

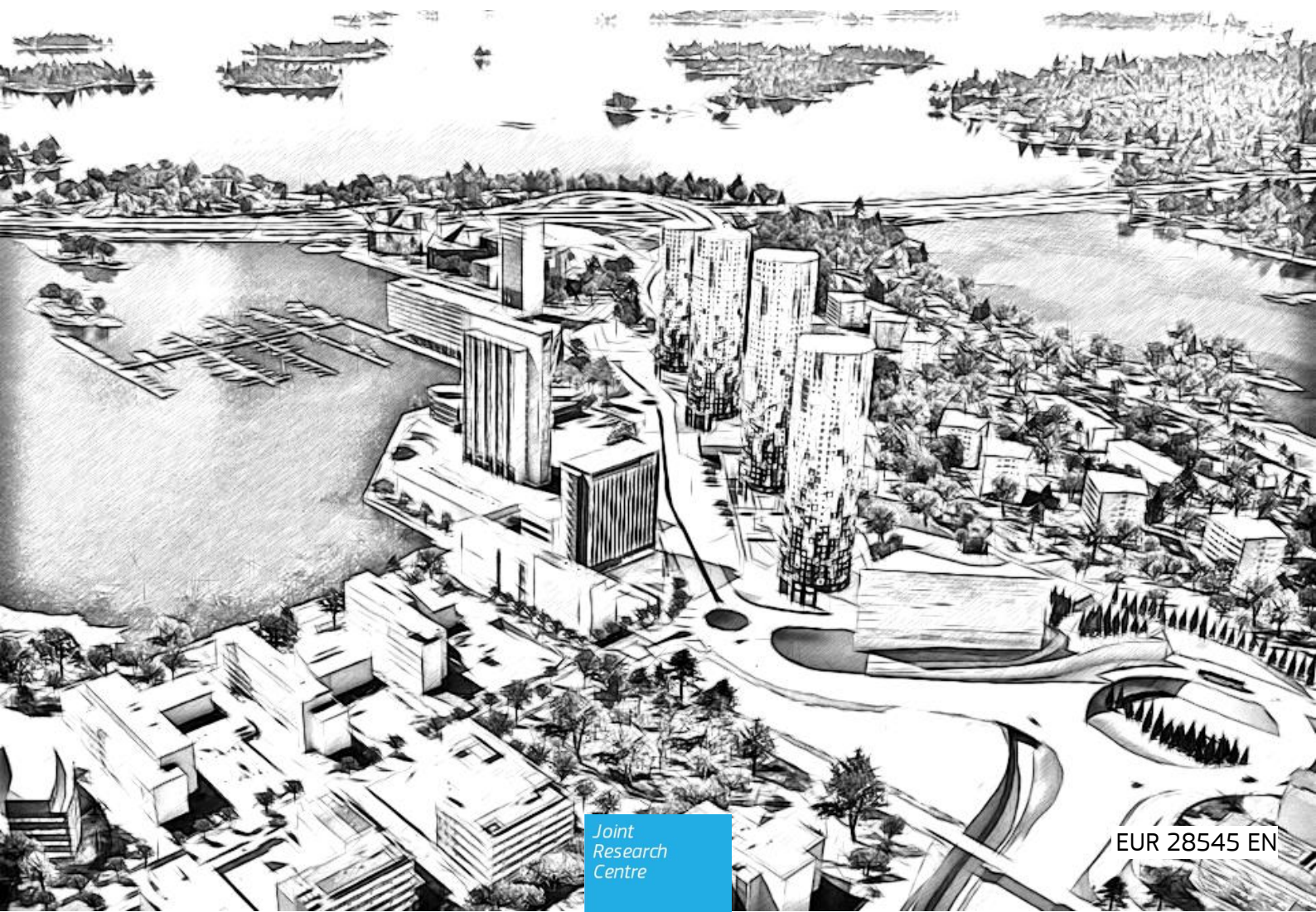


JRC SCIENCE FOR POLICY REPORT

Place-Based Innovation Ecosystems

Espoo Innovation Garden and Aalto University (Finland)

Gabriel Rissola, Fernando Hervás, Milena Slavcheva and Koen Jonkers
2017



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Title: *Place-Based Innovation Ecosystems: Espoo Innovation Garden & Aalto University (Finland)*

Abstract: The present case study aims to identify key success factors in the Espoo innovation ecosystem, with particular attention to the role of Aalto University as an example of an entrepreneurial university. It seeks to inform policies aimed at supporting the strengthening and emergence of existing or new place-based innovation ecosystems and entrepreneurial universities in other EU regions and cities.

Contents

Foreword.....	2
Acknowledgements.....	3
Executive summary.....	4
1. INTRODUCTION.....	6
2. CONCEPTUAL FRAMEWORK.....	7
3. CASE ANALYSIS.....	11
3.1. Territorial context.....	11
3.2. Actors.....	12
Uusimaa Regional Council.....	12
Espoo City.....	12
Aalto University.....	13
Urban Mill.....	19
Impact Iglu.....	20
VTT Technical Research Centre of Finland.....	20
Tekes, the Finnish Funding Agency for Innovation.....	21
Finnish Chambers of Commerce.....	22
Venture capital, investors and serial entrepreneurs.....	23
Large Multinational High Tech Companies.....	23
3.3. Contextual enabling factors.....	24
3.4. Regulatory and institutional enabling factors.....	26
3.5. Formal governance model.....	28
3.6. Quadruple helix.....	30
Coordination and implementation.....	34
Consensus and commitment.....	37
3.7. Strategic choices and vision: orchestrating Espoo innovation ecosystem.....	38
4. CONCLUSION AND NEXT STEPS.....	42
4.1 Conclusions.....	43
4.2 Next steps.....	44
Place-based innovation ecosystems.....	44
Entrepreneurial Universities.....	45
References.....	47
List of figures.....	50

Foreword

This research study was born from a fruitful collaboration between the Committee of the Regions (CoR) and DG Joint Research Centre of the European Commission (JRC) on promoting the importance of evidence-based policy development for regional and urban policy makers. As a follow-up to a joint high level mission to Espoo (Helsinki metropolitan area, Finland), JRC units B.3 *Territorial Development* and B.7 *Knowledge for Finance, Innovation and Growth* teamed up to study in depth the Espoo innovation ecosystem, with a particular view on the collaboration university-business-city and citizens and the crucial role played by Aalto University in the ecosystem.

Acknowledgements

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Authors

Gabriel Rissola, Fernando Hervás, Milena Slavcheva and Koen Jonkers (JRC)

Executive summary

This case study aims to identify key success factors in Espoo innovation ecosystem, with particular attention to the role of Aalto University. In addition to highlighting key enabling factors and catalysers, it describes the main quadruple helix actors and explains their role in facilitating and driving the emergence of this innovation ecosystem. In particular it analyses how several of these actors – notably, but not only, Aalto University – have orchestrated this evolution.

Policy context

This report seeks to inform policy initiatives backing the continuous entrepreneurial discovery process advocated by smart specialisation strategies (S3) for territorial development. Another complementary aim is to inform national and regional policies targeted at promoting entrepreneurial universities, by improving the capacity of universities to evolve into strategic actors in their innovation ecosystems.

Key conclusions

The key success factors for the development of the Espoo innovation ecosystem can be generalised as follows: 1) the historically evolved concentration of highly skilled human capital and research infrastructure in the region, including the ups and downs of Nokia; 2) the vision, political commitment and collaborative culture of Helsinki-Uusimaa Regional Council and Espoo City; 3) the emergence of a strong orchestrating actor, i.e., Aalto University, which, on the basis of a shared strategic vision, stimulated the synergistic activities of the various actors; coupled with 4) the leadership, strategic and cross-disciplinary thinking of the university's management; 5) a local culture of innovation and entrepreneurship cultivated through the active support to bottom-up innovative activities in the university and the wider ecosystem; 6) a focus on the potential and capability of people to inform policies and programmes; 7) financial and policy support from the central government, including the innovation agency Tekes and private firms; 8) the successful involvement of serial entrepreneurs in financing and mentoring further start-up activities.

Main findings

The Espoo innovation ecosystem builds on a strong knowledge base. Decades of government and private investments in research and development intensive activities resulted in a high concentration of Human Scientific and Technological Capital and important research infrastructures.

The entrepreneurial spirit and participation of all actors (including students and citizens) is seen as crucial by leading organisations in the local context. It has been actively supported and facilitated by the university and the regional and city governments.

Co-creation with citizens/users is increasingly being cultivated through open innovation methodologies and open innovation spaces. Shared activities and large scale endeavours bring together all parties involved in an entrepreneurial discovery process of experimenting, taking responsible risks and learning in a collaborative way.

The broader Finnish institutional environment, experiencing a process towards deregulation, has conferred enough flexibility to innovation stakeholders to define and implement their own research and innovation agendas. Innovation brokers have at the same time been mandated to develop public-private partnership networks.

In the development of the Espoo innovation ecosystem there are (at least) three 'innovation process entrepreneurs'. The first and central actor is Aalto University and the university's leadership. The second one is the local government (Helsinki-Uusimaa Regional Council and Espoo City). The third one, rather as funding facilitator, is the national innovation funding agency Tekes.

Aalto University is a unique institution within a very distinctive innovation system. It was born out of the merger of three existing universities with a mandate to become the country's national 'innovation university'. As an endowment university, Aalto University has been able to build a new organisational model, activating at the same time a constellation of entrepreneurial initiatives and spaces. This has positioned Aalto University at the heart of the Espoo Innovation Garden as one of its key orchestrators.

Given the distinctive nature of the Espoo ecosystem and of the context in which it was born, it will not be straightforward for other regions or cities to engage in wholesale institutional learning from this case. Nonetheless, some key initiatives deployed in the Espoo Innovation Garden and the way Aalto University was facilitated to play its orchestrating role can inspire national and regional governments, as well as university administrations, in the development of their own policies.

Related and future JRC work

The present case study feeds into two complementary research lines launched by the JRC in 2017, one precisely on the topic of *Place-based Innovation Ecosystems* (seen under the lens of *Territorial Development*), and the other one on *Entrepreneurial Universities*, in which Espoo Innovation Garden and Aalto University are respectively taken as one of their cases.

Quick guide

This report starts by identifying a conceptual framework that can operationalise the study of concrete place-based innovation ecosystems. The study continues with 1) a presentation of the main local actors and pre-existing enabling factors in the Espoo innovation ecosystem, 2) progressively moves to the catalysers: notably the reforms that enabled the emergence of Aalto University, and 3) finally analyses the interaction between the different actors (public, private, higher education and citizens) that make up the ecosystem and the way these interactions are orchestrated.

1. INTRODUCTION

On 10 May 2016 a high level delegation from the Joint Research Centre of the European Commission (DG JRC) and the Committee of the Regions (CoR) visited Espoo (Helsinki metropolitan area, Finland) to gain knowledge about its innovation ecosystem and relative success factors. The study visits are part of a fruitful collaboration between CoR and DG JRC on promoting the importance of evidence-based policy development for regional and urban policy makers. As a follow-up of the visit, it was agreed (among others) that JRC units B.3 *Territorial Development* and B.7 *Knowledge for Finance, Innovation and Growth* would study in depth the Espoo innovation ecosystem, with a particular view on the collaboration university-business-city and citizens and the crucial role played by Aalto University in the ecosystem.

As a follow-up, a second delegation visited Aalto University in Espoo on 20-21 June 2016 in a 'Fact Finding Mission' aiming to gain an understanding of how the innovation ecosystem operates in Finland, with a particular focus on Aalto University and Espoo as an experiment on innovation ecosystems. The study visit focused on the environment in which the University is embedded, looking in particular at what role the University plays in its interaction with other actors, including Espoo City, a broader business community, and the Finnish Research and Technology Organisation: VTT¹.

Based on these two missions, the present case study pursues to identify the Espoo ecosystem and Aalto University's key success factors that could inform policies aimed at supporting the strengthening and emergence of existing and new place-based innovation ecosystems in other EU regions and cities, as well as of entrepreneurial universities. It starts by defining what a place-based innovation ecosystem is intended to be, and identifies a conceptual framework that can operationalise the study of concrete cases. The study continues with a presentation of the main local actors and pre-existing enabling factors; progressively moves to the catalysers that have made this innovation garden flourish: notably the reforms that enabled the emergence of Aalto University with its governance model; and finally analyses its Quadruple Helix collaboration model and the way the whole ecosystem is orchestrated.

The present case study feeds into two complementary research lines launched by the JRC in 2017, one precisely on the topic of *Place-based Innovation Ecosystems* (seen under the lens of *Territorial Development*), and the other one on *Entrepreneurial Universities*.

¹ VTT (Technical Research Centre of Finland Ltd) is a state owned and controlled non-profit limited liability company.

2. CONCEPTUAL FRAMEWORK

Why does innovation take place in certain places and not in others? Which are the contextual conditions and public interventions enabling such innovations to happen in a specific site? This study emphasises the territorial dimension of innovation by focusing on *place-based* innovation ecosystems. In doing so, it takes into account the smart specialisation concept. Smart specialization, operationalised in Europe through regional research & innovation (R&I) strategies, builds on the economic strengths, collective intelligence and distinctive assets of a certain territory and - through an entrepreneurial discovery process (EDP) involving a wide diversity of stakeholders - identifies the strategic areas of intervention to make innovation flourish. (Foray, 2015)

Therefore, an integrated approach is needed to understand the local knowledge dynamics, the centrality of entrepreneurship in the local innovation system, even the spatial perspectives of the entrepreneurial discovery process. The analysis of a place-based innovation ecosystem needs to consider how actors in the innovation processes are empowered in a way that stakeholders' tacit knowledge is mobilized and incorporated into decision making and priority selection; how embedded local networks work and how they are facilitated — including spatial aspects like proximity and an analysis of the most prominent nodes in the network. In few words, how the local innovation ecosystem is articulated and orchestrated.

As Oksanen and Hautamäki (2014) point out, an innovation ecosystem 'can refer to local hubs, global networks, or technology platforms. It also has roots in industry and business clusters (Porter, 1998; Estrin, 2008)'. Like these authors, among the different typologies we place an emphasis on local and regional ecosystems, particularly on those places that nurture a culture of innovation and make an innovation ecosystem grow. From Manchester (UK) at the beginning of the industrial era to Silicon Valley (USA) nowadays, there are many examples demonstrating that growing cities and metropolitan areas have played a crucial role in making innovation happen.

