Executive summary

Finland has almost gathered 50 years of valuable experience with R&D intensity target setting. The first target of 1.7% for 1980 was set in 1973 and since then it gradually climbed up to reach the still valid 4% target in 2005. The Finnish performance on reaching these targets varies over time and can essentially be divided into two periods. After the introduction of the first five targets set in the 1973–2004 period the level of R&D intensity did go up and apart from the first attempt all targets were actually reached. However, after the introduction of the series of 4% targets set in the 2005–2019 period none of the targets have been reached. While initially the R&D intensity continued to go up until it peaked to 3.73% in the recession year 2009, subsequently it went into free fall until it reached 2.72% in 2017. Since then no major change has occurred. With these dynamics, it remains to be seen if the current 4% target of the Marin government will be reached by 2030 and if so under which constellation of economic growth. The target is being set for a long time, but overall this has not yet been backed up with engagement and actions that will support it.

By the end of the 2000s, the leading Finnish industrial sectors of ICT and forestry started to lose their position in the global markets and value chains. Trade balance weakened rapidly and government foreign debt almost doubled in 2008–2015 from €54bn to €100bn. In practical terms, the economy more or less suffered the entire period starting from the financial crisis from 2008 until 2017, when the GDP in real terms was for the first time higher than that of 2008. For these reasons, among other factors, it is obvious that the preconditions for reaching the R&D intensity target of 4% faded away, and the STI policy gradually lost its position as a priority on the political agenda.

The 4% target has become reflective of political ambitions detached from the realities of the political, economic and social operating environment. In the 2010s, there were no detailed schemes on the target adopted by the government, the Research and Innovation Council (RIC) or responsible ministries together. Consequently, the factors that increasingly hindered the favourable evolution of R&D performance and did stunt the growth of R&D intensity were mostly contextual, and at least not primarily driven by STI policy factors. Eventually, all this led to the persistent downward trend of public and private R&D investment, rundown of the traditional RIC, and the erosion of academia–industry collaboration.

Based on this long-term experience with R&D target setting the case study distilled the following three key lessons that are of relevance to Finland’s peers as well as to Finland’s current and future policy makers as to be able to set R&D intensity in a sustainable and impactful manner. (1) A systemic and integrated policy approach, which preferably should be supported by national long-
term vision and strategy, needs an impactful coordination and governance mechanism or forum. The ability of any such instance to have impact depends on its authority and its mandate given by political actors. (2) A balanced innovation system with well-working Public–Private Partnership (PPP) efforts and mechanisms will do better in spurring the economy and absorbing shocks. Balance should be present in terms of paying attention to all key stakeholders of the innovation system, and including political stability and support needed for multilateral trust building and increasing both private and public R&D investments. (3) A key strategy to be able to absorb shocks is to invest in long-term capabilities. Capability building should happen based on a diversity of skills and focus on more and better cooperation between various stakeholders.

Introduction

This section will provide an introduction to the case study and the TIP project, and will be pre-filled by the OECD Secretariat. It will present in particular the evolution of key R&D indicators in the country.

Methodology

The main goal of our case study is to explore policy experiences in setting and reaching R&D intensity targets in Finnish innovation policy.

This is achieved by investigating:

- The practices in R&D target setting in Finland over time
- The successes and failures in the implementation of R&D targets
- The implementation challenges faced and how they have been addressed
- The role of policy versus the role of other contextual factors
- The lessons learned over the years of the use of R&D intensity targets

The focus of the Finnish case study is mainly on the period between 2005 – when the current 4% R&D intensity target was set for the first time – and the present covering the policy target R&D intensity and other science, technology and innovation (STI) objectives directly linked to it. The innovation policy impact of the study is twofold: it highlights the Finnish lessons learned for other countries and makes policy recommendations for the future of the Finnish Innovation System.

The methods used in the Finnish case study were desk-research, an online survey questionnaire with open questions and semi-structured interviews. The desk research included the in-depth analysis of official reports, such as the minutes of the Research and Innovation Council (RIC) meetings and other key meetings publicly available.

The R&D intensity target questionnaire designed by the OECD was send out to four types of Finnish stakeholders: (1) Ministers and their advisors, (2) civil servants, (3) RIC members and (4) experts. They had the option to complete the survey online, via telephone or via a face-to-face interview or they could opt out. The survey could be answered in English or Finnish. In total 102 carefully selected stakeholders were contacted between 30.1 and 17.2.2020, with 2 survey reminders. After regular survey reminders to all respondents and an additional email of Technical Research Centre of Finland’s (VTT) CEO to the seven current and previous
Prime Ministers\(^1\), 28 (15 surveys, 6 face-to-face interviews, 7 telephone interviews respondents) – out of which two Prime Ministers – participated in the study. All telephone interviews and face-to-face interviews have been recorded and transcribed, enabling further in depth analysis based on the rich set of information obtained.

1. The Finnish experience with R&D target setting

1) Current national R&D intensity targets

Finland has a national R&D intensity target of 4% of GDP by 2030, as set in the two government programs issued in 2019 due to the change of Prime Minister (GP 2019a, 2019b).

2) Target changes

Finland has soon gathered half a century of experience with national R&D target setting and its implementation. Foremost Finland is unique in that it reached R&D intensity targets it had set, in practical terms even four times (see Figure 1).

Since the great recession (i.e. financial crisis) that hit Finland exceptionally hard around 2009, R&D intensity target setting and its implementation has been less ambitious and real commitment to achieving targets has pretty much vanished. The government has still set targets, explicitly or implicitly, but concrete actions to create a path to the targets have been missing. Amid the current global COVID-19 turbulence, the R&D target setting lessons from the past can be vital for long-term economic recovery.

Figure 1 illustrates the history of R&D intensity target setting in Finland. Starting in 1973 (see SPC 1973), the country has set a R&D target for 10 times and is currently holding a target of 4% to be reached by 2030. After a challenging start during the economically turbulent 1970s labelled with oil crises and their extended effects, Finland performed well in reaching its targets and was continuously successful between 1981 and 2004. Based on those successes, innovation policy became a cornerstone of Finland’s approach striving for economic growth.

Building on the consistent development of the Finnish innovation system and policy schemes of the 1980s and 1990s\(^2\), PM Vanhanen’s government introduced for the first time the 4% target in April 2005. The goal was realistic with respect to developments in the Finnish economy and the growth of R&D expenditure since the late 1990s and with the latest intensity figure of close to 3.5%, however driven by the large spending of only one sector, i.e. ICT. While the ICT sector accounted for 27% of all R&D in Finland in the mid-1990s, the share increased to over 40% by the mid-2000s. The 4% target was mentioned in the government’s annual strategy document, which also offered a plan on how to get there. The target was linked to other STI initiatives and development issues, and the government program of 2007 included a separate chapter on STI policy (see PMO 2005; PMO 2006a; PMO 2006b; GP 2007\(^3\)).

