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Evolving Innovation Policy Rationales in Finland

Markku Sotarauta, Jari Kolehmainen and Valtteri Laasonen

Abstract

Innovation policy is a key public policy in many parts of the world and is seen as crucial for securing a better future. It reflects the explicit understanding of knowledge and innovation being fundamental for the economic performance not only of nations but also of regions and cities. In this chapter, we focus on the various rationales informing Finland's evolving innovation policy, shedding light on the changes in this regard from the modern outset of innovation policy from the early 1990s to the early 2020s.

Introduction

Innovation policy is a key public policy in many parts of the world and is seen as crucial for securing a better future. It reflects the explicit understanding of knowledge and innovation being fundamental for the economic performance not only of nations but also of regions and cities. For Edquist (2011), innovation policy is about the activities of public organisations influencing innovation processes, including creating new ideas, implementing them and diffusing them in society (Fagerberg 2018). In this chapter, we follow Edquist's narrow understanding of innovation policy and focus mainly on the changes in the rationales behind it; in other words, we look at the reasons for and logical foundations of why an innovation policy is needed, what it should focus on and how it should be implemented (Laranja et al. 2008). According to Laranja, Uyarra and Flanagan (2008), policy rationale constitutes higher-level government action modes and limits that are commonly embedded in ideological positions.

Innovation policy took pole position among Finnish public policies three decades ago during economically challenging times. A sound and celebrated but still vulnerable innovation economy, supported by explicit public policies, emerged from the economic recession of the

early 1990s (Vihriälä 2019). As a result, Finland became the first country to opt for the concept of a national system of innovation to provide its science and technology policies with a conceptual framework with a distinct innovation orientation (Sharif 2006). However, the rapid expansion and institutionalisation of the innovation policy stagnated around 2008/2009 as the Finnish innovation policy community lost confidence and direction due to the financial crisis. Several economic- and innovation-related causes for the Finnish economy's slow recovery from this period have been identified, including the rapid restructuring of industry (especially ICT and forest industries), the slowing rate of exports, the low level of industrial investment, low employment and decreasing investment in research, development and innovation (Veugelers 2009; Vihriälä 2019).

Nevertheless, Finland's structural strengths – the educational level of the population, its capacity for innovation and the high quality of its governance systems – have not eroded overnight, and thus the country has continued to do well based on international comparisons (Vihriälä 2019). Still, shocks to the economy (e.g. the decline in Nokia's mobile phone production) and weakened cost-competitiveness have led to a decade-long period of slow economic development. Simultaneously, the golden age of innovation policy drifted into a state of confusion. Nevertheless, Finland is still among the world's leading innovation economies by many measures (e.g. Dutta et al. 2020), although it is no longer the international poster child it used to be.

In this chapter, we focus on the various rationales informing Finland's evolving innovation policy, shedding light on the changes in this regard from the modern outset of innovation policy from the early 1990s to the early 2020s.

Innovation Policy in Search of Direction

In the early days of innovation policy development, its rationale rested mainly on economic visions and arguments. Since then, the foundations of innovation policy have been expanding to include social and ecological premises, but these have simultaneously become increasingly fine-tuned. Borrás (2009) identified two main trends: (1) the spread of innovation policy to other areas of public policy (widening) and (2) the introduction of increasingly sophisticated policy instruments (deepening). Of course, recent changes in innovation policy have not emerged in a vacuum; they reflect a general change in the public sector as more decentralised,

multi-scale and multi-functional governance and approaches are developed in tandem with and to replace centralised models (Flanagan et al. 2011).

From Linear Innovation Policy to Innovation Systems

Schot and Steinmueller (2018) identified three framings that grasp the essence of different innovation policy rationales. The first, *innovation policy 1.0,* draws on a linear model of innovation, privileging the technological discovery process, with its focus on scientific breakthroughs, technological development and the commercialisation of new technologies. The primary rationale is to correct market failures by financing public research, subsidising R&D in private enterprises (directly or through tax deductions) and establishing and fine-tuning an intellectual property rights system (Schot and Steinmueller 2018). Vannevar Bush's (1945/2021) book, *Science: The Endless Frontier*, is commonly seen as the initiator of the first innovation policy stream.

Innovation policy 2.0 turns one's gaze towards innovation systems – in other words, to 'networks of institutions in public and private sectors whose activities and interactions initiate, import, modify, and diffuse new knowledge (technologies)' (Freeman 1987, p. 1). Innovation policy 2.0 emphasises a more versatile knowledge base for innovation with the aim of strengthening the links between discovery and the applications of new knowledge. The innovation system approach, explicitly arguing that innovation processes are not linear but interactive and systemic, became influential in the 1990s. The proponents of innovation systems showed that innovation comes in many shapes, with variegated types of actors and networks. The realisation of the diversity of the innovation systems led to a series of studies focusing on national or regional innovation systems. The innovation system-orientated research and policies were based on the realisation that innovation is a key to national and regional competitiveness and crucial for countries choosing a high-road strategy instead of a low-road one based on cost competition. The innovation system concept led to the introduction of a new vocabulary to discuss the roles of universities, research institutes, firms, users, intermediaries, public organisations and educational organisations as elements in a system (Miettinen 2002).

