Orchestrating Regional Innovation Ecosystems

• Espoo Innovation Garden

Editors Pia Lappalainen & Markku Markkula & Hank Kune



Orchestrating Regional Innovation Ecosystems

Espoo Innovation Garden

Orchestrating Regional Innovation Ecosystems

• Espoo Innovation Garden

Editors Pia Lappalainen & Markku Markkula & Hank Kune













Orchestrating Regional Innovation Ecosystems
– Espoo Innovation Garden

This book was created as a part of the EKA C (Forerunner Area Helsinki Region) project, financed by the European Regional Development Fund, Laurea University of Applied Sciences, Aalto University, City of Espoo, and Helsinki-Uusimaa region.

Editors
Pia Lappalainen, Aalto University
Markku Markkula, Aalto University
Hank Kune, Educore BV

Publishers
Aalto University in cooperation with Laurea University of Applied Sciences and Built Environment Innovations RYM Ltd

Graphic design
Juha Pitkänen, Taivaankaari Oy., Finland

Illustrations
Jari Kiviranta, Aalto University and Juha Pitkänen

The research findings described in most of these articles are part of the Energizing Urban Ecosystems research programme in 2012–2016.
The programme is organized by RYM Ltd (see rym.fi).

This book has been partly financed by
the European Regional Development Fund.

Printed book ISBN 978-952-60-3701-1
Electronic book ISBN 978-952-60-3702-8

Printed in Finland
Otavan Kirjapaino Oy
2015

Contents

Pia Lappalainen
Editorial 7

Jukka Mäkelä, Ossi Savolainen
Foreword 9

PART I FRAMING THE REGIONAL INNOVATION CHALLENGE

Markku Markkula, Hank Kune
1. From Research to Reality 15

Markku Markkula, Hank Kune
2. Energizing Urban Ecosystems EUE Research Program 2012–2016 23

Kristiina Heiniemi-Pulkkinen
3. Helsinki Regional Development: RIS3 as the Process Instrument 43

Markku Markkula, Hank Kune
4. Towards Smart Regions: Highlighting the Role of Universities 51

PART II THE HUMAN PERSPECTIVE ON INNOVATION ECOSYSTEMS

Timo J. Hämäläinen
5. Governance Solutions to Wicked Problems: Cities and Sustainable Well-Being 71

Antti Hautamäki, Kaisa Oksanen
6. Sustainable Innovation: Competitive Advantage for Knowledge Hubs 87

Kim Smith, Anna Maaria Nuutinen, Charles Hopkins
7. The Promise of RCEs: Collaborative Models for Innovation, Sustainability, and Well-Being 103

Markku Lappalainen, Pia Lappalainen
8. Nurturing Multidisciplinarity to Promote Espoo Innovation Garden 121

Kristiina Erkkilä, Lars Miikki
9. Aalto Camp for Societal Innovations ACSI 137

Elmar Husmann
10. Entrepreneurial Discovery: we.learn.it 151

PART III INCREASING INNOVATION CAPITAL

Seppo Leminen, Mika Westerlund
11. Cities as Labs: Towards Collaborative Innovation in Cities 167

Atso Andersen, Riina Subra, Annukka Jyrämä, Hank Kune
12. Aalto University's Open Innovation Ecosystem in a European Context 177

Erkki Hämäläinen
13. Experiences of a Professor of Practice at Aalto University 191

Pentti Launonen
14. Determinants for Orchestrating Open Innovation Networks 199

Jari Handelberg, Riikka Kuusisto, Toni Pienonen, Mervi Rajahonka
15. Co-Creating Synergy: Learning-Driven Regional Development 209

Teemu Ylikoski, Elina Oksanen-Ylikoski, Laura-Maija Hero
16. Educational Organizations as Co-Developers in the Helsinki Region 221

Heikki Rannikko, Leena Alakoski, Johanna Lyytikäinen
17. InnoEspoo: Integrating Entrepreneurship and Education 233

Anikó Kálmán, László Farkas, Donát Dékány
18. Budapest BME: Developing a Student Innovation Ecosystem 241