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2 Good examples were the Regional Centres of Expertise programme (OSKE 1994–2013), the Government additional appropriation programme of R&D in 1997–1999 and the introduction of the national cluster programmes coordinated jointly by five Ministries in the late 1990s (e.g. STPC 1996; Prihti et al. 2000).

3 Actually, the first time the R&D intensity target of 4% was mentioned in a policy-relevant paper was in June 2004, when the so-called Working Group on Globalisation (formed on the initiative of PM Vanhanen)
Indeed, in 2007 Finland’s most innovation friendly government programme (GP 2007) was launched after which R&D intensity reached its peak (3.73%) in 2009. After that, the gap between the 4% target and the realised R&D intensity started to widen due to the cutbacks in R&D investments made by ICT companies, mostly by Nokia, but also as R&D funding channelled through the government budget picked up on a downward trend and several R&D and innovation instruments and programs were restructured or fully abolished.

Since 2005, the R&D target has been left untouched at 4%, with the exception of 2015–2017, when the objective was fully abandoned (see Box 1). In 2019, the current government reintroduced the 4% target to the government program (GP 2019a, 2019b).

**Figure 1. Finland’s R&D intensity target changes over the time and its performance in reaching the targets.**

*Source:* VTT, TEM, Statistics Finland. Notes: The blue solid line represents the annual evolution of R&D intensity based on the latest available Statistics Finland data on R&D expenses and GDP at current prices (both series downloaded on 23.3.2020). The R&D intensity series for the even years from 1976 to 1996 are estimates based on an average of the nearest available data. The blue dotted line is the linear trend line of R&D intensity. Coloured balls indicate the start of a R&D target that should have been reached by the time that the target period ends. For example, the first target (T1) was set in 1973 (T1S*: 1973: start of the first target period) and should have been reached by 1980 (T1E: 1980: end first target period). Green (red) balls indicate the target was (not) reached. Orange balls indicate the target was reached in practical terms (i.e. based on the original R&D intensity data used at the time when policy lines and recommendations were originally drafted, but not any more after the GDP data was updated and recalculated a few times much later). A white ball represents a target which by the end of the target period has not been reached yet. Between 2015 and 2017 Finland had no R&D intensity target at all, hence the two-year gap in the bold black line. The number of stars indicates at which level the target was set. One star (as in T1S*) indicates that the target appeared in a council document; Two stars indicates that the target appeared in a government’s economic committee document or in a strategic government document but not in the government programme. Three stars indicates that the target appeared in a government’s economic committee document or in a strategic government document but not in the government programme.

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Stated in its interim report that public R&D expenditure should be increased by 7% annually up to the end of the 2000s. The aim for increased public funding was to act as an incentive to raise R&D intensity to at least 4%. This was one of the key recommendations to enhance the competitiveness of the country and respond to recent challenges posed to Finnish work and production (PMO 2004a). The same proposal was made in the final report of the group in November (PMO 2004b). The proposal was further supported by Sitra (2005) in its innovation policy report in April 2005. This is how the 4% target started to gather momentum.

The Finnish R&D intensity goal of 4.0% was introduced for the first time in the Strategic document of PM Vanhanen’s 1st government (2003–2007) on 7 April 2005. There were no specific analysis papers behind the 4% target. However, it was backed up by several high-impact policy reports published in 2003–2005 (e.g. STPC 2003; PMO 2004a, 2004b; Government 2005), but the actual decision was purely political by nature. The Government programme emphasised that the economic growth and competitiveness would continue to be based on knowledge, utilization of new technology and advanced branding and commercialization activities.

The programme of PM Vanhanen’s 2nd government (2007–2011) reinforced the goal to boost resources in both the public and private sectors with a view to raise R&D funding to 4% of GDP. The aim was to strengthen the innovation capacity by providing strategic inputs in selected areas (e.g. universities, SMEs, services, VC). PPP programmes (OSKE, SHOKs) were enhanced, a new university law enforced and a new university (Aalto University) created through a merger of three former universities (technology, business, arts).

The programme of PM Katainen’s government (2011–2015) stated that the 4% target should be reached by the end the parliamentary term. The focus of funding was e.g. on universities, SMEs and growth companies. By now, the 4% goal had become a relay baton. The target was set by the previous government and discussed e.g. in the context of the Finnish Europe 2020 strategy in spring 2010. A bit later the same target was raised by the EU Ministerial Committee and the RIC. Thus, it was not a surprise that 4% goal found its way also to the next government programme.

After a long period of recession and slow economic recovery (in real terms, the volume of Finnish GDP reached the level of 2008 not until 2017), the (economic) strategy that had earlier put an emphasis on the development of the innovation system and R&D had seriously vanished. This change was reflected in the programme of PM Sipilä’s government (2015–2019) and other policy papers related to it e.g. with no R&D intensity targets set. PM Sipilä later acknowledged that he saw the need to refresh publicly funded R&D (Sipilä 2019), but this manifested mainly as a cut back.

The heavily reorganized (2016) RIC recommended in 2017 as part of the Council’s STI Vision that R&D intensity target of 4.0% should be achieved by 2030. Once again, no planning papers or detailed minutes of the RIC talks concerning the 4% target exist. The government of then did not react to the RIC’s view, although it adopted a positive stance towards the OECD’s (2017) review on the Finnish innovation policy that e.g. emphasised the urgent need to raise R&D funding.

The programmes of PM Rinne’s (2019) and PM Marin’s government (2019–2023) stated that RDI investments will be put on a growth track. A specific roadmap for the government prepared by the MoEC and MoEAE was published in April 2020 with a view to raise RDI investments to 4% of GDP by 2030 and to enhance the (PPP-based) environment for innovation and experiments. However, it remains to be seen to what extent the on-going COVID-19 crisis will encourage the implementation of long-term investments that Finland needs in order to absorb future economic and societal shocks.
3) **Subnational targets at regional, local and sectoral levels**

The R&D target setting in Finland has happened on the national government level only. As the EU wide R&D target of 3% leaves flexibility to its countries on how to reach that EU-wide target, the Finnish target leaves flexibility to its industrial branches or regions on how to reach the national 4% target. However, while no explicit targets on regional and sectoral levels have been set in Finland, policy documents very often have explicitly stressed a regional or sectoral focus, in terms of implementation of the national target (Wallin & Laxell 2013; OSKE 2014).