Innovation policy 2.0 aims to correct different types of system failures, including insufficient infrastructure (communication networks, research and education, intermediaries), capability failure (lack of appropriate competencies, especially relating to emerging technologies),

institutional failure (formal and informal institutions hampering innovation, such as through a lack of risk-taking behaviour) and network failure (e.g. limited collaboration between universities and industries). Network failures may be divided into weak network failures and those that are strong (Smith 2000). The former refers to the poor exploitation of complementary sources of knowledge and interactive learning, while the latter relates to overly intensive collaboration, potentially leading to lock-in to established functions and processes and inbred behaviour.

In the 2010s, the innovation ecosystem concept emerged to (partly) challenge that of the innovation system. Granstrand and Holgersson (2020), for example, defined the new concept as an 'evolving set of actors, activities, and artefacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (p. 91), although this does not differ much from innovation system conceptualisations. In principle, the innovation ecosystem literature emphasises more market mechanisms than the institutionally oriented innovation system literature, as it draws more on business studies. In contrast, the innovation system literature is more embedded in economics, regional development studies and economic geography.

Moreover, the increasing presence of digital platforms and the ecosystems revolving around them have undoubtedly influenced innovation scholars and policymakers. Autio and Thomas's (2014) definition explicitly links innovation ecosystems to platform thinking. According to them, an innovation ecosystem is a 'network of interconnected organizations, connected to a focal firm or a platform, that incorporates both production and use side participants and created as appropriates new value through innovation' (Autio and Thomas 2014, p. 205). Platforms are expected to integrate different but related actors, activities and knowledge (Asheim et al. 2011). In the innovation ecosystem literature, access to global innovation ecosystems is highlighted more than in the innovation system literature, which is more nationally or regionally oriented.

Innovation scholars disagree on the benefits of the new concept. For example, Oh et al. (2016) observed that while the proponents of the 'innovation ecosystem' have contributed to the innovation debate with some interesting ideas, they have not drawn on 'eco' terminology, and thus their contribution is substantially limited. As a result, Oh et al. (2016) warn that the concept of the ecosystem should be avoided or, if used, employed with caution. However, the concept of the ecosystem has also been defended (Ritala and Almpanopoulou 2017), and

beyond any doubt, it is gaining more space in policy and business rhetoric, and its usefulness remains to be seen in the future.

A Call for a Transformative Innovation Policy

The rationale of the innovation system-driven innovation policy is still largely valid, but *innovation policy 3.0* redirects and enriches it in many ways. In particular, the need to solve grand challenges by utilising innovation policy approaches and instruments has come to the fore. Innovation policy 3.0 strategies are openly built upon social values and focus on solving selected social, ecological and economic challenges. As is often the case with emerging concepts and policy approaches, there is also considerable conceptual variation among differing approaches under innovation policy 3.0 (Diercks et al. 2019). *Innovation policy 3.0* is labelled as an eco-innovation or a transformative or mission-oriented innovation policy. All the variations highlight, in their own way, the importance of the explicit mobilisation of science, technology and innovation for meeting grand challenges. In practice, innovation policy 3.0 is layered up and so does not replace earlier innovation policy paradigms (Schot and Steinmueller 2018). Indeed, as Fagerberg (2018) reminded us, Joseph Schumpeter's work and the subsequent stream of innovation studies do not focus on economic growth per se but on qualitative changes in outputs, the organisation of the economy and its structure. Thus, innovation policy 3.0 is not as distant from the earlier incarnations as is often claimed.

The rationale of innovation policy 3.0 is to correct transitional or transformational deficiencies related to the economy and society (Schot and Steinmuller 2018). In this way of thinking, the socio-politico-economic system is not ready to move towards a more sustainable development stage. Therefore, several systemic and market deficiencies must be identified and dealt with more systemically than in innovation policies 1.0 and 2.0. Thus, the public sector is supposed to play a significant role in directing innovation activities and shaping markets in the desired direction. In the 2010s, several policy documents began to frame this emerging rationale.

The systemic perspective of innovation policy 2.0 added complexity to the previous linear approach, and innovation policy 3.0 is adding a whole range of stakeholders and interest groups into the equation, which again adds to the need to devise new governance arrangements. As the variety of individual interests and ambitions increases and directionality becomes imperative, the political nature of innovation policy will become visible, necessitating the state to further specify its role and position in terms of identifying and achieving the desired policy

goals. Thus, innovation policy 3.0 differs drastically from innovation policy 1.0, specifically from its neoclassical interpretation, which aims to build a supporting environment for businesses without making actual choices between industries or companies.

It is crucial to remember that innovation policy 3.0 is not free of problems. To date, it has treated societal needs and the many visible and invisible issues as unproblematic. Inadequate attention has been paid to what is compromised in terms of issues calling for policy attention, such as what should or should not be among the collective concerns and thus the targets for innovation policy (Flanagan et al. 2022). Moreover, the capability of the state apparatus (politicians and bureaucrats) to work with many stakeholders, identify priorities and maintain the policy focus long enough is not guaranteed. Innovation policy 3.0, despite its promise, may shift power and resources to narrow interests while neglecting the many hidden issues that do not have strong policy advocates.

In sum, innovation policy 3.0 emphasises directionality, demand articulation, reflexibility and co-ordination more than the other two paradigms. *Directionality* applies to the identified urge to explicate the societal direction that a policy ought to strive for. Demand articulation is about anticipating user needs and mobilising the identification of latent demand in the direction of societal challenges (Edler and Boon 2018). For its part, reflexibility refers to actors' capacity to anticipate changes and mobilise them accordingly. Finally, co-ordination stresses the importance of managing the policy mix (labour, education, industry, trade) to guide the system as a whole in the hoped-for direction (Chaminade and Lundvall 2019).