PART IV OTANIEMI IN TRANSITION

Antti Ahlava
19. Participant Interests in Developing Aalto's Otaniemi Campus 259

Sirkku Wallin, Aija Staffans
20. From Statutory Urban Planning to Living Labs 269

Eelis Rytkönen, Suvi Nenonen, Robert Eriksson
21. Scaling Business Opportunities to Facilitate Mobile Knowledge Work 281

Katri-Liisa Pulkkinen
22. Sustainable Campus Founded on Social-Ecological Synergies 297

PART V DIGITALISING CITY DEVELOPMENT PROCESSES

Taina Tukiainen, Päivi Sutinen
23. Cities as Open Innovation Platforms for Business Ecosystems 313

Pekka Sivonen, Antti Korhonen
24. AppCampus: Faster Business Acceleration through Vertical Focus 323

Sanna Ahonen, Aino Verkasalo, Kaisa Schmidt-Thomé, Simo Syrman, Raine Mäntysalo
25. Multiple Facilitation Roles by the City: Emerging Electric Vehicle Platform 337

Hannu Hyyppä, Juho-Pekka Virtanen, Marika Ahlavuo, Tommi Hollström, Juha Hyyppä, Lingli Zhu
26. Regional Information Modeling and Virtual Reality Tools 349

Hans Schaffers
27. Experimenting with the Future Internet for Smarter Cities 365

Moving Forward 375

Heikki Hartela, Tero Vanhanen, Peter Vesterbacka, Illustrations on interleaves
Visualised Future of Keilaniemi A Global Startup Village

Editorial

This is an exceptional publication, and a good illustration of how ecosystems work in practice. It presents the results of many months of cross-border and interdisciplinary teamwork, which is now ready to be shared with a wider public.

This project once again shows how contagious good ideas can be and how inspiring minds work. Markku Markkula, the recently elected President of the EU Committee of the Regions, was the motor behind this book, and his idea of documenting the successes, challenges and practices of Espoo Innovation Garden quickly gained momentum, and attracted the attention of a growing group of innovators in Finland and abroad. Fuelled by the shared understanding that smaller- and larger-scale innovations are happening all around us, every day, the seeds of Espoo's innovation ecosystem described in this book have eventually grown to encompass an entire community of innovation professionals, all targeting shared goals with both individual contributions and common efforts.

What we witnessed in Espoo was the beginning of an innovation ecosystem, and we can read about it here. One of its concrete results is in our hands now, and of course the full story is still unfolding, as the research and practice described here continues and is further applied, producing new outcomes which are experienced on the streets of Espoo and in the practice of organizations throughout Finland, Europe and beyond. This is what happens when individuals and organizations with common interests and shared intent put their heads and hands together: they start to resonate, prosper and thrive, complementing each other's capabilities, learning from one another, and driving new practice.

The story of this book is a journey—from project to ecosystem, from ecosystem to innovation, from research to practice, and from research and practice to a book about how it works. It is a commendable journey, with enough lessons for innovators across Finland and Europe to inspire journeys of their own.

The merit for this publication therefore goes to our authors. My heartfelt thanks to them for taking us on this journey.

Pia Lappalainen
Doctor of Science (Tech), M.A.
Lecturer, Aalto University



Foreword

Two thirds of the people in Europe already live in urban areas. Global megatrends like aging, environmental concerns and urbanization call on all of us to turn these challenges into opportunities. This cannot be accomplished by one country, region, city, university or company alone; but by thinking and working together, in the spirit of benchlearning, open innovation and crowdsourcing, we can change the world. This book is a good illustration of putting this mentality into practice.

The Helsinki-Uusimaa Region is among the most prosperous and growing metropolitan areas in Northern Europe. The region is the centre of Finland's economic activity. Its strengths include skilled people, a research and education environment of high international quality, a versatile business landscape and the basis all these create for innovation. There is a high concentration of large companies and small- and medium-sized enterprises (SMEs) in the area—both Finnish and international ones. The region's industrial structure is extremely versatile. We have four scientific universities, seven universities of applied sciences, and several state research institutes. There is plenty of start-up and spin-off activity in the area.