4) **Target criteria.**

While R&D intensity is often considered as a path dependent indicator, the criteria used to determine the specific R&D targets can vary over time, as the Finnish case demonstrates. The essential spark leading to the first target set in 1973 came from the realisation that Finland was clearly lagging behind its Western neighbouring countries in 1969. Gradually but steadily the original target of 1.7% (that was to be reached by 1980) was raised later on with the aim to further catch up with the peer countries. Eventually, the aim became more ambitious as to score higher on the global ranking and as to reach the top countries in the late 1990s and to maintain that position. According to the interviewees, in the first half of 2000s, the aim of the ambitious R&D targets was to become the most competitive and the most technology-intensive country in the world. The criteria and reasons of the target setting between 2005 and present are summarized in Box 1.

While the rationale and criteria to set the targets were the fruits of genuine understanding, interaction and commitment, by 2011 Finland started to enter a new era where targets were stated, but commitment to implement them with a realistic plan gradually evaporated. The situation became more challenging when the Government did not succeed to tackle the great recession with - insufficient and impatient - counter cyclical actions (see Figure 2). The presumption was to produce similar R&D-driven positive impacts that were observed in the context of the Finnish recession in the 1990s. However, the economic scene had changed and the translation process of research into innovation had become more cumbersome. After the collapse of Nokia’s mobile phone business and the Finnish ICT sector during 2009−2013, there were no other globally significant “locomotive enterprises” or ecosystem leaders that could have acted as R&D intensive appliers of new knowledge. Industry–academia collaboration culture eroded, and the central administration’s instruments (SHOKs, OSKE/INKA) that previously had incentivized multilateral PPP cooperation were deleted due to decisions made by PMI Sipilä’s government in 2015. Consequently, firms’ will to fortify their competitiveness through R&D was first dimming and then collapsed. Unsatisfying developments were also seen in the statistics. For instance, in 2005 there were 70 Finnish companies in the list of 1’000 biggest R&D companies in the EU. By 2018 the number of companies was reduced by half. In addition, numerous reports and evaluations transmitted the same message: the volume of R&D investments made by both the public and private sectors were in decline and PPP-based multilateral cooperation was getting weaker (e.g. OECD 2017; EC 2017, 2018). As a consequence of these dynamics short-sightedness gained ground in the economy and society.
In essence, gradually a new political generation took over without a strict commitment to keep a long-term strategy. At the same time, an erosion of institutional memory within the innovation system’s key policy organisations, such as the Government, ministries and RIC, started to develop into a complication.

5) **R&D intensity as a policy indicator.**

The interviewees consider R&D intensity to be an acceptable measure to capture innovation activities in Finland. Instead of having one measure, it would be important to have a set of measures complementing each other but also a set of sub-measures decomposing the R&D intensity measure. It was clear from the Finnish interviewees that the main value of the R&D intensity target is political. As with all measures, the indicator has strengths and weaknesses.

The R&D intensity indicator has multiple **strengths**, as identified by the respondents:

- It is a simple measure and it gives the best possible available idea of the overall orientation of both R&D and innovation (RDI).
- It is understandable and acceptable for decision makers to embrace and to communicate.
- The indicator is widely used and it is a “familiar policy target”.
- It is easy to retrieve from the statistical offices.
- It is a statistical measure that is internationally comparable.
- In the long-term the measure shows the relative direction of the country’s value-added.
- The changes of the measure indicate the direction of the country’s innovation investments.

The Finnish interviewees also identified several **weaknesses** in the indicator:

- The measure can be considered inadequate because its simplicity can be easily misleading. According to the respondents, instead of using an input measure it is better to consider the quality of the R&D inputs, their efficiency, and their impact simultaneously. The relevance and effectiveness of R&D should be evaluated and according to best practice this should be done by external top experts.
- The measure has a bias for certain technologies and sectors. That is why comparisons to peer countries have to be made over time taking into account the economic, industrial and societal structures.
- It is not clear-cut which measures refer to R&D and which ones to innovation. This relates to the fact that R&D is not as much related to innovation as one might think.
- The interviewees also held that the measure is narrow as it does not capture investments in all intangibles that drive wellbeing via productivity growth. Measuring broader innovation would need to be estimated.

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4 Institutional memory or social capital refers to individuals’ and organisations’ understanding of STI policy measures and objectives, awareness of (long-lasting) good policy practices and willingness to follow well-tried procedures, and to determined aspiration to create and enhance partnerships between various stakeholders within the innovation system and across different fields of administration.
The indicator should be broken down to its components as to provide better insights into the strengths and challenges of R&D.

6) Indicator challenges

It turns out that R&D intensity has specific shortcomings in measuring business-led innovation. It was highlighted by the Finnish experts that:

- The measure does not cover the R&D of start-ups with less than 10 employees while many of these small firms may still have a high R&D intensity. As Finland has experienced a boom of tech-based start-ups during the last decade in aggregate terms this identified gap may be problematic.
- Reporting of R&D of the firm should not reveal any information that could harm its competitiveness. In this sense one may expect R&D activities to be under-reported.
- The indicator actually measures money, but not externalities and spill-overs and typically long-term effects are not taken into account which may well lead to wrong conclusions and inferior policy decisions.
- Understanding innovation processes is essential as they vary over firms and sectors and affect the amount and type of inputs that are needed.
- Changes in the content of innovation activities should be measured more accurately.
- The available statistics have several weaknesses: they use outdated classifications, they do not capture all activities such as business R&D due to digitalisation, it is difficult to make decisions based on statistics, there are sampling issues, suboptimal definitions are used, and the interpretation of survey questions can vary.
- Innovation in services and non-technological content may also be inadequately identified by the available indicators.
- It is more important to measure RDI bottlenecks than to measure inputs.

2. The Finnish experience implementing R&D targets and policies

7) Policy initiatives in place

STI Policy background

Finland’s rise to the forefront of productivity and ICT-related technological development in the latter half of the 1990s did happen quite rapidly but would not have been possible without long-term determined investment in human capital and competencies.

In the late 1990s, STI policy became the cornerstone of the national strategy. Both the private and the public sector invested in R&D, innovations and in the utilisation of new technological opportunities. Growth rates of R&D expenditure were record high: in 1995–2000, it was 128%

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5 This trend of R&D and innovation being in the centre of the national strategy achieved its culmination first in the government programme of PM Paavo Lipponen’s second cabinet (1999) and then in the government programmes of PM Matti Vanhanen’s second cabinet (2007) and PM Jyrki Katainen’s cabinet (2011). In all these programmes, there are multiple references to ‘research/R&D’ or ‘innovation’. Also the current government programme of PM Sanna Marin’s cabinet (2019) reaches the same reference level. None of the other programmes comes close to these figures.
in the business enterprise sector and 64% in universities (in nominal terms). At the same time, government’s direct budgetary R&D funding increased by 39%.