'An innovation ecosystem consists of a group of local actors and dynamic processes, which together produce solutions to different challenges' (Oksanen and Hautamäki, 2014). Innovation takes place in a *precise location*, which suggests that the physical proximity of innovation players matters, and much. Also, that there are certain *specific local conditions*, which, individually or combined, make such an innovation ecosystem flourish. There is also a *dynamic process* — often not easily recognisable from outside — that makes such innovation ecosystems develop. This poses the question *who* those sustaining such a process are – either we call them either animators, facilitators or *orchestrators*.

A systemic approach to the process that has enabled the emergence of a certain innovation ecosystem — in our case, the so-called Espoo Innovation Garden — requires one to consider the critical need of a range of factors:

- from leading public institutions committed to develop the territory and attract the necessary resources, to top-level universities and research institutions capable of nurturing its human capital;

- from a (relatively) harmonic business sector where established large companies and new start-ups specialise and cooperate under value chains and clusters, to local markets permeable to product innovations and connected to global networks;
- from a risk-taking entrepreneurial culture to a local society which accepts facing major challenges and is open to change and evolution.

Other enabling factors include the continuous movement of ideas and people, fluid interaction and 'cross-fertilisation' between business and academia, academia and government, government and business, organisations and individuals. Dynamic companies play a pivotal role in the ecosystem, but services supporting knowledge transfer and commercialisation of products and developing innovation networks are equally needed. The latter is precisely the role played by *intermediary organizations* like technology centres, enterprise incubators and a vast range of territorial innovation agents rooted in the local society.

When most or all of those conditions are met, place-based innovation ecosystems usually emerge and consolidate over time, developing hand-in-hand with local society. Indeed, a sense of community and belonging grows among local actors, who associate their success to that of the local or regional community. The location itself — usually a metropolitan area — consolidates as a brand, which, building on a historically grown knowledge base, progressively attracts interest, talent and investment from outside (e.g. Cambridge, Amsterdam, Barcelona, Berlin, to name some of the most noticeable examples in Europe).

A quick desk research suggests that there is not much literature specialised in the critical analysis of place-based innovation ecosystems by means of an integrated approach that combines the spatial dimension with theories of innovation and territorial development. For this reason, and taking stock of all the above specifications, we will use as analytical tool a conceptual model for transforming regions into innovation ecosystems proposed by the above cited authors, which will help us in building our case study.

According to the authors in question, this model enables a systemic approach and consists of four elements (shown in the illustration in next page) based on Triple Helix cooperation, the method of authentic dialogue, and the concept of core organization. Even if the authors caution that 'including users or citizens in the model has its own challenges', due to its relevance for this case study we will take the risk to add cooperation with the fourth Helix (i.e. the local civil society) to our analysis.

Core organisation(s) coordinating the process can be regional governments, innovation agencies, universities or firms, which, often in interplay, orchestrate² the interaction between the different actors in the innovation ecosystem. The lack of one, or several, coordinating actors can impede the development of an innovation ecosystem. These organisations or talented/leading individuals within them may also take up the role of policy entrepreneurs, who, by identifying policy opportunities and taking risks, set in motion new policy initiatives, programmes and institutional arrangements that can generate positive developments.

² This orchestrating role can take different forms ranging from strong central management, laissez faire or mixed governance models.

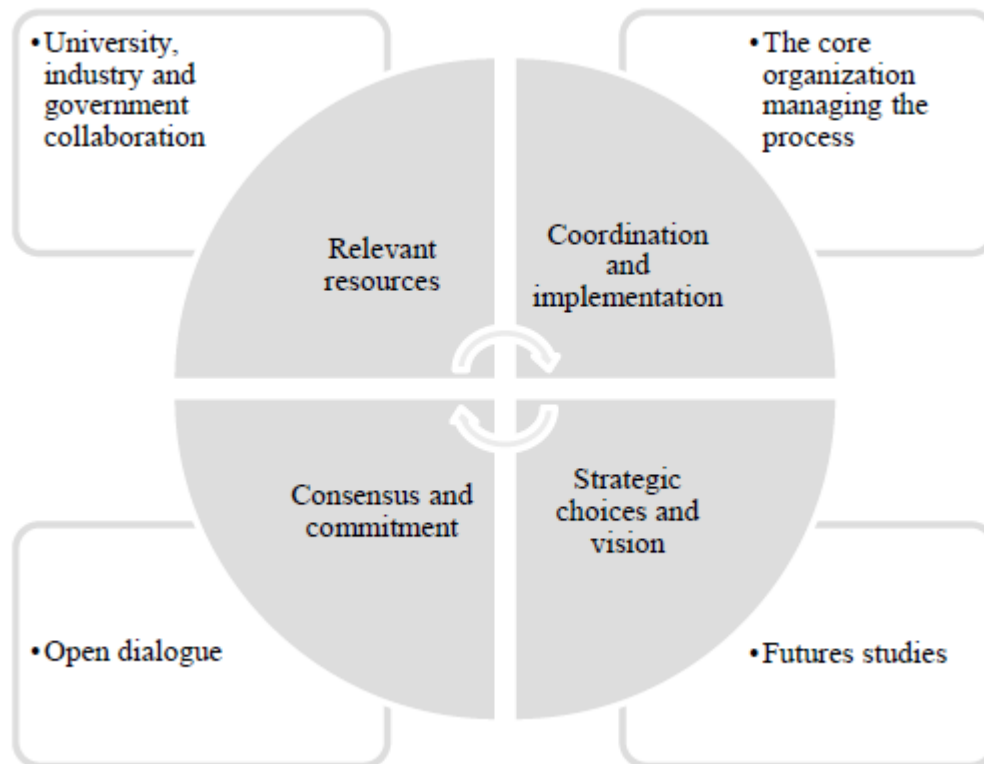


Fig. 1 – *Model for building innovation ecosystems*. (Credits: Oksanen and Hautamäki, 2014)

Nonetheless, as a recent article on the importance of *context* for the flourishing of entrepreneurial innovation (Autio et al., 2014) points out, it is the combination of policy and institutional top-down interventions described above with bottom-up, decentralised, non-linear processes, social networks and resource orchestration that have co-created successful context-tailored, place-based entrepreneurial innovation ecosystems. The authors argue that, by associating entrepreneurship with innovation, governments and national systems on innovation (NSA) have generally adopted policies and initiatives to stimulate innovation in entrepreneurial firms (including university-based start-ups) without paying sufficient attention to *when* and *where* entrepreneurs innovate. Focusing mostly on structures and institutions, they have neglected the micro-processes of entrepreneurial innovation, the weight of individual agency in them, and how those are regulated by the context. Context explains, for example, why entrepreneurial innovation may vary across regions within a country, or across industries. In turn, by focusing on patents, innovation literature has paid limited attention to softer forms of innovation (organizational, business models). Entrepreneurship literature, on the other hand, has been more interested in the non-linear bottom-up trajectories of entrepreneurial individuals and teams, forgetting to consider how context regulates their behaviour, choices and performance.

Thus, Autio et al. (2014) highlight some elements characterising entrepreneurial innovation, which will be relevant for the analysis carried out here.

- Individuals/teams are not isolated but operate within a context that includes social, institutional, business and spatial networks.

- Innovation agents operate within a multi-dimensional, multi-level and multi-actor process.
- Innovation is co-created by the multiple actors and evolves with the ecosystem.
- At policy level, these inter-dependencies, potential synergies and conflicts point out to the need of a 'policy mix' tailored to a 'context mix'.

The Smart Specialisation instrument helping to identify collaboratively the more adequate 'policy mix' is the Entrepreneurial Discovery Process (EDP) mentioned at the beginning of this section. It is potentially an excellent instrument to foster the development of entrepreneurial innovation ecosystems as they are characterised above. By means of an inclusive and interactive process that gathers together stakeholders from different environments — i.e. governments, firms, higher education institutions, civil society —, the EDP pursues the integration of entrepreneurial knowledge fragmented and distributed over many sites and organisations. It builds connections and partnerships in a coordinated effort of discovery of markets and technological opportunities that are also informative for governments' policy and decision-making processes.

The critical need of orchestrators to facilitate the dynamics of (entrepreneurial) innovation ecosystems has been previously raised in this section. In this study of Espoo's place-based innovation ecosystem, special attention is given to the role of Aalto University as a strong case of an entrepreneurial university that plays such a role. An entrepreneurial university is an organisation that engages strategically with its environment in order to address big (and smaller) societal problems. The role of such a university in training and attracting potential entrepreneurs, in stimulating bottom-up institutional development by faculty and students and in interacting with business, non-governmental organisations (NGOs), policy makers and public actors through informal interaction, contract research, knowledge transfer and the spinning out of high tech firms can be an important source of dynamism in place-based innovation ecosystems. Also in systems in which the university is a leading, orchestrating actor, there are other organisations, including large firms, start-ups and SMEs, business associations, research and technology organisations (RTOs), innovation agencies and regional governments, each of which plays its own role in the emergence of a dynamic ecosystem.

The extent to which universities can interact strategically with their environment depends on a number of factors including the amount of (free) resources a university has at its disposal and the control it has over them. Organisational autonomy, including the degree of independence from the government and funders, strongly influences the ability of a university to act strategically. Internal authority, i.e. the degree of control it has over its faculty, also affects (for better or worse) the room for manoeuvre which the university leadership has. Given the nature of a university as a professional (academic) work organisation (Whitley, 2003), there are limits to the degree of control and steering exercised by university leadership. Academic freedom and the room for own initiative are necessary for the university faculty and students to sustainably produce excellent science and to engage in the kind of bottom-up dynamics that are characteristic of successful (entrepreneurial) universities.

3. CASE ANALYSIS

As pointed out previously, we aim here to analyse the Espoo Innovation Garden and Aalto University as a case study of innovation ecosystems by decomposing it into the main categories underlined in Section 2. We start by presenting its main resources, devoting special attention to Aalto University. This university is the result of a relatively recent policy intervention to merge three universities into one so as to gain critical mass and relevance. The university actually plays a central role in the dynamics of the local innovation ecosystem. While analysing actors, we identify ties and collaboration practices among them, showing their cohesion in a highly networked environment.

We then proceed by identifying pre-existing enabling factors that made the local innovation ecosystem develop: from intangibles like a local culture of entrepreneurship to formal ones like regulations and governance principles. Then we concentrate on the Quadruple Helix coordination and implementation, as well as on the strategies and mechanisms applied to create broad consensus and commitment. We finalise the case study by scrutinising the process that led the City of Espoo and its host region (Helsinki-Uusimaa) to a shared and inclusive long-term vision reflected in a set of strategic choices that have reinforced its innovation ecosystem, with special emphasis on its orchestration, a role mainly played by Aalto University.

3.1. Territorial context

The Helsinki-Uusimaa Region is the only large metropolitan area of Finland. Its land area (9,440 km²) represents only 3% of the total Finnish territory and, in contrast, its population (1.6 million) stands for 30% of the total country population, this percentage doubling in terms of non-Finnish/Swedish speaking residents (56% of total in the country). The national GDP share amounts to 38.2%, as this region is the economic engine of Finland relying on an extremely versatile industrial structure, a dynamic business landscape, highly-skilled workers, and a high-quality research and education environment. The region is well connected on the national and local levels, and also to neighbouring countries (Estonia, Sweden, Norway and Russia).

Espoo is the second largest city in Finland, with a population of nearly 275,000 inhabitants. It is part of Helsinki Capital Region (together with Helsinki, Vantaa and Kauniainen) which, in turn, forms part of Uusimaa Region. Most of its population lives in the inner urban core of the Helsinki metropolitan area. Several major companies are based in Espoo as well, including Nokia Networks, Microsoft Mobile, KONE, Neste Oil, Fortum, Orion Corporation, Tieto, Outokumpu, as well as the video game developers Rovio, SuperCell and Remedy Entertainment. Otaniemi-Keilaniemi-Tapiola, a 4 km² area in Espoo, hosts a thriving science community that includes Aalto University and numerous start-ups and organizations such as VTT. The area has 44,000 residents and hosts an almost equal number of jobs, 16,000

of which are in ICT or ICT-intensive services sectors. 5,000 researchers and 16,000 students are present in the area. 200 local companies are foreign. People from 110 different nationalities live and work in the area.

3.2. Actors

Espoo is in many ways a city of opportunities and the innovation garden is its dynamic heart. Things originate here where Aalto University—Europe's Innovation University—and three other universities, as well as VTT Technical Research Centre of Finland and many other R&D actors are located: Europe's Living Labs movement started here, Rovio's Angry Birds started here, Slush—the largest start-up event in EurAsia—was created here, ACSI (the Aalto Camp for Societal Innovation) began here. For several years we called this area T3 according to the Finnish words Tiede, Taide, Talous (Science, Art, Business), now as a result of recent development Espoo Innovation Garden. (Lappalainen, Markkula and Kune, 2015a, p. 16)

Uusimaa Regional Council

Uusimaa Regional Council is the regional authority for the Helsinki-Uusimaa Region, formed by its 26 municipalities. Its main mission is to support sustained wellbeing and economic growth by means of regional development and land-use planning, and the promotion of local and regional interests. As a council it plays a coordination and consensus building role among the smaller territorial units, articulating common regional needs and long-term development goals and conditions for sustainable development. The Regional Council works in close cooperation with member municipalities, the government, universities and research institutions, the business sector and civic organizations. As we will analyse, the Regional Council has been a key enabler of the Espoo innovation ecosystem.

Espoo City

The City of Espoo is one of the members of Uusimaa Regional Council and has been an important supporter of the establishment of Aalto University in 2010. It was its decision to support and embed the planned new Aalto University campus within the city's territorial planning (e.g. new transport infrastructure investments to connect the campus to Helsinki).

The City of Espoo has paid great attention to urban planning in the development of Aalto University. Concentration has been pursued for facilities within a 350m radius of the metro station. Green corridors have been developed ensuring that the urban environment is properly integrated into the natural surroundings.

The ground floors of buildings are turned into open spaces/labs in an attempt to foster the impression of openness and transparency. A school³ has been brought into the core of the campus according to the *School-as-a-Service* principle. In this way the children can interact with the environment in various university buildings instead of being concentrated in a single school building. This concept won the International Quality Innovation Prize in the category of education in 2016.⁴

Aalto University

Aalto University was created in 2010 by merging the Helsinki University of Technology, the University of Art and Design, and the Helsinki School of Economics. The objective was to create a single multi-disciplinary institution capable of benefiting from the synergies generated by the combination of diverse disciplines and approaches. The mission the government gave to Aalto University was to become the country's national 'innovation university'. (Markkula and Lappalainen, 2009) The university consists of six schools that are responsible for independently organising education and research in their academic fields within the framework set by the university-level policies, strategy, and the annual operating plan and budget. The university also has separate and shared units for arranging academic and service activities, and units operated jointly with other universities. The executive bodies of the university are the board and the president who in this capacity also acts as the managing director.

