



Internationally significant innovation and growth ecosystems in Finland

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Spinverse Oy

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Abstract

One of the long-term objectives of the Finland 2030 vision is that there are several business-run billion-euro growth ecosystems which produce competitive solutions to global needs. To support this objective, Technology Industries of Finland commissioned a study "Internationally significant innovation and growth ecosystems in Finland", with the main goals of establishing the following key points: 1) recognise and describe business-driven innovation and growth networks with business and growth opportunities, 2) examine the views of the key network actors on strategic capabilities and investing needs in the network, 3) examine the priorities of the key actors in the networks on how the scope, management and schedule related focus in the national and EU funding would strategically increase the networks capability to reach its objectives and create billion-euro businesses, and 4) gather the proposals from the network on other concrete EU-level, national or regional activities that would support in reaching objectives of the network.

The study was implemented in four phases: 1) background analysis with the aim to present the current drivers, themes, strategic capabilities, networks and strengths of Finland that could form a base for the billion-euro future businesses; design of thematic interviews, 2) first round of thematic interviews focusing on strategic management of companies to identify most potential innovation and growth networks and views, priorities and proposals for supporting growth, 3) second round of thematic interviews of companies and stakeholders in the selected innovation and growth networks to deepen analyses of the business-driven networks and suggestions for supporting their growth, and 4) analysis, conclusions and recommendations.

Based on the company interviews, five innovation and growth networks of different maturity levels were selected for further analysis: LuxTurrim5G led by Nokia, Clever Health Network led by HUS, KEKO- Connectivity Platform for Smart Buildings led by Kone, BATCircle led by Aalto University, and Advanced Manufacturing Network as a new concept for an innovation network. Each network is described for its structure, market potential, connections to other ecosystems, strategy, challenges and recommendations by interviewed industry partners.

Key conclusions from the company and stakeholder interviews are:

- Creating ecosystems calls for vision and win-win
- More competence needed for ecosystem leadership and orchestration
- More support for commercialisation and scaling-up needed
- More collaboration needed between ICT companies and manufacturing industry
- Collaboration of companies and universities/RTOs needs come-back
- University/RTO IPR terms need clarification and re-adjustment to attract industry
- Competitive and flexible, but more predictable national funding is needed for RDI growth
- Companies need to utilise EU opportunities and BF to support them
- Industry needs to be able to trust on the availability of the skilled experts

The report gives recommendations for industry, Technology Industries of Finland, cities and regions, universities and RTOs, Finnish government, Business Finland and European Commission.

The Study was undertaken by Maria Rinkkala, Pentti Launonen, Niklas Weckström and Pekka Koponen from Spinverse Oy, and the Steering group consisted of Mervi Karikorpi and Matti Mannonen from the Technology Industries of Finland and Pekka Koponen and Niklas Weckström from Spinverse Oy.

1 Introduction

In October 2017, The Research and Innovation Council Finland set up a **vision and a roadmap for Finland to become the most attractive and competent environment for experimentation and innovation by 2030**¹.

This vision and roadmap for Finland in 2030 is the foundation for this study *Internationally significant innovation and growth ecosystems in Finland* by Spinverse for Technology Industries of Finland. This Final Report summarises the work carried out by Spinverse within the study.

According to the roadmap document published by The Research and Innovation Council, Finland is an innovative, caring, and safe country with world-class quality of living and possibilities for entrepreneurship. The welfare, sustainable growth and competitiveness of Finland are based on a high level of competence, education, creativity, openness, trust, productivity, adaptability, and experiment-based cutting-edge innovations.

The Finland 2030 vision also identifies the willingness of the Finnish people to learn new things, the appreciation of know-how in its various forms, and the efficient utilisation of know-how both in business life and in the other sectors of society. Finland has built a solid competence base consistently over a long period of time, while seizing the opportunities and addressing the needs for change brought along by megatrends such as digitalisation and artificial intelligence in a timely manner. Also, the Council points out that Finland produces solutions to global problems and respond to international demand.

One of the long-term objectives of the Finland 2030 vision is that **the Finnish public and private sectors invest together 4% of the GDP in research and innovation activities in an effective and profitable manner**. These investments improve, for their part, the wellbeing of the population and society. The Council highlights that working together, both in Finland and abroad, is the strength of Finland as a nation.

Another long-term objective of the Finland 2030 vision is that **there are several business-run billion-euro growth ecosystems which produce competitive solutions to global needs**. To support this ambitious objective, the main goals of the overall study are to establish the following key points:

- Recognise and describe business-driven innovation and growth networks with significant business and growth opportunities
- Examine the views of the key network actors on strategic capabilities and investing needs in the network
Examine the priorities of the key actors in the networks on how the scope, management and schedule related focus in the national and EU funding would strategically increase the networks capability to reach its objectives and create billion-euro businesses
- Gather the proposals from the network on other concrete EU-level, national or regional activities that would support in reaching objectives of the network

The study was implemented in four phases as described in Figure 1:

1. Background analysis with the aim to explore the current drivers, themes, strategic capabilities, networks and strengths of Finland that could form a base for the billion-euro future businesses; design of thematic interviews
2. First round of thematic interviews focusing on strategic management of companies to identify most potential innovation and growth networks and views, priorities and proposals for supporting growth
3. Second round of thematic interviews of companies and stakeholders in the selected innovation and growth networks to deepen analyses of the networks and suggestions for supporting their growth

¹ The Research and Innovation Council's Finland 2030 vision and roadmap available via [this link](#)

4. Analysis, conclusions and recommendations

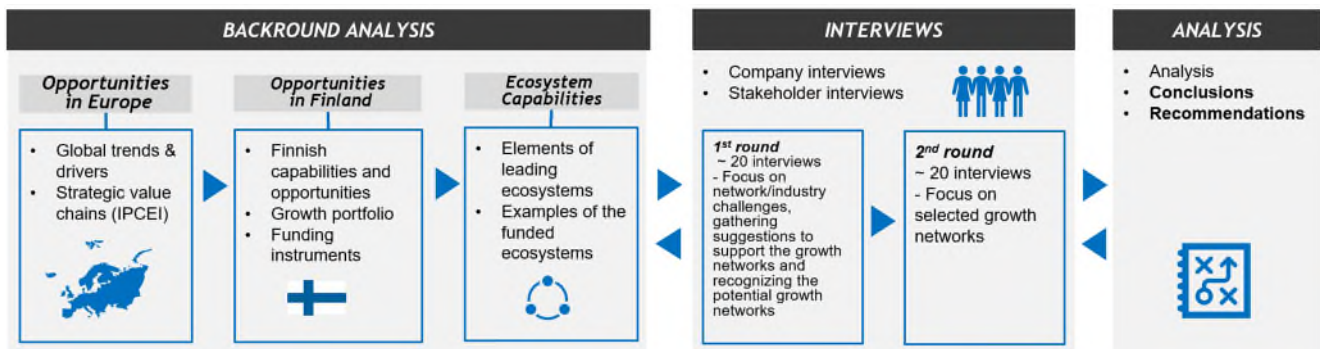


Figure 1 – Structure of the study

Companies were selected based on multiple criteria like representativeness of Finnish capabilities and opportunities as identified in the background study, membership of Technology Industries of Finland, investments in RDI in Finland and in the EU, company size and growth rate, public funding and venture capital investments, knowledge of research and innovation projects with significant roles, and potential for industry transformation or for ecosystem. Some stakeholders of innovation ecosystems were also interviewed to identify the most potential ecosystems.

The first round of interviews was focused on interviewing the strategic management of the chosen companies. The objectives of the first 20 interviews were to recognise and describe innovation and growth networks important for the chosen companies in view of business and growth opportunities and to examine the views of the key network actors on strategic capabilities and investing needs in the network.

To better understand the potential, support needs, strategic capabilities and investing needs of the specific networks, further ecosystem interviews of the key network actors were conducted in the second phase of the study. For this second phase, the most potential networks were selected using the following criteria:

1. Significant growth potential
2. Companies willingness to commit (e.g. own investments)
3. Network building on a new theme or a new angle
4. Building on Finnish competences
5. Relevant to technology industries and industry driven

The interviews were carried out during September and December 2019. The companies and stakeholders interviewed are listed in Appendix 1.

This Final report has the following structure: Chapter 2 gives an introduction to innovation networks and ecosystems together with key elements for their leadership; Chapter 3 presents findings from the background study of the Finnish foundations for the future billion-euro businesses; Chapter 4 describes the selected high-potential innovation and growth networks of different maturity levels and presents thematic key findings from the interviews; and Chapter 5 summarises conclusions from the study and gives recommendations for players of innovation ecosystems.

2 Introduction to innovation networks and ecosystems

Innovation as a discipline and organizational activity has gone through a drastic transition in the past 15 to 20 years. Closed innovation was for a long time seen as the best way for beating out the competition. Closed innovation is based on a model of internal and centralized research and development, with all ideas being produced, developed, created, commercialized, and implemented in-house.

But the focus and insistence on closed innovation has been falling behind, and businesses and organizations are increasingly opting for what is known as open innovation. Essentially, the largest concession made with open innovation is realizing that the wealth of knowledge does not lie internally.

The first moves within this transition for open innovation was towards collaborative innovation, where innovation was initially conducted with established subcontractors and partners. It further developed involving more actors within the whole value chain. Relationship management, collaboration facilitation and win-win situations were key to the success.

In the past few years, as a logical development from collaborative innovation, we have seen more and more innovation taken place in innovation ecosystems. Here an even wider variety of different players, even across different industries, are involved in solving large problems with a joint vision and a win-win-win approach. As we move from closed innovation towards open innovation in ecosystems, more and more actors get involved and the degree of openness increases, as shown in Figure 2 below.

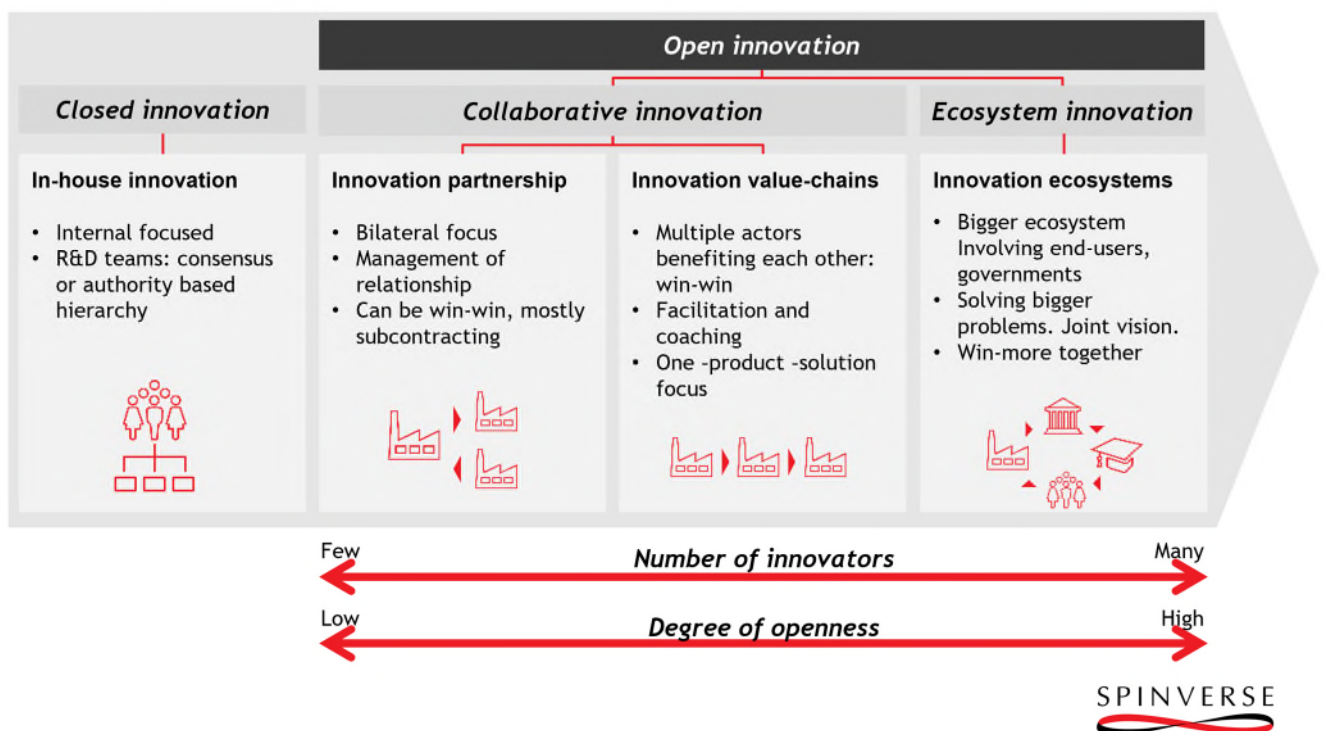


Figure 2 - From closed to open innovation and ecosystems with many innovation partners²

2.1 Lifecycle of an open innovation ecosystem

An ecosystem by its definition is an organized group of actors – companies, organisations and individuals – that together bring new value to the customers. To exist, unlike in a natural

² Adopted from: Mika Westerlund, Risto Rajala, Martin Curley

ecosystem, a man-made ecosystem requires leadership, alignments with a vision for the future, and the creation of benefits for customers. Creating value for customers is at the centre of an ecosystem. An ecosystem is a community comprised of actors that interact to deliver products, services and solutions that their target customers value.