In the 2000s, a high-quality education system and innovativeness became a key component of Finland’s country image both at home and abroad. Long-lasting favourable development of the economy and productivity growth supported the belief in consistent investments in R&D and skills. This belief rested on e.g. Finland’s good performance in international innovation and competitiveness rankings. Finland was the 1st or 2nd in World Economic Forum’s Competitiveness comparisons in 2001–2005 and among the top five countries in IMD’s competitiveness comparison in 1997–2003. Rankings remained strong until the onset of the 2010s, despite the economic and employment slowdown that had already started.

A major overhaul of the structures and funding of the innovation system started to unfold by 2010 with the aim to increase both research efficiency and social relevance. The state’s commitment to the long-term development of research and innovation was based on the Government Resolution on the Structural Development of the Public Research System (see PMO 2005). This resolution was published in the 7th of April 2005 and was a central factor that started the wave of significant renewals in the Finnish innovation system mostly in 2006–2010.

Following the great recession, new economic growth ambitions were focused on the diversification of industrial base and the support of seed stage, start-up and growth enterprises and SME exports e.g. in the form of increasing public venture capital investments and internationalisation assistance. By mid-2010s, it became obvious that reforming the structures of the innovation system was not enough to maintain Finland’s position in international markets and competition. Even though the cuts in government’s R&D budget started already in the beginning of PM Katainen’s government term (−12% from 2011 to 2015 in real terms), the biggest cut was made (−8.5% in just one year) at the onset of PM Sipilä’s Government (2015–2019). A part of the cuts was “compensated” during the rest of the government term, but the volume of R&D budget in 2019 was still five per cent lower (in real terms) than it was in the beginning of the term. This, together with the events and renewals of the previous electoral period, meant a significant change of direction of STI policy when seen against earlier developments (see Koski et al. 2019).

**STI Policy Reforms and Initiatives**

**The Centre of Expertise Programme**

The Centre of Expertise Programme (OSKE, 1994–2013), which supported regional innovation, has been the most important tool for regional innovation policy in Finland. The OSKE directed activities to focus areas of national importance and supported cooperation between research and business. The idea behind the programme was to promote the utilisation of internationally top-level expertise based on regional strengths. The OSKE covered three programme periods (1994–1998, 1999–2006 and 2007–2013) and in the final period, cluster-based cooperation was developed in 13 different focus areas (see OSKE 2014).

**The Innovative Cities Programme (INKA)**

The experience gained from the OSKE was utilised in the Innovative Cities Programme (INKA) launched in 2014. It stressed the role of cities in building regional innovation hubs: the goal was to create more attractive, globally networked hubs in urban areas. Unfortunately, as part of the budgetary cutbacks in 2015, the Government decided to phase out the INKA programme by 2017. However, as a counterbalance to this, an increasingly large portion of the EU Structural Fund assets in the funding period 2014–2020 are allocated to R&D,
technology and innovation. After all, regional innovation is currently under transition. The aim is to have better policy instruments to channel national and regional resources into more strategic and broader development entities, including international networking.

**The Strategic Centres for Science, Technology and Innovation (SHOKs)**

The objective of the SHOK⁶ initiative that was initiated by the RIC in June 2006 and created during 2007–2009 was to enhance RDI driven business and renewal of the business enterprise sector in Finland by creating new competitive advantages both at organisational, cluster and system levels. SHOK activities aimed at introducing new public-private -partnership (PPP) type of cooperation and interaction as well as testing new kinds of collaborative platforms and environments. The basic idea was to have both enterprises and research organisations carrying out research based on a jointly drafted research agenda and with a view to produce concrete innovations and business models in 5–10 years of time. Thus, initially SHOKs had long-term perspective on RDI-driven development, and gradually SHOKs became one of the principal instruments of Finnish innovation policy. It can be estimated that the volume of SHOK funding was a total over 600 million euro in in 2008–2015. On average, 60% of funding came from Tekes/BF and 40% from enterprises involved in the SHOK projects. At its largest, Tekes/BF committed up to ¼ of their annual funding through the appropriation dedicated for the SHOK programmes (see e.g. STPC 2006; Lähteenmäki-Smith et al. 2013; Piirainen et al. 2019).

**The university reform**

Reforms of universities and universities of applied sciences were carried out in 2010 and in 2014–2015. The key elements of these reforms were to strengthen economic and administrative autonomy, add flexibility to personnel policy, diversify the financial base, and to improve the conditions for cooperation and profiling between universities (Wennberg et al. 2018). In addition to detaching universities from the state organization and transforming them as independent legal entities under either public law or the Foundations Act, the aim of the reform was to enhance universities’ preconditions for profiling and structural reforms and increase universities’ involvement in societal interaction. Unfortunately, according to various evaluations the progress made in these issues has been comparatively slow (see e.g. Owal Group 2016; Wennberg et al. 2018).

**The R&D institutes reform**

As from 2013 the public R&D institutes and their research funding scheme underwent a reform. Some of the state’s research institutes were merged into larger entities or incorporated into a university. As a result, the number of state’s R&D institutes decreased from 20 to 12 in 2015. Due to the reform and other government decisions, R&D institutes’ budgetary research funding dropped between 2013 and 2016 with 37% to 197 million euro (Haila et al., 2018). Alongside these reforms, the Technical Research Centre of Finland (VTT) has strengthened its role in research and innovation that aims at responding to social, economic and other grand challenges (Hjelt et al. 2019). Two cornerstones of this reform included: (1) the establishment of a financial instrument, managed by the Strategic Research Council (SRC), in connection with the Academy of Finland in 2014 and; (2) strengthening of the analysis, assessment and research activities (VN TEAS) that support the Government’s decision making (Government

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⁶ The SHOKs refer to six companies and their areas of expertise. The SHOKs were: Metal products and metal engineering, FIMECC Ltd; Built environment innovations, RYM Ltd; Energy and the environment, CLEEN Ltd; Information and communication industry and services, TIVIT (currently DIGILE Ltd); Forestcluster (currently Finnish Bioeconomy, FIBIC Ltd); Health and wellbeing, Salwe Ltd.
The reform’s unwanted consequences have received ample attention (Haila et al. 2018, most recently Ormala 2019 and Koski et al. 2019). However, despite many well-argued critical views on the R&D institutes and funding reform, the situation within the public R&D institute sector has not changed for the better. The sector’s combined volume of public R&D budget funding in 2019 was astonishingly smaller (47%) than in 2011 in real terms, dropping from 304 million euro to 184 million euro (in nominal terms) in eight years.