Aalto University is a (private) foundation based university. The capital of the university foundation was formed by donations of at least EUR 700 million. This capital was accumulated in stages between 2008-2010 by a government donation of EUR 500 million and donations of at least EUR 200 million from Finnish industries and other financiers. The total revenues of the university increased from EUR 394 million in 2011 to EUR 420 million in 2013 (ETER, 2016) in a context of generally stable university funding by the Finnish government (Eurostat, 2016). However, for 2015 Aalto University reports that funding received decreased to EUR 384 million in the context of government cuts in the research and development (R&D) budget. Between 2010 and 2015, Aalto University's funding through competitively allocated projects increased from 37.3 MEuro to 53.3 MEuro.⁵

³ Haukilahti Upper Secondary School, http://www.aalto.fi/en/about/for_media/press_releases/2016-08-12-002/

⁴ <https://www.qualityinnovation.org/participate-now/>

⁵ http://www.aalto.fi/en/about/reports_and_statistics/

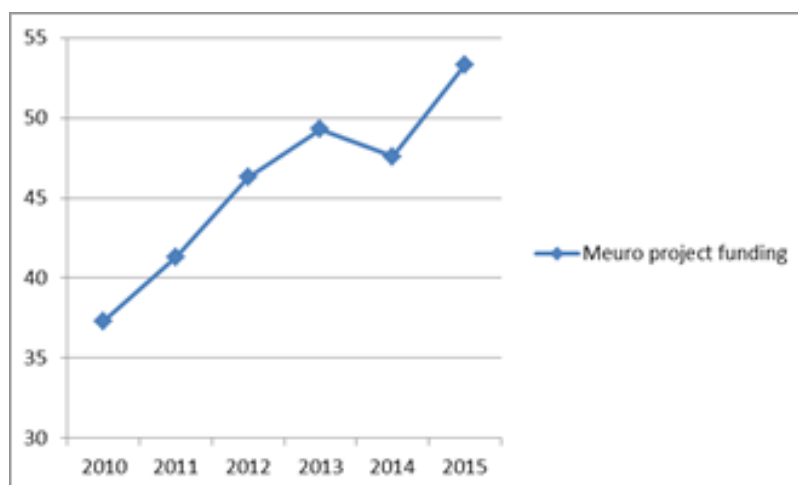


Fig. 2 – Aalto University revenues (Source: Aalto University, 2016)

The *University Reform* in 2010 was a key factor in facilitating the creation and development of Aalto University. The president of the university is appointed by a board representing stakeholders, remaining independent from the government and having a major leadership role. This external board is focused on ensuring transparency and social accountability. The appointment of the president by a board representing stakeholders, rather than an election by faculty, increases the president's independence from staff, but makes the president potentially more responsive to external stakeholders. Aalto University crucially relies on bottom-up initiatives from staff and students and thus relies on university leadership to facilitate this process.⁶

In 2013 Aalto University faculty and staff totalled around 4,970 full-time equivalent (FTE), 57% of whom academics (ETER, 2016).⁷ In 2016 the university reported that the number of staff had been reduced to around 4,000 in the context of budget cuts: this constitutes a substantial reduction whose effects on future performance are hard to predict.⁸ A tenure track system for university professors was introduced to attract the best talent from Finland and the rest of the world. Between 2011 and 2013 the share of foreign academic staff at Aalto University increased from 29% to 36% (ETER, 2016).⁹

Teaching in English at Master and PhD levels is now generalised through flexible interpretation of rules and has helped to attract young foreign researchers and entrepreneurial talent. The student body, totalling around 16,000 (ISCED5-7) is highly diverse with considerable intake of foreign students (around 27 % of master students in

⁶ The relative impact of different governance models on a university's entrepreneurial potential is a topic that will be explored in more depth in a comparative study into entrepreneurial universities to be carried out in 2017 by the JRC.

⁷ In 2015, the number of personnel employed by the University was 4,555. A total of 57% of the personnel were employed in teaching and research positions, 12% were degree students working as teaching and research assistants and 31% belonged to other personnel groups. In total 24% of the personnel were doctoral candidates. (Aalto University Annual Board Report 2015)

⁸ Comment: Sirkku Linna, Aalto University.

⁹ The University reports a somewhat different share of non-Finnish personnel: 23% (20%, 19%). Regardless of the exact percentage this indicates the strong international focus of the University.

2013 had foreign nationality) (ETER, 2016). The faculty has also managed to attract a strong international component largely thanks to a focus on recruiting new faculty members based on their expected potential for growth rather than documented achievement.

Research excellence is considered a critical factor to attract business collaboration with the university. Improvement of research excellence in Aalto University has been driven by an important turnover of faculty staff, as well as by the attraction of new teachers-researchers with high potential and an internationalisation of the staff. This has been possible after a legislative reform allowing the university to offer tenure track contracts to young promising staff. Building research excellence requires long term investment of resources and time (around 15 years) into the development of new research lines. However, Aalto University did not start from scratch being the result of a merger of three existing universities.

Over the past five years one observes a notable improvement in Aalto University's research performance both in terms of the quantity and scientific impact of its scientific research output. We observe that the total output has increased by 60% and that the average output paper receives between 20% and 86% more citations than the world average. For comparison, the Field Normalised Citation impact lays around 1.35 for Finland as a whole, indicating that Aalto University did not yet systematically outperform the average output of the Finnish research system in terms of citation impact.¹⁰ In spite of its staff reductions the university expects the number of articles and their impact to develop positively as it continues to implement its strategy.¹¹

Highly competitive research funding obtained by Aalto University increased by 12%, mainly due to an increase in funding acquired from the Academy of Finland and EU framework programmes. In 2015 Aalto University participated in seven national Centres of Excellence and two Academicians of Science worked at the University. The quality of research conducted at the University is also reflected in the fact that the University has 16 recipients of research grants from the European Research Council (ERC), six Academy professors, 36 Academy researchers, and 14 professors and fellows working within Finland Distinguished Professor Programme (FiDiPro). (Aalto University Annual Board Report, 2015)¹²

¹⁰ The year 2014 may be an exception or may eventually prove to be a first step in that direction. The university itself provides a field normalised citation impact score of 1.52 which would indicate it is above the Finnish average.

¹¹ Comment: Sirkku Linna, Aalto University.

¹² http://www.aalto.fi/en/midcom-serveattachmentguid-1e5f0e46065260cf0e411e58c514bbedbeb29782978/aalto_university_annual_report_2015_final.pdf

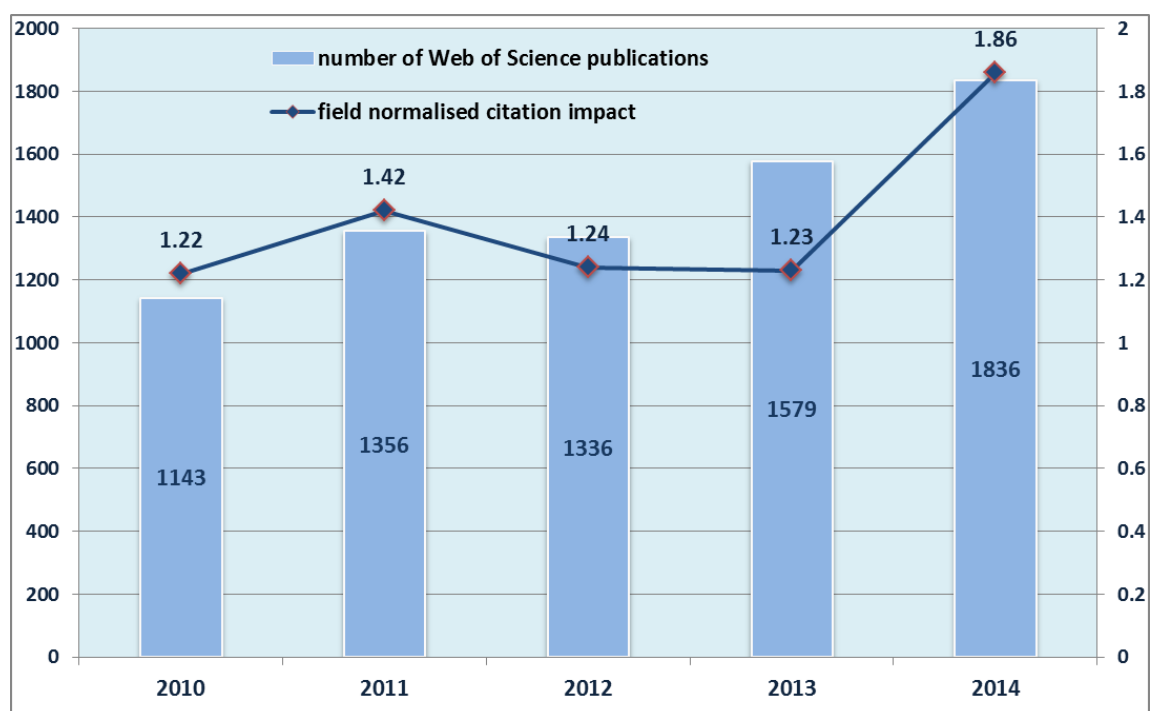


Fig. 3 – Aalto university publication output and impact (Source: Thomson Reuters INCITES platform, 2017)

The new mission of the university is to generate tangible societal benefits by focusing on translating research outputs into usable results to be exploited with an entrepreneurial vision in collaboration with multiple stakeholders. Following an international peer review assessment of its key strengths, Aalto University, in an interactive process with staff, decided to focus on four main *areas*:

- ICT and digitalisation;
- art and design;
- new materials and sustainable use of natural resources;
- business activities in a changing global environment.

These areas are complemented by three *cross-cutting themes*:

- human centred living environments;
- health and well-being;
- advanced energy solutions.

Several *multidisciplinary research platforms* focus on:

- energy;
- digital;
- living;
- health;
- materials;
- entrepreneurship.

The process of identifying priority activities for each platform is bottom-up, iterative and repeated annually.

Since 2010 the university has improved substantially its cooperation with the cities of the region and the business sectors focusing on inter-disciplinarity (science, art and business), excellence in research, tight industrial collaboration, start-up driven innovation ecosystem, and student participation (student-centric model). This in-depth change is taking place top-down through changes in the organisation of the different departments, and bottom-up with the active contribution by the *Design Factory*, the *Startup Sauna* and privately-run innovation and start-up actors such as the *Urban Mill* (all discussed below in more detail). The *Aalto Center for Entrepreneurship (ACE)* is another part of Aalto University. It connects the university entrepreneurship activities with the surrounding ecosystem of incubators, accelerators, and investors.

Finland has a binary university system, distinguishing between research universities such as Aalto and universities of applied sciences such as the Metropolia University of Applied Sciences that operates throughout the Helsinki/Espoo metropolitan area. The latter, being more applied in nature, are only in recent years expected to play an active role in carrying out research and innovation related activities. However, as suppliers of graduates they have also contributed to the vibrant Aalto University innovation ecosystem which is home to several higher education institutions of applied sciences — namely, the aforementioned Metropolia University of Applied Sciences, as well as Haaga-Helia University of Applied Sciences, Laurea University of Applied Sciences, and Omnia Institute for vocational education and non-formal adult education.¹³

Aalto student movement and Aalto Entrepreneurship Society

The movement of students and alumni of Aalto University and the Aalto Entrepreneurship Society (AaltoES) are widely credited with having been driving forces in the development of the Aalto ecosystem and will be discussed in different parts of the following section. Apart from the Startup Sauna and the Aalto Ventures Programme initiated by them, other AaltoES-based and student-led activities include the 'Summer of Startups' and 'Startuplifers'.

Startup Sauna

The Startup Sauna is a space (business incubator of sorts) offered by the university to the students to promote start-up creation. It is a laboratory where students can discuss and implement their business ideas in an open and creative space made available by the university. The Sauna is student led. It offers mentoring for competitively selected projects (summer school). A number of mentors including prominent entrepreneurs make their time available to come and coach the companies and entrepreneurs using the Startup Sauna. This has given birth to *Slush*, the most important start-ups event in Northern Europe

¹³ Aalto University works closely together with some of these universities. For example, its economics department has close collaboration both in teaching and research with the University of Helsinki and Hanken University based on a joint initiative — Helsinki Center of Economics Research (HECER) and its computer scientists collaborate with the University of Helsinki in the so-called HIIT: www.hiit.fi.

contributing to a significant increase in the number of students who consider entrepreneurship as a possible professional path. As of 2017 Startup Sauna also receives financial support from the City of Espoo and the Ministry of Economic Affairs and Employment.

Aalto Ventures Programme (AVP)

The Aalto Ventures Programme (AVP)¹⁴ was initiated by students and today is a major player in the ecosystem. During the first four years of its existence there were 2,080 individual students in its academic entrepreneurship and innovation programme, and 14,800 participants in its co-curricular entrepreneurial events. AVP is the nexus in the ecosystem, running joint courses with AaltoES, organizing events with Startup Sauna, running coursework together with Design Factory, and providing training on customer experience to all the 2400 Slush volunteers as well as leadership training to all Slush team leaders annually. The AVP provides Aalto students with the inspiration, capability and network necessary to build new scalable businesses. All Aalto University students can opt for a Minor study for their master's degree or can take individual courses as electives. AVP also organises study trips, support for teachers and various events.

Aalto Start-Up Center

Active since 1997, the Aalto Start-Up Center¹⁵ is Finland's largest business accelerator operating within Aalto University. It helps start-ups accelerate their growth with a combination of commercial, technical and design know-how. The Aalto Start-Up Center provides a wide range of development services for entrepreneurship, high-quality business advice, extensive networks of experts, as well as modern facilities. The accelerator cooperates with researchers, students, as well as corporate partners, cities, public and private organizations in strategic fields and has become an important actor of Finland's innovation ecosystem. According to recent surveys, approximately 30% of the Aalto Start-Up Center alumni companies are fast growing gazelle companies. The Aalto Start-Up Center success stories include companies like Rovio, Futurice, Fondia, Synoste, and Frogmind.