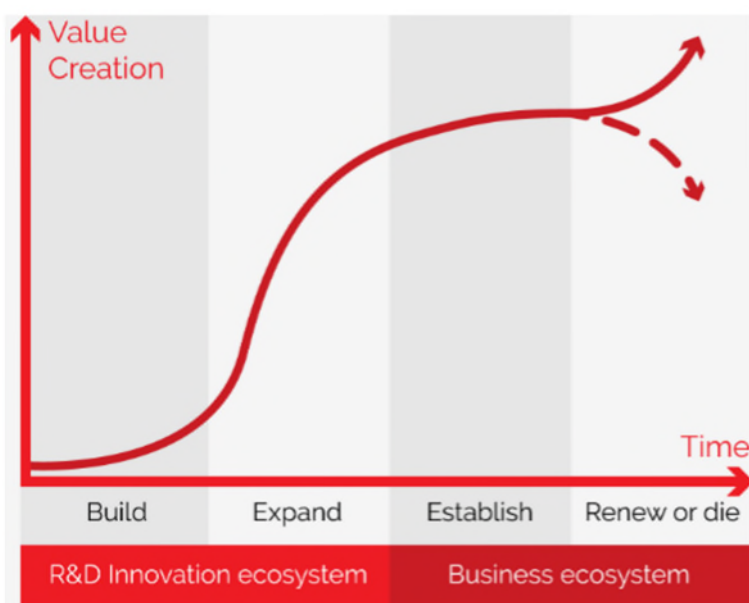
When speaking about an innovation ecosystem, it is important to state how it relates to two other ecosystems: business ecosystem and knowledge ecosystem. In this context, we see that innovation ecosystem, focusing on creating business growth on novel ideas for the future, is an integrating mechanism between the exploration of new knowledge (created in a knowledge ecosystem) and its exploitation for value co-creation in business ecosystems. In a business ecosystem the ecosystem actors work cooperatively and competitively to create new products, satisfy customer needs and coevolve capabilities around innovation. Therefore, an innovation ecosystem usually preludes and gives birth to new business ecosystems where the value for the customer is co-created and captured.

For clarity, let us imagine the main events in a birth and evolution of an illustrative industry driven innovation ecosystem. There is usually an initiating company, so called focal company, which has the first idea or a seed for a breakthrough or disruptive innovation. This idea could also have resulted from the work of a knowledge ecosystem where this focal company was active. They need partners to co-create the idea further. First, they engage with one or two potential partners and share their thinking. In the beginning, the number of core partners is limited, while the initial idea is developed further. If the partners do not spend enough time on clarifying the common vision and strategy for the ecosystem, they end up having different understanding of the objectives. This happens because they are biased and guided by their own company or organization strategy. At this point, the focal company may contract an intermediary organisation to help in building the ecosystem: to find the needed partners and to facilitate in creating a strategy and "rules of the game" for the ecosystem. As the needed partners are found and selected, the first ecosystem project is planned, financed and launched and the co-creation work begins. After a while, new projects supporting the ecosystem strategic roadmap are launched.

Over time, partners co-evolve their capabilities and roles, and tend to align themselves with the directions set by one or more focal companies. New partners may join, and some will leave. The role of the ecosystem leader is valued by the partners, because it enables members to move toward shared visions to align their investments and to find mutually supportive roles.

In the course of time, the innovation ecosystem projects start to produce results that will expand the ecosystem for commercial stage through demonstration and pilot stages of first-of-its kind innovations. Eventually, the innovation ecosystem evolves into a business ecosystem (Figure 3). In the end of the business ecosystem, it either dies or renews itself.

The actors in an innovation ecosystem are more heterogeneous compared to actors in the other two ecosystem types. Typical actors may vary from researchers to company business developers or salespeople. Also, research organisations and universities have inherently different strategic baseline directions than commercially focused companies. Thus, because of this diversity, the



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Figure 3 Evolution from an Innovation ecosystem to a Business ecosystem

leadership of innovation ecosystem is more demanding compared to the other two ecosystems; see Figure 4.

When it comes to the classification of the ecosystems, it should be noted that often there is not a clear pipeline of three ecosystems in which the knowledge transforms into idea and then further into innovation and business. Figure 4 illustrates the three ecosystems as separate coexisting ecosystems between which the knowledge and ideas are drizzling. Figure 4 also illustrates that other ecosystems are not the only source of knowledge, ideas and innovation which can enter the ecosystem also from outside.

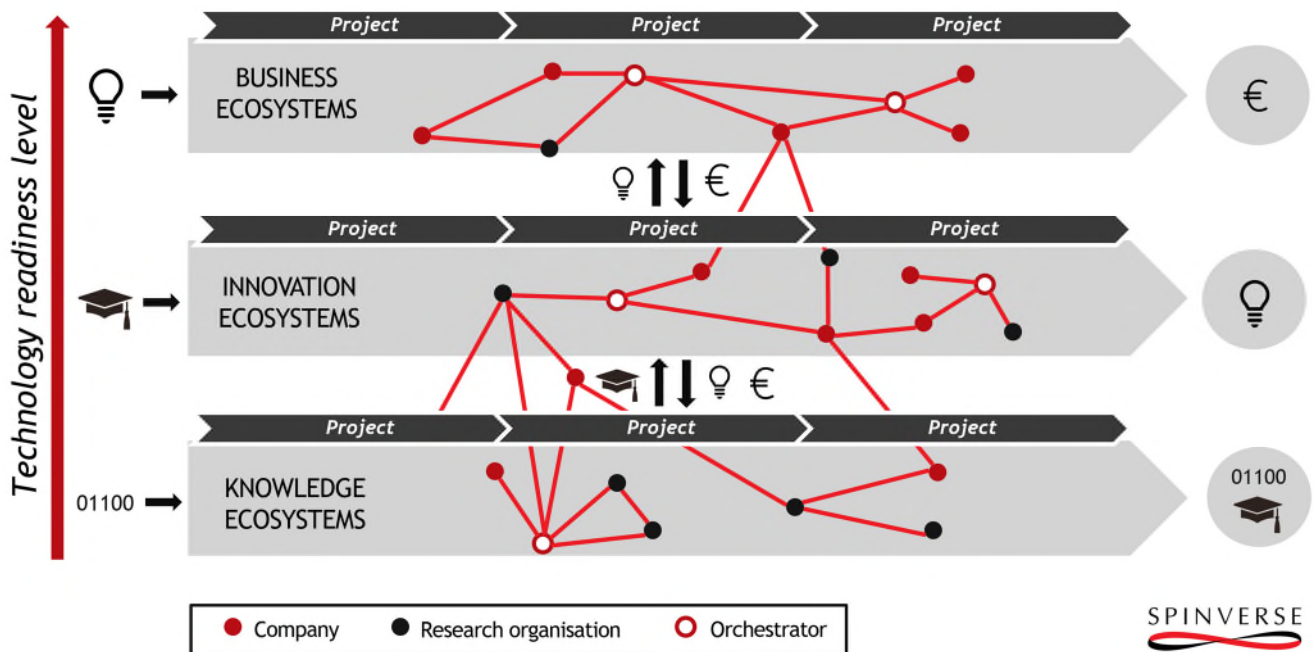


Figure 4 Ecosystems have different drivers and their co-operation needs public funding and many orchestrators

Business ecosystems are driven by most short-term return on investment with minimum risk. Vast majority of new business in business ecosystems is therefore built on commercially available, mature technologies (e.g. Google or Apple ecosystems). Input from innovation ecosystems brings represent projects with most demanding new technologies and new knowledge. They are much riskier both in terms of investment payback and commercialization timelines.

Knowledge ecosystems are usually driven by universities or research organizations. The organizations behind them usually value academic measures, such as degrees or research paper citations over more commercial targets, such as spin-offs or patent licencing fees.

Because of these incompatibilities of targets, transfer of ideas and projects between three ecosystems is complex. Therefore, public funding instruments and ministerial guidance has an essential role to encourage co-operation.

2.2 Leading an innovation ecosystem is based on six key elements

Spinverse has conducted some research around the success criteria for managing innovation ecosystems³. Six key elements can be identified that are pivotal for building and leading a suc-

³ Spinverse analysis and white paper, available at <https://spinverse.com/wp-content/uploads/2018/04/Innovation-Whitepaper-v4.1.pdf>

Successful innovation ecosystem. These six elements can help ecosystem partners run their innovation projects more successfully, see Figure 5:

1. Joint visioning with the dream team partners
2. Co-create win-win business models
3. Set transparent and clear enough roles & responsibilities
4. Lead in complexity
5. Facilitate interactions and dialogue
6. Manage the balance between discipline and creativity

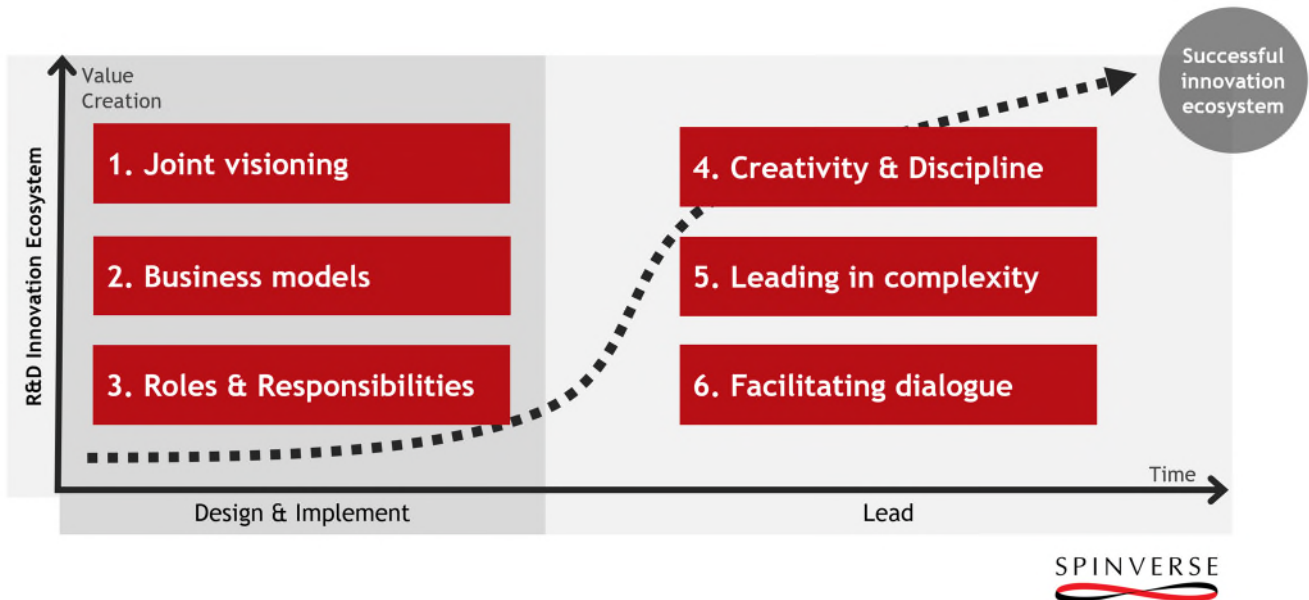


Figure 5 Spinverse open innovation ecosystem leadership model with key elements for building and leading successful innovation ecosystems

1. Joint visioning with the dream team partners

Spending enough time in articulating a shared vision and strategy for the ecosystem is crucial

Organisations that are involved/part of the open innovation ecosystem need a common vision and strategy. This ecosystem strategy visualizes the shared focus, aim and – perhaps the most important – how each organization plans to do business as a result of the ecosystem. If the vision and strategy are not done, this will result in the organisations' own strategies guide them in different directions. At some point this leads to discrepancies and tensions, first below the surface and finally to actual disagreements. The activity slows down, and projects are prolonged.

Choosing the ecosystem partners should be based on pre-assessed criteria that are derived from the ecosystem strategy. An innovative ecosystem consists of different actors that complement and enrich value added to the customers. In short, we want to set up a dream team for the ecosystem. Partners need to know why they are involved, to take their role and act accordingly. Partners are mainly corporations and SMEs, but also research organisations and universities can have a critical role in ecosystems adapting innovative technologies.

2. Co-create win-win Business models

Consider and define at the early stage the value co-creation and capture models for each actor

By nature, innovation ecosystems aim to produce breakthrough or radical innovations, often in parallel with incremental innovation activities. Hence, describing and agreeing upon how each partner is going to do business or benefits from the value co-creation is difficult at the early stage.

However, all the partners should be engaged in tentative business model discussions – at least share their assumptions or preliminary plans on their business expectations. As the ecosystem projects evolve the value capture models for each actor can be iterated and refined. Spending time on these discussions and negotiations early enough will build trust among partners and help prevent unpleasant surprises.

3. Set transparent and clear enough Roles & Responsibilities

Agreeing from the very beginning among actors who is doing what and when

At the start of the ecosystem building, it is good to make a common operational model, where everyone formally agrees on the applicable operational processes and the roles and responsibilities. A common operational model clarifies and enforces what is done. It also includes the decision-making forums such as the steering group and the decisions to be made.

It is important to go through the roles and the responsibilities to avoid any surprises. In the worst case it can cause conflicts, overlapping work, ineffectiveness and outstanding tasks. In the best case, the varying roles of the actors complement each other and strengthen trust, which brings results faster. Since ecosystems are dynamically evolving through interactions between ecosystem actors, role descriptions should not be deterministic or linearly driven, but provide flexibility. It's also possible to include competitors into selected parts of the ecosystem, when the rules of the game are clear.

Understanding the operational model and its coordination mechanism and how it evolves over time is important, both for steering and orchestration and for updating ecosystem roadmap.

4. Lead in complexity

Leading complex ecosystems require simple guiding principles that enable self-organising cooperation with fast execution

Even though the responsibilities are good to document also in the contracts, the innovation ecosystem is generally a loose organization from a judicial point of view. The leader of the ecosystem does not have formal authority over the different actors. Often the leader makes use of an intermediary or coordinator specialized in building and leading ecosystems. In cases where a common operating model or rules of the game have not been agreed, the different actors can be too loosely committed to the joint tasks. As a result, leading the ecosystem is challenging and activities slow down. In addition, the motivation and morale of the ecosystem partners decrease due to poor leadership. In worst cases, actors critical to the ecosystem leave and activities come to a halt.

Therefore, describing interdependencies among partners in ecosystem projects are important. In general, the dependencies between the ecosystem participants are beneficial. They strengthen the engagement to common goals and motivate to cooperate.

5. Facilitate interactions and dialogue

The quality and the frequency of the interactions between partners make ecosystem productive

The leadership contains also facilitating the interaction and dialogue between the partners. It enables the shared and collective understanding of complicated and challenging issues. Efficient and skilled way of interacting among partners assists in preventing unnecessary misunderstandings. If leading a single organisation is challenging, then leading a diverse multiparty temporal meta-organisation is even more challenging. Ecosystem leadership and orchestration requires proper competence, skills and tools.

6. Manage the balance between discipline and creativity

Orchestrating ecosystems to have a right balance between discipline and creativity

The leadership mandate is often given to a specialized intermediary, orchestrator or coordinator that is an impartial actor in the ecosystem. In innovation ecosystems, intermediators play a significant role in bridging the actors together and thereby facilitating interaction and building dependencies between them.