Urban Cleantech, Human Health Tech, Digitalising Industry, Welfare City, and Smart Citizen are the five key strengths of Helsinki-Uusimaa region. These are also the priorities chosen for our smart specialisation strategy. By cooperating regionally, nationally and internationally, we aim to improve our strengths, combine our skills, and create diverse applications for newly discovered solutions. Our region is strongly committed to sharing our strengths with other European regions in joint R&D partnerships, promoting entrepreneurship, developing smart city solutions and promoting the renewal and growth of SMEs.

Espoo Innovation Garden is one of the European forerunners in innovation. The heart of our Innovation Garden is in the Keilaniemi-Otaniemi-Tapiola area, which is the home of Aalto University, VTT Technical Research Centre of Finland, and the headquarters of companies like Kone, Fortum, Neste Oil, Rovio and Nixu, among many others. It has the hottest Startup Sauna on the planet, inspiring cultural and sports activities, as well as a renowned community of scientists and researchers. The area has a strong international character, thanks to more than 100 different nationalities that are working, studying or living there.

Innovation Garden is an open network of residents, companies and communities. One does not even have to live or work in Espoo to join this initiative as an innovation gardener. Anyone can become a gardener—science and research organizations, companies, cultural and sports organizations, city employees, students and residents. Bringing the mindset of collaboration, co-creation and open innovation is a must. The youth, with their slushes and entrepreneurship societies, are staying ahead of the game, transforming the change in mentality into difference-making, concrete action.

Espoo's success in the European Commission's first call for the European Capital of Innovation in 2014 inspired the gardeners to continue cultivating the soil to make it an even more fertile ground for growth and innovation. Encounters—planned or serendipitous—between people and ideas are a continuing source of inspiration and new experiences.

This book tells stories about these encounters. The storytellers are enthusiastic innovation gardeners who share the dream of providing Europe with innovative solutions for good and sustainable living environments, and opportunities for businesses to grow and prosper.