There are a number of other science and technology parks located right around Aalto University: The Life-Science Center, Keilaniemi Business Center, Innopoli 1-3 Technology Parks, Spectri Business Parks, etc. All these parks comprise hundreds of smaller and bigger companies, incubators, etc.

Design Factory

Multidisciplinary 'factories', of which the 'Design Factory' is the best-known internationally, are based at Aalto University's departments but are strongly tied to industry. In these 'factories' students with different backgrounds are brought together in multi-disciplinary teams to work on primarily externally funded design challenges.

¹⁴ <http://avp.aalto.fi/>

¹⁵ <http://www.start-upcenter.fi/en/>

A large number of external collaborations are in place (with Airbus, Audi, etc.). A number of networked design factories¹⁶ all over the world collaborate together and are connected through live video streams. The atmosphere is collaborative and informal with a very flat hierarchy and little in the way of formalised management and control structures.

Aalto University Innovation Services

Innovation Services¹⁷ is located in campuses in Espoo and Helsinki. Its objective is to identify commercially potential research results and inventions and transfer them to patents, licenses and start-ups. The commercialisation is performed in close cooperation with Aalto University's researchers and legal counsels.

Small Business Center

The objective of the Small Business Center¹⁸ as a separate department of the Aalto University School of Business is to promote entrepreneurship and provide diverse services to support the start-up, development and expansion phases of businesses. The cooperation with different departments of Aalto University enables the partner organizations to tap into up-to-date research-based know-how. The Small Business Center has been operating for almost 35 years. Its offices are located in Mikkeli, Helsinki, Saint Petersburg (Russia) and Tallinn (Estonia).

Aalto University Executive Education Ltd

As part of Aalto University, Aalto University Executive Education Ltd¹⁹ is an internationally recognized executive education and leadership development organization. The operations of Aalto University Executive Education Ltd provide a sizeable income to the university community in various forms such as dividends, tuition fees and rents. The organisation aims at market leadership in the Nordic countries and at consolidating its position as a major player among the best European business management trainers. The Aalto University Executive Education Ltd relies on the university's strengths such as entrepreneurship, design, innovation, research and development.

Urban Mill

Situated at the heart of Aalto University campus in Espoo Innovation Garden, Urban Mill is a public-private-people partnership run by a private company and the City of Espoo as one of the main partners. It defines itself as a 'Co-working and Co-creation Platform Prototype for Urban Innovations'.²⁰ Basically it is a physical co-creation and co-working space in a building owned by Aalto University

¹⁶ Design Factory Global Network (DFGN), <http://dfgn.org/>

¹⁷ <http://innovation.aalto.fi/>

¹⁸ <http://pienyrityskeskus.aalto.fi/en/>

¹⁹ <http://www.aalto.fi/en/about/contact/services/aaltoee/>

²⁰ <https://urbanmill.org/english/>

Properties Ltd and rented to an operator. It proposes itself as a human-driven and innovative built environment, and as a common, neutral platform for multiple operators developed collaboratively. It brings together different research and innovation actors, mostly involved in *built environment*, *ICT* and *urban services*.

The concept was piloted in 2013 close to Aalto Design Factory and the Startup Sauna. In 2015 the Urban Mill became fully operational. It brings together the urban environment, urban life and services connecting the expertise of different parties through ubiquitous ICT: researchers, innovators and users; municipal civil servants, corporate representatives, entrepreneurs, teachers, students, alumni, and citizens. In addition to being a meeting point and collaboration venue, Urban Mill is also a community and a service which actively networks with other thematic hubs and platforms. Urban Mill aims to help in creating user-driven, competitive concepts that are applicable to both existing and new areas e.g., integrating solutions to mobility and energy usage into urban planning. Also, joint ventures promoting well-being services, food ecosystems, organic food production, and smart networked spaces come into being. Students from different fields are connected to the activities through multi-disciplinary courses. All activities run in the Urban Mill are open so that there is a learning process which is mutualised.

Impact Iglu

Impact Iglu is a fast growing community that supports entrepreneurs who address societal challenges. It works with Aalto University's community and beyond, serving as a link between entrepreneurs and emerging markets so as to foster the creation of positive impact across borders. Impact Iglu organises community events such as 'fireside chats with entrepreneurs', 'impact business hackathons' and capacity development programmes for entrepreneurs and start-ups.²¹

VTT Technical Research Centre of Finland

Otaniemi is not only the part of Espoo in which Aalto University is based. It is also home to several other research and business facilities. It is the main site of VTT Technical Research Centre, Finland's largest RTO. VTT aspires to rely on an income distribution constituted by ~1/3 Government grant, ~1/3 competitive public project funding (national or EU funding) and ~1/3 business project funding. At present VTT has an annual turnover of around 250 million Euro of which 22% comes from private sources. It is the 5th largest recipient of EU Framework Programmes funding in Europe which accounts for 12 % of its budget (Zacharewicz, Sanz Menendez and Jonkers, 2017) and thus plays, apart from offering support to SMEs and larger firms, an important role in embedding the Aalto University innovation ecosystem in European networks. However, as will be discussed in Section 3.3, the government funding for VTT and Tekes — one of VTT's principal sources of project funding — has been drastically reduced. One of the biggest challenges for VTT is the

²¹ <http://impactiglu.org/>

rejuvenation of its workforce. It is aging as a result of a relatively high level of departures of promising young researchers.

On 1 January 2015, VTT began to operate as a non-profit, fully state-owned limited company. The objective for establishing this new organisational form was to simplify its organisational structure, and to improve the financial planning and business operation. VTT Ltd. continues to receive research funding from the government (OECD, forthcoming). It is currently going through a strategy development that has determined six broad 'lighthouse priority areas'. Within each of them it is in the process of identifying specific projects. The identification of projects is a complex process characterised by the following elements:

- Bottom-up. VTT teams are invited to suggest their ideas. It is not uncommon for research groups to propose continuation of ongoing activities. For this reason, particular attention is given to ideas that are at the interface between several disciplines/departments.
- Business input. VTT consults widely with industry, paying particular attention to ideas coming from start-ups and scale-ups. Large well established businesses (e.g. Nokia, Forest sector) proved less capable in the past of helping to identify new growth areas.
- Cooperation with Aalto University in areas where there are clear synergies (e.g. digital and bio-economy platforms). VTT already has formal collaborations with the university, for example through the jointly run Otanano²², Finland's National Research Infrastructure for micro- and nanotechnology, which explicitly aims to serve and support also domestic high-tech firms.

While VTT is the biggest research centre in the region, there are other public R&D facilities as well, including MIKES, Geological Survey, Micronova, and the CSC It Center.

Teke, the Finnish Funding Agency for Innovation

Teke, the Finnish Funding Agency for Innovation, is the most important public funder of innovation activities in the country. Apart from allocating R&D subsidies and soft loans for innovative activity, it provides fund-of-funds venture capital equity investments through *Teke Venture Capital*. Arguably some other Teke activities — e.g., its *Young Innovative Companies* programme — can be considered venture capital investments, even if Teke does not take an equity stake in its targets (OECD, forthcoming). The internationalisation of Venture Capital markets in Finland and cooperation with private VC investors had already been mandated to Finnvera and Tesi (Finnish Industry Investment Ltd) in the early 2000s, but they had limited success in doing this; students then made this happen themselves (a bottom-up process). This however may not have happened without public incentives for

²² <http://otanano.aalto.fi/en/>

young innovative companies like Tekes' YIC programme and combined public R&D funding.²³

Indeed, these funding instruments have had an important effect on the development of Espoo innovation ecosystem, in which government funding is viewed as a mark of quality and can facilitate the attraction of further private funding. For example, the successful Supercell company received the first few millions from Tekes to develop, but is now the biggest tax payer in Finland. It claims that it does not relocate its activities to another country in part out of appreciation for the support it received from the Finnish state. The CEO of Supercell, Ilkka Paananen, says that Supercell pays its taxes to Finland without any tax optimisation: 'We have received a lot of help from the society and now it is our turn to pay back'.²⁴ Tekes has funded the development of some of the central institutions in Espoo innovation ecosystem, including student's bottom-up initiatives as well as the cooperation between companies, universities and research institutes. In recent years, Tekes budget was radically cut.²⁵

Finnish Chambers of Commerce

The Finnish Chambers of Commerce operates as a decentralised network with each chamber enjoying a high degree of autonomy and discretion in its activities. Regional chambers of commerce work closely with regional and local authorities in the implementation of smart specialisation strategies.

In their representatives' view,²⁶ Finland will try in the future not to be over-dependent on one sector or company as was the case with Nokia: both the company and the country should have tried to diversify much earlier. However, the sale by Nokia of the handset business to Microsoft and the purchase of Alcatel-Lucent appear to have been a success. European firms will probably be unable to compete with Google, Facebook, and other tech giants. But they have a big opportunity in building B2B digital applications. The Future Internet Public Private Partnership (FI-PPP) is a very important actor in this area mobilising over one thousand companies. The German leadership with its Industry 4.0 initiative is proving very useful. The Finnish/German partnership in this area is also proving to be effective.

The Chambers of Commerce opine that the trend towards public funding of companies using financial instruments, e.g. loans, private equity, guarantee funds, etc., may be too strong. Grants can still be very powerful instruments as long as the related bureaucracy is

²³ Comment: Veli-Pekka Saarnivaara (JRC RIO expert and former CEO at Tekes). On ecosystem interactions, see for example (Huhtamäki, 2016).

²⁴ 'Yhtiön perustajista Mikko Kodisoja maksoi viime vuonna veroja 54,4 miljoonaa euroa. Ilkka Paananen puolestaan 54,1 miljoonaa' [English translation: 'The company's founders Mikko Kodisoja paid taxes last year for EUR 54.4 million. Ilkka Paananen, in turn, 54.1 million']. This quote is of potential interest in relation to Mariana Mazzucato's argument in *The Entrepreneurial State: debunking public vs. private sector myths, Anthem* (2013).

²⁵ Comment: Veli-Pekka Saarnivaara.

²⁶ As reported by JRC participants to Espoo-Aalto fact-finding mission, June 2016.

not too complex. For example, the light system implemented within the FI-PPP programme was highly appreciated by companies.

Venture capital, investors and serial entrepreneurs

Recent venture capital market statistics of the private equity industry provided by the Finnish Private Equity and Venture Capital Association (FVCA) show that the venture capital investments in Finland were 0.06% of GDP (2014). This is the second highest value among European member states.²⁷ Still it is rather low in a world-wide context (Gampfer et al., 2016). According to *Invest Europe 2016*, all private equity investments combined constituted 0.5% of GDP in 2015, which is higher than the EU average of 0.28% of GDP. In 2015, a total of 229 Finnish companies received private equity investment, out of which only 37 portfolio companies received later stage venture funding and 25 received growth funding. Yearly venture capital investments seem to be relatively high in Finland, but later stage private equity investment is generally considered to be more of a challenge, according to FVCA (Gampfer et al., 2016).

The European Investment Fund (EIF) plays a role in the financing of Finnish companies. One of its intermediaries in offering loan guarantee products is Finnvera, a specialised state-owned financial company, which provides financing for the start, growth and internationalisation of Finnish enterprises. Between 2011 and March 2016, the EIF allocated €170m to seven venture capital and private equity funds leveraging around €650m of investments to SMEs in Finland (Gampfer et al., 2016).

Besides the Tekes Venture Capital Ltd., the Finnish Industry Investment Ltd., a government-owned investment company, promotes entrepreneurship, employment and economic growth through venture capital and private equity investments. Sitra, the Finnish Innovation Fund, was founded as an organisation of the Bank of Finland in 1967. It is a strong expert formation, which combines the competences of the public and private sector. Sitra's funding consists of the returns of endowment capital and capital investments. In 2015 the market value of Sitra's endowment capital was €771m (OECD, forthcoming).

Large Multinational High Tech Companies

Nokia and Microsoft are internationally the best known, but not the only examples of large Multinational High Tech Companies with their R&D facilities in the Espoo region. Both firms remain important actors in the local ecosystem and have strong connections to the university. Nokia set up the AppCampus, an incubator to support promising ventures. In doing so, it decided not to take up Tekes' offer to match its 28 million funding in order to have greater freedom in deciding which firms to support. Another Nokia initiative, the Bridge Programme, is a career support programme that provides funding and loans to Nokia employees who set up their own firms. It continues to pay their salary for a certain period and provides 25,000-50,000 of seed funding and a similar amount in loans.

²⁷ http://www.fvca.fi/files/920/Pa_a_omasijoittaminen_Suomessa_2014.pdf

Especially with several former employees teaming up to start a venture this provides a good starting capital. The programme has led to the set-up of some 400 new firms between 2011 and 2013 (Halme and Saarnivaara, 2017). Microsoft Mobile was established in Espoo following the acquisition by Microsoft of Nokia's Devices and Services division (finalised in 2014). It established its own career support programme Polku. After a difficult period, Nokia returned to profitability and continues being an important firm in the ecosystem even if it now has a different business model based on licensing its intellectual property (IP) to other tech firms in Finland and abroad.

3.3. Contextual enabling factors

The central government has played an important role in the development of the Espoo innovation ecosystem. Around half of the R&D activities in Finland are undertaken in the 4km² Otaniemi area of Espoo. This concentration of R&D activities is built on decades of investment by the Finnish government in the national innovation infrastructure (Graham, 2014). In addition to Aalto University, Otaniemi is home to more than 25 other research centres and higher education institutions, including VTT Research, Mikes Metrology, CSC Supercomputing Center, Laurea University of Applied Sciences, Helsinki Institute of Information Technology (HIIT) and the European Institute of Innovation and technology (EIT) Digital (Graham, 2014). Also EIT Raw Materials Knowledge and Innovation Community (KIC) and its Co-Location Centre (CLC) in the Baltic Sea are located in this area. This concentration of Scientific and Technological Human Capital (Bozeman et al, 2001) and research infrastructures in the Otaniemi area of Espoo has been an important factor in enabling the emergence of the local innovation ecosystem. The same can be said for its long standing entrepreneurial culture. Indeed, Otaniemi was one of the forerunners in supporting university innovations and start-ups. As early as late 1990's (before Aalto) there were people working within the university to help innovators. They also had some financing at the time from the Finnish Foundation for Inventors and Tekes TULI instrument to evaluate the inventions and support start-ups.^{28 29}

Beyond the actors we have identified in the previous section as fundamental components of Espoo innovation ecosystem, the locality counts with some intangible assets that facilitated the emergence of the ecosystem. According to Graham (2014), one of them is a aforementioned culture of innovation and risk-taking rooted in the *student-led entrepreneurship movement* that emerged in late 2008 triggered at that time by the Helsinki University of Technology. This was motivated by a genuine desire to create a vibrant start-up environment irrespective of — at the time scarce — regional and university support for entrepreneurship and the rapid decline of private funding. Today experts identify the movement as a pillar of Espoo's emerging reputation as an entrepreneurial

²⁸ Comment: Kristiina Heiniemi-Pulkkinen (Helsinki-Uusimaa Regional Council).