An efficient way to lead an ecosystem is a balanced combination of well-structured project management and leadership of complex adaptive systems. This enables the development and commercialisation of innovations that are novel and profitable.

2.3 Ecosystems need support and leadership throughout their lifecycle

An ecosystem, or the partners in it, continuously face challenges throughout their lifecycle from early ideas to commercial stage that they need to navigate through. These challenges can be related to funding, but also to partner company capabilities or readiness, balance shift in running the ecosystem, change in objectives, technology failures, competition, company agendas changing, etc.

The fact that an innovation ecosystem has received initial funding and is publicly known and followed is by no means a guarantee of it being able to navigate through the challenges and risks, and often, unfortunately, they lose momentum and fade out, not reaching the ambitious international scale they set out to achieve. Furthermore, very few of the ecosystems in the initial/early stages make it big, even if they can describe an ambitious and rational business plan and receive initial funding.

3 Background study

3.1 Introduction to the background study

The aim of the background analysis within the study *Internationally significant innovation and growth networks* is to explore the most important current drivers, themes, strategic capabilities, networks and strengths of Finland that could potentially form a solid foundation for the future billion-euro businesses. The study summarises opportunities in Europe, capabilities and opportunities in Finland, funding instruments for ecosystems, and examples of funded ecosystems.

3.2 Opportunities in Europe

Europe is facing **challenges** calling for radical new approaches for deploying technologies and innovative solutions, while **drivers** are shaping the technological transformation

In the preparation of the first Strategic Plan for *Horizon Europe – the European Union Framework Programme for Research and Innovation 2021 – 2027*, the following main Challenges and Drivers have been recognised by the European Union⁴ (**Table 1**):

Table 1 The challenges facing Europe and the driving forces behind them, according to the European Union⁴

<i>Challenges</i>	<i>Drivers</i>
<p>1. Climate change and the environmental collapse: Humanity is overstepping planetary boundaries and the outcome runs the risk of being irreversible</p> <p>2. Future prosperity and sustainable growth: Increased global and un-ruled competition is a test of our competitiveness and sovereignty</p> <p>3. European security and the wellbeing of our citizens: An increasingly multipolar world and the rise of global and internal insecurity puts our social contract, societal values and welfare model and the future of work under pressure</p>	<p>1. Demographic change: As people live longer, population especially in Africa and Asia will continue to grow with the global population expected to reach 8.6 billion by 2030 and up to 9.8 billion by 2050.</p> <p>2. New powerhouses in the global economy: Africa and Asia will take their place on the international scene as the new powerhouses in the global economy, creating an increasingly complex and volatile security environment for Europe</p> <p>3. Increasing mobility including urbanization: Increased mobility across borders and in particular within borders and towards cities. More than two thirds of the global population will be living in cities by 2030</p> <p>4. Scientific and technological development:</p>

⁴ The document "Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe" can be found [here](#)

	Developments providing endless new opportunities and enabling to better address global challenges across the board
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The European Commission has set up a Strategic Forum for Important Projects of Common European Interest (IPCEI)⁵. The following strategic value chains have been chosen for further work:

- Batteries (transnational work ongoing)
- Microelectronics and High-Performance Computing (transnational work ongoing)
- Connected, automated and electric vehicles
- Smart Health: Medical devices and personalized medicine & analytics
- Low-carbon industries
- Hydrogen technologies and systems
- Industrial IoT
- Cybersecurity

Table 2 presents the full list of the recognized potential strategic value chains for IPCEI, with the highly relevant value chains for technology industries presented in **bold text**.

Table 2 The full list of the recognised potential strategic value chains for IPCEI

<i>Potential strategic value chains</i>	
<ul style="list-style-type: none"> • Personalised medicine • Space-launchers • Cyber security • Wired and wireless networks • Industrial IoT • Personal and clinical medical devices • Hydrogen based and other low-carbon energy conversion • Low carbon steel making • Low carbon industrial processes and carbon capture and valorisation technologies • Bio-based materials 	<ul style="list-style-type: none"> • Electric mobility for vehicles - propulsion, wireless energy transmission and smart charging applications • Critical raw materials for innovative applications • Connected and autonomous mobility for vehicles • Net zero energy building construction and renovation • Additive manufacturing • Smart vessels (autonomous vessels, electric propulsion)

3.3 Capabilities and opportunities in Finland

For decades, Finnish success has been based on new knowledge, skills and technology. In the core of efficiency and economic growth are innovations based especially on new knowledge and technologies created through various R&D&I activities.

The strengths leading to the growth taking place from 1990s to 2009 are largely still valid - operational political and economic institutions and the trust of citizens to them, education, attitude for new technology, innovation activities, relatively flexible allocation of workforce and other resources to new areas as well as societal cohesion.

The identified weaknesses are aging population, the lack of growth in the level of education, deteriorating skills of young people, declining investments towards research activities, adaptability to macroeconomic shocks, the deficit of the public sector and the energy-intensive economy among other factors.

⁵ [Commission Decision of 30 January 2018](#) setting up the Strategic Forum for Important Projects of Common European Interest IPCEI

Table 3 presents the SWOT analysis of the Finnish Innovation System, as adapted from multiple sources^{6,7,8}. The SWOT analysis gives a comprehensive overview of the various development needs as well as prerequisites for the Finnish innovation landscape and the different policies directly influencing the Finnish development and innovation systems.

Table 3 SWOT analysis of the Finnish Innovation System, adapted from TIN (2014)⁶, OECD (2017)⁷ and VM (2019)⁸

<i>Strengths</i>	<i>Opportunities</i>
<ul style="list-style-type: none"> • Political stability, trustworthy and safe environment for people and companies to function • Reliable public sector, good governance, functioning legislative environment • Ability to carry out multilateral cooperation, social capital • Strong know-how on certain key industries e.g. ICT, natural resources and health • Highly skilled work force (ICT, health and mechanical engineering) • High quality education system, which is excellent in basic level education and good in higher level education • Most skilled adult population within the OECD countries • Strong start-up culture • Public and private R&D expenditure still on a relatively high level • Experimental policy making becoming more common 	<ul style="list-style-type: none"> • Modernization of industrial structures in segments of higher degree of processing based on the strengths of existing industrial and service sector players • Sense of urgency i.e. exploiting the possibilities enabled by digitalization, promoting the concept of creative destruction • Increased interest among international investors (venture capitalists and business angels), start-up networks and accelerators • The reformation and profiling of universities to improve the quality of university research and improved compatibility with the demands of the society • Taking better into consideration societal challenges and demand in innovation policy making and innovation funding • Improving knowledge-based decision making and the prerequisites for it • Creation of long term, well-resourced and strategical platforms and environments for R&D and innovation
<i>Weaknesses</i>	<i>Threats</i>
<ul style="list-style-type: none"> • Role of SME companies in R&D and innovation activities is comparatively small • Limited number of radical innovations, instead focusing on small improvements and improving the overall efficiency of processes/activities • Relatively slow rate of development in the quality improvement of research • Bias in the structure of funding i.e. less emphasis on applied research and the development of key technologies • Fragmented and insufficiently internationalized university system with 	<ul style="list-style-type: none"> • Reduced overall competitiveness and exports • Decreased R&D spending in the public and private sectors • Reduced political appreciation for R&D and innovation activities • Lack of belief that research creates a strong basis for innovations and growth, distrust in research and innovation politics and research organizations • Poor consistency in decision making in innovation politics, uncertain business and innovation landscape

⁶ Tutkimus- ja innovaationeuvosto (2014). Uudistava Suomi: tutkimus- ja innovaatiopolitiikan suunta 2015–2020. Tutkimus- ja innovaationeuvosto, Helsinki.

⁷ OECD (2017). Innovation policy review Finland. OECD, Paris.

⁸ VM (2019). Uudistuva, vakaa ja kestävä yhteiskunta. Valtiovarainministeriön virkamiespuheenvuoro. Valtiovarainministeriön julkaisu 2019: 11.

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|---|--|
| <p>decreased ties to the industry and business world</p> <ul style="list-style-type: none"> • Lack of a national and multidisciplinary vision committing all different sectors together for a substantial time frame | <ul style="list-style-type: none"> • Remaining in the marginal in the case that the challenges of internationalization are not sufficiently tackled • Ageing population decreasing the amount of surplus publicly available for investments and innovation • Inability to set up new public-private partnerships, large innovation schemes and ecosystems |
|---|--|

Finland has a strong digitalisation related competence

Finland ranks first out of the 28 EU member states in the European Commission’s Digital Economy and Society Index (DESI) in 2019 (**Figure 6**). With the score of 69.9 Finland clearly surpasses the EU average of 52.2. The strengths of Finland include e.g. digital public services and human capital.

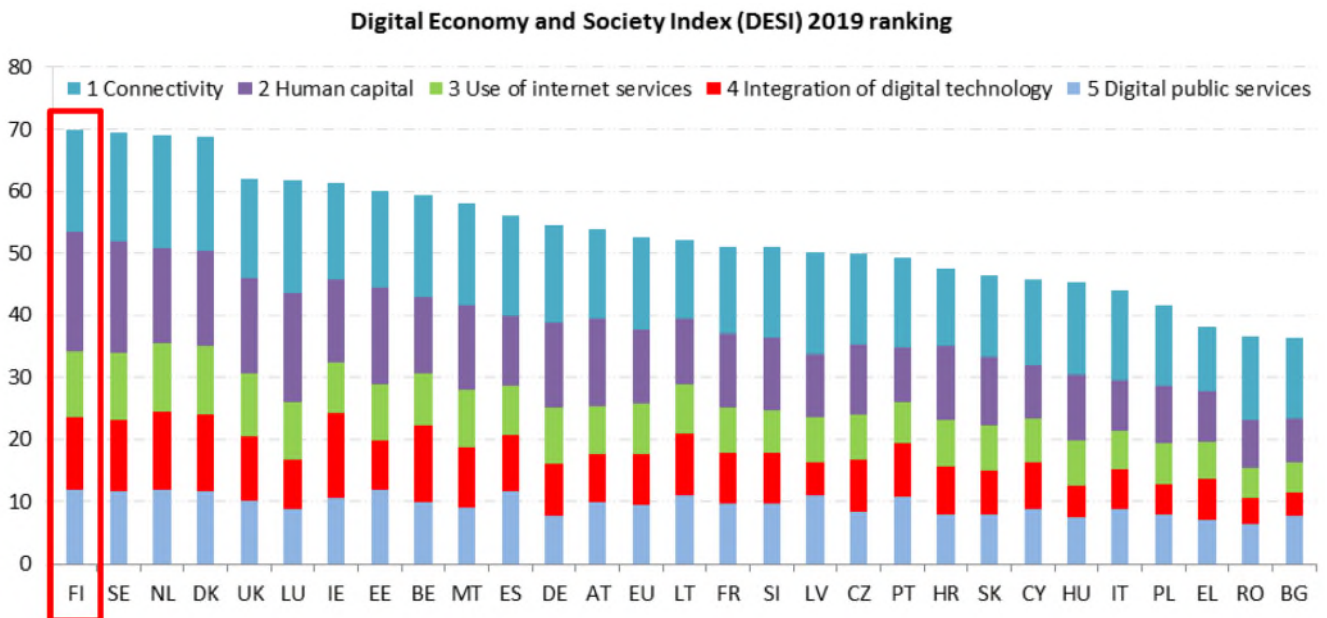


Figure 6 The Digital Economy and Society Index (DESI) 2019 ranking⁹

Finland among the leading countries to utilize digitalisation

⁹ The European Commission, [DESI ranking 2019](#)

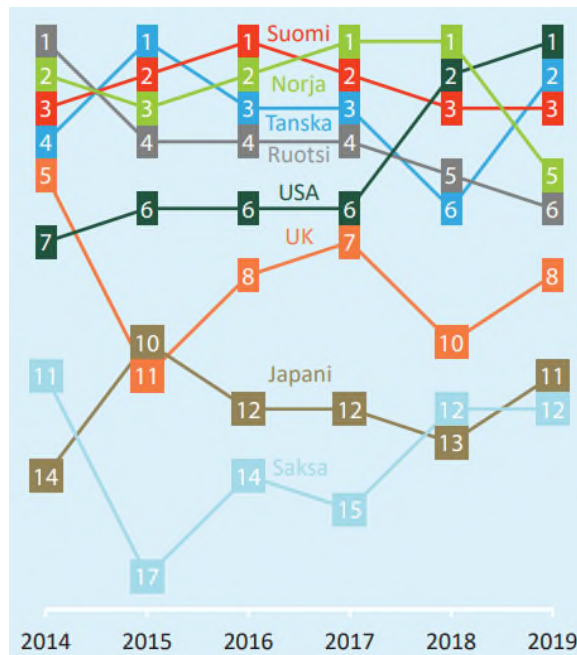


Figure 7 The Digibarometer (Digibarometri) 2014-2019 published by ETLA

The Digibarometer published by ETLA evaluates how well individual countries utilize digitalization. It measures the utilization of digital capabilities with the measurement being carried out on three levels (capabilities, utilization, and implications) and across three sectors (company, civic, and public). Finland has consistently ranked in the Top 3 countries of the Digibarometer each year since 2014¹⁰ (Figure 7). It is noteworthy that from the 2014 ranking, USA has improved its ranking the most (from 7th place to 1st) while Sweden has decreased its ranking most in the last five years (from 1st place to 6th).

The new drivers for growth and recognised opportunities in Finland

Table 4 presents the new drivers for growth as presented by the Ministry of Economic Affairs and Employment of Finland in their publication "Innovaatiopolitiikan lähtökohdat"¹¹. The drivers for growth as well as the Growth Portfolio presented in **Table 5** are based on a comprehensive mapping of the most important international and global growth trends and on the strategic publications and views of the most important innovation stakeholders (e.g. universities and research organizations) and enablers of innovation funding.