The Evolution of Innovation Policy in Finland

Becoming a Poster Child: The Finnish Version of Innovation Policies 1.0 and 2.0

Overall, Finnish innovation policy has evolved along the generic avenue identified by Schot and Steinmueller (2018). The pre-history of Finnish science- and technology-based innovation (STI) policies dates from the Second World War to the 1970s, when the foundations for the current system were constructed. In the 1980s, Finland adopted an unambiguous technological orientation to strengthen the technological capacity of Finnish industries, thus mitigating the dependence on material-based production and exports. Therefore, among the main objectives of the 1980s was to move to a targeted and systematic technology policy. At this stage, the main elements of an entity, which was later labelled an innovation system, were established.

The National Technology Agency (Tekes) was founded in 1983[1], and many of the functions carried out by the Ministry of Trade and Industry (e.g. R&D loans and grants, appropriations to target technical research) were passed on to Tekes. In addition, the Science Council was established in 1963, later named the Science and Technology Council (1987) and the Research and Innovation Council (2009). Moreover, the Academy of Finland was established in 1948 and modernised in 1969. The state had a central role in building the institutional capacity for science and technology, but city councils also played an active role, as local technology transfer mechanisms for the commercialisation of science were established (Georghiou et al. 2003). The first local technology centre was established in Oulu in 1982, and many other prominent cities followed its example in the 1980s.

The recession of the early 1990s is often mentioned as a critical juncture that shifted Finland from an investment-driven, dominantly linear science and technology rationale to an innovation-driven, systemic policy (Boschma and Sotaraut 2007; Sotarauta 2012; see Figure 1). In Finland, the 1990s were characterised by a severe recession (in the early 1990s) and by the exponential growth of the Nokia-led ICT cluster (from the mid-1990s onwards). The rationale changed in the 1990s, and a shift to indirect measures became a fundamental organising policy principle (Hermans et al. 2005). Thus, in the 1990s, amid a severe recession, Finland adopted the concepts of an innovation system (Lundvall 1992) and a cluster (Porter 1990) to frame its policy design (see Hernesniemi et al. 1995). A cluster-flavoured innovation policy with the ambition to diversify the economy towards new high-technology industries and away from resource dependency fitted well with the situation (Romanainen et al. 2001). The policy shifted to emphasise indirect policy approaches and avoided direct interventions in the product markets (Hermans et al. 2005). Moreover, as Schienstock and Hämäläinen (2001) reminded us, the government recognised the need to find ways to support the competitiveness of Finnish industries as inexpensively as possible. In concert with national innovation system thinking, a cluster-based policy fitted well into the new mix of policy rationales. Importantly, resources were directed towards both public and private R&D activities.

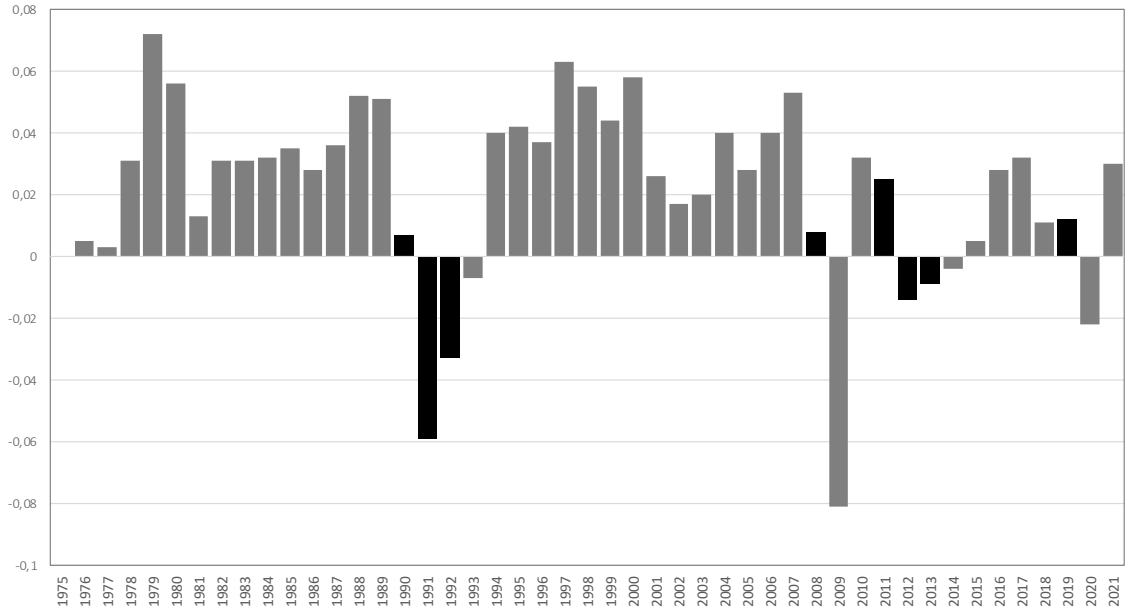

Figure 1. Annual change in the volume of gross domestic product (Official Statistics of Finland 2022).