²⁹ Also some of the institutional development sketched in the preceding section predated the foundation of Aalto University: *Start-up Center* was established in 1997 and *Otaniemi International Innovation Centre, OIIC*, in 1998 at the Helsinki University of Technology (Turunen, 2017).

environment, as well as the catalyser of a positive cultural change towards start-up activities and entrepreneurship. The movement was started by a small group of students who, through events and other activities, managed to engage the local start-up community and attract new students. Thanks to its *inclusive approach* towards any potential entrepreneur from Northern Europe and Russia, and the *operational support* of Aalto University, the Aalto Entrepreneurship Society (AaltoES), a not-for-profit student-run society with over 5,000 members from Aalto University and other Helsinki-based universities, rapidly scaled up. The *engagement of the local start-up community*, which the students managed to motivate, was essential to inform the vision of establishing Espoo as a key hub for *high-growth technology-driven entrepreneurship* within Northern Europe and Russia.

In addition, Espoo City has been successful over the last decades in attracting the *headquarters of large Finnish companies as well as subsidiaries of multinational companies (MNCs)*. Large companies operate as anchors of the innovation ecosystem, attracting SMEs and driving collaboration with the university. Companies have also been strongly involved in the set-up of Aalto University. Important investments have been made to improve the accessibility of the campus (metro and train connection to Espoo and Helsinki) and firms provided part of the endowment fund of the university.

Entrepreneurial spirit and participation of all actors (including students and citizens) is seen as crucial by leading organisations in the local context. Entrepreneurial education has become very important in Aalto University and not just in terms of start-up companies. It is more understood as something that encourages people to take responsibility and exercise leadership (entrepreneurial mind-set) in the execution of tasks and projects. Students participate directly in the functioning of the innovation ecosystem and one impressive success-story of their involvement was the creation of *Slush*, now a major international start-up event attracting thousands of actors from all over the world,³⁰ while the *Urban Mill* experience shows the importance of focusing on a common topic to generate a bottom-up/open/participatory innovation process that delivers successful ideas/solutions (in this case, the topic is urban management).

The entrepreneurial development of Otaniemi area takes place in an overall environment favourable for the financing of firms. The *Survey on the Access to Finance of Enterprises* (SAFE, 2015)³¹ shows that only 7% of the Finnish SMEs participating in the survey claim the access to finance to be the most important barrier, which is below the EU average of 10%. Similar results are reported in the *Survey of the Confederation of Finnish Industries* (June 2015)³², as well as in the *Business Outlook Barometer* (August 2015)³³. (Gampfer et al., 2016)

³⁰ This student-driven event is a showcase of Finland. The event has grown to 17,500 attendees and 1 million live stream viewers. In 2016 over 2,300 start-ups, 1,100 venture capitalists, and 600 journalists from over 120 countries came to SLUSH. However, the SLUSH event did not start out being a student initiative but - given the realisation that it was important to get students involved - the student entrepreneurship society was empowered at a later stage to take over the running of the event.

³¹ http://ec.europa.eu/growth/access-to-finance/data-surveys_en

³² http://ek.fi/wp-content/uploads/PKyritysten_toimintaymparisto_kesakuu2015.pdf

³³ <http://ek.fi/wp-content/uploads/SB-elo2015.pdf>

3.4. Regulatory and institutional enabling factors

Espoo/Aalto University ecosystem operates in the broader Finnish institutional and regulatory environment. The success of its development is partially a consequence of this broader institutional framework. Finland is considered to be among the five most competitive countries in the world in the areas of education, societal framework, health and environment, and technological infrastructure, but falls behind in factors related to e.g. the labour market, fiscal policy, employment, international investment and trade, as well as prices and public finance (IMD, 2016)³⁴. It has a strong overall performance in the *World Bank's Doing Business index*³⁵ (2016) and according to the Legatum Prosperity Index 2016³⁶ Finland has the best and most efficient public administration in the world. Nonetheless 9.1 % of Finnish companies consider inefficient government bureaucracy among the most important factors hindering business.

These firms consider excessive regulatory requirements as obstacles to growth and competition on some markets. In order to address this, the new government has set deregulation as one of its key priorities. Legislative amendments were passed in autumn 2015, and are expected to be implemented between 2016 and 2018. In comparison to other European countries the insolvency regulations in Finland, i.e. the time and costs involved in resolving bankruptcy as well as the recovery rate (how many cents on the dollar secured creditors recover from an insolvent firm), are already very well developed and efficient. Finland also has one of the most competitive *Small Business Act for Europe (SBA)* profiles. It performs above the EU average in six SBA domains. It is most competitive in 'second chance' and 'responsive administration'. In the majority of SBA areas, however, Finland's performance either stagnated or deteriorated compared to that of previous years. The decline was steepest in access to finance. The government has tried to counter this trend by introducing policy activities in these areas (European Commission, 2016)³⁷.

The introduction of a *new University Act* (2010) was essential to the establishment of Aalto University.³⁸ The change in the judicial status of universities led to their formal separation from the state and made them independent legal entities — public corporations or private foundations (like Aalto University). The financial autonomy of universities was increased and they became more independent from direct steering and control by the state (OECD, forthcoming). The approach taken for selecting the university president may have resulted in a greater potential for leadership by the university and its president, which they have used to facilitate and stimulate a number of bottom-up dynamics.

In contrast to general governmental R&D support, Finnish government expenditures on R&D in the higher education sector have remained relatively stable in recent years.³⁹ As was seen in section 3.2, Aalto University's budget increased partially as a result of an

³⁴ <https://worldcompetitiveness.imd.org/countryprofile/FI>

³⁵ <http://www.doingbusiness.org/data/exploreeconomies/finland>

³⁶ <http://www.prosperity.com/globe#FIN>

³⁷ <http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review>

³⁸ Though the process of establishing Aalto University preceded the 2010 act as it started in 2007-2008 (Jan Storgard, 2016).

³⁹ It may have decreased in real terms however.

increase in its success in attracting competitive project funding. A relative scarcity of funding could reduce a university capacity for strategic action. On the other hand some analysts argue that it can also be an external driver for universities to seek more contract research from outside firms and governments. According to the data collection in the PREF study⁴⁰, Finland's public allocations for R&D are made for 56 % and 44% in the form of institutional and project funding respectively. Already in 1994, the Finnish government introduced performance agreements with universities. The formula based allocation of competitive research funding system that was in place since 1998 was changed in 2010, in 2013 and again in 2015. The core funding of universities is based on a fixed formula. Before 2010, the key components of the system considered education indicators such as the number of degrees and PhD degrees awarded and the amount of funding generated from external sources including firms. In 2013, research output criteria were introduced and in recent years the employability of graduates is also being considered as an indicator.⁴¹ At present, the funding model for universities does not have strong incentives for activities related to entrepreneurship.⁴²

Finland is one of the few countries in the world with national guidelines for entrepreneurship education. Aalto University has made entrepreneurship education a very central part of its mission, dovetailing with the central role which student-led dynamics play in the local ecosystem. That the Finnish government ties the allocation of institutional funding to universities like Aalto University in part to its ability to attract third party funding and the employability of its graduates gives the university leadership additional incentives to actively engage with its innovation ecosystem and promote student entrepreneurship. In addition, such government policy can create an atmosphere in which universities and university staff are stimulated to seek engagement with outside partners.

Many brokers in Finland such as the Technology and Business Parks, business offices of municipalities, and business or start-up hubs of universities have a mandate to build public-private partnership networks. The network of Finnish Technology Parks⁴³ consists of about 29 technology or science parks around Finland. The largest are in Espoo and in Oulu (North Finland). Most of them support incubator activities for start-up or spin-off companies.

⁴⁰ CNR-IRCRES et al (forthcoming): data collected in the framework of a study funded by the European Commission (DG JRC) entitled 'Collection of public R&D funding data by theme and mode of allocation (project vs institutional funding)' by a consortium of contractors consisting of CNR-IRCRES, NIFU, AIT and the University of Lugano.

⁴¹ For a more detailed description of the Finnish Research Funding Allocation System see Jonkers and Zacharewicz, 2015. In 2015 the government approved the decrees related to *the revision of the university funding model*. Government appropriations will be directed especially on the basis of performance and quality. The new Universities Act (558/2009) and the use of the new funding model came into effect in 2013, and the model was updated in 2015. Further development of the funding model is intended to take force in 2017. The basic structure and emphases of the funding models will remain as before, but necessary adjustments will be made to criteria describing effectiveness, quality and internationality. Further information:

http://www.minedu.fi/export/sites/default/OPM/Koulutus/yliopistokoulutus/hallinto_ohjaus_ja_rahoytus/liitteet/uni_funding_model_2015.pdf

⁴² Comment: Veli-Pekka Saarnivaara

⁴³ TEKEL (Finnish Science Park Association), http://www.tekel.fi/in_english/

The 2010 University Act also marked a fundamental change with regard expectations related to the organisation of knowledge transfer in Finnish universities (Halme and Saarnivaara, 2017). Like in other countries (Germany, Austria, Denmark and Norway) the so-called professor's privilege was reconsidered. Instead of university academics, the university now holds the ownership of 'inventions made in externally-funded research, e.g., research conducted with funding from the major national science funding agencies, the Academy of Finland and the Finnish Funding Agency for Technology and Innovation (Tekes), or as commissions from industry and other societal partners' (OECD, forthcoming). The rationale for this reform was to encourage the universities to take measures for enhancing the commercialisation of research results. As the Norwegian experience shows, such changes do not always have this desired effect (OECD, forthcoming). In Finland, when universities have strengthened their knowledge transfer services and overall interest in these issues, the role of technology parks and various other ('semi-public') knowledge transfer intermediaries are reported to have decreased, and many of those have been closed down (Halme and Saarnivaara, 2017).

3.5. Formal governance model

The Finnish R&I governance model is centralised in terms of national guidelines, strategies and funding, but a mix of national and local administration allows regions a relatively high degree of autonomy in the design and implementation of regional policies. The R&I system is divided into four strategic and operational levels. Innovation policies and strategies are led by the Finnish government, which decides on national development goals and sets the general guidelines.

The Finnish government is guided in this task by the Research and Innovation Council along with the relevant ministries. Funding agencies, universities and research institutes have substantial freedom of creating and implementing their strategies. R&I policy has been increasingly connected with societal issues (e.g. globalisation, ageing, the environment and public health) that pose a challenge to growth and well-being. Such challenges can be tackled with public incentives for private innovation, public sector innovation (or public procurement), growth entrepreneurship, service innovation as well as user and demand-driven innovation. This policy framework also aims to support collaboration and engagement between the public and private sectors on these issues (Halme and Saarnivaara, 2017).

The Finnish Funding Agency for Technology and Innovation (Tekes) has played an important role in providing financial support to many of the activities of the emerging ecosystem (Graham, 2014). However, overall government funding for R&D has declined in real terms by 13% between 2010 and 2014. Especially institutional funding for VTT and the funding mandate of Tekes have declined: real governmental R&D investments to foster an industrial knowledge base and for the renewal of industries have dropped in four years by 35 %. For example, the volume of Tekes R&D grants for companies is estimated to diminish from the current €330m (2016) to €220m (2020). These cuts, combined with the

diminishing R&D investments of the private sector may significantly change the overall picture of the Finnish innovation policy during the next years (Halme and Saarnivaara, 2017).

One of the major changes initiated by Sipilä's government⁴⁴ is the *regional administration reform*, which is likely to have significant impact also on the implementation of research and innovation policy. According to the Government Programme, and as a part of the project *Regional Innovations and Experimentations (AIKO)*, the government will ensure competitiveness, promote growth, and use resources and expertise available in different parts of the country. Launching regional innovations and experimentations (AIKO) involves three tools:

- 1) measures for anticipated structural change (ERM),
- 2) growth agreements between the state and selected cities, and
- 3) establishing nationally important growth zones.

A total of €30m will be available for the measures in 2016-2018 - the period covered by the agreements (Ministry of Economic Affairs and Employment, 2/2016)⁴⁵. Financial support is provided for regional and industry-specific centres of excellence, and according to the Government Key Project, major investments by cities and municipalities (including joint municipal authorities) will be used as a testing ground for new innovations and model projects to promote exports. To support these efforts, a unit for innovative public procurement will be established. Tekes' *Smart Procurement Programme* will also be utilized to this end. The promotion of experimentation, local government leadership and public procurement of innovation will continue to remain important elements of the Finnish government in the new programming period.⁴⁶

At regional level, regional councils in Finland are formed by municipalities who are responsible for territorial development. Their plans and programmes are legally binding for local and national authorities who must take them into account in their own actions. In the case of Uusimaa, the Regional Council (formed by 26 municipalities out of which 14 are located at Helsinki metropolitan area) has set two R&I related regional strategies, the *Uusimaa-Programme* and the *Regional Smart Specialisation Strategy (RIS3) for the period 2014-2020*. Indeed, R&I is seen as a tool for *regional development* in the Helsinki-Uusimaa region. RIS3 is the process instrument to both promote innovation and to further develop the region.

⁴⁴ Juha Sipilä took office as Prime Minister of Finland on 29 May 2015.

⁴⁵ <http://tem.fi/en/regional-innovations-and-experimentations>

⁴⁶ The measures of a key project in the new government programmes which aims to introduce 'a culture of experimentation' are that: 'Legislation will be amended to facilitate experimentation, including the Local Government Act; obstacles to experimentation will be eliminated. A parliamentary advisory board will be appointed to promote experimentation. Public procurement will also be used as an active tool for promoting experiments and reforms. Setting up an experiment fund will be explored. Drawing on European structural funds will also be explored. The experimentation function would be responsible for the fund.' (Halme and Saarnivaara, forthcoming).