**The Research and Innovation Council (RIC) reform**

The original RIC that was established in 1987 held its last meeting in December 2014 soon after the Council adopted its final extended STI policy review. Over the years, the RIC functioned mainly as a forum for wide discussions on alternative policies and priorities and aimed at forming national strategic consensus on the most essential policy issues. This was linked with monitoring the state and effectiveness of the innovation system as a whole. The creation of the new RIC took place in April 2016 and it entailed a number of changes: (1) The RIC became much smaller. The Council was still chaired by the Prime Minister and its members were the Minister of Education and Culture, the Minister for Economic Affairs, one other minister appointed by the Government and five other members representing research and industry. (2) The Council’s independent secretariat and the two subcommittees were abolished and preparatory work was assigned to a group of civil servants from the Ministry of Education and Culture, the Ministry of Economic Affairs and Employment, the Prime Minister’s Office, Tekes/Business Finland, and the Academy of Finland (see OECD 2017).

Hence, the nature of Council efforts and the way the work is being organised has changed a lot since 2016. In addition, most of the recommendations made in the independent evaluation of the RIC published in Spring 2014 (Pelkonen et al. 2014) were not put into practice, and the RIC activities in 2016–2019 (before the current government) were not as intensive and sovereign as earlier (see Lemola 2020). This is also reflected in the Council’s meeting minutes (RIC 2020). However, one bullet point of the Council’s eight-slide Vision 2030 in 2017 stated that the Finnish public and private sector together should invest four percent of the GDP in STI activities. This item is still topical and included in the current government programme of PM Sanna Marin.

**The merger of Tekes and Finpro**

In the latest structural reform, Tekes (the Finnish Funding Agency for Innovation) and Finpro (provider of internationalisation advisory services) merged into Business Finland in 2018. The aim is to clarify and simplify the enterprise service system, internationalise the innovation system, and strengthen the exports and internationalisation of SMEs.

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7 The evaluation states that RIC still has an important role as a body that brings together politicians and experts and that its key impacts are seen in government programmes, R&D funding and the significance of R&I issues on the political agenda. At the same time, it was seen that RIC has lost some of its position and effectiveness, it does not have a particularly strong position in horizontal policy and that it works quite reactively. Consequently, to meet the needs of a changing operating environment, RIC’s operating methods should be renewed. The key recommendations include: (1) RIC needs more strategic activities that draw systematically on foresight and assessments; (2) RIC should rely more on external experts and stakeholders; (3) sectoral ministries should become more involved in the RIC’s work; (4) interaction, transparency and communication of RIC’s operations should be reinforced; (5) RIC’s subcommittees should be replaced by thematic drafting bodies or working groups; (6) RIC’s resources must be increased; (7) RIC’s secretariat could be placed in the Prime Minister’s Office, thus stressing RIC’s horizontal and strategic position. From all of these, only proposal (4) was partly put into practice when the new RIC was launched in 2016. Eventually, the renewal of RIC and its motives was mostly about something else taking place within the central administration and between ministries.
### Other initiatives

During the recent years, several initiatives listed below aimed at the increase of the quality of R&D and the effectiveness of public RDI funding (see e.g. AF 2020; BF 2020):

- **Funding instrument for challenge-driven research:** Business Finland’s ‘Challenge Finland’ was the funding programme (22m€ in 2017–2018) for promoting the emergence of radical innovations in particular;

- **Development of innovation capacity and commercialisation activities in research organisations:** Business Finland’s ‘Innovation Scout’/KINO programme 2015–2017. The volume of funding channelled through the programme was 7.2 million €. It was linked to the TULI-programme ‘Creating Business from Research’ that started in 1993 and is still on-going but many times redesigned and currently called TUTL instrument (‘New knowledge and business from research ideas’): In 2012–2017, the volume of funding channelled through TUTL programme was some 138 million € (Valtakari et al. 2018).

- **Development of enterprise-driven business ecosystems:** Business Finland’s ‘Growth Engines’ funding (60m€ in 2018–2019) aimed at creating PPP-based cooperation networks to support new business activities that strive e.g. to create new growth sectors;

- **Flagship Programme (Academy of Finland)** for academic centres of expertise provides long-term funding for large flagships/ecosystems (currently 6), each operating in their specific field. It promotes cooperation between research, business and society, and helps to create solutions to societal challenges and develop new business opportunities. In 2019–2022, total funding will be some 320m€ and the share of the Academy will be over 54m€;

- **Establishment of the network-based Competence Centre for Sustainable and Innovative Public Procurement (KEINO).** The main objectives of the centre of 14 experts and their six background organisations are that: the number of innovative and sustainable procurements will increase; public procurement is recognized and actively used as a management tool; contracting entities disseminate information on their own experiences and learn from one another. The value of public procurements is some 35 billion € a year (appr. 16% of GDP) (KEINO 2020).

In addition, the Ministry of Education and Culture and the Ministry of Economic Affairs and Employment published in April 2020 a new RDI roadmap compiling a set of initiatives on how to support the government’s STI policy objectives and R&D intensity target of 4% (RDI Roadmap 2020).

#### 8) Successful policies

A set of policies that were the most and less successful in driving R&D intensity in Finland were identified based on the opinions of interviewees in line with existing evaluation studies. However, as several of the available evaluations are not ‘independent’ not surprisingly the quality of the evaluations has been heterogeneous\(^8\). The opinions of the respondents sometimes differed on what constitutes a success and a failure. Some policy initiatives were

\(^8\) The gold standard for evaluations are broad-based evaluation panels of foreign top experts such as the one undertaking the evaluation of the Finnish innovation system during 2008 and 2009 (Veugelers et al. 2009a/2009b).
indeed seen both as successes and failures. Based on the interviewees’ opinions the consensus on key initiatives and their mechanisms is summarized below.

The establishment of the National Technology Agency (Tekes) in 1983 was an important milestone for the Finnish Innovation System and R&D target setting. The set-up of Tekes was part of a broader Finnish strategy focusing on investments in knowledge and technology, and initially driven by visionary members of the Technology Committee, including wide-ranging representation from the public administration, the business enterprise sector and STI community (Committee Report 1980). Tekes was a success because over time it served as a buffer for change. The overarching long-term approach of Tekes was to invest in capabilities. This turned out to be of strategic importance with success stories in ICT, gaming and carbon neutrality.