Innovation policy 2.0 was at the core of Finnish innovation policy for almost three decades. The most visible programmes were those of the Strategic Centres of Excellence for Science, Technology, and Innovation (SHOK 2007–2016) and the Centre of Expertise (CoE 1994–2013), which provided a national and regional context for increasing collaboration between the main parties to boost specialisations. As a result of an increased emphasis on innovation, Finnish R&D expenditure, which in the 1970s had been among the lowest in the OECD countries, had risen to be among the highest in the world by 2010 (see Figures 2 and 3), decreasing drastically after 2010. After being among the leading countries globally, Finland has fallen far behind the globally leading countries (Israel and the Republic of Korea) and the top Nordic country (Sweden). It is, however, still above the European Union and OECD averages (Figure 4).

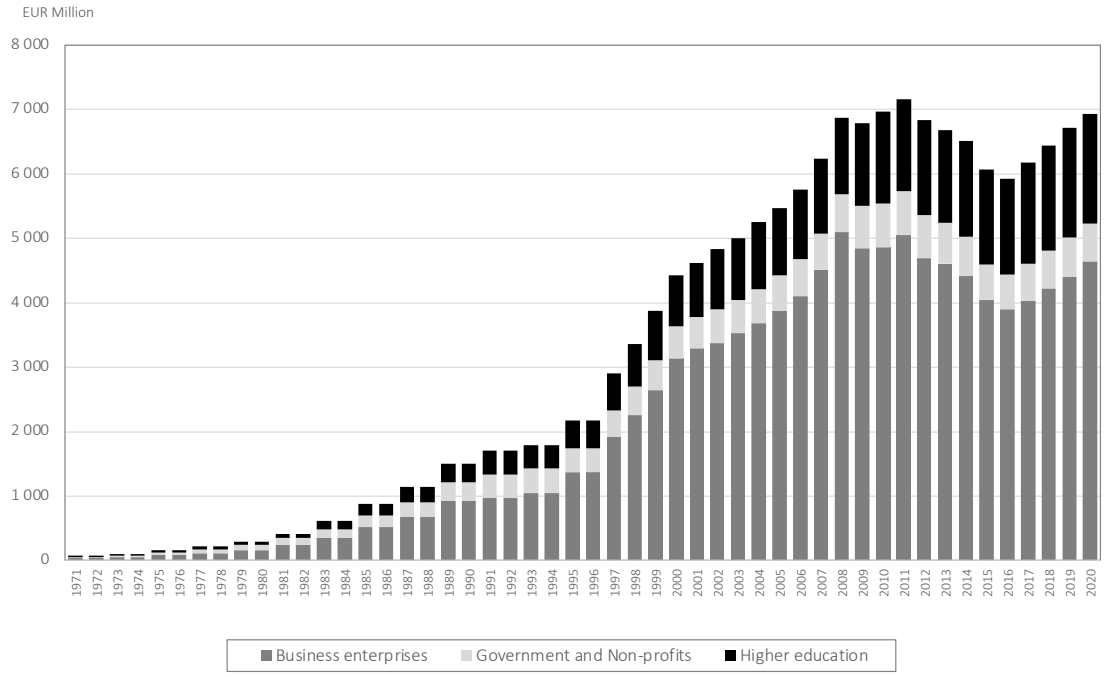

Figure 2. Research and development expenditure in Finland by performing sectors (EUR million) (Official Statistics of Finland 2022).

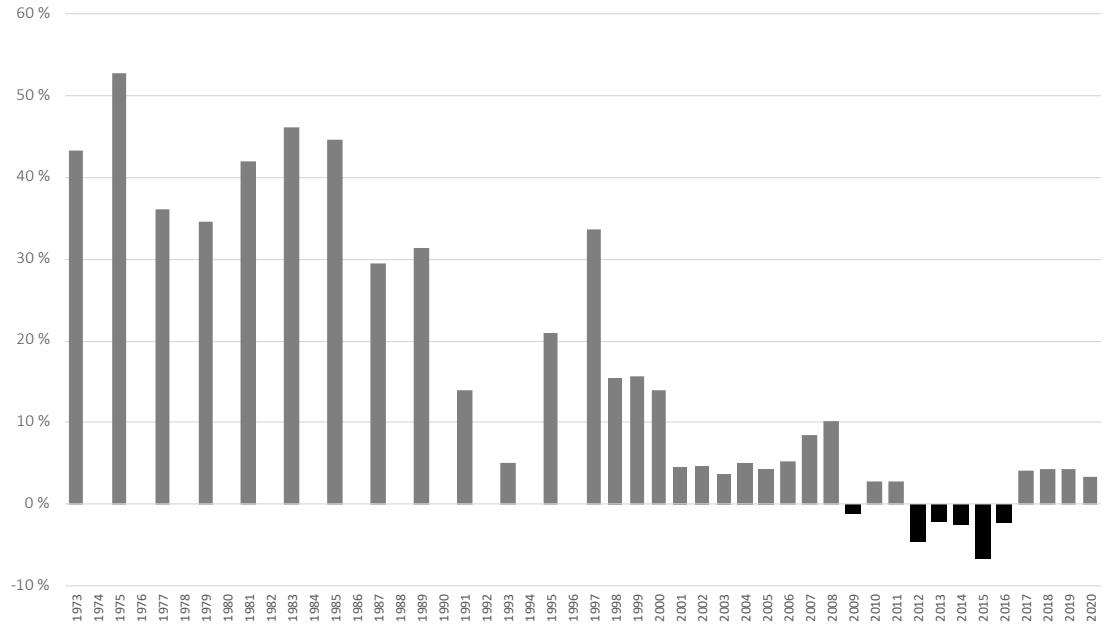

Figure 3. R&D expenditure in Finland, annual change % (Official Statistics of Finland 2022).