Table 4 The new drivers for growth, adapted from "Innovaatiopolitiikan lähtökohdat"¹¹

<i>The new drivers for growth</i>		
Disruption in work and competence requirements	Actions and jobs of higher added value	Cooperation and ecosystems
<ul style="list-style-type: none"> • Competition on experts and skilled workforce • New competence requirements • Leadership 		<ul style="list-style-type: none"> • Public and private sector partnerships • Experimentation and development platforms

¹⁰ [The Digibarometer \(Digibarometri\) 2014-2019 published by ETLA](#)

¹¹ [Innovaatiopolitiikan lähtökohdat](#), by The Ministry of Economic Affairs and Employment of Finland

<ul style="list-style-type: none"> • Bold individuals • The differentiation of growth and jobs 		<ul style="list-style-type: none"> • Rapid commercialisation of innovations • Radical innovations • Bold money • Positive regulation towards innovation
<p style="text-align: center;">Societal reforms</p>		<p style="text-align: center;">The unity of technology, humanism and creativity</p>
<ul style="list-style-type: none"> • Education reform • Social and healthcare reform (SOTE) • "Liikennekaari" initiative 		<ul style="list-style-type: none"> • Artificial intelligence, robotics • Ethics • Multidisciplinary and expanded skill sets • Utilization of creative know-how
<p style="text-align: center;">Global division of labour and value networks</p>		<p style="text-align: center;">Societal value</p>
<ul style="list-style-type: none"> • Shifts in values • Significance • Usability 		<ul style="list-style-type: none"> • Sustainable development • Finite resources: food, water and time • Wellbeing and social equality • Social and sharing economies • Phenomenon-based approach
<p style="text-align: center;">Customer needs</p>		
<ul style="list-style-type: none"> • Shifts in values • Significance • Usability 		

Growth comes from new knowledge and scientific research, technological development and transversal technologies - artificial intelligence and machine learning, utilisation of data, digital platforms.

The report¹¹ by The Ministry of Economic Affairs and Employment identifies that the key target for Finland is to be the competitive developer, quick adopter as well as the most successful user of new technologies and innovations. This approach to innovations and innovation activities will generate wellbeing and solutions to challenges on a global scale. Investments to know-how, research, product development and innovation will be the key factors to a positive overall shift in productivity.

Table 5 presents The Growth Portfolio, which brings together the various identified themes of potential growth – collected by companies and stakeholders. The Growth Portfolio aims to be a highly useful tool supporting the decision-making process of companies as well as enabling the best possible distribution of funding opportunities and other important resources.

Table 5 The Growth Portfolio, adapted from "Innovaatiopolitiikan lähtökohdat"¹¹

The Growth Portfolio – Growth potential by growth themes		
The digital turning point, new value creation and technologies as enablers		
<ul style="list-style-type: none"> • Platform economy • AI and analytics • 5G, IoT and connectivity • Block chains 	<ul style="list-style-type: none"> • Information security and privacy • Synthetic biology • Photonics and micro electronics 	<ul style="list-style-type: none"> • Disruptive value chains • Virtual solutions and gamification • Arctic know-how

		<ul style="list-style-type: none"> • New application fields for space technology
The turning point in mobility and logistics	Resource efficient growth	The new age of industry
<ul style="list-style-type: none"> • Seamless mobility and logistics • Security • Marine technology • Carbon neutral transport 	<ul style="list-style-type: none"> • Bioeconomy • Circular economy • Intelligent energy solutions and electrical grid 	<ul style="list-style-type: none"> • Intelligent factories • Sustainable and healthy food • New functional materials
Health and wellbeing	The modernizing consumer	The diverse communities
<ul style="list-style-type: none"> • Developing patient treatment and diagnostics • Individualized health and inclusive health care 	<ul style="list-style-type: none"> • Tourism and the experience economy • Lifelong learning • New solutions in retail • Relevancy 	<ul style="list-style-type: none"> • Work in transformation • Sustainable living and effortless everyday life • Interactive service networks

Business Finland programs 2019

Business Finland is launching programs in specific areas with significant new market potential for Finnish companies (**Figure 8**). The key purpose of Business Finland's program activities is to enable businesses to benefit from market transitions and to increase general understanding of different themes affecting the future of business on a global scale. This enables Finnish companies to increase their international business operations and simultaneously renew the entire Finnish society.

Business Finland's programs enable the participants to resolve common challenges and learn from their peers. The programs provide a unique way for bringing together various operators: companies of different size seeking growth, renewal and internationalization as well as research and other organizations working in cooperation with the companies. The programs mobilize a critical mass of actors and build joint offerings from Finland in strategically selected sectors and markets.

Business Finland program activities are committed to making progress towards sustainable development with equal emphasis on environment, economy, and people as presented in the United Nations' Agenda for Sustainable Development¹². There are prominent business possibilities for Finnish businesses for example in smart, digitalized solutions to the challenges of sustainable development.

¹² The United Nations – [The Sustainable Development Agenda](#)

Business Finland programs 2019

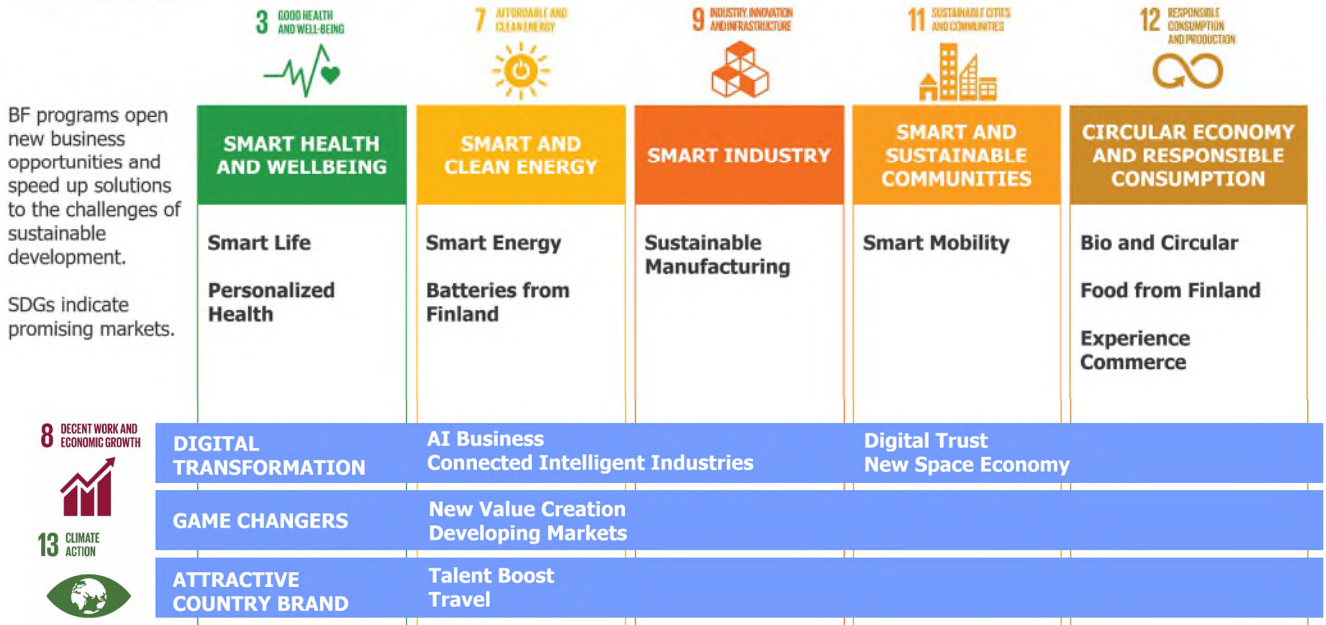


Figure 8 The different programs of Business Finland playing an integral part in building up the growth ecosystems of the future¹³

3.4 Funding instruments for ecosystems

Funding is one of the most important strategic capabilities. In recent years, Finland has experienced a rather sharp reduction in its overall R&D intensity when compared to other countries (**Figure 9**).

¹³ Business Finland - [Business Finland Programs](#)

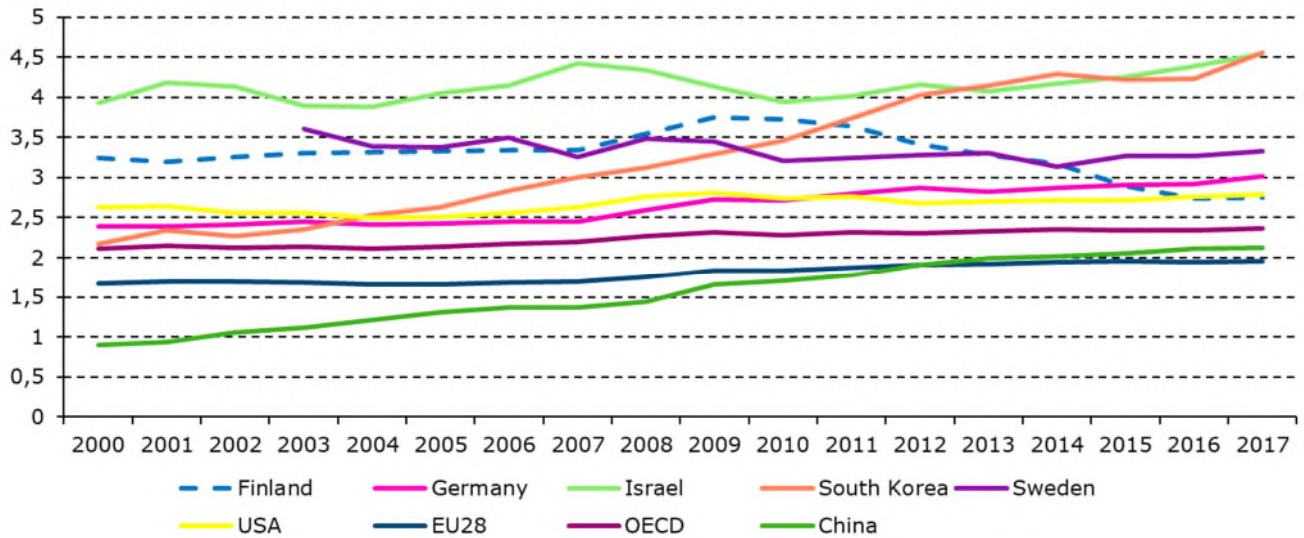


Figure 9 R&D intensity during 2000-2017 (R&D expenditure in relation to GDP, %)¹⁴

According to OECD estimates, the positive changes of the last couple of years have not returned R&D expenditure to the previous levels (see Figure 10), also R&D funding from enterprises to universities has steadily dropped from 2010 onwards (see Figure 11).

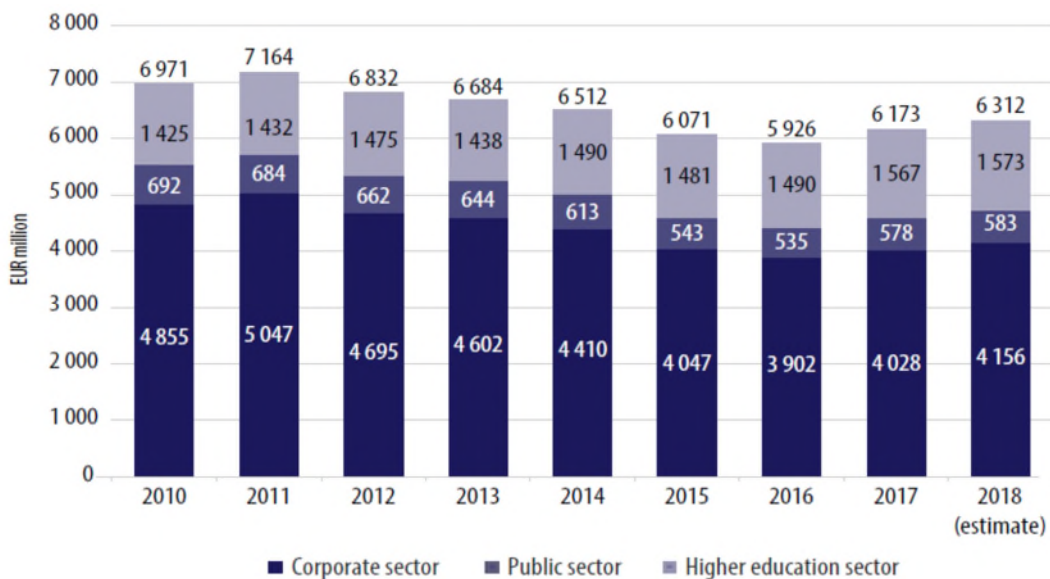


Figure 10 Changes in R&D expenditure by sector during 2010-2018¹⁵

¹⁴ OECD, <https://data.oecd.org/>

¹⁵ "Securing Finland's competitiveness and economic growth in the 2020s. Rapporteur's Report", publication of the Ministry of Economic Affairs and Employment of Finland, 27.03.2019

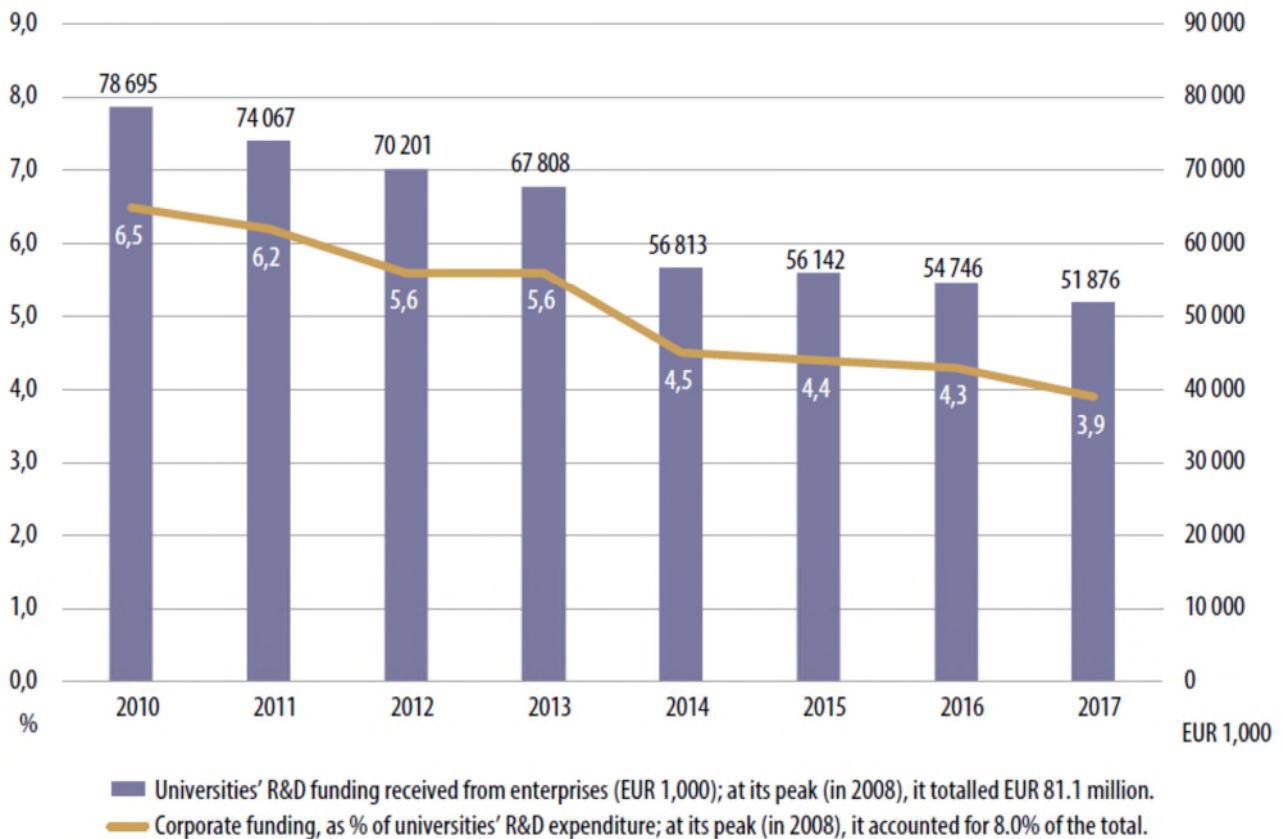


Figure 11 Universities' R&D funding granted by enterprises during 2010-2017¹⁵

The most prominent national (**The Academy of Finland** and **Business Finland**) and European funding instruments (**Horizon2020** and **Horizon Europe**) are briefly introduced in the following paragraphs.