The initial blessing for Tekes was that its funding was taken care of in a way that allowed it to: (1) interact with customers, (2) have the freedom to develop its own processes and (3) build everything itself. As a result Tekes national technology programs in the 1980s were the first instruments to stimulate collaboration between different stakeholders and were - and this is of fundamental importance - from the on-set co-created with industry.

The programs marked the start of a strong collaborative Finnish culture. The industry–academia collaborative projects from the 1980s in the form of the first wave of the national technology programs were renewed in the 1990s and early 2000s. Especially in the latter part of the 1990s, the ground-breaking technology programs of Tekes, research programs of the Academy of Finland, and the jointly designed and implemented programs by Tekes and the Academy became important in driving R&D intensity but this collaboration started to diminish in the early 2000s.

In 1996, under PM Paavo Lipponen’s first government, state property was sold and a part of these funds were used (based on government’s economic policy committee’s decision in September 1996) to launch a specific additional appropriation programme of R&D to be implemented in 1997–1999. Notwithstanding the fact that in the beginning of PM Lipponen’s government term in spring 1995, the attitude towards major increases to be made in R&D and innovation was still very cautious. But it soon became obvious that the purpose was to enhance the operation of the national innovation system to the benefit of the economy, the business environment and job creation. In 1999, an appropriation increment of FIM 1.5 billion (i.e. >250m €) was introduced on a permanent basis. Both the implementation and impacts of this programme can be considered as a success (Prihti et al. 2000).

In 2006, the RIC made important recommendations especially concerning the SHOKs and industry–academia collaboration and having an impact on the financial instruments of the Academy of Finland and Tekes. Building on previous experience with collaborations, 2007 marked the launch of a Public Private Partnership policy model and instrument that further drove R&D intensity towards its peak in 2009.

The OSKE cluster programs have been successful (e.g. Pentikäinen 2000). The OSKE funding had a major catalytic effect on R&D in regions. The main beneficiaries of the OSKE were the small and medium-sized enterprises that were able to develop their R&D within large urban areas (Wallin & Laxell 2013).

The Council’s leadership role over electoral periods can be considered as a success of highest relevance. The role of the Council has been instrumental in offering a platform for political dialogue and for having in-depth discussions on how STI policies and R&D targets should be implemented. In Finland the RIC had been essential in driving R&D intensity in a well-
balanced manner to serve the common interest but its importance started to weaken for various external and also internal reasons by 2012 (see Pelkonen et al.).

While not all of these success factors have (always) been in place in Finland we consider the following eight factors as the most relevant in driving the success in raising R&D intensity:

- Raising the level of commitment of all the stakeholders;
- Adoption and implementation of multilaterally drafted joint STI policy vision;
- Better multilateral understanding of the goals, and the line of reasoning by participants that opens up a possibility to work based on shared views and a joint R&D agenda;
- Possibility to enhance in (long-term) partnerships between public and private players;
- Pooling of economic resources from various sources and bringing smaller volumes together into bigger entities;
- Bringing together and "collide" expertise of various stakeholders and fields of expertise.
- Implementing measures by multiple stakeholders together often functions better and reaches more impact.
- Expressing long-term support and commitment of political decision-makers and top-level civil servants is a precondition for success, especially for significant renewals.

9) Implementation failures

Implementation of policies to drive R&D intensity is challenging and therefore it is not surprising some policy instruments did not reach the intended objectives. Moreover, as the ‘great recession’ picked up speed Finnish GDP plummeted, R&D intensity peaked in 2009, and the economic and policy environment became more volatile and turbulent (see Table 1).

An overall failure in driving R&D intensity in Finland has been the introduction of tax incentives. Both during the 1980s and in 2013−2014 there were attempts to launch these policies. In the 2013−2014 period the R&D tax credit did not succeed because it was ill-designed, poorly implemented and lacked uptake. The measure has received a bad evaluation as it only reached (the wrong) fraction (8%) of its a priori expected impact (Kuusi et al. 2016). Currently tax incentives for R&D are again on the agenda and appeared on the new RDI roadmap of the Finnish government.

Despite the good idea - the diversification of the Finnish Economy and fostering collaboration between industry and academics - the implementation of the SHOKs did not work out because the initial SHOK model of the forest industry was copied without taking into account the specificities of each industry. The programme’s evaluation identified some weaknesses in the SHOK model and suggested improvements (Lähteenmäki-Smith et al. 2013).

Surprisingly the government program of 2015 decided to terminate the SHOK financing programme quiet abruptly leaving a vacuum for collaboration between industry and universities. These cuts in Tekes funding addressing all the cooperation programs between industry and academics have been a fundamental failure. The recent impact study (Pirinen et al. 2019) states that the SHOKs contributed greatly e.g. in the creation of lasting networks and culture of collaboration between research organisations and enterprises, and enabled platforms for negotiating strategic agendas and building consensus for example related to standards.

According to some of the interviewees it is of foremost importance to pay attention to the specificities of the sectors when designing and implementing STI policy instruments. Based
on their experience there is an inherent risk that programs that work for one sector will fail when applied to other sectors. For example, several characteristics of the ICT sector are rather unique and this has to be taken into account in policy making. Furthermore, some of the interviewees pointed out that in some cases public support may have crowded out private support. Unintended misallocation of support should be prevented as there is evidence it is likely to persist (see Busom et al. 2017).

According to some of the interviewees the more recent move in 2018 to the new organization Business Finland – a merger of Tekes and Finpro – has not convinced all stakeholders in the innovation policy arena. It has shifted the attention away from innovation towards internationalisation replacing the long-term capability building and shock absorber approach with a short-term approach focusing on exports setting with very high expectations.

The distinction between regional policy and STI policy has not always been successful. The tension between national STI policy and regional policy and more recently the policies of the biggest cities have undermined the systemic approach taken earlier when the belief was that the system is as good as its weakest link. Armstrong and Taylor (2000) review the literature on the tensions in detail. Giving multiple examples, they highlight that tackling interregional disparities can be seen as a way to reduce unwanted inequalities between individual regions while simultaneously promoting national economic growth.

10) Challenges of implementing policies with the aim of enhancing R&D performance

The current Achilles heel in the Finnish STI policy is that Ministries set their own national strategies that are not that much integrated with the practices of different economic sectors. This can lead to the situation that the average national policy impact on firms remains too low. Sectors and companies innovate in a different way and policy makers should take this better into account when designing and implementing policies. This weakness originates from the fact that there is too little coordination and governance for a systemic and integrated policy to emerge. Still in the 2000s, the Sectoral Research Advisory Board made efforts to coordinate activities between the different stakeholders, including the companies, but found it demanding especially without a mandate to make major decisions over the Ministries and without a decent budget of its own.