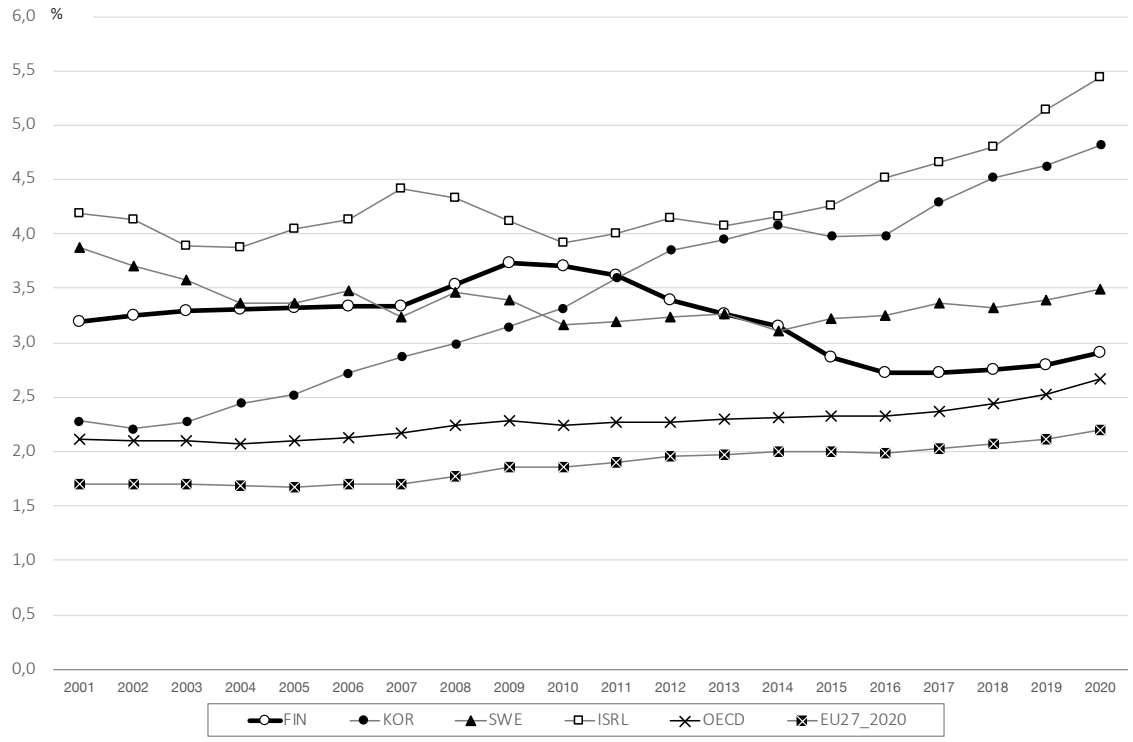

Figure 4. Total R&D expenditure of selected countries, the OECD and the EU27 as a percentage of GDP (GERD). (Source: OECD data.)

The Years of Confusion and the Search for a New Approach

The first critical juncture in the evolution of Finland's innovation policy occurred in the early 1990s, and the second happened around 2008 – about the same time as when the global financial crisis began. Interestingly, in 2008, a national innovation strategy was drafted and passed on to parliament for a political debate, not as a reaction to the financial crisis, which had not yet surfaced, but to lift Finland to the next level. The new strategy aimed to renew the innovation policy rationale by fine-tuning the strong science and technology establishment and complementing it with a stronger emphasis on the demand side of the innovation coin. The shifting policy rationale well reflected Lorenz and Lundvall's (2006) idea of the two innovation modes, namely science, technology and innovation (STI) and doing, using and interaction-based innovation (DUI). The conviction was that Finland was doing well in terms of the STI mode, but was behind its closest rival and benchmark countries in terms of DUI. More broadly, the innovation strategy highlighted the importance of a broad-based innovation policy and introduced the idea of innovation ecosystems.

> Finland's long-term investments in expertise and technological research & development have produced good results, and its successful science and technology policy has created

> a basis for many successful industries. This provides a good basis for constructing the future. However, the challenges of growth and competitiveness can no longer be tackled only by means of a sector-based, technology-oriented strategy. Instead, a demand-based innovation policy must be strengthened alongside a supply-based innovation policy. (Proposal for Finland's National Innovation Strategy 2008, p. 2)

> In order to meet global challenges, innovation policy must be broad-based and comprehensive. Individual and separate policy measures will not suffice to ensure a pioneering position in innovation activity, and thus growth in national productivity and competitive ability. (Proposal for Finland's National Innovation Strategy 2008, p. 11)

> Instead of national innovation systems, innovation ecosystems and innovation centres are drawing attention, being locally and regionally fixed but globally networked at the same time. (Proposal for Finland's National Innovation Strategy 2008, p. 11)