Academy of Finland funding – Flagships

Academy of Finland offers research funding for Finnish universities. The Academy's Flagship R&D&I program supports the Finland 2030 vision of creating billion-euro ecosystems. Substantial, long-term funding is granted for **six large ecosystems, Flagships**, each operating in their specific field. The host organisations of the flagships include six universities, two research institutes and Helsinki University Hospital.



Between 2019 and 2022, the organisations will fund the flagships with a total of **EUR 320 million** while the Academy of Finland's funding contribution comes to **EUR 54.5 million**.¹⁶

Business Finland funding services for ecosystems

Business Finland offers the following funding services:

- **Business Finland programs:** Internationalization and innovation-funding services
- **International growth:** Advisory and online services for internationalization



¹⁶ <https://www.aka.fi/en/research-and-science-policy/flagship-programme/>

- **Cooperation between companies and research organisations:**
 - Co-creation funding
 - Co-innovation funding
 - New business from research ideas (TUTLI) funding
- **Growth engines:**
 - The aim of the growth engines supported by flagships is to develop promising growth ecosystems on the basis of the strategic priorities defined in the Finland 2030 vision¹
 - The Government has directed EUR 60 million of capital funding for Growth Engines in 2018 (EUR 30 million) and 2019 (EUR 30 million). In addition, Business Finland directs its normal funding and services to projects fulfilling the growth engine criteria
 - Funding for the orchestration of growth engines
 - Competitive bidding on ecosystems
 - Funding in the form of capital loans for Growth Engine platform companies
 - Starting support for the growth engine platform company by provision of capital loans
 - Capital loan financing for the preparation of growth engine projects
- **Testbed Finland:** Funding and support for companies developing testbed activities seeking international leadership
- **Sustainable Manufacturing Finland:** strengthening innovation and production of manufacturing companies in a sustainable way, supporting business development and growth of SMEs
- **Leverage from anchor firms** (Veturiyritysistä vipuvoimaa): Funding and support for ecosystems led by internationally operating anchor firms

In its strategy, Business Finland has set up specific objectives, which it is envisioning to achieve by 2025:

- Double the R&D investments and exports of SMEs
- Create new world-class ecosystems worth EUR 20 billion in total
- Become the most attractive destination for FDI in Northern Europe
- Become the most desired travel destination in the Nordics

EU funding – Horizon2020 & Horizon Europe

Horizon2020 is the largest EU Research and Innovation programme ever with nearly EUR 80 billion of funding available over a seven-year period (2014 to 2020). **Finland has received in total EUR 895 million funding¹⁷ from H2020** which has been distributed to the different recipient organizations as follows:



- Universities **39 %**
- RTOs **24 %**
- SMEs **21 %**
- Large companies **16 %**

EU's H2020 funding is structured around three main pillars: 1) Excellent science 2) Industrial leadership and 3) Societal challenges. The main changes in the Horizon Europe¹⁸, the upcoming framework programme superseding the Horizon2020 are the following:

- Increased budget (suggested target budget of EUR 100 billion)

¹⁷ [Business Finland news story](#), published 24.04.2019

¹⁸ [Horizon Europe](#): developing EU innovation and research

- New generation of objective-driven and more ambitious partnerships
- Enhanced synergies with other Union Programmes¹⁹

3.5 Examples of funded ecosystems

Growth Engine is a term used by Business Finland²⁰ to describe cooperation networks or ecosystems, which are primarily aimed at new business activities amounting to more than one billion euros. An enterprise-driven partnership model between companies, research organisations and public stakeholders forms the core of a Growth Engine, which according to Business Finland seeks to find solutions to global market disruptions and create new growth sectors in Finland.

The Academy of Finland has established The Finnish Flagship Programme²¹ to provide a unique and novel way of undertaking research, development, and innovation activities in Finland. The Academy has granted substantial and long-term funding for six large ecosystems called Flagships with each operating in their specific field. In the Academy's programme active collaboration between research, business, and society in the field of each Flagship is especially endorsed. Between 2019 and 2022, the organisations will fund the flagships with a total of EUR 320 million with the Academy of Finland's funding amounting to EUR 54.5 million.

Examples of funded and ongoing Growth Engine and flagship ecosystems are detailed in **Table 6** and **Table 7**, respectively.

Table 6 Examples of important Growth Engine ecosystems²⁰

Growth Engine	Platform company/Orchestrator
Compensate (Vauhtia hiilensidontan markkinoiden kasvattamiseen)	Compensate
AWAKE.AI (Älyä satamien ja meriliikenteen toimintaan)	Awake.AI
Silo.AI (Tekoälyn markkinapaikka)	Silo.AI
Flexens (Uusiutuvan energiatuotannon yhteiskuntakokoluokan demosta kansainväliseksi kokonaisratkaisujen toimittajaksi)	Flexens
Smart Mobility Ecosystem	Kyyti Group
Platform of Trust	Suomen Tilaajavastuu
Internet of Locations	Iceye
Vedia Caas	Vediafi
Plastic Waste Refining Ecosystem	Griffin Refineries
Silo.AI (Tekoäly, support for start)	Silo.AI
OneSea	DIMECC
Baltic Offshore Wind	Gaia Consulting

¹⁹ [An overview](#) of European Union's funding programmes

²⁰ Business Finland's [Growth Engine](#) initiative

²¹ The Academy of Finland's [Flagship Programme](#)

Table 7 Examples of important flagship ecosystems within The Finnish Flagship Programme by The Academy of Finland

Flagships	Flagship director and host organization
6Genesis – 6G Enabled Wireless Smart Society & Ecosystem	<i>Director:</i> Academy Professor Matti Latva-aho , University of Oulu <i>Host organization:</i> University of Oulu
FCAI – Finnish Center for Artificial Intelligence	<i>Director:</i> Academy Professor Samuel Kaski , Aalto University <i>Host organization:</i> Aalto University
FinnCERES – Competence Centre for the Materials Bioeconomy	<i>Director:</i> Professor Orlando Rojas , Aalto University <i>Host organizations:</i> Aalto University and VTT Technical Research Centre of Finland Ltd.
iCAN – Digital Precision Cancer Medicine Platform	<i>Director:</i> Academy Professor Kari Alitalo , University of Helsinki <i>Host organizations:</i> University of Helsinki and Helsinki University Hospital
INVEST – Inequalities, Interventions and New Welfare State	<i>Director:</i> Professor Jani Erola , University of Turku <i>Host organizations:</i> University of Turku and National Institute for Health and Welfare
PREIN – Photonics Research and Innovation	<i>Director:</i> Professor Goëry Genty , Tampere University <i>Host organizations:</i> Tampere University, University of Eastern Finland, Aalto University and VTT Technical Research Centre of Finland Ltd

4 Key findings from interviews

This Chapter presents the key findings from the interviews, with Chapter 4.1 depicting the ecosystems highlighted by companies for significant growth potential and Chapter 4.2 collecting thematical findings from the company and stakeholder interviews.

4.1 Strategic innovation and growth networks

The first round of interviews was focused on interviewing the strategic management of the chosen technology industry companies. Summary of the networks highlighted by the interviewed companies is presented in Table 8.

Table 8 Strategic innovation and growth ecosystems highlighted by the interviewed companies

Company	Network	Description
Nokia	5G Connectivity in industry (several networks)	Important growth area for Nokia (esp. when heavy infrastructures; harbours, mines)
	Smart city: LuxTurrim 5G+, autonomous traffic	See Ch. 4.1.2 for further description
	5G Testbed Finland	5G Testbed recruiting for more partners, Aalto University also involved
	6G Flagship	Research program and collaboration platform for 6G. Partners involved: Univ. of Oulu (coordinator), Aalto, VTT, Joint Center for Future Connectivity by Nokia Bell Labs and Univ. Oulu - to grow to have 5-6 strategic partners and 50-100 other collaborators
	Reboot Finland	Reboot IoT Factory brings together forerunner factories, IoT solution providers and top-class research organizations to revolutionize the competitiveness of Finnish manufacturing industry, with VTT coordinating the ecosystem
Konecranes	IndEX	IndEx – Industrial Data Excellence of top Finnish companies pursues growth through better utilization of data and AI, aiming to build a Data Community and a common data platform to Finland, with DIMECC as programme facilitator
	MACHINAIDE	Knowledge-bases services for and optimisation of machines. Part of ITEA Cluster programme of EUREKA. Partners involved incl. Konecranes (coordinator), Aalto University, IDEAL PLM & Remion.
	Optimum	Optimised Industrial IoT and Distributed Control Platform for Manufacturing and Material Handling, Part of ITEA Cluster programme of EUREKA, partners include: e.g. Demag Cranes & Components GmbH (coordinator), Bosch-Rexroth AG and Comnovo GmbH
GE Healthcare	AI (CleverHealth network)	See Ch. 4.1.3 for description

	Elastronics (Enabling the future of wearable electronics)	Printable, disposable electronics, partners: Tampere University (coordinator), VTT, Univ. Oulu, Finnish companies incl. Suunto & Inkron)
	Health Innovation Village	Campus for growth companies in health technology in Helsinki.
	Reboot Finland IoT Factory (with Nokia, BF) for factory automation	See above
	5G wireless hospital (langaton osaamiskeskus)	Centre of excellence for wireless patient monitoring
Wärtsilä:	Smart technology hub	New centre under construction for research, product development and production, in Vaskiluoto, Vaasa, specialised in smart shipping and a smart energy sector.
	Smart marine ecosystem	Network of interconnected vessels, ports, suppliers, customers and other stakeholders.
	Remote service lab	Integrated optimisation of the vessel efficiency; data collection and experiments with Wasaland, privately funded initiative
	Engine Research Initiative	Collaboration on developing world-class research into sustainable future applications for internal combustion engines. Universities involved: Aalto University, Tampere University of Technology, Åbo Akademi University, and the University of Vaasa
KONE:	KEKO - Connectivity Platform for Smart Buildings	Solutions aiming to that improve buildings as efficient logistic nodes and new digital services, new project starting soon – see Ch. 4.1.4
	Combient foundry	Community bringing together leading Nordic companies, tech start-ups on a global growth path, and in-depth industry expertise to co-create financially solid services and solutions in long-term business partnerships.
UROS:	IoT and 5G Innovation Center utilizing tech from Qualcomm Technologies	Innovation centre to be opened in collaboration with UROS and Thundercomm in Oulu with a focus on smart cities, wearables, artificial intelligence (AI), robotics, drones, industrial IoT, fintech and automotive.
Outotec:	BatCircle	Finland-based circular ecosystem of battery materials; see Ch. 4.1.5 for further description
	Symmet	Symbiosis of metals production and nature (BF 2018-20): improvement of material and energy efficiency in the materials production, recycling and reuse in the metals manufacturing ecosystem
Fortum:	Infinited Fibre Company	Bio-to-X: sustainable clothing fibers from biomass, with complete value chain Cempolis, Infinited Fibre

		Company, RGE, H&M; clothing manufactures targeting to have all fibers sustainable by 2030
	Circular economy	Bio-to-X: biofuels, second life for batteries with consolidation potential; Ekokem for plastics
	Charge and Drive	Software for charging stations of electric vehicles, only profitable player, sold SaaS for 30+ players in Europe
Ponsse:	EPIC	Platform potential for control systems in a.o. forest and mining machineries; 2,5 B€ market
	ReBoot IoT Factory	See above
	AVM2020	Autonomous Vehicles and Maas 2020, electrification of transport as growth platform; Sandvik and others as leaders, Synocus orchestrates - received recently BF Ecosystem funding
	EDGE	BF Co-innovation funding, Ponsse with a small share
Normet:	Design & Manufacturing Excellence	BF2018 ecosystem creation: Sandvik, AGCO, Roima, Normet, Intopalo, Wapice, Creanex, Futurice, Insta
Tieto:	14 networks	<ol style="list-style-type: none"> 1. CleverHealth (HUS) 2. Autonomous sea (DIMECC) 3. DIMECC (clients from IndEx); 4. VirpaD and Intelligent Building (BF, NCC, Abloy, Lassila & Tikanoja, Siemens, Sodexo, others) 5. Committed Energy, privately funded with Wärtsilä, Fortum, ST1, Demos Helsinki (coordinator) 6. FCAI 7. Sitra ´s IHAN, with HUS, Olympic Committee, National Defence Forces, for MyData (2.0) 8. ForestHub for data communication between players in forest industry, various partnerships 9. Standardisation for banks and insurance companies 10. Technology partnerships with Microsoft, IBM, AWS, Google and others 11. Product development services for verticals like car manufacturers, telecom 5G and others 12. AI Forums with TEM and VM 13. Blockchain projects, e.g. with Kela for smart money 14. MyData, IHAN and Blockchain for standardisation and technology understand
F-Secure:	Celtic-Next	Transport of secure information (EUREKA Cluster for next-generation communications enabling the inclusive digital society)
	3 x H2020, 3 x BF	H2020: Identifying intrusions and threats; Identity and access management (EIT Digital); BF: 5G Force, 4API – orchestration for APIs, Energy Fleximar – identifying intrusions; IoT Scott (ECSEL) – security connected trustable things