Jukka Mäkelä
Mayor, City of Espoo

Ossi Savolainen
Regional Mayor, Helsinki-Uusimaa Region

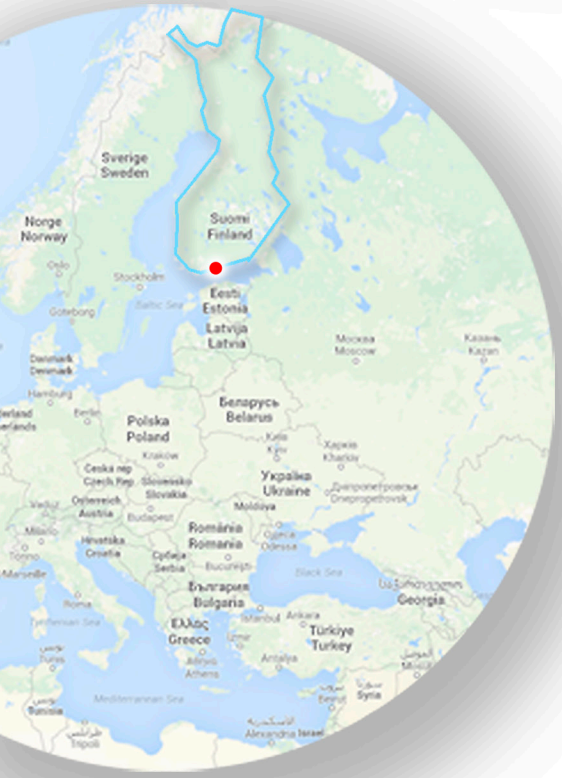


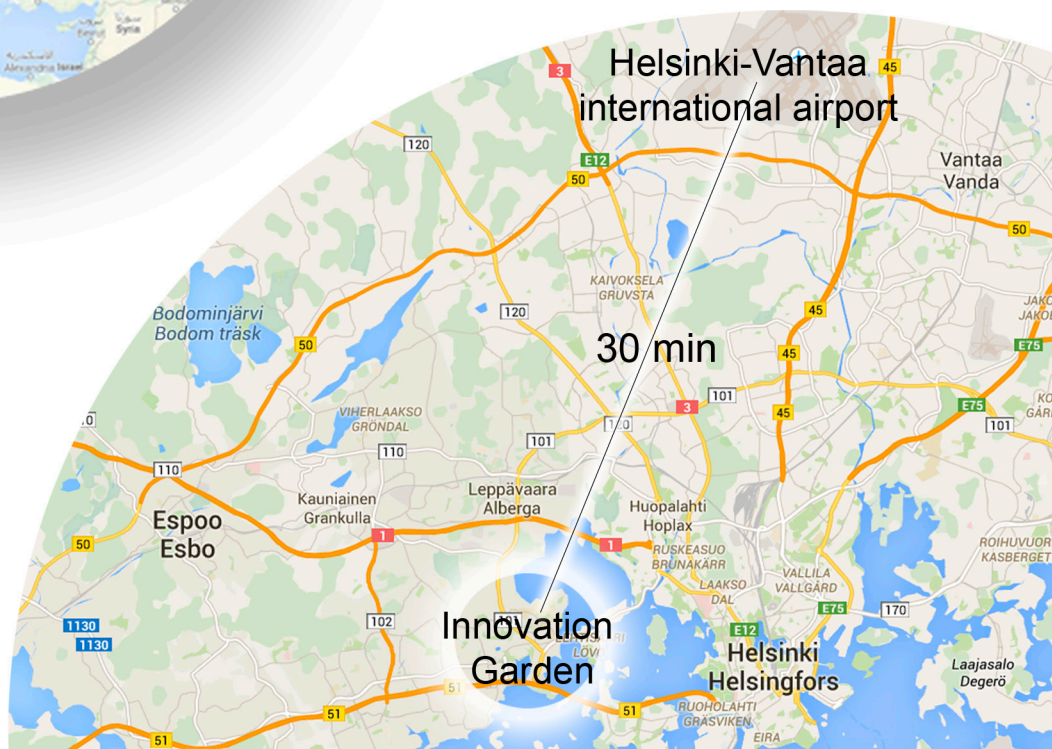
A GLOBAL STARTUP VILLAGE

OUR PLANET IS spinning, circling and moving with a remarkable speed. The same applies to economics, globalization and politics.

THIS CHALLENGE, called change, is the opportunity of a lifetime. The best cradle for it is the Innovation Garden in Espoo, an ecosystem where everything in life can flourish.

FROM A GLOBAL viewpoint, this platform is located in Finland, at the prime junction of the Eurasian world. This is the best location for a Garden of Innovation to grow and prosper. On the following pages we will show the huge potential of this unique garden from a developer's perspective.





A UNIQUE WATERFRONT ROUTE

GLOBAL HEADQUARTERS, dozens of startups, a competitive university, a green garden city, sport centers, wild birdlife, fishing, and forest experiences—all these along one vivid waterfront.

IN THE FUTURE our children can play in this pure and safe environment and develop into healthy zero-carbo-diginatives.

DOZENS OF NEW highlights are under development along the route. Together these projects make the Innovation Garden stand out among all other places in the world.

CURRENTLY IN THE conceptual development phase: new 100 000 sqm startup village, thousands of housing units and numerous Eurasian company headquarters.



I
FRAMING THE REGIONAL INNOVATION CHALLENGE



The first chapter of our book opens the curtains to show the activities of regional innovation ecosystems by presenting their central philosophies, policies, instruments and spearhead projects. **MARKKU MARKKULA** and **HANK KUNE** start off by describing how one of Europe's most vibrant innovation areas , the Helsinki Region and within it the Espoo Innovation Garden, have set out to leverage regional renewal capital by means of cutting edge research programs. **MARKKU** and **HANK** continue in the second article by showcasing an example of such programs; their account of the Energizing Urban Ecosystems program demonstrates one way of building future city ecosystems. **KRISTIINA HEINIEMI-PULKKINEN** illustrates how the smart specialisation strategy is implemented in regional development and land use planning through the collaboration of local and national authorities. Finally, **MARKKULA** and **KUNE** conclude this section by proposing ways in which universities could promote smart regions.

