the drastic reduction of Nokia's R&D activities, and the economic crisis ([OECD 2017a](#)). The OECD Review recommends improving the strategic use of resources at HEIs by considering reducing the proportion under performance-based criteria in institutional funding thus minimising the unintended negative effects of performance-based funding, and on the other hand, considering adding an "impact" dimension to the assessment to better recognise "third-mission"/"societal interaction" activities (such as technology commercialisation) and advance a specific impact assessment and measurement agenda in this context.

While only bibliometric indicators have been used in the 2016 review of the state of scientific research in Finland (Academy of Finland 2016) to measure quality, the relevance of the research has not been measured, one should be cautious in drawing conclusions. As an example, the review defines Finland's performance to be poor in ICT related sciences, but in ICT related patenting Finland is on top globally. This indicates the need for broadening the scope of indicators in assessments as well as in funding models of universities. Related to this, regional policies may also affect its ability to reach scientific excellence as several universities are established in remote locations with low local demand combine with a lack of specialisation that might otherwise attract top talents or support comparative advantages.

The OECD Review assess that it is too early to say but the funding cuts, combined with new sources for funding for research on societal challenges – such as the SRC and the Prime Minister's Office's resources for research and analysis – could mobilise PROs to seek more external funding, which in turn could help them become more dynamic and relevant. It is not evident that the reform of the research institutes has led to a reallocation of resources, and a strengthening of more strategic research, which was one of the key objectives behind the reform.

Relevance of research is also important if societal and economic impacts are sought. The policy of the Government (related to the funding cuts) redirects the priority in research funding allocation towards curiosity driven, open research, and the priority in innovation funding towards incentives nearer to markets. Therefore the knowledge-base development for the needs of enterprises, including applied research, appears to be insufficiently funded, and enterprises' role in choosing research topics and guiding the

research in cooperation initiatives is weakening. Funds allocated to the Key Projects are marginal compared to the cuts in the same areas.

Finland's international attractiveness could be increased by strengthening specialisation and excellence in key areas of research and innovation, and better global marketing of the best local skills and technology assets ([OECD 2017a](#)). Universities themselves have been active in boosting internationalisation. However, the slow progress may reflect the lack of internationalisation of the economy and society as a whole, including immigration policies. To support EU programme participation and broader internationalisation, the University funding model reforms sought to increase incentives for internationalisation.

5 Focus on R&I in National and Regional Smart Specialisation Strategies

New policy developments

In Finland smart specialisation is tightly linked with smart regions. The Decision on Regional Development ([MEAE 2016](#)) directs regions to pay attention to their regional smart specialisation to enhance competitiveness and vitality.

Nationally, the priority areas of Finland's Smart specialisation are: 1) Manufacturing and industry, 2) Key Enabling Technologies, 3) Sustainable innovation, 4) Human health & social work activities, and 5) Information & communication technologies. ([EC 2017d](#)) Government's vision for 2025 is that regions will have created growth based on high-quality competence and sustainable development, and that smart specialisation based on regional strengths, active renewal of business structures, and a better basis for entrepreneurship and business operations have created economic prosperity. Utilising the resources of the whole country, the Government aims to raise Finland's economy to a sustainable level. Priorities of the regional development are summed up as three policy outlines: 1) Growth through renewal, 2) vitality through well-networked regions, 3) well-being through partnerships. At the regional policy level the aims and measures are linked to the five priority areas of the government programme: 1) employment and competitiveness, 2) knowledge and education, 3) wellbeing and health, 4) bioeconomy and clean solutions, and 5) digitalisation, experimentation and deregulation ([MEAE 2016](#)).

Amongst the national level activities targeted towards the regions are the Innovative Cities (INKA) Programme and the government Growth Agreements signed in 2016 (10 agreements) with the major cities. Although current plans include many INKA activities, the Government has decided that the INKA-Programme will end during 2017. Cooperation between universities, universities of applied sciences and research institutes is aimed to build stronger but fewer regional knowledge hubs to boost European SF interventions in RDI. In June 2016, the Government decided to allocate an additional €9m to regional innovations and experiments (AIKO) for the current year. In total it allocated €30m to the AIKO activities for 2016-2018, under the Government Key Projects. These activities include the growth agreements with major cities, as well as Anticipated Structural Reforms (ERM) of regions. The ERM covers several experiments and activities to enhance regional economic resilience and adaptation.

Government plans on establishing a centre of excellence during spring 2018 to enhance innovative procurements which concerns especially municipalities. As part of the Government's Finland 100 – renewal package the Government also plans on providing additional funding to Tekes to establish new public-private partnerships (so called growth engines/kasvumootorit) and to Academy of Finland to boost research activities through strategic flagships ([Prime Minister's Office 2017b](#)).