	ECSO, ENISA	European bodies for cyber security
M-Files:	Own platform and ecosystem	Value Added Resellers, system integrators, software and service providers on top of M-Files; mix of technology stack and related platforms
BaseN:	Own platform	Network of own datacenters globally for IoT and digital twins, European alternative for global enterprises FISC (Finnish Cyber Security Cluster) PIA (Association of Finnish Defence and Aerospace Industries)
BC Platforms:	Own platform and network (BC Platforms Rquest)	Platform for genomic data management and analysis for health care and drug development, aggregating and analysing national health care data
	FinnGen	BF-financed public-private collaborative for personalized medicine from 0.5M Finns; BCP connecting players
	Nine FP7/H2020/IMI projects	Technology provider for projects
	CleverHealthNetwork	With HUS (global leader in personalised medicine), Tieto, global drug companies utilising national health data through BCP's platform. See Ch. 4.1.3.
Glaston:	Bystronic glass	Acquisition for strengthening positioning in the glass processing value chain

To better understand the potential, support needs, strategic capabilities and investing needs of the specific networks, further ecosystem interviews of the key network actors were conducted in the second phase of the study. For this second phase, the most potential networks were selected using the following criteria:

1. Significant growth potential
2. Companies willingness to commit (e.g. own investments)
3. Network building on a new theme or a new angle
4. Building on Finnish competences
5. Relevant to technology industries and industry-driven

The most potential innovation and growth networks chosen for further analysis were the following:

1. LuxTurrim5G
 - Nokia drives smart city development with 5G, data-driven services and new operating/business models
2. CleverHealthNetwork
 - HUS commercializes public health data with industry for better diagnosis of diseases
3. KEKO - Connectivity Platform for Smart Buildings
 - Kone drives intelligence in buildings for best people flow experience
4. BATCircle
 - Aalto-driven research ecosystem on battery metals enables industry to invest in Finland

5. Advanced Manufacturing Network (concept)


- Industry drives Finland-wide knowledge and innovation ecosystem on advanced manufacturing technologies

Spinverse has worked with innovation ecosystems, in all related phases of maturity, and has also acted as leader or orchestrator for them. Based on this experience, Spinverse has developed a framework for describing an innovation ecosystem, describing all key aspects of it. This framework is illustrated below in Table 9. This framework has been used to describe the five above mentioned ecosystems.

Table 9 Spinverse framework for describing an innovation ecosystem

Network Description	
<i>Name: [Name of ecosystem]</i>	
<i>Leader/s:</i>	<i>Orchestrator:</i>
<i>Key partners and roles:</i>	
<i>Segment/Industry:</i>	
<i>Customer problems:</i>	
<i>Solutions/s:</i>	
<i>Competition:</i>	
Strategy	
<i>Vision/objectives:</i>	
<i>Value proposition:</i>	
<i>Strategic capabilities:</i>	
<i>Internationalization/scalability:</i>	
<i>Link to other ecosystems:</i>	
<i>Investments to date and future needs:</i>	
<i>Status and main future actions to achieve goals:</i>	
Market potential	
<i>Market opportunity:</i>	
<i>Market size:</i>	
<i>Achievable market size:</i>	
<i>Revenue streams:</i>	
Challenges & Recommendations suggested by industry	
<i>Challenges:</i>	
<i>Recommendations:</i>	

4.1.1 LuxTurrin5G

Network Description	
Name: LuxTurrin5G	
Leader/s: Nokia and Nokia Bell Labs	Orchestrator: Spinverse
<p>Key partners and roles: A multidisciplinary group of companies and research groups, with 26 partners incl. Nokia Bell Labs (project lead, 5G radio technology & networks), Tehomet (poles), Vaisala (sensing), Teleste (situational awareness), Sitowise (digital twin for city and city infra), A-Insinöörin (city infrastructure development), Rumble Tools (drones), Caruna (optical fiber and electricity network), Traficom (regulation), City of Espoo (city development and piloting), Aalto University and VTT (research) – for complete list of partners and their roles, please see the project website ²²</p>	
	
<p>Segment/Industry: Telecommunications, smart cities, urban development, several service industries</p>	
<p>Customer problems: Smart cities need a robust digital service infrastructure to improve safety, energy efficiency, air quality, effectivity of transportation and quality of living; insufficient capacity of mobile networks for the ever-increasing number of users utilizing new and advanced digital services; expensive to roll-out next generation networks</p>	
<p>Solutions/s: Creating the digital backbone of the smart city and new data-based services, with connectivity platform based on 5G smart poles. The aim of the project is also to create a data platform capable of receiving, handling and enriching large masses of city data from various sources in a reliable and efficient manner for use cases (e.g. comprehensive situational awareness for the city).</p>	
<p>Competition: Verticals for single purposes, not holistic</p>	
<p>Project website: https://www.luxturrin5g.com</p>	
Strategy	
<p>Vision/objectives: Creating digital backbone of the smart city and providing platform for new data-based services.</p>	
<p>Value proposition: Building next generation telecom networks and smart city services cost-effectively; integrating next generation networks into city structure; providing real-time views and situational awareness of the city; providing secure platform for city data and creating a new data market.</p>	
<p>Strategic capabilities: 5G research, ecosystem with capabilities for collaboration, Kera area as significant pilot ground for new smart city solutions</p>	
<p>Internationalization/scalability: Rolling out to Finnish cities, with several pilot projects in planning. International pilots in 2020 along sales and external funding.</p>	
<p>Link to other ecosystems: Traficom's 5G Momentum, 5G Test Network Finland, 5G Finland, Traffic Lab, Corridor as a Service (CaaS), One Sea, Arctic Drone Labs, DroneFinland, Research Alliance for Autonomous Systems, 6GFlagship; Alliance for the Internet of Things Innovation (AIOTI) Open and Agile Smart Cities (OASC, 120 cities worldwide)</p>	

²² <https://www.luxturrin5g.com/new-blog/2019/11/4/nokia-driven-luxturrin5g-smart-city-ecosystem-extending>

Investments to date and future needs: The first phase of the LuxTurrim5G project, successfully developed the 5G smart pole concept, which integrates the 5G base station, weather and air quality sensors, video cameras, monitors electric vehicle charging unit and other active devices. The current plan includes building 15 new smart light poles which will cover the 1.5 km route from the Nokia Campus to the Kera railway station during 1Q 2020. Through a two-year, EUR 26 million, intensive co-development effort the group of 26 partners target the global smart city markets.

Status and main future actions to achieve goals: LuxTurrim5G+ focuses on the productization of the smart pole concept and extension of the 5G smart pole pilot network in Kera neighbourhood in Espoo (+ new pilot implementations in Finland and abroad), while the Neutral Host Pilot project focuses on data-driven business and service development, intelligent network construction and new business and operation models for high-speed city networks.

Market potential

Market opportunity: Constructing and operating dense next generation 5G and IoT network and data platform for cities enabling data-driven services

Market size: Global smart city markets worth hundreds of billions of euros.

Achievable market size: +10 B€/year

Revenue streams: New service concepts and business models being developed for transport, logistics, energy management, urban infrastructure, health and safety, and network operations.

Challenges & Recommendations suggested by industry

Challenges: Future of radio frequencies for next generation networks not decided yet; current sales channels not addressing target segment of cities; current business strategies, business models and operating procedures may not fit the new business.

Recommendations: 26 GHz frequencies need to be allocated locally for enabling building smart city ecosystems; a new company may need to be established to sell the solution to target segments.

The partners collaborate a.o. in the following areas:

- AINS Group, Sitowise, Caruna, Destia, Ensto and the City of Espoo are involved in the planning and implementation of the novel city infrastructure
- Tehomet and Orbis drive smart pole development
- Vediafi, Agora Networks and VTT develop new solutions for the first and last mile logistics to ensure efficient supply chains in a city
- Sitowise and A-Insinöorit take forward urban planning and new operating models and services related to construction
- Teleste, Vaisala, Rumble Tools, and Sensible 4 take forward the sensing and monitoring of a city environment and developing new solutions and services for smart cities
- Traficom, VTT, Aalto and University of Helsinki research rules of the data market

4.1.2 Clever Health Network

Network Description

Name: **Clever Health Network**

Leader/s: HUS (The Hospital District of Helsinki and Uusimaa)

Orchestrator: HUS and Spinverse

Key partners and roles: The joint activity of 14 world-class technology companies and leading healthcare professionals develops together efficient patient care solutions for specific clinical needs utilizing precise health & wellness data. The companies are specialized in data collection and analysis, software, genomic data as well as health technology devices and applications: BCB Medical, BC Platforms, CGI, Elisa, Fujitsu, GE, Innofactor, Microsoft, Noona, Planmeca, Productivity Leap, Reaktor, Takeda, Tieto.



Segment/Industry: Health care, health technologies

Customer problems: The amount of healthcare data is growing exponentially, but the knowledge and resources of healthcare professionals are not adequate; efficiency and improved healthcare solutions urgently needed globally; digital, artificial intelligence-based healthcare solutions are promising but solutions do not yet exist.

Solutions/s: Data-driven digital health care innovations - program portfolio for eMOM GDM, AI Head Analysis, Child with Diabetes/IHAN, eCare for Me

Competition: Other countries investing in creating attractive data ecosystems with genomic data sequencing of populations

Project website: <https://www.cleverhealth.fi>

Strategy

Vision/objectives: To be an internationally renowned ecosystem, which processes and cultivates health and welfare data, a forerunner in the health care revolution, and to create dozens of world-class solutions related to the cultivation of healthcare data; Objectives: 1) Create product and service innovations in the field of health and wellbeing technology, 2) Improve health and patient care of Finns, 3) The innovation function takes place in the development & innovation projects, that are established within the ecosystem

Value proposition: A new approach to solving global healthcare problems using real-world data, AI, and machine learning all in a real-time clinical and research setting, resulting in improved treatment planning, more accurate diagnostics, proactive and more personalized treatment - The world's fastest track to commercialization for digital health and wellbeing innovations

Strategic capabilities: Data lake - co-creating new solutions with a globally unique data-set: 3.5 million population with unique national ID number, collected since 1950's including whole population; leading expertise of clinicians; CE-marked secure environment; HUS brand, largest academic research hospital in Europe; Biomedicum innovation hub

Internationalization/scalability: Annually several projects start that will create world-class solutions related to the cultivation of healthcare data; Co-development with member and contributing companies to test, scale, and develop for commercial use; global market via company partners

Link to other ecosystems: HUS linked to European University Hospital Alliance and PiPPI Procurement Innovation program; a large number of other companies and research institutes take part in CleverHealth Network's development projects; HUS collaboration with Oulu University Hospital

Investments to date and future needs: Funding from Business Finland, participating companies and HUS

Status and main future actions to achieve goals: Growth Engine status by Business Finland. Development projects with separate funding.

Market potential

<p>Market opportunity: Building novel health- and well-being technology products and service innovations for specific clinical needs</p> <p>Market size: New technology exports and increased foreign investments to Finland with a turnover of EUR 11 billion & EUR 7.7 billion export earnings envisioned for the CHN companies</p> <p>Achievable market size: Please see above</p> <p>Revenue streams: Efficiency and efficacy of healthcare solutions, exports of company solutions, commercialization of data lake for development of medicines, development fees</p>
<p>Challenges & Recommendations suggested by industry</p>
<p>Challenges: Law for the secondary use of health information not clear, complicating business; the proposal for the genomics law would stop the business, as adopted from Denmark where medical industry stopped investments; public sector planning to adopt monopoly roles where already commercial business existing; data access for commercial research incl. AI model training in Europe; limited public financing of development at hospitals; companies moving from the role of subcontractor to innovation partner</p> <p>Recommendations: Companies understand business and processes better than national monopolies – do not close possibilities for ecosystems; data ethics: national benefits from genomics information override individual protection – securing access to data; life science requires industry experienced Venture Capital – role of VAKE in consolidation?; create practices and pricing models to utilise the data lake; expedite secondary use of health information</p>

Figure 12 shows the ongoing projects and involved partners at the Clever Health Network. More projects are currently in planning.