Markku Markkula
Advisor to the Aalto Presidents
Aalto University
markku.markkula@aalto.fi

Hank Kune
Societal Innovation Coach
New Club of Paris
hankkune@educore.nl

1. From Research to Reality

1. Introduction: Infusing the Region with Knowledge

It is evident that Europe's future prosperity depends on its ability to leverage the renewal capital of its organizations, regions and citizens. This book illustrates how one of Europe's key pioneering regions is getting the job done.

Helsinki Region is an innovation-driven society. It engages in diverse and consistent activities to increase its intellectual capital, conducting groundbreaking research and creating conditions to apply this in practice. Within the region, the City of Espoo is especially active in undertaking initiatives to create more value for its citizens and the business community. Espoo Innovation Garden is a shared mentality and set of concepts demonstrating how regional innovation ecosystems works in practice, and—proactively learning through doing—defining how to orchestrate the ecosystem to realize the shared goals and collective ambitions of its business, academic and governmental partners, and ultimately to benefit all the people who live and work there.

Through the Energizing Urban Ecosystems (EUE) research program and diverse other research programs in the region, a growing body of knowledge and practice is being developed for others to share, adapt, apply, and improve. Partners in the regional innovation ecosystem—universities, business, government, NGOs and citizens—are involved in an ongoing science-society dialogue, translating knowledge into practice and research into reality. By continuing to ask questions about the role of innovation capital in regional well-being, about the importance of people, prototyping and digitalisation in development processes, and about ways of orchestrating a well-functioning innovation ecosystem, the region is using the provisional answers to drive its urban development processes, discovering new evidence-based answers to support the provision of services to its stakeholders, and at the same time learning how to contribute to well being in a world without borders.

This book is about groundbreaking research and how that research is being put into practice. It describes pioneering and prototyping activities realizing both local objectives and diverse EU innovation policy targets. The region recognizes and actualizes the Committee of the Regions' call in its Opinion on **Closing the Innovation Divide,** that "the key success factor in regional innovation strategies is effectiveness in bridging the gap between existing global research knowledge and actual regional practice. Structures and processes in cities and regions must be developed, even radically changed, in accordance with the latest research results."(Committee of the Regions 2013). In this sense, this publication can be of inspiration and value for other urban and regional development activities across Finland, Europe and the wider world.

2. Main Themes of the Book

The book presents a variety of perspectives on how research is applied in real world practice. Diverse initiatives in Espoo Innovation Garden, the Helsinki Region (and even further afield) are described here in the 28 articles that are grouped into five chapters:

1. Framing the regional innovation challenge
2. The human perspective on innovation
3. Increasing innovation capital
4. Otaniemi in transition
5. Digitalising city development processes

Together, they offer a broad view of how EUE and other research is being used to create a vibrant innovation garden. 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. "It is one of those places where things are **possible,** not (as it seems in so many other places) impossible. There is a prototyping mentality here: things start up, some take off, some take time to develop and prove useful later, and others fail—but they **do** start. Espoo—and especially T3 (Otaniemi-Keilaniemi-Tapiola)—is one of the great entrepreneurial innovation benchmarks in Europe. In conversations about societal innovation projects throughout Europe, people often know that something special is going on in Finland—and it usually turns out to be happening here. Opportunity capital is rich here, and enriches the world well beyond the physical borders of T3." (City of Espoo, 2013)

All across Europe, regions are taking up the **challenge** of creating pioneering cities and regions, and maintaining the momentum of continuous development and

improvement. In transforming the Espoo Innovation Garden area, several challenges and opportunities are being addressed. 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 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. European regions should move towards open innovation, within a human-centred vision of partnerships between public- and private-sector actors, with universities playing a crucial role. This means modernizing the traditional Triple Helix model of academia, industry and government. This way the area will further evolve as a regional innovation ecosystem, which serves its actors, activities, and events and its external stakeholders. Special emphasis is on how Espoo Innovation Garden can become a global pioneer as a societal innovation test-bed. (Helsinki Smart Region, 2014)