Progress on implementation

Finland aims for every region to formulate a Research and Innovation Strategy for Smart Specialisation (RIS3), which are set and overseen by the Regional Councils. The principles of Smart Specialisation have traditionally been applied in Finland both on national and regional levels with a focus on the knowledge base, lead markets initiatives and ecosystems development. A broader goal is to increase specialisation of universities and PROs through increasingly strategic R&I choices.

In the Capital Region (Uusimaa), RIS3 strategy is implemented in the form of five main priorities and related priority portfolios, and their activities are organised on shared, thematic innovation platforms. The platforms enable to coordinate the progress and change processes as well as to promote active collaboration between and within the key actors and their stakeholders. It is also typical that the smart specialisation strategies are tightly coupled with other regional plans, regional strategic programmes and other plans of the provinces.

Innovation is a common topic to all regions in Finland and the RIS3 objectives are not difficult to align with other regional objectives. The current period of EU Structural Funds (SF) 2014-2020 includes a range of innovative actions through smart specialisation. The activities included in the strategies and funded under the SF, are typically complemented with other nationally and regionally funded innovation activities.

Specialisation of universities is a part of the national and regional smart specialisation. It is catalysed by the MEC (Strategic development option of the funding model) and by funding incentives of the Academy of Finland (€50m). Universities Finland (UNIFI) is taking part in the process by negotiating to agree priorities and focus areas among universities. Some structural reforms are also fostering specialisation – a recent example is the establishment of the new technical network-university FITech (Finnish Institute of Technology) to be started in autumn 2017, which is intended to get more engineers in Southwest Finland, especially to serve regions shipbuilding and automotive industries.

In addition to smart regions the national smart specialisation strategy of Finland focuses on developing smart cities. **The Six City Strategy** of the biggest cities of Helsinki, Espoo, Tampere, Vantaa, Oulu and Turku is carried out as part of Finland's structural fund programme for sustainable growth and jobs (2014–2020). The three focus areas of the Six City Strategy are open innovation platforms, open data and interfaces, and open participation and customership. In addition, the strategy supports sustainable urban development including robotisation, artificial intelligence and digital platforms. The six cities work together on an open operating model based on the creation and testing of innovations while also increasing productivity. The total ERDF funding is approximately €80m+ESF (not earmarked) ([Valanta, J. 2017](#), [SixCityStrategy](#)). EU-funded pilot projects [SOHJOA](#) and Climate Streets have started. SOHJOA develops sustainable intelligent transportation solutions, with electric buses already operating in Helsinki. Climate Streets develops and tests solutions to cut down greenhouse gas emissions and energy consumption levels, in cooperation with local business, real estate owners, residents and the city administration in the fields of housing and transport. ([EC 2017e](#))

Monitoring mechanisms and the feedback loop

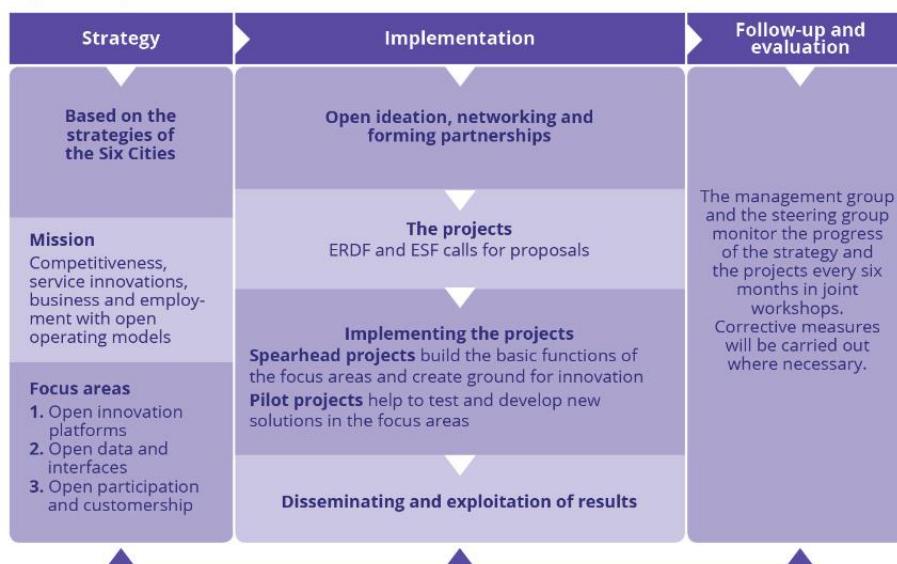
According to the [Regional Development Act](#), the progress of regional plans must be reviewed externally at least once per programme period. Regions of Ostrobothnia, South Ostrobothnia, Satakunta and the region of Central Finland cross-reviewed the regional plans (2014–2017) of each other. In connection to that smart specialisation strategies have also been reviewed. ([Regional Council of Ostrobothnia 2017](#))