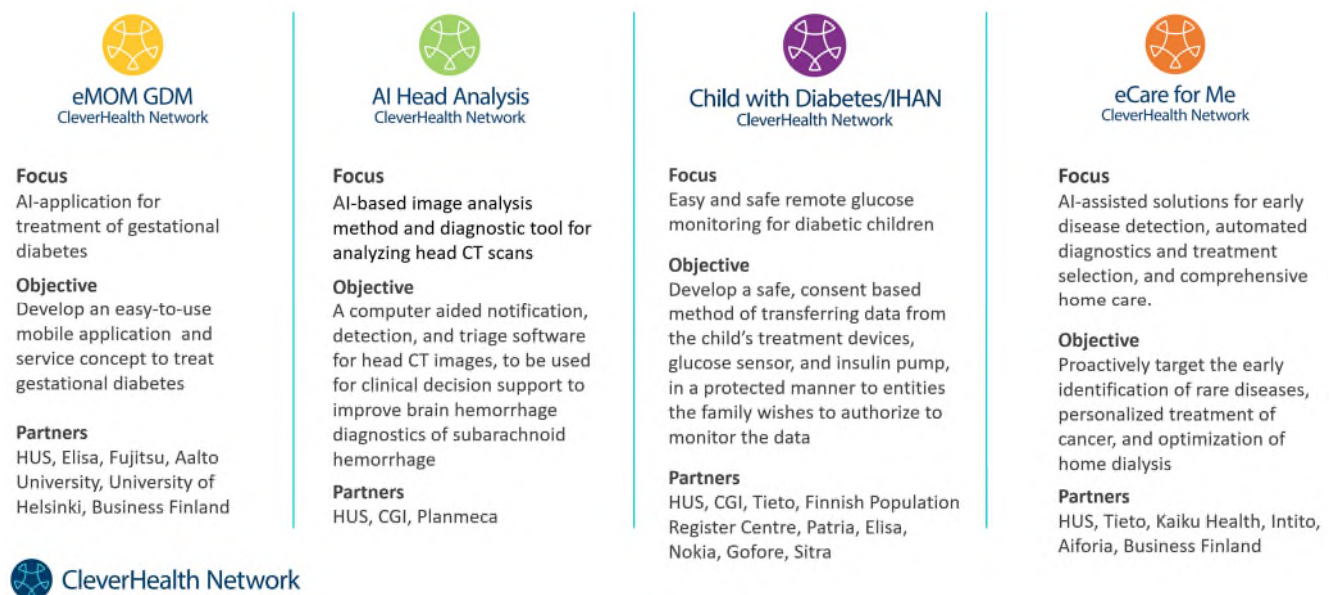


Figure 12 Projects ongoing in Clever Health Network

4.1.3 KEKO - Connectivity Platform for Smart Buildings

Network Description	
Name: KEKO - Connectivity Platform for Smart Buildings	
Leader/s: Kone	Orchestrator: VTT

Key partners and roles: YIT (constructing and administering future buildings), Caverion (administering buildings), Nokia (scaling 5G to buildings and environment), Ukkoverkot (partner with Nokia, selling and maintaining systems), Netox (cyber-security), Halton (air quality solutions), VTT (researching business case and orchestrating)

Segment/Industry: Smart Cities, construction, facilities management, logistics

Customer problems: Price per square meter in buildings as the basic driver in competition – need for creating value-added for customers in the competition between buildings; more users enabling more services. Flexible solutions needed for buildings. Connectivity inside buildings and sharing data between players for creating joint solutions for pro-active buildings. Bringing efficiency during construction phase. Flexible use of premises. Administering buildings remotely with sensors and actuators. Creating common platform for smart buildings and end-users, with common connectivity, security, interfaces, business models.

Solutions/s: Solutions for buildings – ecosystem platform for connectivity, enabler for building solution and service businesses. People Flow with larger system solutions and value-added, away from commodity solutions.

Competition: Siemens etc. providing proprietary solutions for buildings.

Strategy

Vision/objectives: Pro-active buildings with digitalisation, People Flow, providing automation to end users, creating connectivity between now separate solutions inside buildings. Open ecosystem and platform.

Value proposition: Sharing data of People Flow to enable pro-active services, increasing a.o. energy-efficiency and creating personalised services for users of the buildings

Strategic capabilities: Customer relationship globally, open interfaces and ecosystem. Known innovation ecosystem with trust among players.

Internationalization/scalability: Open ecosystem for scalability, APIs for creating additional services. Kone as leader for Go-To-Market, with customer relationships globally. Scalable services to global markets.

Link to other ecosystems: LuxTurrim5G

Investments to date and future needs: Technology research and development of Kone API, Nokia 5G technology. Total budget 20 M€ '20-21. Research project.

Status and main future actions to achieve goals: BF funding decision in Nov '19. Proof of Concepts with partners, purchasing solution components from additional partners incl. SMEs. Creating ecosystem model and business models, creating knowledge of smart buildings. Building on 5G technology. Involving customers into project (like YIT and Caverion for Kone) and end-users (user testing).

Market potential

Market opportunity: Value-added smart services for buildings and their users

Market size: 10-20 mrd €

Achievable market size: 15%, 1.5-3 mrd €

Revenue streams: Increased solution sales, service sales incl. maintenance, operating fees for systems, further business models during project esp. data business

Challenges & Recommendations suggested by industry

Challenges: Sharing data from buildings to cloud and among players; IPR challenges. Linking new strategic projects to daily business, competing with business priorities and resources. Building common interest and vision for the project. Building the ecosystem and driving the project to concrete business

Recommendations: -

Partners collaborate per research programs.

4.1.4 BatCircle

Network Description
<p><i>Name:</i> BATCircle - Finland-based circular ecosystem of battery materials</p> <p><i>Leader/s:</i> Aalto University</p> <p><i>Key partners:</i> 4 universities, 2 research centres, 8 large companies, 14 SMEs, 2 cities</p> <div style="text-align: center;">  </div> <p><i>Segment/Industry:</i> battery metals, metals refining and recycling</p> <p><i>Customer problems:</i> Rapid electrification of mobility resulting in high need for sustainable recycling of batteries and minerals used in them</p> <p><i>Solutions/s:</i> improved manufacturing processes for mining metals and battery chemicals industries, increased recycling of lithium-ion batteries</p> <p><i>Competition:</i> Other research ecosystems, companies (e.g. Umicore)</p> <p><i>Project website:</i> https://www.batcircle.fi/</p>
Strategy
<p><i>Vision/objectives:</i> The primary goal is to strengthen the cooperation between companies and research organizations in Finland, and to find new business opportunities</p> <p><i>Value proposition:</i> BATCircle consortium aims at improving the manufacturing processes of mining industry, metals industry and battery chemicals, and to increase the recycling of lithium-ion batteries</p> <p><i>Strategic capabilities:</i> globally known metallurgical knowhow, Finland has one of the largest lithium deposits in the E, over 10 % of global cobalt refining, 4 % of global nickel refining, Excellent industrial infrastructure</p> <p><i>Internationalization/scalability:</i> global potential for scaling up the developed technologies</p>

<p><i>Link to other ecosystems:</i> EU's Strategic Energy Technology Plan (SET Plan), European Battery Alliance EBA250, ETIP Batteries Europe, Battery 2030+, SYMMET, Battery IPCEI²³ (European commission has approved the first Important Project of Common European interest (IPCEI) on batteries that was jointly notified by seven European countries including Finland. Finnish companies include three BATCircle companies: Keliber, Terrafame and Fortum)</p> <p><i>Investments to date and future needs:</i> Status and Investments done to date: 21 M€ (10 M€ from Business Finland), Investment needs for demonstrations in order of millions, investment needs for recycling plant in order of dozens to hundreds of millions</p> <p><i>Status and main future actions to achieve goals:</i> in process of securing future funding</p>
Market potential
<p><i>Market opportunity:</i> Battery minerals (Mn, Ni, Co, Li) demand for electric vehicles is expected to increase from $\sim 50 \times 10^3$ to $\sim 950 \times 10^3$ tons by 2030²⁴</p> <p><i>Market size:</i> future total market potential in order of dozens of billions</p> <p><i>Revenue streams:</i> -</p>
Challenges & Recommendations suggested by industry
<p><i>Challenges:</i></p> <ul style="list-style-type: none"> • Low TRL technology needing long term commitment, risk taking capability, R&D funding, large investments and committed large industrial player(s) • Role of the public funding and government highlighted due to the long-time horizon and high risk • Tighter schedule and larger investments needed than traditionally, due to the rapid uptake of electric vehicles and upcoming technology competition • Large governmental investments in other EU countries for battery ecosystems • New business opportunity for battery recycling differing from the business of traditional metal refining companies. <p><i>Recommendations by industry:</i></p> <ul style="list-style-type: none"> • Long term funding and support needed for strategic low TRL level technologies and piloting for speeding up the commercialisation of the high potential technologies • Resources for permitting process to assure timely process • Paving the way for the companies by showing interest and attracting investments • Legislation that supports a low environmental footprint throughout the batteries value chain, including recycling

4.1.5 Advanced manufacturing Network

Network Description
<ul style="list-style-type: none"> • Advanced manufacturing suggested to cover broadly manufacturing technologies that companies do not currently use or that are not used in Finland yet, e.g. due to too large investments for a single company <ul style="list-style-type: none"> ◦ Examples discussed often in Gartner hype curve¹ like digital twin, ALD, 3D printing of metals, simulation ◦ Knowledge of materials technology important ◦ Digital processes form the base for manufacturing

²³ https://ec.europa.eu/commission/presscorner/detail/en/IP_19_6705

²⁴ https://www.researchgate.net/figure/Lithium-ion-battery-and-material-demand-from-electric-vehicles-sales_fig1_326972638

- solid foundation of digitalisation competence in strategic industrial areas needed together with good collaboration between RTOs and industry, ideally the competent network would be attracting the most skilled labour and universities could offering relevant high-quality services for industry
- The service should be scalable for being able to be used not only for piloting and demoing but also for production, as a service
- Manufacturing cell as automated as possible, with ML, robotics, etc.
- The network would benefit also the companies providing the technologies by increasing volume and thus cumulate process knowledge

Market potential

Target market should not be limited to Finland but to Europe and elsewhere; likewise, new technologies can be brought into Finland or networked with in Europe and globally

Challenges & Recommendations suggested by industry

Challenge who carries the risk of investments, operations, business model, sales

- RTOs role not to scale to production
- Should Business Finland financing be pooled to 20-30M€ investment?
- Protection of IPs in the network

Shortage of coders familiar with modern software development and industrial context

For selected, nationally important industries – benchmarking and positioning like “Made in China 2025” and Industry 4.0 needed

4.2 Findings from value networks

*Objective: Examine the priorities of the **key actors in the networks** on how the scope, management and schedule related focus in the national and EU funding would strategically increase the networks capability to reach its objectives and create billion-euro businesses.*

Objective: Gather the proposals from the network on other concrete EU-level, national or regional activities that would support in reaching objectives of the network

DISCLAIMER: The actions presented in this Chapter are collected from the interviews and are not recommendations by the authors nor Spinverse.

4.2.1 Creating and joining ecosystems calls for vision and embryos

Creating ecosystems calls for vision and win-win

Challenges related to creating and joining ecosystems:

- **The somewhat changing politics around structures and funding hinders proper investments into ecosystems**
- An innovation ecosystem is not easy to create, it takes time to get interest from the right partners, and decisions on funding grants require time
- **Lack of visionary drive** when soliciting participants often leads to hasty unqualified decisions by prospects and weak commitment and uplift
- Unless the vision of the ecosystem is aligned with one’s company strategy, it is futile to join

“Finnish companies need to collaborate and join forces for critical mass and investments – the competition is global, not in Finland”

- Limited areas of specialisation often mean that a research partner is needed from abroad
- We don't have enough ecosystems with critical mass and specialised partners in e.g. AI & digitalisation
- **There is a systemic gap of creating ecosystem embryos among industrial partners**

Best practices/key learnings:

- Attending events, meeting people, sharing and incubating ideas and gaining insights is very useful
- Gaining trust on an individual level is important, more so than on a corporate level
- Fostering a culture of openness and equality with partners that share the ecosystem vision
- **Consortium not to have partners in direct competition for enabling win-win combinations**

Actions to support the networks suggested by industry:

- Sufficient funding and stepwise funding mechanisms with lower threshold for initial funding
- Supporting creation of industry-driven vision and embryos for the ecosystems, with win-win business potential
- Having long-term vision for funding for establishing long-term relationships both on personal and organisational levels

4.2.2 Ecosystem leadership & orchestration

More competence needed for ecosystem leadership and orchestration

Challenges in ecosystem leadership and orchestration

- An ecosystem, or the partners in it, continuously face challenges throughout their lifecycle from early ideas to commercial stage that they need to navigate through.
- These challenges can be related to funding, but also to partner company capabilities or readiness, balance shift in running the ecosystem, change in objectives, technology failures, competition, company agendas changing, etc.
- **There is currently a lack of competences in ecosystem leadership, orchestration and related best practices and documentation**
- There is also a gap in Finnish public funding that has discontinued a lot of co-operation between industry and academia – how can we close it?
 - There is a problem in the innovation chain, “the ball drops between the tables”
- How can testbeds and pilot labs be made more useful for the industry?

“It is important to understand the big picture in the industry and the direction of change, as disruption is not coming from where you expect”

Best practices/key learnings

- Joint vision and ability to develop joint win-win business models
- Getting the best out of each participant
- Flexible legislation enabling experimentation, example Japan's Society 5.0 (SuperSmartCity)

Actions to support the networks suggested by industry

- **There is a need for facilitation and support - Who are the actors to take roles in this? What other competencies are needed?**
- There is a demand for an ecosystem Playbook to help setting up and driving value in ecosystems

4.2.3 Commercialisation and scaling up

More support for commercialisation and scaling-up needed

Challenges

- **Commercialisation phase needs efforts/funding. Promising growth companies are too often acquired in an early phase.**
- Scaling-up to large global scale needs too often funds from outside Europe (e.g. from U.S, with well-functioning financial market)
- Lack of ambition in commercialisation was especially challenging when companies within the same ecosystem had very different ambition levels.
- **Lack of willingness to change business models.** There is not enough focus on "process and business model innovations" i.e. companies' ability to rethink processes and business models. The capability to innovate is more and more important when the use of data and AI become more common.
- Current business strategies, policies and models do not support new innovations, which often require establishment of spinoffs or new business units
- Lack of common offering: Companies are too often trying to market their own technologies that address only a part of the problem customer has. There is not enough collaboration to build joint turnkey offerings under one brand.

"Secret to our success have been high technological competence paired with highly ambitious go-to-market strategy, strong global partnership network with matching ambition"
- Successful Finnish growth company

Actions to support the networks suggested by industry

- Visibility for success stories to set an example and encourage SMEs towards more ambitious and global business
- Actions to encourage to common offerings
- Creating/enabling a low barrier for testing and experimenting technologies and business models
- Innovative public procurement to support Finnish companies and ecosystems, like in other EU countries, for getting first references at home
- **Continued support of BF for internationalisation especially in centrally led countries²⁵ (not only funding)**
- Supporting the experimental way of working

²⁵ e.g. in Asia and Latin America where hierarchies are high and the state has a significant role (for opening doors)

4.2.4 Towards data driven business models and ecosystems

More collaboration needed between ICT companies and manufacturing industry

Digitalisation was a cross-cutting theme in the interviews and a prerequisite for staying competitive in the future.