As the CoR Opinion on Closing the Innovation Divide indicates, "Regions need new arenas as hotspots for innovation co-creation. These could be described as 'innovation gardens' and 'challenge platforms', which together form prototype workspaces for inventing the future. These are needed to address challenges — from small local challenges to major societal challenges at global level. RDI activity is therefore required that will pilot and create prototypes of (1) spatial configurations with physical, intellectual and virtual dimensions, and (2) the orchestration and knowledge management toolkits needed to address challenges." (Committee of the Regions, 2013)

This is clearly recognized here. And when looking at the **human perspectives** in innovation ecosystems, we see how 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 is an excellent demonstration of the Open Innovation 2.0 approach recommended by the European Commission's Open Innovation Strategy and Policy Group (OISPG), who see open innovation as an innovation model based on extensive networking and co-creative collaboration between all actors in society, beyond organizations and beyond normal licensing and collaboration schemes. OISPG believes that collaboration from a broader spectrum of people brings much more creativity to work processes across the board.

This creativity leads to connection, increased participation, active contribution and inclusion.

In open and participative innovation processes, ecosystem participants experience multiple gains—business can develop the scalable product and service solutions that users want, the public sector can provide effective and affordable solutions to regional challenges, citizens share ownership of the specific, often highly personalized solutions they need, and universities can actively contribute knowledge and reap new knowledge and insights in return.

Mutual trust 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. This is evident in Espoo Innovation Garden, and demonstrates how the region is moving beyond the Triple and Quadruple Helix models to true ecosystem thinking. The illustration shows one such mega-endeavour, the West Metro linking the innovation garden and other southern areas of Espoo with downtown Helsinki. This major transportation infrastructure project, with an investment of close to one billion euro, is an example of effective collaboration within the innovation ecosystem.



Figure 1. West Metro creates a growth and development corridor in Southern Espoo

Increasing **innovation capital** is essential for enhancing the quality of life in the region. Over the past decade, a new economic landscape has been emerging, based on intangibles, knowledge assets and intellectual capital. This evolution toward knowledge as a key factor in economic and social well-being is being incorporated into new steering and governance initiatives in both the public and private sectors. The importance of fostering **regional renewal capital**—the capacity of a region to utilize its human, structural and relational capital in order to foster continuous learning, innovation and development, in order to sustain its competitiveness and quality of life even in changing conditions—is an important measure of resilience, vitality and fitness for the future.

In their paper prepared for the Committee of the Region's Innovation Union Conference in 2013, The New Club of Paris described national innovation capital as "the source or **intangible ecosystem** for national economic wealth, growth, human de-

velopment, and quality of life," indicating a direction for making "guided decisions about the effective investment and development of national intangibles in the era of the knowledge economy." Summing up issues to consider for vitalizing European Renewal Capital, they conclude that Open Innovation 2.0 is the core concept for reparadigming regional renewal and development, and suggest:

- Supporting Open Innovation 2.0 developments to create favorable conditions for increasing Renewal Capital of the regions, for example, through innovation gardens and challenge platforms;
- Mobilizing activities for societal innovations, such as ACSI (Aalto Camp for Societal Innovation);
- Organizing more cross-European Partnerships that proceed along these lines, i.e. regional innovation ecosystem initiatives such as the Danube Region activities, the [kind of] three-city/region collaboration resulting from ACSI, and the Digital Agenda Futurium;
- Increasing cross-cultural and cross-generational innovation alliances, especially with Asia.
- Initiating more regional PentaHelix prototyping to ignite regional agility and cross-disciplinary effects; in other words: visualize the growth of Renewal Capital as early as possible.

  (Lin et al, 2013)

Finally, we understand that **digitalisation** is a central process in urban development, and recognize the need to build it into diverse regional processes, prototypes and experiments. Designing a digital region means making full use of the state-of-the-art processes, software and technology available, and discovering how to apply them in practical real-life contexts. Working proactively with emerging new concepts now—for example, 3D regional information modeling, the Aalto AppCampus, and Slush—and the people who make them possible—means we will be able to make full use of them in providing state-of-the-art urban planning in the future. Learning how to leverage the broad range of existing and potential resources to actualize the Helsinki Region Local Digital Agenda and the Espoo Innovation Garden is in itself an entrepreneurial discovery process. And, in many ways, one key to effective ecosystem orchestration. The challenge is to engage urban planners to realize Local Digital Agenda objectives which create value for people, and at the same time prototype new models for pioneering digital regions. Digitalisation feeds the future.