The priorities set under Helsinki-Uusimaa's RIS3 are:

- Urban Cleantech
- Human Health Tech
- Digitalising Industry
- Welfare System
- Smart Citizen

These priorities were selected and adopted through an entrepreneurial discovery process which proceeded in several phases as described in the following section. The strategy is currently being implemented in close cooperation with the innovation actors in the region (universities, research institutes, companies, municipalities) collaborating in joint thematic platforms which are action and collaboration-oriented: *action*, through project portfolios related to each theme; *collaboration*, through systemic orchestration and synergetic co-operation of all involved parties. RIS3 also contains an element of internationalisation which is considered essential for the success of the region.

The RIS3 strategy guides the regional financing granted by the Regional Council, as well as is a precondition for projects to get financial support from structural funds, which in turn is complemented with other (national and EU) funding sources. A Regional Cooperation Committee (known as MYR) is setup to follow up projects aligned to the *Uusimaa-Programme* and the RIS3, evaluating their actual contribution to regional development plans and providing feedback to the Council to eventually refine its RIS3 (Heiniemi-Pukkinen, 2015).

3.6. Quadruple helix

As said earlier, Uusimaa Region encompasses 26 municipalities, including 14 in Helsinki metropolitan area (one of which is Espoo), all them deciding their own priorities and local strategies. Additionally, the Helsinki metropolitan area has drawn up a joint competitiveness strategy which stresses the internal cooperation among municipalities, setting an agenda with common goals and the international projection of the region. Heiniemi-Pukkinen (2015) reports on the participative consultation followed. In it, a scenario planning process was combined with a future analysis. The latter was further validated through wide-scale participation by different parties and also citizens, using crowdsourcing as a working method. Other regions were consulted during the process as well. The opinion of specialists with different backgrounds (government, academia, business) were contrasted with the opinion of 280 participants in 41 workshops organised in a three-day seminar in view of the application to the national Innovative Cities Programme INKA.

With all those inputs, the Regional Council, in cooperation with the Centre for Economic Development, Transport and the Environment for Uusimaa, released the *Uusimaa Programme*. This step was preceded by another final round of interactions between

quadruple helix actors: municipal decision makers, regional development agencies, companies, educational institutions, third sector organisations and citizens. The programme includes a long-term vision and strategy as well as strategic choices for 2014-2017. The following step was to refine this programme through Entrepreneurial Discovery Process dynamics to realise the *Smart Specialisation in the Helsinki Region, Research and Innovation Strategy in Regional Development 2014-2020*. This is the RIS3 document that specifically defines the regional priorities, the implementation process and the international dimension. Through additional consultation with different stakeholders, the identified strengths of the regions led to the identification of the priority areas to be focused on during the current RIS3 programming period. These priorities are: Urban Cleantech, Human Health Tech, Digitalising Industry, Welfare City & Smart Citizen. The linkages of these priorities to RIS3 as a system can be seen in the figure below.

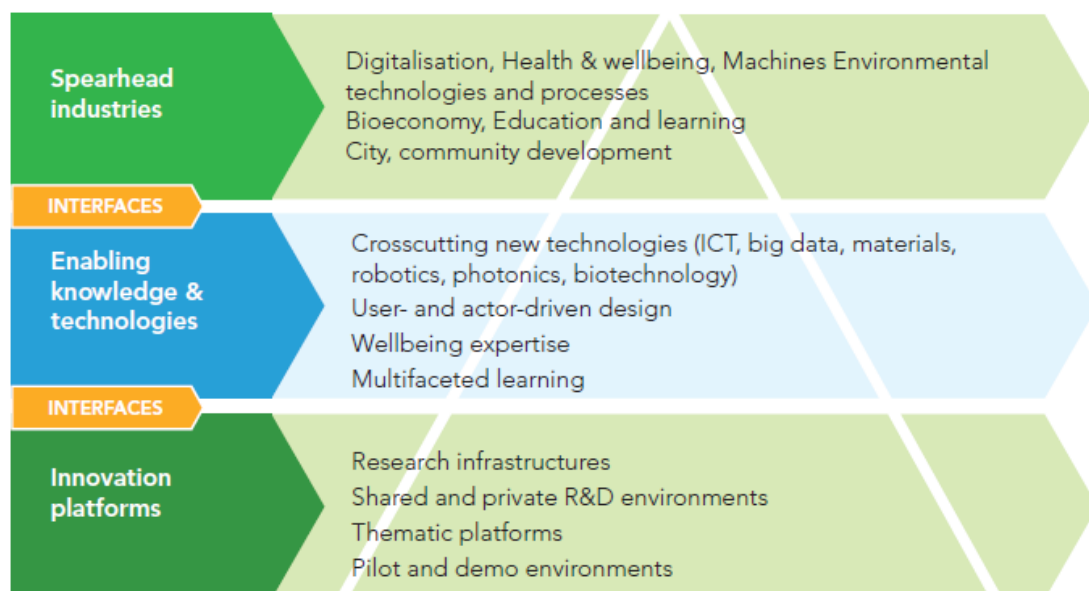


Fig. 4 – Helsinki-Uusimaa RIS3 concept based on systemic orchestration of all key innovation actors (Credits: Heiniemi-Pukkinen, 2015)

The target area (Espoo) is highly digitised, leading to opening up innovation processes, *open innovation*, and more broadly, a *democratisation of innovation*. Linear models of innovation are giving way to systemic and collaborative models that enable the inclusion of users from the very start of the innovation process, increasing the effectiveness of the impact generated by investment in R&I. The collaboration of all stakeholders under a quadruple helix paradigm (companies, research and innovation centres, the public administration and citizens) in the design and implementation of innovation strategies not only echoes democratisation, but makes strategies stronger in terms of adequacy to local needs and societal challenges, thus serving better the purpose of territorial socio-economic development.

Such a model requires the participation of the entire economic and social engine of the concerned territory, and enables the emergence of new, open and collaborative innovation

structures (living labs, fab labs, social innovation networks, open data labs, etc.), new types of work, and new economic forms (co-working sites, the circular economy and the collaborative economy, among others). The territories that are capable of building these new, more open and inclusive innovation systems have more chances to advance more quickly towards a smarter, more sustainable and inclusive growth model, with greater social cohesion and more and better jobs.

Espoo/Aalto University ecosystem seems to have realised this potential. Firstly, Espoo projects itself as a *pioneering society with a prototyping mentality*, capable of opening new space for energizing society and enhancing regional innovation, breaking silos and barriers to create new possibilities for thinking and acting. Local mentality assumes that things can be realised: things start up, some take off, some take time to develop and prove useful later, and others fail—but they *do start*. In particular Espoo, and more concretely the so-called T3 (Otaniemi-Keilaniemi-Tapiola), host of Espoo Innovation Garden, is one of the places where this mentality concretises ideas into projects and results, being recognised outside as a great entrepreneurial innovation benchmark in Europe. 'Opportunity capital is rich here, and enriches the world well beyond the physical borders of T3. (City of Espoo, 2013)' (Heiniemi-Pukkinen, 2015, p.16).

Against challenging and blocking situations, experimentation, new thinking and progress are fomented. This is not randomly happening, but devoted methodologies are developed ad hoc (e.g. ACSI-Aalto Camps for Societal Innovation) building on an army of well-prepared facilitators and pathfinders. Co-creative processes of learning-by-doing end up in promising solutions which are further tested in practice. Demonstrations of work-in-progress lead to deeper insights into what really works and what people really need. These solutions either concern new products and services or policies and possible futures that can be prototyped effectively. 'Prototyping is the key to innovation acceleration' (Lappalainen et al., 2015, p.38).

This action-learning approach also leads practitioners to scrutinise R&I processes in order to understand how processes work, to translate this into practice for supporting projects to work effectively, and to improve operational work practices. Research results are converted into practical solutions and interventions through rapid demonstrations and prototypes. This decreases the time required to move from ideas to market. It embeds user experience, while feeding a process of understanding through feed-back loops.

Prototyping and experimentation go beyond the boundaries of traditional labs to take place in the region as a real-life lab, involving the society at large.

Laboratories for research and innovation are no longer traditional university facilities, but regional innovation ecosystems operating as test-beds for rapid prototyping of many types of user-driven innovations: new products, services, processes, structures and systems which need to be transformative and of scalable nature. The new generation of innovation activities is a socially motivated and open innovation ecosystem, which is complex and global by nature and which exists thanks to the participation of all using the online community. (Lappalainen et al., 2015, p.17)

When coming to the role of society in the generation of innovation through collaboration and co-creation with the other actors of a quadruple helix model (i.e. government, R&I and

business), Finland is an exceptional country with several other concrete examples of initiatives to engage citizens in such a collaborative process. For example, *Reboot Finland* is a new joint activity by the Ministry of Employment and the Economy, Tekes, and Finpro to challenge companies, cities and public organisations to restart their services with digital services. Its 100 concrete actions aim to redefine public services with the help of clients, citizens, companies and public service providers. In addition, the Prime Minister Office announced in 2015 that the government will undertake studies of policies on the bioeconomy and clean solutions for use by government and ministries.

There is also a number of citizen-science initiatives, including *Open Science and Research*⁴⁷, a broad-based cooperation initiative (2014-2017) between ministries, universities, research institutions and research funders such as the Academy of Finland and Tekes, Finnish Social Data Archive (FSD), National Library of Finland, Federation of Finnish Learned Societies, FinnOA-the Finnish Open Access Working Group, CSC-IT Center for Science Ltd (Open Science); and *Open Knowledge Finland (OKFFI)*⁴⁸. The latter is a not-for-profit association founded in 2012 with more than 200 members, which represents the Finnish 'open'-scene including individuals, companies and other organizations. It is part of the wider international 'Open Knowledge network' and aims to promote the usage of open knowledge and to advance the development of an open society in Finland. It is also supported through *Open Citizen Science*⁴⁹, a project commissioned to Open Knowledge Finland by the Finnish Ministry of Education and Culture's Open Science & Research initiative, launched last August, which brings together open science and citizen science.

When thinking of citizen engagement in innovation it is worth reminding oneself that in addition to the ACSI methodology (created ad hoc at Aalto University, as detailed later), a myriad of 'lightweight low threshold' open innovation concepts and spaces (e.g. Urban Mill, Startup Sauna, Design Factory and others) have become increasingly popular in the region and in Finland. Finland incubated the living labs movement in Europe and the creation of its European Network of Living Labs (ENoLL)⁵⁰ a decade ago. Living labs are precisely those spaces that promote and facilitate the collaboration between quadruple helix actors to create, prototype, validate and test new products and services in real-life conditions. Such space can be physical or virtual, or a combination; it can be a single building (e.g. Citilab in Barcelona metropolitan area) or a whole city (e.g. Espoo).

A city as a living lab can promote collaborative innovation with different aims, comprising improvement of everyday activities and life conditions, creative consumer experiments, experimentation and implementation of new technologies, and creation or recreation of economic opportunities. According to Leminen and Westerlund (2015), the Innovation Garden in Espoo — as a living lab — enables all these four forms of collaborative innovations, orchestrating a network of platforms for collaborative innovation in the benefit of the four helices. Universities — Aalto University, but also Laurea University of Applied Sciences — are main orchestrators of the Innovation Garden. An indication of this orchestrating role is that Aalto University campus area hosts the Urban Mill, Design

⁴⁷ <http://openscience.fi/>

⁴⁸ <http://fi.okfn.org/projects/open-citizen-science/>

⁴⁹ <https://fi.okfn.org/projects/open-citizen-science/>

⁵⁰ <http://openlivinglabs.eu/>

Factory, Otasizzle, and Startup Sauna and that a number of living labs is hosted at the campuses of Laurea University of Applied Sciences.

To sum up, the four prior identified forms of collaborative innovations exist in Espoo Innovation Garden. Such collaborative innovations include (i) events for self-employment in Urban Mill at Aalto University, (ii) creative consumer experiments in cities with users and citizens as a part of living lab activities in Laurea Living Lab Networks (cf. Leminen, 2011), (iii) experimenting and implementing technologies at Otasizzle (cf. Tang, 2014), and (iv) opening up data and processes in Espoo (Erkkilä, 2014). (Leminen and Westerlund, 2015, p. 172)

Coordination and implementation

Synergies with knowledge stakeholders are augmented through meeting places and networks that facilitate a business project-oriented approach to open up to and surface the synergies their projects actually need. Interesting people and relevant ideas connect and feed into individual projects and the system as a whole, creating the synergetic effects on which innovation thrives. For example, Aalto University develops its premises as a collaboration hub, where collaboration includes not only cross-disciplinary interaction within the university, but also partnering within the physical ecosystem, which is called Aalto City. The university has invested into accommodating all its core functions in Aalto city. In order to enhance open innovation and encounters between people, the university activities mix with other uses and user groups. At the moment, the university is developing parts of the innovation ecosystem like a media centre, a 40,000 sq-m2 business centre, a shopping centre, and is co-creating a bio-economy centre, a student centre and lots of new housing in the area.⁵¹

Physical spaces for collaboration are amplified by virtual spaces like knowledge-sharing clouds, brainstorm-clouds, and experiential workshop spaces which allow creative encounters in real-time and virtual time to share, apply and co-create new knowledge essential to those projects, benefiting not only the latter but other knowledge stakeholders in the region and beyond. Still the importance of physical meeting spaces and prototyping together in actual places remains equally important, as Espoo innovation ecosystem demonstrated for example with Urban Mill (already presented) and Espoo's Metro line project. The latter is a major transportation infrastructure project (with an investment of around 1bn EUR) that links the innovation garden and other southern areas of Espoo with downtown Helsinki. In relation to that project the local municipality initiated a planning process called *West Metro Growth and Development Corridor* carried out jointly with Tekes, local industry, universities, and other stakeholders — including citizens. While using it as a test-bed to experiment and test new smart city business solutions, special attention was paid on stimulating global level start-ups, digitalisation, and other entrepreneurial developments.

⁵¹ http://www.aalto.fi/en/midcom-serveattachmentguid-1e5d3dab1d171d4d3da11e59ad5217242948c0f8c0f/aalto_university_strategy_2016-2020_web.pdf

For such kind of collaboration to be successful requires a solid foundation that provides the facilitating and enabling factors to empower innovation in practice: process tools, physical spaces, knowledge concepts, working methodologies, mind-set and attitude, the culture of creativity, new values and business models and more. While the business consortia driving the projects are free to exploit the innovations produced collaboratively in Espoo Innovation Garden, what is created within the ecosystem programme is a capital that remains in the ecosystem namely formed by the facilitators and enablers, the mind-set and methodologies, the process tools and knowledge concepts. These interactive and interdependent facilities belong to the entire ecosystem, and are available to all participants to use, learn from, add to and improve. (Markkula and Kune, 2015a)

To mobilise quadruple helix collaboration in virtuous cycles, devoted methodologies are highly recommended. With this scope, Aalto University led the creation of an ad hoc methodology called *ACSI-Aalto Camps for Societal Innovation* (see Fig. 5 below). An Innovation Camp aims to create a context where to build over the disposition of multiple stakeholders to innovate and collaborate — even if they are local competitors who can benefit from joining together international markets — and catalyse the power of collective/distributed intelligence for local development by means of a participatory, bottom-up approach which extensively relies on self-organising and rapid-prototyping principles (Rissola and Kune, forthcoming).