In the region of Ostrobothnia an Ostrobothnian model / connectivity model has also been created in partnership with many educational institutes and researchers to function as a development tool for smart specialisation planning across the EU. The model includes a questionnaire to triple helix actors (companies, universities and public organisations) and Sustainable Competitive Advantage (SCA) methods including gap analysis inside companies. The Ostrobothnian model uses the gap index as an output indicator for a smart specialisation strategy aimed at improving the connectivity of the region. Measurements are to be repeated in order to identify bottlenecks in the triple helix network.

A study has been conducted on the connectivity of triple helix³ actors in the region of Ostrobothnia (Pohjanmaa) in 2014. The major finding of the study was that the innovation system in Ostrobothnia is business oriented and relatively well connected. Universities and energy technology companies in particular are well connected through their regional triple helix. ([Mariussen, Å. Eds. 2014](#), see also [Björk, P.& Johansson, C. 2017](#))

As part of the operating model (Figure 7) the progress of the Six City Strategy is monitored regularly and corrective measures are carried out biannually when considered necessary in the management group and steering group's shared workshops. Interim evaluations have not yet been carried as the strategy is planned to be implemented in three phases, the durations of which are 3+2+2 years. Interim evaluations of the strategy will be conducted between phases. The indicators are defined for each phase during the launch phase. On the project level, the Six City Strategy management group monitors and evaluates the projects with particular emphasis on how the experiences, learning outcomes and developed solutions of each project are regularised. The Six City Strategy projects are subject to the same rules and instructions than other ERDF- or ESF-funded projects. ([6Aika, 2015](#).) The management group of the Six City Strategy is also planning on utilising an impact model similar to the one used by [INKA](#). ([Management group of the Six Cities Strategy](#))

Figure 7: Operating model of Six City Strategy (Six Cities Strategy)



³ 'Triple Helix' refers to the triadic relationship between university-industry-government in the Knowledge Society.

Evidence of impact

An analysis of regional strengths has been conducted to support the Government's efforts to enhance growth and employment through regional specialisation and to provide information for the ongoing regional development efforts. According to the analysis there are differences between regions but many of them have similar strengths. The emphasis of regionally relevant towns is also shown in the analysis. Finland belongs among the most competitive countries even though Finland is sparsely populated country with long distances and the location of the country is remote considering global markets. In majority of the regions the specialisation is concentrated on forestry, metal and related industry. Secondly important specialisation sectors are technology and high skill level services that have concentrated on regions with high population growth ([Wennberg, M. et al. 2017](#)).

Studying the structural data provided by the Statistics Finland for seventy sub-regions and 24 sub-industries in manufacturing [Kaivo-oja, J. et al. \(2017\)](#) have analysed the operationalisation of smart specialisation strategies in the regional policy in Finland and come to a similar conclusion of regionally similar comparative advantages. Inter-regional synergies and opportunities for strategic cooperation between regions are therefore on a high level in Finland.

Outstanding issues

A process is ongoing to further strengthen specialisation, and implementation, with the latter aiming to combine both top-down and bottom-up approaches in order to avoid the risks involved in making poor top-down policy choices.

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Finnvera Ltd. <https://www.finnvera.fi/eng/>

Finpro <http://www.finpro.fi/web/finpro-eng>

HEI, Higher Education Institutions (Universities, Universities of applied sciences) <http://minedu.fi/en/heis-and-science-agencies>

IRI/JRC <http://iri.jrc.ec.europa.eu/scoreboard16.html>

MEAE, Ministry of Employment and the Economy <https://tem.fi/en/frontpage>

MEC, Ministry of Education and Culture <http://minedu.fi/en/frontpage>

PRO, Public Research Organisations <http://minedu.fi/en/science-agencies-research-institutes-and-scientific-organisations-in-finland>

Reboot Finland (2017) <http://www.rebootfinland.fi/en/>
RIC, Research and Innovation Policy Council <http://valtioneuvosto.fi/tin>
SA, Academy of Finland <http://www.aka.fi/en/>
Sitra, the Finnish Innovation Fund <https://www.sitra.fi/en/#>
Tekes, Finnish funding agency for innovation <https://www.tekes.fi/en/>
TESI, FII, Finnish Industry Investment Ltd, a government-owned investment company
<http://www.industryinvestment.com/>
The Six City Strategy: <https://6aika.fi/in-english/>
VTT, Technical Research Centre of Finland <http://www.vttresearch.com/>