Challenges

- **There is not enough collaboration between the ICT companies and manufacturing industry**
- **There are challenges in sharing data and getting data outside the site where it has been generated**
- Utilisation of AI is in an early phase and the possibilities are not well understood, especially when it comes to disrupting the traditional business models
- Decisions on which AI capabilities should be in the focus are not thought well enough, AI field in Finland is fragmented with many small companies
- Companies are not integrating AI to their processes early enough i.e. already before completely understanding all the possibilities Software understanding will be needed in all the industries. The lack of competent coders is hindering the development.
- **Cyber security is not on adequate level**
- Utilising AI requires data management which is not at the sufficient level at companies – roadmap not clear
- Building data ecosystems is not a technology development but business strategy decision

Actions to support the networks suggested by industry

- **Consistent regulation supporting digitalisation and digitalisation of administrative practices** (e.g. electronic documents are not always valid).
- Decisions on the focus of AI capability development in Finland should be decided in good collaboration between the companies and the Universities / RTOs
- Synergies in AI development between companies should be sought after. Playbook for collaboration might be needed for this.
- Finland should focus on application of AI. Companies should be encouraged to hire data scientists and to rethink their business models in collaboration with partners/customers.
- **Cybersecurity could be a competitive advantage for Finland and should be considered already when developing software.** This needs efforts in developing the education of software engineers and attracting and keeping the current and future software experts in Finland (e.g. through faster labour immigration).

4.2.5 Collaboration between companies and Universities / RTOs

More competence needed for ecosystem leadership and orchestration

Challenges related to collaboration between companies and Universities / RTOs

- **While funding for Universities / RTOs has been reduced, the investment horizon of companies has shortened, increasing gap between companies and Universities / RTOs**
 - Many companies have limited resources and are looking for innovations that would be commercialised within max 5 years; however, large technology companies emphasised the importance of long-term collaboration

- University /RTO research scattered and partially behind companies' research
- **KPIs and funding for universities / RTOs not supporting collaboration with companies**
- Modified IPR terms have reduced collaboration
 - Conflict of interest between Universities / RTOs and companies? Modified IPR rules on background and foreground rights as well as pricing have reduced collaboration
- Alternating politics preventing long-term investments

Best practices/key learnings

- Marine industries building future for 2050, incl. roadmap and solutions for clients; universities choose research questions compatible with their competence areas
- Public procurement: Singapore made commitment of 65 MRD for the climate change for the next 50 years
- Multi-party / ecosystem projects provide scientific information faster than publications and provide access to visions of leading research groups
- Collaboration important at recruiting for companies

Actions to support the networks suggested by industry

- Incentivising universities and professors for collaboration
- Correcting IPR rules and expectations from Universities / RTOs
- Innovative public procurement
- Testbeds and pilots – companies to be involved in planning, require financial or usage commitments before investment decisions in innovation ecosystems?
- **Each type of ecosystem needs their own type of actors for leadership and orchestration**

4.2.6 Intellectual Property Rights

University/RTO IPR terms need clarification and re-adjustment to attract industry

Challenges related to IPR

- **Modified IPR rules on background and foreground rights as well as pricing have reduced collaboration between several industries and Universities / RTOs**
- In several cases, universities required rights to companies' foreground - rules on IPR have become a barrier for joining a project
- Current rules and expectations confusing, many companies in several industries jumped out in frustration – standard rules from BF changed, difficult or impossible to change in projects
- Unclear framing and applicable terms of IPR contracts, e.g. companies with terms for companies and terms for joint projects in research collaboration with Universities / RTOs
- Cases where universities have moved to commercialise findings internationally without first offering to and negotiating with companies in the consortium
- National IPR contracts differ from those in EU projects

"If the IPR issues are not solved, then companies stay away from joint projects with RTOs."

- RDI Director in a large Finnish company

- High risk of potential technologies not to be commercialised due to lack of agreement on IPR issues

Best practices/key learnings

- Clear terms for win-win for IPRs in the frame contract / consortium contract / playbook from the start, reflecting investments required for commercialisation
- Terms in SHOKs a good benchmark – background, foreground, decision-making during project

Actions to support the networks suggested by industry

- **Re-adjustment of standard (Business Finland) IPR rules between companies and RTOs**
- **Clarification of applicability of rules**
- Role of governance bodies incl. Steering Board clarified
- Adoption of best practices in SHOKs and EU projects

4.2.7 Finnish competence

Industry needs to be able to trust on the availability of the skilled experts

The following strengths were highlighted in the interviews:

- Low hierarchy, ability to collaborate
- Good testing and experimenting environment
- Skilled R&D labour with costs in mid-range; “with public funding, at par with Asian countries”
- Public data records
- Impartial and trusted

Challenges

- Industry is expecting more clear national vision on sustainability issues and consistent roadmap and communication. Uncertainty especially related to changing regulation is hindering the investment decisions.
- **Shortage of skilled workforce in certain industrial areas is hindering the growth** (e.g. software developers)
- Risk of declining level of high technology competence and high-quality services offered for industry by universities. Finnish companies are lacking the knowhow especially in the productization and marketing that would be crucial for commercialisation/scaling-up
- **Not enough focus in structured cross-industrial benchmarking with non-competitors, related especially to digitalisation and quality** manufacturing
- Not utilising the full potential of the public data records and adopting related legislation harmful for business
- Regional politics and competition have a risk of resulting in lack of collaboration and declining competitiveness

Actions to support the networks suggested by industry

- **Investing in keeping the high technology competence in Finland and improving the marketing and productization capabilities**
- **More efforts to (re-)educating and expanding knowledge pool** by 1. branding of the industry to attract more students 2. better matching the study programs with industrial

needs 3. establishing knowledge centres supporting industry in strategic areas and attracting competent labour 4. Supporting usage and deployment of foreign experts, e.g. faster work permit process

- Finland could show leadership in driving towards sustainability without losing the competitive advantages. E.g. tendering favouring sustainable solutions could be used more actively.
- Supporting cross-industrial benchmarking, related especially to manufacturing, digitalisation and service business – organisation to arrange benchmarking visits
- More consistent and daring communication and branding with the focus on proven competences incl. digitalisation

4.3 Findings related to innovation system

Objective: Gather the proposals from the network on other concrete EU-level, national or regional activities that would support in reaching objectives of the network

This Chapter presents findings related to the innovation system, mainly to national and EU funding.

4.3.1 National funding

Competitive and flexible, but more predictable national funding is needed for RDI growth

Challenges in national funding

- **Finnish national funding by the Business Finland (BF) is seen unpredictable by the industry**
- R&D&I activities of large companies are not funded by the BF, only subcontracting to SMEs or universities – how to make this more attractive for industry?
- With the increasing use of open innovation and outsourcing of the R&D&I work in corporations, there is a limited amount of own “in-kind” work available to match subcontracting costs
- The focus is too much in funding “value chain networks” and not ecosystems for which the final result and the partners are not clear in the beginning
- Finnish “value chain networks” are difficult to build as the value chains are global and the preferred partners are not always in Finland
- **Focus is strongly in technology development and not enough in support for commercialisation** - competing EU countries for investments (e.g. Germany) have national funding also for projects of higher TRL
- Delayed funding decisions force companies to move their RDI resources to other uses
- With low TRL development, there was frustration for short term projects during which true commitment is impossible. On the other hand, the sense of urgency i.e. pressure to commercialise innovations fast was limiting the willingness of companies to attend long R&D projects
- Requirements for low TRL projects were seen contradictive and not taking account different technology development stages and horizons
- **Need for balanced funding from strategic long-term activities to agile commercialisation support**

“It is difficult to do internal resourcing when the funding decisions don’t come on time.”

Actions related to national funding suggested by industry

- Venture Capital like fund for a certain industry/ecosystem
- Longer term gradual funding for companies, with funding rate decreasing with time
- Instead of selling companies abroad at an early stage, VAKE could consolidate players and build a player competitive at international markets

4.3.2 EU funding and opportunities

Companies need to utilise EU opportunities and BF to support them

Overall the EU-level funding of the European growth companies was seen important in order to support the competitiveness of Europe. Although, it was highlighted that the EU-funding is not compensating the lack of internationally competitive financial market.

Challenges in EU funding and opportunities

- **Difficulties to find the right call, project or partners that support the business - requires companies own proactive work and leadership**
- **Complex process and heavy bureaucracy**
- Long application times and low success rates
- Insufficient understanding on the ways to affect the funding call descriptions and scope
- Perception of lack of focus, leading to generic or unclear topics, and difficult to see the benefits of advancing the R&D and participating; alternatively, call scope too limiting
- In Finland we generally seek EU funding once national funding is exhausted, while other countries are more pro-actively seeking EU funding at earlier stages
- Rules on IPR utilisation by research organisation as a barrier for joining the project
- Preparations of the proposals start too close to the deadline

Best practices/key learnings

- Actively utilising EU funding and arena to gain new contacts and broadening the market reach
- Understanding the EU funding opportunities and having them as integral part of overall R&D planning can increase the speed of development in the company
- Companies with established internal/outsourced EU funding support for larger companies

Actions related to EU funding and opportunities suggested by industry

- Increasing the support for companies in the application phase for EU funding
- Stronger link between national and EU funding, also promoting earlier EU funding applications

5 Conclusions and Recommendations

Conclusions

- Creating ecosystems calls for vision and win-win
- More competence needed for ecosystem leadership and orchestration
- More support for commercialisation and scaling-up needed
- More collaboration needed between ICT companies and manufacturing industry
- Collaboration of companies and universities/RTOs needs come-back
- University/RTO IPR terms need clarification and re-adjustment to attract industry
- Competitive and flexible, but more predictable national funding is needed for RDI growth
- Companies need to utilise EU opportunities and BF to support them
- Industry needs to be able to trust on the availability of the skilled experts

Recommendations for Industry

- Open Innovation in Ecosystems is proven to be the most effective way to innovate competitively. Build, hire, acquire, and subcontract skills to do it well
- Participate Knowledge Ecosystems for learning and helping universities/RTOs to understand relevant research areas
- Drive Innovation Ecosystems to set right vision, market understanding, engineering skills and rightly timed investments
- Build or participate in world-class international Business Ecosystems with best partners

Recommendations for Technology Industries of Finland

- Act as Initiator in selected new ecosystems, where single industrial leader is not enough, e.g. Advanced Manufacturing Network
- Contribute to increased competence in ecosystem innovation by publishing a playbook of building and leading ecosystems. Benchmark best practices and set a platform for sharing learnings.
- Technology Industries of Finland has the strongest position and motivation of all industry associations to drive the innovation agenda in EU. Become the orchestrator for Finnish lobby towards EU. Invite key companies, universities/RTOs, government representatives and private sector experts for joint vision, action plan and share of responsibilities

Recommendations for Universities and RTOs

- Industry commercializes IPR better. Soften requirements for IPR-licensing terms, let the industry make money and expect bigger public funding through bigger taxes
- Commercializing research is successful when research topics come from industry need – renew Technology Transfer Office operations to pull industry needs in, not to push in-house research out
- Incentivize professors for collaboration with industry, not only to research and teaching – this leads to better and more relevant research and teaching as well
- Collect industry needs early when investing in research and piloting infrastructure: set company commitment in the form of usage or co-investment as internal criteria for investment approval
- Develop the education of R&D-, innovation and project management to better train skills for managing complex projects

Recommendations for Finnish Government

- Ensure predictable and internationally competitive innovation funding level to maintain industry's trust for long-term investments in Finland. Predictable funding level is not in conflict with continuous 3-5 years cycle of renewal on topics and projects. Make and execute the roadmap for 4% RDI intensity.
- Make and keep Finnish legislation and public organizations as forerunners in opening public data for industrial commercialization
- Use innovative public procurement extensively. Legislation and 10% target are there - next encourage pilots of large projects with high-level attention and centralized risk-balance funds
- Start-up ecosystem in Finland has reached internationally competitive level, now it is time to enable scale-up funding

Recommendations for Cities and Regions

- Create best environment to attract Innovation and Business Ecosystems to your area:
 - Set ambitious targets on innovative procurements and follow them through at the highest level of administration
 - Ensure fast permitting and necessary infrastructure investments
 - Define smart specialization of your region and actively market it in international domains. Pursue actively co-operation with industry, other cities and regions.
 - Remember benefit of Finland. If there is more competitive region in Finland to attract an international mega-project, support it instead

Recommendations for Business Finland (BF)

Innovation funding

- We cannot reach 4% RDI-target without Large Enterprises and their ecosystems. Guide more funding for them. It also helps bring back the co-operation between industry and academia.
- Review BF recommended IPR rules between companies and universities/RTOs – acknowledge the industry's role as the commercializing party. Use best practices of SHOK-projects and model agreements from selected EU Joint Undertakings like ECSEL.
- Encourage increased use of EU opportunities, especially for large enterprises and ecosystems behind them. Enhance your support and funding for better linking to European strategies and roadmaps, networks, funding.
- Funding rules should encourage finding the best international partner, not force working with Finnish ones. Even if an international partner is not funded, it can be part of the evaluation criteria.

International co-operation

- BF can help internationalisation in rising economies with strong governmental control
- BF should continue to build bi-lateral partnerships with countries outside EU and raise awareness of opportunities
- Industry-driven ecosystems can serve as internationalization channels for SMEs and start-up companies globally. Consider and support them as integral part of toolset in renewal from Finpro export legacy.

Recommendations for European Commission

- Industry creates jobs and business that funds our whole system of research and innovation. It also has strong motivation and insight to solve Societal Challenges. Design and implement the New Integrating EU Industrial Policy together with industry. Direct MFF towards renewal and sustainable growth.

- Simplify funding terms and bureaucracy
- Simplify industry's entry to EU-funding by a single information platform with clearly documented opportunities and vast number of open APIs and data
- Enable faster time to money by faster evaluation
- Increase amount of bottom-up over top-down calls – market knows better what is needed
- Set KPIs to measure emerging evidence of outcomes and impact on competitiveness and sustainability
- Enable subcontracting to private sector experts at market rates – large project management is complex and best expertise is needed

APPENDIX 1 – List of companies and stakeholders interviewed

Table 10 Companies and stakeholders interviewed during September-December 2019

No	Company
1	ABB Technology Oy
2	BaseN
3	BC Platforms
4	Beneq
5	Business Finland
6	CombiWorks
7	EPEC
8	Flexens
9	Fortum
10	F-secure
11	GE Healthcare
12	Glaston
13	HUS
14	Kone
15	Konecranes
16	LUT
17	Metso-Outotec
18	M-Files
19	Nokia
20	Normet
21	Ponsse
22	Sandvik
23	Siemens
24	Silo.AI
25	SitoWise
26	Straquest
27	Tieto
28	Uros
29	Valmet
30	Vasek
31	VTT
32	Wärtsilä



**Technology Industries
of Finland**