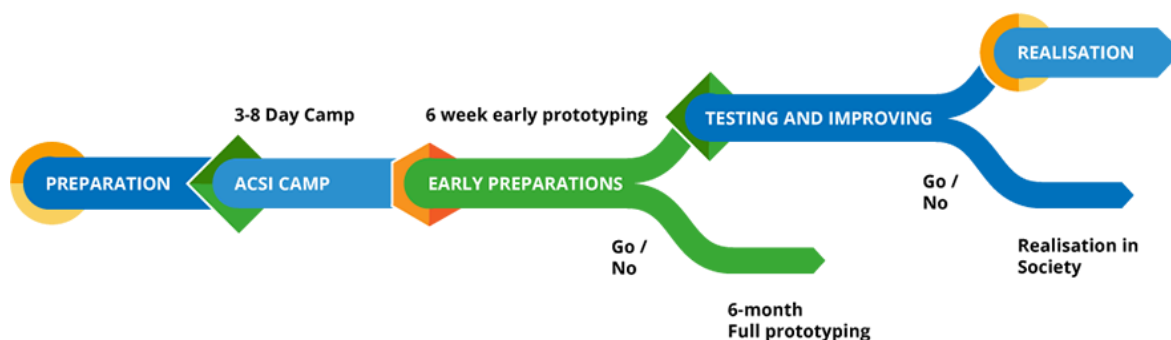


Fig. 5 – ACSI challenge-to-rapid-prototyping methodology (Credits: ACSI ESPOO 2015)⁵²

This original approach has been instrumental to two major achievements of Espoo, *Urban Mill* (instigated as a public-private partnership prototype in 2013) and the *Espoo Innovation Garden* (that we are analysing in this paper) as a preparation for EU Innovation Capital competition held in 2014 (where it was ranked 6th, Barcelona being the winner). Both were boosted by the series of ACSI camps organised in 2011-2012 to identify new solutions to strengthen the Espoo Innovation Garden located at the T3 area. New types of intermediary spaces (meeting points, venues) and services to support multiple stakeholders collaboration were envisaged and proposed there — an example of which was the *T3 Space Network Prototype* — together with the innovation 'garden' metaphor to refer to the

⁵² <http://impactiglu.org/acsi/>

ecosystem modernisation and enlargement to new actors (in an explicit attempt to evolve from a Triple Helix to Quadruple helix model) (Erkkilä and Miikki, 2014).

Closer in time, the ACSI 2015 organised by the European Commission, the Helsinki-Uusimaa Region and the City of Espoo (as a prelude to *EU Open Innovation 2.0 Conference*) invited participants to re-think the impact of innovation systems, strategies and practice, while working on actual real world challenges. As an example of quadruple helix cooperation for grand challenges one can consider the campers' cooperation on *West Metro corridor as a development zone for innovative urban solutions*. Campers reflected on how to use the Corridor as an opportunity to develop and test innovative solutions for energy, health-care, and citizen services. Coherently with the methodology orientation towards the production of prototypes as outcomes of the camp's collaborative work, challenge 1 on Espoo West-Metro Corridor as an Innovation and Business Zone generated four prototypes:

1) Citizen engagement and services

- creating shared identity for the city of Espoo together with the current and future residents
- testing new services and concepts with the citizens
- creating experiences out of local environments

2) New interfaces for participation and engagement

- different pop-up methods that the city and stakeholders can utilize
- a civic hub that engages citizens in conversation and co-creation
- stories and results made visible physically and virtually (Twitter, Facebook)
- iterative process for curating and implementing the ideas in practice, also taking into account the monetary incentives: from conversation to insights, action and innovation

3) Urban Planning

- 5-10 prototypes for testing new urban solutions, buildings and infrastructure
- different types of test areas: 1 brownfield, 2 greenfield and 3 greyfield planning, 4 energy-related areas

4) Wunderground

- using the underground system as a physical/digital test-bed for mobility applications, focus on digitalization and connectivity
- data collection, system of engagement

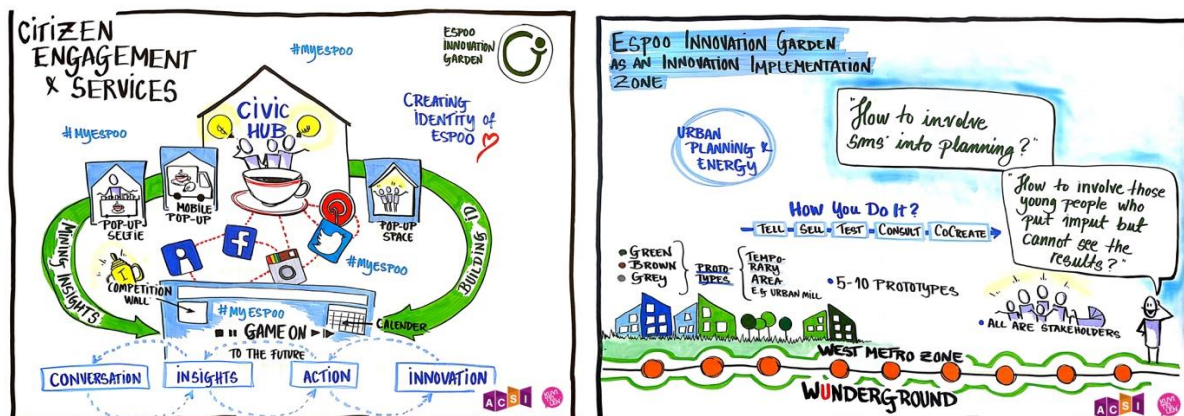


Fig. 6 – Prototype 1 'Citizen Engagement & Services' and Prototype 4: 'Wunderground' (Credits: ACSI Kuvitellen, 2015)⁵³

Consensus and commitment

Until now we have observed the centrality of an open entrepreneurial mind-set and a collaboration culture in the emergence of Espoo Innovation Garden. We have also learned how it is structured in a continuous entrepreneurial discovery process — a core element of smart specialisation strategies — that involves research, education and innovation — i.e. the knowledge triangle, which is smoothed by the methodologies of the ACSI Camp for Societal Innovation, itself a local creation pioneered and prototyped in the T3 area. In this systemic approach to innovation, the beneficiary area is not only the narrow area of T3 but also the city of Espoo and the whole Helsinki-Uusimaa Region, as well as the people making it happen — researchers, knowledge workers, civil servants who also benefit from it as residents living there. Therefore, the infrastructure they create supports themselves to face together today's challenges and create a sustainable, caring, tolerant and multicultural society.

Evidently, all these local features make consensus and commitment easier to reach, since there is mutual trust and benefit, and the involvement of stakeholders from all parts of the ecosystem leads to broader engagement in the prototyping, testing and improvement of new products and services, and eventually to their faster adoption and use. This clears the way forward for shared activities and mega-endeavours, involving all parties in the entrepreneurial discovery processes of experimenting, responsible risk taking and collaborative learning essential for innovation in the ecosystem. Moving beyond the Triple and Quadruple Helix models to true ecosystem thinking is the genuine vocation of Espoo Garden that is realising an Open Innovation 2.0 model 'based on extensive networking and co-creative collaboration between all actors in society, beyond organizations and beyond normal licensing and collaboration schemes...This creativity leads to connection, increased participation, active contribution and inclusion.' (Markkula and Kune, 2015a, pp. 17-19; Markkula and Kune, 2015b, p. 39).

⁵³ <http://rym.fi/results/aalto-camp-for-societal-innovation-acsi-2015-connecting-smart-citizens-in-open-innovation/>

3.7. Strategic choices and vision: orchestrating Espoo innovation ecosystem

Section 3.3 introduced the notion of 'innovation process entrepreneurs' who bring together the relevant actors and resources, and stimulate or facilitate them to succeed in innovation and their economic activities. Such actors develop mechanisms and initiatives to orchestrate the interplay of the different actors in the ecosystem. This does not necessarily involve top-down planning, rather it helps to create the bottom-up dynamics that were central to the evolution of the innovation ecosystem. Such orchestrating actors are also important for the governance of the different types of public-private partnership initiatives. In the development of Espoo innovation ecosystem there are (at least) three such actors. The first and central actor is Aalto University and its leadership. The second one is the local government (Helsinki-Uusimaa Regional Council and Espoo City). The national funding agency of innovation Tekes is considered by some to have also played an important role, though perhaps less as an orchestrating actor in the system but as a facilitating source of funding.

Markkula and Kune (2015b) identify three approaches universities (can) take to foster their innovation ecosystems: 1) *coaching*, 2) *fostering entrepreneurship*, and 3) *knowledge creation and dissemination*.

Universities play an active role in developing new scientific and technological knowledge through the R&D they carry out themselves. They also function as knowledge hubs scanning, capturing and translating knowledge created elsewhere. Finally and most importantly, as a core mission, universities educate people and prepare them for taking part in society and the economy by understanding, developing, adopting, using and disseminating the innovative insights, products and services into the place-based ecosystem.

As discussed in section 3.2, Aalto University plays an active role in developing relatively applied scientific knowledge contributing to the further development of the innovation ecosystem. The merger of three universities and the subsequent reorganisation around distinctive strengths is a strategic process that takes time, determination and vision by the university leadership. Vision and leadership is also required to bring along the university faculty and overcome personal and institutional resistance to change. As is common in such reorganisation processes, it has reportedly⁵⁴ not been easy for all faculties of the old universities to adapt to the new realities. Over time, also with the recruitment of new faculty members from within Finland and crucially also from abroad, there have also been changes in the university faculty composition so that it becomes more suited to the new structure and objectives. Time is needed for such a large scale reorganisation to bear all its fruits and for excellent new research lines to develop. If Aalto University in the short time that has passed since its creation has already succeeded in becoming the successful entrepreneurial university that it is made out to be, then further positive developments can reasonably be expected in the future.

Aalto University does not (only) generate new knowledge in isolation, but strongly engages in its research with industry and society. Its new campus was designed in a way that

⁵⁴ Anonymous response by a university faculty

facilitates personal contact and interdisciplinary exchange (e.g. all ground floors conceived as open-innovation spaces/labs). SMEs and start-ups are offered free office space (e.g. Aalto Industrial Internet Campus), in an attempt to bring them to the campus. In line with the prominence given to personal interaction, the concept of space management as a service is implemented on the Aalto University campus. (Rytkönen, 2015; Rytkönen et al., 2015) Examples of this are the Urban Mill, a privately operated space within the campus shared with the City of Espoo and with companies willing to contribute to innovation projects related to urbanism and especially Espoo challenges/needs, or the Startup Sauna, a space offered to students to promote start-up creation. There are also plans to share some of the campus facilities with primary and secondary schools, as well as kindergartens and services for elderly people in order to enhance liveability and encounters in the area. Other examples are the cross-disciplinary learning platforms called 'Factories' in which university faculty and students from different university departments work closely together with industrial collaborators.

The Aalto University leadership has been a vocal supporter of entrepreneurship since its inception. Its approach is to nurture entrepreneurial activity in its surroundings irrespective of whether the firms have spun out of university activities or not. Capacity building trumps income generation. The Aalto Technology Transfer Office (TTO) invests in IP creation within the university, and transfers the IP to spin-out companies as well as to other companies.⁵⁵ The university and its TTO are more focused on supporting regional start-ups and creating new business based on university research results than on securing IP and a return on investment (Graham, 2014). This may be a fruitful approach for universities to consider in general. Nightingale and Coad⁵⁶ argue that most (US) universities actually lose money on their technology transfer offices. The University of California system, which is among the most successful in the US in this respect, sees technology transfer as a service to society rather than a way to generate income. In line with the Finnish policy, the university owns IP generated in externally funded projects at Aalto University. However, the university grants ownership of the invention back to its inventors in most cases where it decides against further commercialisation. That is, in around 95% of invention disclosures. In industry funded projects the intellectual property rights are granted to the sponsoring firm when the project is completed (Graham, 2014).

Aalto University has played an important role in facilitating the development of the students' entrepreneurial movement described in section 3.2. Despite having no explicit E&I policy at the time, the university senior management supported the student-led entrepreneurial movement since its early beginnings in 2008, for example by providing public endorsement, financial help and physical space for its activities. Indeed, the university management created the conditions for the organic growth of the emerging ecosystem through a flexible approach which was adaptive to the changing conditions. It revealed to be successful when it was later institutionalised in 2010, when entrepreneurship activities started to spread beyond the students body and take root within the university-based E&I support activities, which, echoing the entrepreneurial students movement, ended with a focus on the creation of a regional hub for high-growth entrepreneurship supported by active partnerships with the existing local start-up

⁵⁵ Aalto TTO does not support start-ups financially.

⁵⁶ <http://quarterly.demos.co.uk/article/issue-2/innovation-and-growth/>

community (Graham, 2014). A number of university faculty members started to engage with both start up activities and entrepreneurship and innovation support activities. In 2012, the Aalto Venture Programme emerged from these activities offering entrepreneurship courses to students from all departments. In 2013, two Growth Entrepreneurship Professorships were appointed within the School of Science. As already pointed out in section 3.2, in 2013 the university established AppCampus with support from Nokia/Microsoft. This is a mobile application accelerator open to applicants from across the world (Graham, 2014).

Aalto University's senior management is seen to have been especially responsive to the ideas from the students movement, something which would have been less likely in a more established institution (Graham 2015). Another relevant lesson from this process can be drawn from the observation that the financial support which Aalto University has devoted to stimulating the students entrepreneurial activity is relatively modest.⁵⁷ Other universities in Europe may learn from this experience in the sense that even without great investment of financial resources university leadership can be in the position to play an important facilitating role for students' entrepreneurial activity.