Abbreviations

BERD	Business Expenditures for Research and Development
EC	European Commission
ELY	Centres for Economic Development, Transport and the Environment; Elinkeino-, liikenne- ja ympäristökeskus
ERA	European Research Area
EVCA	European Private Equity and Venture Capital Association
FDI	Foreign Direct Investments
FTE	Full Time Equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
HEI	Higher Education Institutions; Korkeakoulut
HGF	High Growth Firms
ICT	Information and Communication Technology
INKA	Innovative Cities Programme; Innovatiiviset kaupungit -ohjelma
IU	Innovation Union
JRC	Joint Research Centre
MEC	Ministry of Education and Culture; OKM, Opetus- ja kulttuuriministeriö
MEAE	Ministry of Economic Affairs and Employment; TEM, Työ- ja elinkeinoministeriö
NRP	National Reform Programme; Kansallinen uudistusohjelma
PRO	Public Research Organisation
RIC	Research and Innovation Policy Council; TIN, Tutkimus- ja innovaationeuvosto
RIS3	Research and Innovation Strategies on Smart Specialisation
RTDI	Research, Technological Development and Innovation
R&D	Research and Development
R&I	Research and Innovation
SA	Academy of Finland; Suomen Akatemia
SBA	Small Business Act
SHOK	Strategic Centre for Science, Technology and Innovation;
SITRA	Finnish Innovation Fund; SITRA - Suomen itsenäisyyden juhlarahasto
SME	Small and medium sized enterprise
SRC	Strategic Research Council; STN, Strategisen tutkimuksen neuvosto
Tekes	Finnish funding agency for innovation; Innovaatorahoituskeskus Tekes
VC	Venture Capital
VIGO	Business accelerator; VIGO-kiihdyttämöohjelma
WEF	World Economic Forum
YIC	Young Innovative Company; NIY, Nuori innovatiivinen yritys

Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GDP per capita (euro per capita)	33900	34900	36500	36900	37400	37600	38200	39300		
Value added of services as share of the total value added (% of total)	68.02	67.3	68.38	70.23	70	70.43	70.38	70.16		
Value added of manufacturing as share of the total value added (%)	19.13	19.53	18.87	16.86	16.94	16.9	17.16	16.9		
Employment in manufacturing as share of total employment (%)	15.31	14.69	14.66	14.49	14.03	13.7	13.51	13.28		
Employment in services as share of total employment (%)	71.1	71.63	71.79	72.1	72.66	73.08	73.27	73.54		
Share of Foreign controlled enterprises in the total nb of enterprises (%)	1.25	1.21	1.23	1.26	1.24	1.29				
Labour productivity (Index, 2010=100)	96.8	100	101.6	100	100.6	100.7	100.9	102.9		
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.32	1.16	1.19	1.17	1.22	1.28	1.26	1.27		
Summary Innovation Index (rank)	2	3	3	3	3	3	3	3		
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				52.6		55.3				
Innovation output indicator (Rank, Intra-EU Comparison)			6	8	7	6				
Turnover from innovation as % of total turnover (Eurostat)		15.3		11.1						
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						10	10	13	13	13
Ease of getting credit (WB GII) (Rank)						34	39	40		
Venture capital investment as % of GDP (seed, start-up and later stage)	0.048	0.053	0.039	0.04	0.049	0.049	0.047			
EC Digital Economy & Society Index (DESI) (Rank)						3	2	2	2	
E-Government Development Index Rank		19		9		10		5		
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	64	68	68	70	69	80	79	82	83	
GERD (as % of GDP)	3.75	3.73	3.64	3.42	3.29	3.17	2.9	2.75		
GBAORD (as % of GDP)	1.07	1.11	1.05	1.03	0.99	0.97	0.96	0.85		
R&D funded by GOV (% of GDP)	0.9	0.96	0.91	0.91	0.86	0.87	0.84			
BERD (% of GDP)	2.68	2.59	2.56	2.35	2.26	2.15	1.93	1.81		
Research excellence composite indicator (Rank)	1	3	3	3	3	4				
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		10.18	10.48	10.42	10.69	10.73				
Public-private co-publications per million population	91.25	88.39	89.48	84.05	82.19	85.12	63.05			
World Share of PCT applications	1.01	0.98	0.88	0.89	0.79	0.72	0.57			
Global Innovation Index				6	4	6	5	8		

Data sources: various, including Eurostat, European Commission and International scoreboard data.

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