3. The Openness of an Open Innovation Garden

Espoo Innovation Garden sees innovation as key to its further development, and its ability to create excellent quality of life within the ecosystem. This cannot succeed

without good connections to similar European initiatives. Europe's future is connected to its power to innovate. It has long been evident that if European companies are to remain competitive in the global economy, EU public policies should focus on creating an environment that promotes innovation. Europe has long lacked an internal market for innovation, where it can pool resources for research and innovation.

The Innovation Union, a European flagship initiative for creating an innovation-friendly Europe, was created to address this. It is one of the seven flagships developed to spearhead actions for realizing the Europe 2020 strategy, which aims to create smart, sustainable and inclusive growth. Innovation Union activities are intended to create the kind of innovation-friendly environments in which ideas grow and become products or services that benefit economies throughout Europe. It aims to revolutionize the way the public and private sectors work together, notably through innovation partnerships, which aim to tackle the major challenges facing our society.

In the proceedings of the CoR Conference on the Innovation Union, speakers outlined observations and recommendations for Europe 2020. Only four Member States could be labeled as **innovation leaders.** One tenth of EU regions, 30 in total, are responsible for 40% of EU research. Given this innovation gap, regional innovation support programs should be better tailored to meet each region's specific assets and strategies. There is a need to increase European renewal capital, following the Open Innovation 2.0 approach, focusing more on multidisciplinary and multicultural collaboration, mobilizing activities for societal innovations and organizing more cross-European partnerships. (Committee of the Regions, 2014)

In order to tackle issues like these, the Committee of the Regions recommends that regions and cities should create pioneering initiatives that are genuinely European in nature: multicultural, human-centred, focused on societal innovations and capabilities to create better structures for the welfare society. This is not always easy to do, as some of the stories in this book describe. But as the Opinion on **Closing the Innovation Divide** stresses, "We cannot address societal challenges through minor adjustments and conventional management methods. Boosting renewal capital is critical to success: creativity, innovation and the confidence to innovate and reform are also the keys to success for local and regional decision-makers." (Committee of the Regions, 2013)

The success of orchestrating innovation ecosystems depends on learning from practice. Putting research into practice shows what can be done, and what should—or should not be done—to increase the effectiveness of the ecosystem. As indicated in so many cases across Europe, we recognize the importance of experiments, prototypes, and action—a culture of doing things and learning-by-doing that goes beyond plans and papers to actualize promising ideas in practice. This is the doing way, and the learning way, and the way forward for European regions, both for the pioneers, the innovation builders, and the regions of opportunity.

Research in Espoo Innovation Garden is not conducted as separate projects for their own sake, but to understand how processes work, to translate this into practice for supporting projects to work effectively, and to improve operational work practices in WPs and projects. In order to develop valuable business output and

first-mover advantage, it is important to apply research results in practical solutions and interventions. Rapid demonstrations and prototypes of relevant research will decrease the time required to move from ideas to market, and creates new research openings based on user experience. At the same time, these demos will feed the process of understanding.

Espoo is an innovation garden and it is still learning how to leverage this metaphor in practice. The gardening metaphor was developed during ACSI in 2012, became a central metaphor at the Brussels Innovation Union Conference in 2013, and formed the basis of Espoo's i-Capital of Europe application in 2014. It is fertile ground for sowing the seeds of transition and change, but people here know that even on fertile ground, nothing worth harvesting grows without gardeners. People are needed to prepare the ground, to plant the seeds, and to care for them throughout the growing season. The garden must be watered, weeded, and maintained. And caring for the soil is also a long-term investment. Activities proceed with an eye to what happened last year, and what the intentions for the next years are. Otherwise, even fertile soil will not support the harvest forever.