The formulation of the new strategy was supported by an extensive international evaluation of the Finnish National Innovation System (Veugelers 2009). It concluded that Finland was losing ground in competitiveness, the growth aspirations of enterprises were low, the policy orientation was overly technological, the primary manufacturing companies dominated the innovation scene and the level of internationalisation was low, as was international researcher mobility. The strategy document also mentioned the Nordic paradox, namely, that R&D expenditure was not synonymous with innovation activity. Finland (and Sweden) had invested significantly in R&D, but the levels of commercially successful innovations were relatively low. Some years later, Prime Minister Juha Sipilä, reflecting on the latter point, expressed his doubts about the long-held innovation policy rationale by asking:

> How in the world [has] this happened? Why weren't we better able to exploit global economic growth despite exceptional investments in expertise and R&D? (A speech at the Summer Conference of the Finnish Union of University Professors and the Finnish Union of University Researchers and Teachers 2016)

In addition to the critical observations in the international evaluation, Sabel and Saxenian (2008) argued that Finland was at risk of becoming a victim of its own economic success. They concluded:

> The core products of both industries – pulp, paper and packaging for the one, cell phones for the other – have become commodities in the fast-growing markets in the rapidly expanding economies of the developing world … Prospects of longer-term growth in Finland will require rethinking … [The system] that fuelled successful innovation … appears to have become self-limiting in the global environment of the 2000s. (Sabel and Saxenian 2008, p. 112)

By 2010, Nokia had become the world's largest mobile phone manufacturer, with approximately 40% of the market share, and it played a central role in the Finnish economy and the innovation system. Nokia's production volume and R&D expenditure continued to increase until its market share in mobile phones shrank drastically after 2010, when the Apple and Android ecosystems began proliferating. Eventually, Nokia sold its mobile phone division to Microsoft, leaving a systemic hole in Finland's innovation system. Moreover, the historically strong collaboration between Finnish universities and industries decreased. In 2010, private sector funding for Finnish universities was approximately €78 million; by 2017, it had dropped to approximately €52 million. At the same time, Finnish companies were carrying out more R&D abroad than previously (Ormala 2019).

In sum, the innovation strategy aimed to reform the policy rationale, but then Finland simultaneously hit the Nokia and the global financial crises, and several years of no or slow growth followed (see Figure 1). As a result, all the flagship programmes ended, and the successful policy path with much international visibility faded away. The new catchwords that surfaced from the confusion included ecosystems, platforms and open innovation.

The ideology became visible, albeit with immature (or non-existent) theory, but introducing new policy initiatives and instruments proved difficult. For example, the Innovative Cities programme, introduced in 2014 and drawing on an ecosystem rationale, ended in the middle of the first programme period.

The National RDI Roadmap (Kestävän ja kehittyvän yhteiskunnan ratkaisuja tuottava Suomi 2020) states that to strengthen, broaden and increase the impact of innovation policy, business and research networks need to be grouped into larger ecosystems. Consequently, in the 2020s, innovation policy explicitly emphasised the facilitation of ecosystems crossing regional and industrial boundaries. The most visible of them, drawing on a platform/ecosystem rationale, is

the Growth Engine initiative, which, instead of strengthening selected clusters, aims to generate billion-euro export businesses in Finland. The initiative provides financial support to platform companies (instead of clusters) to achieve set business goals (Figure 5). The selected companies are expected to construct a globally strong ecosystem around them by mobilising an extensive network of companies of different sizes, including research organisations and public actors, to identify and achieve a common set of concrete business goals. By 2022, the six platform companies that have received funding are ABB for Green Electrification, Sandvik for innovative solutions for mining, the Fortum & Metsä Group for accelerating the development of sustainable bioproducts, KONE for developing a new concept based on the flows of urban life, Neste for novel sustainable and scalable solutions for transportation and chemicals and Nokia for unlocking industrial 5G beyond connectivity (Business Finland 2021).

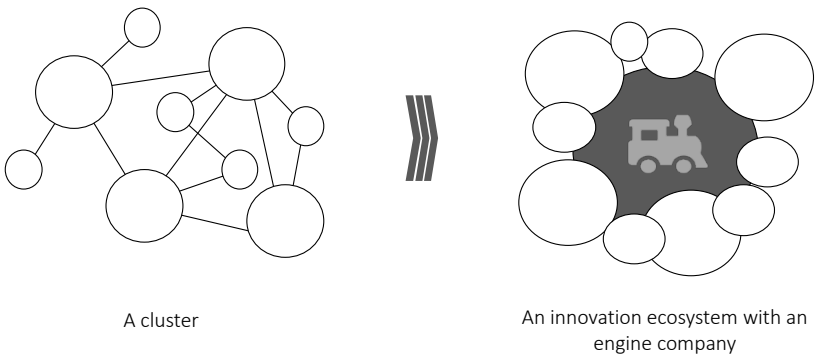

Figure 5. Visualisation of the rationales between a cluster programme and the Growth Engine initiative.

Another significant change in policy rationale is the shift from the programme to the contractual mode of operations. Prime Minister Sanna Marin's Government Programme is introducing 'an ecosystem agreement procedure' to create the world's most functional experimental and innovative environment by 2030 (Finnish Government 2019). Consequently, ecosystem contracts strengthening the innovation activities of and in cities are now among the critical elements of the innovation policy. According to the government programme, contracts for the strategic allocation of public and private research, development and innovation funding to strengthen globally competitive ecosystems will be drawn up with university cities. The ecosystem contract procedure reflects the broadening and deepening innovation policy at the same time; the contracts are not only customised to serve local needs, but are also implementable locally. The contractual procedure between the government, represented by the

Ministry of Economic Affairs and Employment of Finland, and the respective city councils exemplifies the operationalisation of the ecosystem approach alongside the Growth Engine programme.