In addition, the lack of coordination between government programmes is a major challenge. Finland used to be world leader in innovation policy coordination at the time when the Ministries and funding organisations cooperated more intensively in the 1990s and 2000s and when the Council still had higher impact. Coordination deteriorated between 2012 and 2016 pushing the Finnish innovation system into a crisis. This period was characterised by a weak development of the economy, a continuous decrease of public and private R&D funding, diminishing industry-academia cooperation, weakening links between central government and regional efforts in RDI, and dismantling of the traditional RIC (after Dec 2014 when the last RIC meeting was held) and its way to organise multilateral discussions and decision-making advice. Diminishing public and private R&D resources and weakening governance has led to a situation where Finland’s relative innovation performance has been weakening. For investments in R&D to happen, there was definitely a need for a stable policy environment in terms of regulation and instruments.

Moreover, since 2011/2012 the new generation of policy makers has put less emphasis on RDI and its role in economic and social policies, and has possibly had different ideas about the role and content of STI policy and leadership. This has led to a weakening institutional memory (or social capital) with respect to the innovation system and its performance and cooperation.
procedures overall. The recessive economy and rapidly growing government budget deficit increased the pressures to make radical changes even in issues and entities that were not broken and were actually working relatively well.

For many policy domains to be designed and implemented successfully, sufficient cooperation is needed between the Ministries. The natural friction between the Ministry of Education and Culture and the Ministry of Economic Affairs and Employment and their predecessors has always existed but sufficient trust used to be present based on the understanding that a common approach would benefit both Ministries and the entire system. As the trust between the Ministries gradually weakens, it becomes increasingly challenging to coordinate the design and implementation of policies without a series of governance reforms. Moreover, due to this increasing fragmentation of the innovation system and its operations, the scale of the measures becomes often too small and as such the related small effects cannot always be noticed even if they are positive. The RIC that used to play a real coordination role bringing all the players from the innovation system together has lost its role to do so and no other bodies such as Prime Minister’s Office have managed to implement compensatory coordination throughout the system. However, most challenging is the decision making because a clear long-term vision and a strong belief in risk taking in STI do not exist in these days in the political and economic environment.

11) The role of policy and other factors

Policy and other contextual factors are interlinked (see Figure 2) and the focus should be mainly on systemic policymaking. Good policy decisions – long-term oriented innovation policy – certainly has played an important role in that it made possible a diverse set of capabilities that enabled industries to make the right decisions and grow (see e.g. PMO 2005; STPC 2006; Veugelers et al. 2009a, 2009b). From the 1980s until 2011 a balanced policy was developed to fund academic R&D and to encourage private R&D. Initially, there was the possibility to drive R&D intensity by increasing public sector R&D only. However, policy guidelines are only one of the factors that influence the RDI system and the RDI investments. The main reasons for R&D cutbacks were the prolonged recession that Finland faced from the early 2012 until mid-2015, and the internationally relatively weak cost competitiveness of the export sector (e.g. Kajanoja, 2015). It is quite revealing that the Finnish GDP reached its 2008 level (in real terms) only in 2017. This period is called the lost decade. At the same time, the rate of productivity declined considerably and the competitiveness of the Finnish industry weakened compared to its foreign competitors. Furthermore, the rapidly growing public foreign debt (from 54 billion euro in 2008 to 100 billion euro in 2015) and significant budget deficits resulted in diminishing resources that could be allocated to R&D.

After 2011, the Governments also lost their faith in the regenerative and healing force of R&D on the economy, which made it easier for them to reduce public R&D financing. This was the principal policy line despite the fact that cutbacks actually sent a negative signal for the business sector with respect to intangible investments. These developments definitely did not help to enhance trust in the future and increase willingness to take further risks among decision-makers.

A key contextual driver has always been the small size of the Finnish home market that forced Finland to focus on knowledge accumulation and export markets. For a small economy, access to sufficient talent has been a key issue. How talent can be attracted and retained in the future will certainly be of major importance.

Over time there have been considerable economic and societal changes affecting both the public sector and the private sector in Finland. Severe economic downturns both the national
recession of the early 1990 and the Great Recession from 2008 onward, have speeded up structural changes in Finnish industries. In between these two major recessions, Nokia played a key role in driving R&D intensity via large-scale RDI activities until reaching its peaking market share in 2008. This triggered a behavioural change among policy makers and the focus shifted to stimulating private R&D via industry-academia collaborations. Nokia’s successful role also explains why the private share of R&D intensity used to be well over 70% instead of the current two thirds and why the R&D intensity peaked to 3.73% in 2009. Nokia’s downfall and the setback of traditional backbone of the Finnish economy, i.e. the forest industry, in combination with the great recession in 2009 later distracted politicians and policy makers in their decision-making and the faith in innovation policy and R&D intensity started to diminish.

However, still in 2009−2011 policy-makers took counter-cyclical actions and increased R&D as can be seen in the Figure 2. Downward trend and loss of faith started to happen after that, starting in 2012. The truly serious collapse of Nokia took place in 2011−2012, and the mobile business was eventually sold to Microsoft in the autumn 2013 (see e.g. Laamanen et al. 2015; Peltonen 2018). Some two years later, Microsoft had written off the deal and laid of almost 8,000 jobs during the process. On the positive side, the downfall of Nokia enabled the release of lots of talent into other industry fields and fuelled the Finnish start-up boom (Pajaranen & Rouvinen 2013).

Figure 2. Development of key indicators over the different development stages of Finnish STI policy in 2005–2020.

Note: Figure is based on Statistics Finland data on volumes of GDP and export, gross domestic expenditure on R&D and Government R&D financing in Finland in 2005–2020 in real terms (index 2005 = 100, in 2010 prices).
In terms of driving R&D intensity, the current landscape and technological cycle is different from the ones of the 1990s as the magnitude of the growth opportunities offered by the emerging ICT technologies in the 1990s and the probability of success was in relative terms much greater than the opportunities offered in the current competitive landscape. Not surprisingly big companies – but also SME’s – have been reluctant to focus on the development of radical innovations. Instead of raising their R&D investments, they have been mainly focusing on incremental innovations.

12) **Policy lessons.** What are the main policy lessons learned during the implementation of policies for increasing R&D intensity? What would be your concrete advice to countries intending to set R&D targets and policies to achieve them for the first time?