The entrepreneurial spirit and participation of all actors (including students and citizens) is actually seen as crucial by leading organisations in the local context. It is important to realise that this was not a given in the Finnish context, in which the national culture was long considered to be unsupportive of risk taking and entrepreneurship. The main aim of most students used to be to work for government or big multinational companies such as Nokia. There had been also little tradition in entrepreneurship education in the universities that were merged to form Aalto University, as these had focused primarily on catering for the large tech firms (Graham, 2014). Since its inception however, entrepreneurial education has become very important in Aalto University and not just in terms of start-up companies. It is more understood as something that encourages people to take responsibility and exercise leadership (entrepreneurial mind-set) in the execution of tasks and projects.

Students participate directly in the functioning of the innovation ecosystem and one impressive success story of their involvement is Slush. The university leadership empowered the students movement and the *Aalto Entrepreneurship Society (AaltoES)* to take a leading role in organising and running this national start-up conference in 2012, which has quickly become a major international start-up event attracting thousands of actors from all over the world (Graham, 2014). Volunteering is a central part of student life in Finland and is much appreciated by future employers, which can be a feature that distinguishes Finland from some other European countries. The Urban Mill experience shows the importance of focusing on a common topic to generate a bottom-up/open/participatory innovation process that delivers successful ideas/solutions (in this case, the topic is urban management).

As said earlier in this section, the local government is another key orchestrator of Espoo innovation ecosystem, and perhaps the first one in time, as it enabled the emergence of Aalto University, the other key orchestrator. Local government refers here to the tandem of Helsinki-Uusimaa Regional Council and the City of Espoo.

⁵⁷ Personal communication by Jan Storgards (2016).

The whole region benefits from a rich concentration of test-beds, living labs facilities, datasets, user environments, experts and other resources, as well as a diverse set of stakeholders who are brought together with common objectives. The Regional Council has agreed on a set of regional priorities through consensus among member municipalities and productive collaboration with local driving actors. It is politically committed to realise these priorities which can be summarised as the ambition to become the region with the highest concentration of innovation activities in the Baltic Sea Region; that innovation serves the purpose of sustainable development; and that the region becomes carbon-neutral by 2050.

The collaborative processes put in place by the regional government have also led to a definition of the main political instruments to realise such ambition, the *Helsinki-Uusimaa Regional Programme (Vision and Strategy 2014; Strategic priorities 2014-2017)* and the *Regional Smart Specialisation Strategy (RIS3) for the period 2014-2020*. These complementary regional instruments are supporting the transformation of the territory into a strong regionally based innovation ecosystem, comprised of several networked locally based ecosystems, each focusing on specific business developments. The so-called Espoo Innovation Garden (i.e. a metaphor of Espoo/Aalto University ecosystem) is probably its most visible outcome, and is instrumental to the regional ambition. It flourishes in Otaniemi-Keilaniemi-Tapiola, a 4 km² area in Espoo which hosts one of the largest technology, innovation and business hub in Northern Europe. RIS3 provides the regional government additional support and collaboration opportunities to further growing this promising garden (Helsinki Smart Region, 2014).

The City of Espoo, in turn, supports its innovation garden by stimulating collaboration and co-creation between and within local communities through the provision of physical spaces and also financial support. The number of labs, co-creation spaces, incubators and accelerators have multiplied in the area to host over thirty recently established communities (e.g. EIT ICT Labs, Startup Sauna, Vertical Health Accelerator and RDI units of Huawei, Intel, and Samsung), with a special focus on *RDI to address societal challenges*. The City of Espoo is in very close collaboration with Aalto University with regards to, among other things, urban development, education, research, and Smart & Clean technologies, opening itself up as a piloting and research platform for the university. Espoo City is also a co-founder of Urban Mill, the public-private co-working and co-creation platform for urban innovations hosted at Aalto University campus. Espoo City also innovates in-door, having started its own project to apply design-thinking and next-generation digital tools to reinvent public services, making them citizen-driven (Committee of the Regions, 2016).

4. CONCLUSION AND NEXT STEPS

As explained in previous sections, Otaniemi-Keilaniemi-Tapiola is a 5 km² area in Espoo which hosts one of the largest technology, innovation and business hub in Northern Europe. It is a highly digitalised area, which hosts a society with open entrepreneurial mind-set, a collaboration culture and a prototyping mentality. The entrepreneurial spirit and participation of all actors (including students and citizens) is actually seen as crucial by leading organisations in the local context, something that was not a given in the Finnish context, in which the national culture was long considered to be unsupportive of risk taking and entrepreneurship.

Co-creation with citizens/users is increasingly being cultivated through open innovation methodologies (e.g. ACSI) and spaces (living labs, fab labs, social innovation networks, open data labs, co-working spaces), in a movement towards a systemic approach to innovation (i.e. ecosystem thinking) based in the conviction of local decision-makers that what is created within the ecosystem programme (facilitators and enablers, mind-set and methodologies, process tools and knowledge concepts) is a capital that remains in the ecosystem, and that shared activities and mega-endeavours requires all parties involved in an entrepreneurial discovery processes of experimenting, responsible risk taking and collaborative learning which are essential for innovation.

We noticed how the broader Finnish institutional environment, organised in four strategic and operational levels, combined with a legal framework moving towards deregulation, have conferred enough flexibility to innovation stakeholders (among which local governments, universities and funding agencies) to define and implement their own R&I agendas. At the same time innovation brokers were mandated to develop public-private partnership networks. As per the R&I agents (notably the universities), they benefited from a new University law, subsequent adjustments in the formula based allocation of universities' competitive research funding system, and the concession to universities & research centres of the ownership of inventions made in externally funded research, all this resulting in an increased participation in competitive funding projects and commercialisation of research results.

In this favourable context to innovation, we identified the 'innovation process entrepreneurs' as those who develop mechanisms and initiatives to orchestrate the interplay of the different actors in the ecosystem, including the governance of the different types of public-private partnership initiatives. In the development of Espoo ecosystem there are (at least) three such actors. The first and central actor is Aalto University with its leadership. The second one is the local government (Helsinki-Uusimaa Regional Council and Espoo City). The third one, rather as funding facilitator, is the national funding agency of innovation Tekes.

4.1 Conclusions

The aim of this study has been to identify key success factors in the development of Espoo innovation ecosystem, and the role of Aalto University as a key orchestrator of it. The success factors can be generalised as follows: 1) the historically evolved concentration of highly skilled human capital and research infrastructure in the region, including the ups and downs of Nokia; 2) the vision, political commitment and culture of collaboration of Helsinki-Uusimaa Regional Council and Espoo City, which together created the conditions for the ecosystem to flourish; 3) the emergence of a strong orchestrating actor (Aalto University), which, on the basis of a shared strategic vision, stimulates the synergistic activities of the various actors; 4) the strategic and cross-disciplinary thinking of the university management; 5) a local culture of innovation and entrepreneurship cultivated with the active support to the bottom-up drive for innovation in the university and the wider ecosystem; 6) a focus on the potential and capability of people in policies and programmes; 7) financial and policy support from the central government (including Tekes) and other actors (including Nokia); 8) the successful involvement of serial entrepreneurs in financing and mentoring further start-up activities.

The intellectual power of the region, as well as significant material resources were channelled into building an internationally renowned centre of higher education, science and entrepreneurship in Espoo. Aalto University is a unique institution within a very distinctive national innovation system. It was formed from an amalgamation of well-established institutions, each with a strong vocational orientation. It can be considered a 'new' 'old' university, which, rather than changing a conservative established capital city university, has been able to build a new organisational model. Its location on a large greenfield site —with abundant space to set up ventures like the Aalto Factories — within a new town on the edge of a rapidly growing capital city region was not an indifferent enabling factor. It has made attraction of international investors and academic staff easier than elsewhere in Finland. The large endowment to establish the new institution and greater autonomy than established Finnish Universities through a university foundation made it easier to concentrate on capacity building in the innovation ecosystem with less pressure on short term income generation. Another important element was the support received from actors in the long established Finnish innovation system, particularly Tekes with its distinctive model of funding companies to reach into the university research base — a demand pull rather than supply push model — and the network of regionally orientated universities of applied sciences. (Goddard et al., 2016)

The combination, good balance and interaction of top-down and bottom-up initiatives, based on open innovation and entrepreneurial education have been vital for the development of the ecosystem orchestrated by Aalto University together with the regional government and the City of Espoo, a model that has not evolved linearly. Experts argue that it could have been faster if the university, a key driver, would have had more resources for activities related to entrepreneurship and commercialization. Indeed, Universities' funding models in Finland includes very weak incentives for that, a weakness partially mitigated for several years by Tekes funding of Aalto University entrepreneurial structures and student's bottom-up initiatives. This funding source was dramatically cut

recently. For Aalto University, the experiment has also faced challenges which broadly relate to the tension between building a scientifically highly rated institution whilst at the same time engaging with the wider society, as there might be dangers of the former ambitions driving out the latter.

Aalto University and the innovation system it belongs to are the result of the close cooperation and partnership among strategic actors from the university, the business community, the state and local authorities as well as civil society groups. The synergies built strengthen a continuous entrepreneurial discovery process (EDP) where new ideas are born, new activities emerge, excellent scientific results are achieved, which are further utilised in industry. RIS3 is a useful resource to consolidate the local EDP process, but surely not its initiator. A remarkable feature of the Aalto enterprise is the bottom-up movement, which is supported and further promoted by university leadership. The ability of the university governance to listen to the students' opinion and ambition has paved Aalto University's way to success.

This case study of Espoo innovation ecosystem and the pivotal role played by Aalto University helps to define a conceptual framework for a comparative analysis of place-based innovation ecosystems and entrepreneurial universities which will help us to assess the validity of the identified success factors. This case study already provides a number of benchmarks in assessing the performance of the universities and their advance towards entrepreneurship and innovation, as well as the maturity and cohesion of place-based innovation ecosystems and their critical role as enablers of continuous entrepreneurial discovery processes in which a wide range of stakeholders participate through 'quadruple helix' collaborative relations.

4.2 Next steps

The JRC is planning two research lines for the period 2017-2018 where the present case study will fit in and expanded. These are briefly introduced below. Where possible the units will seek synergies and draw on each other's work.

Place-based innovation ecosystems

This research line aims to study the place-based innovation ecosystems in a set of regions which are comparatively advanced in terms of their regional smart specialisation strategies (RIS3) plans, notably in terms of adopting a quadruple helix stakeholder model. Such analysis will aim to understand their specific contribution to make their region's innovation plans to succeed, investigating their key enabling factors, drivers, dynamics, governance and sustainability, as well as mapping in a relational model the diversity of intermediary institutions and places making part of, as well as their interlinks and ecosystem orchestrators.

As the Committee of the Regions envisages, cities and regions are called to lead dynamic urban and regional innovation ecosystems:

Creating jobs and sustainable growth are key challenges for Europe. Boosting competitiveness is an essential requirement and depends largely on promoting innovation, creativity and entrepreneurship, a task in which cities and regions have a crucial role as lead partners in dynamic regional innovation ecosystems. (C. Buchmann, Chair of the Commission for Economic Policy, Committee of the Regions, 2016).

This research work will produce sound evidence on the role that a territorial innovation ecosystem can play to develop a culture of innovation and an entrepreneurial mind-set, especially when facilitating and taking stock of bottom-up processes and shifts from technological to social innovation, enabling the transition from a triple to a quadruple helix model, or from a knowledge economy to a knowledge society. On top of traditional (triple helix) knowledge brokers such as Higher Education Institutions, Research Centres and Technological Parks, this approach requires a thorough analysis of emerging territorial innovation enablers like Regional Clusters (e.g. Lapland) or a whole range of grassroots co-creation spaces which encourage citizens' innovativeness such as maker spaces, fablabs, living labs, co-working spaces or new digital and media labs (e.g. Catalonia).

This WP builds over the work carried out under the S3 platform, notably in support of the Entrepreneurial Discovery Process that calls for strong multi-stakeholders engagement as a pre-condition for successful implementation of regional operational programmes. Coherently with the nature of the studied subject, a continuous stakeholder consultation process (including EU and regional policy makers) will be activated - from setting the scene to outcomes validation. Intermediate and final outcomes will be presented and discussed regularly in S3 events and beyond.

In addition, the case of Alto will be instructive for the JRC's project on Higher Education for Smart Specialisation that was launched in 2016. In collaboration with DG Education and Culture, the project analyses how universities and other higher education institutions can be better integrated into the policy mixes of smart specialisation strategies. The role of entrepreneurial education in building a regional innovation ecosystem around Alto provides a good example for other places in Europe, since many regions focus disproportionately on the research activities of their local universities while forgetting their core mission of nurturing talent, creativity and skilled graduates.

Entrepreneurial Universities

This project aims to study why some national institutional frameworks are more conducive to the evolution of entrepreneurial universities than others. The expectation is that university autonomy and the national incentive system in place in a given country are among the main variables affecting the potential for universities to evolve into more strategic actors. The presence of other actors, such as technology intensive multinationals, that co-evolve with the universities is also expected to be important.

A first step in the operationalisation of this project is to come to an operational definition of entrepreneurial university and to explain the broad differences in the strategies of 4 different types of universities (research universities; universities that co-evolved with high tech multinationals; polytechnics and teaching universities) to become more 'entrepreneurial'. In developing this definition the JRC will closely link to the work carried out by the OECD and DG EAC in its work on the HEInnovate tool.

From here the project develops two lines of work. The first is a comparative, mainly qualitative, case study analysis of a restricted set of universities. The second is a more quantitative analysis of a larger sample of European universities drawing on data from the European Tertiary Education Register (ETER), U-Multirank and other data-sources.

Combining the quantitative and qualitative analyses the JRC aims to identify which types of universities are more and which are less successful in becoming like an entrepreneurial university and why some national institutional frameworks are more conducive to the evolution of universities into entrepreneurial universities than others?

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List of figures

Figure 1. Model for building innovation ecosystems (Credits: Oksanen and Hautamäki, 2014).....	9
Figure 2. Aalto University revenues (Credits: Aalto University, 2016).....	14
Figure 3. Aalto university publication output and impact (Credits: Thomson Reuters INCITES platform, 2017)	16
Figure 4. Helsinki-Uusimaa RIS3 concept based on systemic orchestration of all key innovation actors (Credits: Heiniemi-Pukkinen, 2015)	31
Figure 5. ACSI challenge-to-rapid-prototyping methodology (Credits: ACSI ESPOO 2015)	35
Figure 6. Prototype 1) 'Citizen Engagement & Services' and Prototype 4: 'Wunderground' (Credits: ACSI Kuvitellen, 2015).....	37

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