Conclusion

The primary shifts in policy rationale have taken place during and after significant critical junctures that challenged the economic basis of the country. Finnish policy institutions, and consequently policy rationales, have adapted to the global economy and changes in the policy environment and have been learned from the experiences of other countries (Boschma and Sotarauta 2007). The pre-history of the Finnish innovation policy strengthened the institutional system related to Finland's post-World War II modernisation and industrialisation process. Later, the innovation system emphasised a nationwide effort to survive the economic recession of the early 1990s. Moreover, the period of slow economic growth and economic restructuring, which began with the 2008 financial crisis and Nokia Corporation's restructuring, also called for reforms in the innovation policy rationale. Simultaneously, global demand to solve the grand challenges was incorporated into the innovation policy mix.

As is the case in the other Nordic countries, there are clear signs of efforts to include mission-orientated and transformative elements in policy strategies (Scordato et al. 2022). As Laasonen, Kolehmainen and Sotarauta (2020) showed, Finnish innovation policy has expanded and deepened at the same time, and in the 2020s, the innovation policy now incorporates all three innovation policy paradigms, namely the technology push of innovation policy 1.0, the enhancement of innovation systems from innovation policy 2.0 and efforts to push for transformative changes, as indicated by innovation policy 3.0. Consequently, innovation policy has become more layered than before as new policy goals and instruments have been added to existing policies without explicitly constructing a unique policy mix with clearly defined responsibilities. To some extent, new goals and words have replaced the old ones without a clear understanding of how the new approach should change concrete measures. Policy layering and drift are potentially the primary sources of policy confusion.

The simultaneous expansion and deepening of innovation policy, accompanied by the ambition to 'save the globe', is of utmost importance but notoriously complex. It goes without saying that finding a new path in a multi-vocal innovation policy environment is no joyride. Instead of leading Finland to a more sustainable future, the layered and drifted policy rationales and

related instruments may also lead to a dissipating innovation policy. If innovation policy is everything to everyone, is it nothing to anyone anymore? Will it become a forum for endless political debates, making policy short term and fragmented, and thus precisely the opposite of what it was intended to do? Moreover, the conceptual ambiguity and underdeveloped theory so visible in the innovation policy of the 2020s may detach grand ambitions from specific ends and means, not to mention actions. The emerging policy rationales call for enhanced capabilities for leading the ecosystem and constructing supportive governance systems.

References

Asheim, B., Boschma, R., & Cooke, P. (2011). Constructing regional advantage: Platform policies based on related variety and differentiated knowledge bases. *Regional Studies*, 45(7), 893–904.

Autio, E., & Thomas, L. D. W. (2014). Innovation ecosystems: Implication for innovation management. In M. Dodgson, M. Gann, & N. Phillips (Eds.), *The Oxford handbook of innovation management* (pp. 204–228). Oxford University Press.

Borrás, S. (2009). *The widening and deepening of innovation policy: What conditions provide for effective governance?* (CIRCLE Working Paper No. 2/2009). Lund University.

Boschma, R., & Sotarauta, M. (2007). Economic policy from an evolutionary perspective: The case of Finland. *International Journal of Entrepreneurship and Innovation Management*, 7(2–5), 156–173.

Bush, V. (2021). *Science: The endless frontier*. Princeton University Press. (Original work published 1945.)

Business Finland. (2021). *Veturiyritysten ja -ekosysteemien rahoitus* [The financing of engine firms and ecosystems]. Retrieved October 13, 2022, from https://www.businessfinland.fi/suomalaisille-asiakkaille/palvelut/rahoitus/veturiyritysten-ja-ekosysteemien-rahoitus

Chaminade, C., & Lundvall, B-Å. (2019). Science, technology, and innovation policy: Old patterns and new challenges. In *Oxford research encyclopaedia of business and management*. Retrieved October 1, 2022, from https://oxfordre.com/business/view/10.1093/acrefore/9780190224851.001.0001/acrefore-9780190224851-e-179

Diercks, G., Larsen, H., & Steward, F. (2019). Transformative innovation policy: Addressing variety in an emerging policy paradigm. *Research Policy*, 48(4), 880–894.

Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2020). *Global Innovation Index 2020*. Cornell University, Insead and the World Intellectual Property Organization. Retrieved October 11, 2022, from https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

Edler, J., & Boon, W. P. (2018). The next generation of innovation policy: Directionality and the role of demand-oriented instruments. Introduction to the special section. *Science and Public Policy*, 45(4), 433–434.

Edquist, C. (2011). Design of innovation policy through diagnostic analysis: Identification of systemic problems (or failures). *Industrial and Corporate Change*, 20(6), 1725–1753.

Fagerberg, J. (2018). Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, 47, 1568–1576.

Flanagan, K., Uyarra, E., & Laranja, M. (2011). Reconceptualising the 'policy mix' for innovation. *Research Policy*, 40, 702–713.

Flanagan, K., Uyarra, E., & Wanzenböck, I. (2022). Towards a problem-oriented regional industrial policy: Possibilities for public intervention in framing, valuation and market formation. *Regional Studies*. Advance online publication. https://doi.org/10.1080/00343404.2021.2016680

Freeman, C. (1987). *Technology policy and economic performance: Lessons from Japan*. Pinter.