For countries to be able to increase R&D intensity in a meaningful way, the big picture (incl. current state of affairs in the economy and the innovation system, a long-term vision and a strategy for reaching the policy targets) should be clear to all the stakeholders. R&D is only one important part of the big picture. What is decisive is the "stage and direction of development" of the national innovation system and its components. A sustainable policy approach needs to be systemic and therefore it requires that education, science, technology and innovation policies are integrated and are all heading to the same course. However, more important than setting targets is thorough understanding and argumentation as to why and how additional R&D investments are being made. Here R&D quality, efficiency and impacts matters as much as R&D quantity. This requires thorough systemic planning, foreign expert ex-ante evaluations and absolute R&D targets set in interaction with the relevant ministries responsible for STI and the Ministry of Finance.

Even if national innovation systems are by nature systemic, their functioning depends largely on individuals that can lead, motivate and inspire. That Finland became world famous (for a limited time) for its innovation system and innovation policy was a result of hard and long team work jointly driven by visionary leaders from industry, politics, ministries and the RIC, and generally speaking, by innovative people across the labour market. At the same, while the issue is about consensus-driven systemic actions, collaboration and the ability to follow multilaterally designed and adopted policy development lines and visions, the issue is about individuals and leadership. Thus, the significant role that insightful leaders, experts and other individuals play in the development of STI policy and their impact on the direction and trend of the innovation system is probably much greater that is thought in general or how the history of STI policy has been written out.

An example of such a leader for the Finnish innovation system was certainly PM Paavo Lipponen in the latter part of the 1990s. He had a genuine understanding of STI policy and he made sure that the money received from selling state property was partially reinvested in R&D along the advice of his Council. In addition, the two governments in the 2000s of PM Matti Vanhanen showed a similar long-sighted commitment to STI though with a different kind of policy toolkit. Those leaders also had a belief in multilateral collaboration for the common good and saw it as a precondition for success of the innovation system. Social capital, institutional memory, trust building, collaborative culture and interaction across the borders between players and the types of STI activities are all crucial for a strong system. They enable knowledge flows and spill overs that benefit both the generation and diffusion of innovations. Therefore, it is important to monitor how knowledge flows over institutional borders but also over generations, governments and parties.

Because a system is as good as its weakest link, a systemic dialogue is needed when planning long-term policy initiatives in order to guarantee their sustainability. To facilitate such a dialogue between the different stakeholders of the innovation system there is a need for a...
platform that offers an arena for consensus making and an independent soundboard over government terms. This is exactly the role the PM-led RIC used to fulfil. Such a platform – although being in an advisory role and without a budget and legal right of decision over public bodies – helped to balance policy issues and made it easier to reach shared views on policy designs between various players within the system, and smoothed the path between research, development and different forms of innovation. A balance between policy instruments that foster both research and innovation and that enhance the interaction between industry and academics has been absent in recent years to the detriment of the Finnish innovation system. That is why public support should, in the first place, focus on collaboration and on programs that are nation-wide and on programs that are long-term. However, this can only happen if there is sufficient capacity and will across the innovation system to build joint views about the needs, objectives and measures of STI policy.

For reaching R&D targets industry needs to be fully committed and this can partly be stimulated via supporting industry−university and other PPP-based cooperation. Currently there is a broadening gap between universities and industry – on the EU-level and especially in Finland – as the autonomy of universities made them focus on becoming internationally competitive in science and putting less emphasis and placing less incentives for industry cooperation especially when most of the funds for collaboration were cut in the 2015 Government Program (GP 2015).

For setting-up large overarching programmes based on megatrends all types of business actors have to be invited to take part in drafting the programmes, in order to raise the level of commitment of the private sector. Ministries should facilitate discussions and not steer them as too much public sector influence may limit commitments of key players. National roadmaps for RDI should channel their resources over time and not through one government only as to smoothen R&D expenditures and make them more predictable over time. Stability of the system is the key though it does not rule out the capacity for change the system needs in order to renew itself, create new competitive advantages and react to shifts in the operational environment. From all these perspectives, the main conclusions of the OECD (2017) evaluation of the Finnish innovation system are still valid.

In general terms and based on this case study, we can conclude that the central factors and dimensions having an impact on the possibility to reach officially set R&D intensity targets – in addition to STI policy issues as such – are as follows: political factors (e.g. does government prioritise R&D); economic issues/national economy (growth of GDP); public economy (balance of public budgets); human resources (e.g. quality of education, sufficiency of well-educated); governance issues (discussion culture, PPP-based forums); social factors (social capital; institutional memory); business enterprise sector’s dynamics (e.g. industrial structure, intensity rate of the business enterprise sector R&D); regulatory framework, infrastructure and technical issues (e.g. RDI-related laws and degrees, public procurement, availability of joint facilities and platforms).

Based on the long-term experience with R&D target setting, the case study distilled three key lessons that are of relevance to Finland’s peers as well as to Finland’s current and future policy makers as to be able to set R&D intensity in a sustainable and impactful manner:

(1) A systemic and integrated policy approach needs an impactful coordination and governance mechanism or forum. The ability of any such instance to have impact depends on its authority and its mandate given by political actors. Finland used to be world leading in STI policy coordination and multilateral collaboration, e.g. industry–academia cooperation. The RIC offered an arena for discussion and consensus making and an independent soundboard beyond government terms. Simultaneously, multiple STI
agencies and ministries were coordinating their actions. Furthermore, via sectoral committees strong coordination existed between the sectors and national policies. All these coordination actions made the STI policy approach more sustainable.

(2) A balanced innovation system with well-working joint PPP efforts and mechanisms will do better in absorbing shocks. Balance should be present in terms of paying attention to all key stakeholders from research, development and innovation perspective but also in terms of making sure that policies are balanced and stable over time. This is why in the first place public support should focus on collaboration, on programs that are nation-wide and long-term, and on supporting novel and bold openings that would not be carried out without further public support. Political stability is a precondition for trust building and for lifting private R&D investments. Creating PPP efforts do not require new organizations, but new innovation policy approaches and initiatives that go across the borders of sectors, fields of administration and organisations to make this a priority.

(3) A key strategy to be able to absorb shocks to the economy and society is to invest in long-term capabilities. Capability building should happen based on a diversity of skills and focus on more and better cooperation between various stakeholders. However, a long-term focus means there will be a need for more leadership and more diplomacy pushing aside organisational agenda’s and short-term wins for the common economic and societal good of the entire country. Given the grand challenges we face, visionary STI policy leaders, bridge-builders and intermediaries will continue to be in high demand.

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