Georghiou, L., Smith, K., Toivanen, O., & Ylä-Anttila, P. (2003). *Evaluation of the Finnish Innovation Support System Publications, 5/2003*. Ministry of Trade and Industry.

Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation*, 90–91, 1–12.

Hermans, R., Kulvik, M., & Ylä-Anttila, P. (2005). International mega-trends and growth prospects of the Finnish biotechnology industry: Recent economic research and policy implications. *Journal of Commercial Biotechnology,* 11, 134–145.

Hernesniemi, H., Lammi, M., & Ylä-Anttila, P. (1995). *Kansallinen kilpailukyky ja teollinen tulevaisuus* [National competitiveness and the industrial future]. Etla/Sitra.

Kestävän ja kehittyvän yhteiskunnan ratkaisuja tuottava Suomi. (2020). [Finland that produces solutions for a sustainable and developing society]. The national roadmap for research, development and innovation. Retrieved October 13, 2022, from https://okm.fi/documents/1410845/4449678/

Laasonen, V., Kolehmainen, J., & Sotarauta, M. (2020). The complexity of contemporary innovation policy and its governance in Finland. *Innovation: The European Journal of Social Science Research*, 35(4), 547–568.

Laranja, M., Uyarra, E., & Flanagan, K. (2008). Policies for science, technology and innovation: Translating rationales into regional policies in a multi-level setting. *Research Policy*, 37, 823–835.

Lorenz, E., & Lundvall, B.-A. (Eds.). (2006). *How Europe's economies learn*. Oxford University Press.

Lundvall, B.-Å. (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*. Pinter.

Miettinen, R. (2002). *National innovation system: Scientific concept or political rhetoric*. Edita.

OECD data. (n.d.). *Gross domestic spending on R&D*. Retrieved October 10, 2022, from, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm)

Oh, D-S., Phillips, F., Park, S., & Lee, S. (2016). Innovation ecosystems: A critical examination. *Technovation*, 54, 1–6.

Ormala, E. (2019). *Suomen kilpailukyvyn ja talouskasvun turvaaminen 2020-luvulla* (Ministry of Economic Affairs and Employment Publication No. 2019:1) [Securing Finland's competitiveness and economic growth in the 2020s].

Finnish Government. (2019). *Osallistava ja osaava Suomi – sosiaalisesti, taloudellisesti ja ekologisesti kestävä yhteiskunta* (Government Publication No. 2019:31) [An inclusive and capable Finland: A socially, economically and ecologically sustainable society]. Pääministeri Sanna Marinin hallituksen ohjelma [Prime Minister Sanna Marini's Government Programme].

Porter, M. E. (1990). *The competitive advantage of nations*. Macmillan.

Proposal for Finland's National Innovation Strategy. (2008). Retrieved October 11, 2022, from https://ec.europa.eu/invest-in-research/pdf/download_en/finland_national_innovation_strategy.pdf

Ritala, P., & Almpanopoulou, A. (2017). In defense of 'eco' in innovation ecosystem. *Technovation*, 60–61(Feb.), 39–42.

Romanainen, J. (2001). The cluster approach in Finnish technology policy. In *Innovative clusters: Drivers of national innovation systems* (pp. 377–388). OECD.

Sabel, C., & Saxenian, A.-L. (2008). *A fugitive success: Finland's economic future* (Report No. 80). Sitra.

Schienstock, G., & Hämäläinen, T. (2001). *Transformation of the Finnish innovation system: A network approach* (Sitra Report Series No. 7). Hakapaino Oy.

Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47, 1554–1567.

Scordato, L., Bugge, M. M., Hansen, T., Tanner, A., & Wicken, O. (2022). Walking the talk? Innovation policy approaches to unleash the transformative potentials of the Nordic bioeconomy. *Science and Public Policy*, 49(2), 324–346.

Sharif, N. (2006). Emergence and development of the national innovation systems concept. *Research Policy*, 35(5), 745–766.

Smith, K. (2000). Innovation as a systemic phenomenon: Rethinking the role of policy. *Enterprise and Innovation Management Studies*, 1(1), 73–102.

Sotarauta, M. (2012). Policy learning and the 'cluster flavoured innovation policy' in Finland. *Environment & Planning C: Government and Policy*, 30(5), 780–795.

Official Statistics of Finland (OSF). (2022). *Annual national accounts and RDI funding*. Retrieved October 24, 2022, from https://pxdata.stat.fi/PxWeb/pxweb/en/StatFin/StatFin__tkke/

Veugelers, R., Aiginger, K., Edquist, C., Breznitz, D., Murray, G., Ottaviano, G., Hyytinen, A., Kangasharju, A., Ketokivi, M., Luukkonen, T., Maliranta, M., Maula, M., Okko, P., Rouvinen, P., Sotarauta, M., Tanayama, T., Toivanen, O., & Ylä-Anttila, P. (2009). *Evaluation of the Finnish National Innovation System: Full report*. Taloustieto Oy.

Vihriälä, V. (2019). Uralta pudonnut Suomi [Finland that fell out of the path]. In S. Honkapohja & V. Vihriälä (Eds.), *Suomen kasvu: Mikä määrää tahdin muuttuvassa maailmassa? [Finland's growth: What does determine the pace in a changing world?* (ETLA B 278, pp. 11–33). Etla.