So it is not about tomorrow—everybody is concerned about that—but about what comes after tomorrow, and what comes after that. And extending the metaphor, the ecosystem must be orchestrated. Innovation gardening is about leveraging the power of entrepreneurial imagination, facilitating people and organizations to make new things effectively in the face of the unknown. It is about leveraging the sense of opportunity and people's passion to commit to and drive the innovation process, not only as leaders but as followers too, contributing what is required at the moment it is needed, or anticipating the need and providing it beforehand. It is not about optimizing the system, but changing the game.

Orchestrating innovation ecosystems is about both research **and** society: conducting the research, having access to the results, understanding the implications, and ultimately putting the research into practice. Planners, project managers and politicians knowing that the answers relevant to their challenges are available, and about researchers understanding the challenges and problems of planners, project managers and politicians, and organizing research to address them.

This is the dance of research and practice, the science/society dialogue that Europe needs, and it is being practiced here: this is how putting research into reality creates value for society.

How can we contribute to well-being in a world without borders? By embracing the provocative questions, the difficult challenges, and the disruptive nature of modern society; by translating them into research questions, conducting the multidisciplinary research, and applying it in open innovation ecosystems. By infusing the region with knowledge, tending the fertile soil, and enabling things to grow.

Helsinki Region, and in particular Espoo Innovation Garden, are doing this, and in doing so they hope to attract the talent, investments and best partners they need for important co-creation activities in the future. The book will realize its main objectives if the articles contribute to:

- encouraging more people and organizations in the Espoo area to actively enter and participate in Espoo Innovation Garden
- helping potential partners understand what is happening here
- inspiring similar initiatives in Finland and Europe
- building more practical knowledge of know to orchestrate regional innovation ecosystems.

This will support Espoo and Finland in playing a lighthouse function for Europe: providing a source of illumination for regional innovation ecosystems and a source of direction, learning and energy for society.

References

City of Espoo i-Capital application documents (2013). T3-Espoo Innovation Garden "T3's Champions".

Committee of the Regions. (2013). Opinion Closing the Innovation Divide, CdR 2414/2012 final, (Official Journal of the European Union, 30.7.2013).

Committee of the Regions (2014). Innovation Union: The Contribution of Europe's regions and cities (Proceedings of the conference of 27 November 2013). Available at: www.cor.europa.eu/europe2020.

Helsinki Smart Region. (2014). Pioneering for Europe 2020, Second Edition,(4.6.2014), Helsinki-Uusimaa Regional Council.

Lin, Carol Y.Y., Edvinsson, L., Ståhle, P. (2013). What National Intellectual Capital Tells…. Paper prepared by New Club of Paris for the Innovation Union Conference at CoR.

About the authors

Markku Markkula is the President of the EU Committee of the Regions (CoR) since 12.2.2015. He has been a member of CoR from 2010, being the Rapporteur on several opinions related to topics such as Europe 2020, digitalisation, single market, as well as research and innovation. His experience includes memberships of several High Level Expert Groups. He is a member of the EU Smart Specialisation Mirror Group.

Mr Markkula works within Aalto University as the Advisor to Aalto Presidents, focusing on European Union strategy affairs. His previous work experience includes Directorship of the Lifelong Learning Institute Dipoli and the Secretary General of the International Association for Continuing Engineering Education IACEE. He is a former member of the Finnish Parliament (1995–2003). As an MP his international role included the Presidency of EPTA Council, European Parliamentary Technology Assessment Network.

In the Helsinki Region, he is a Board member of the Regional Council, and the chair of the Steering Board making decisions on the use of Structural Funds. He is a longstanding Espoo City Council member, as well as the chair of the City Planning Board.

Hank Kune works with diverse corporate and government organizations in projects about societal innovation and renewal, with a special emphasis on hands-on problem solving in complex social, societal and organizational situations. He is director of Educore BV, Founding Partner and member of the governing board of the Future Center Alliance, and an active member of the New Club of Paris, a global network organization working as agenda developer for knowledge societies, where his focus is on entrepreneurial initiatives and societal innovation coaching.

Markku Markkula
Advisor to the Aalto Presidents
Aalto University
markku.markkula@aalto.fi

Hank Kune
Societal Innovation Coach
New Club of Paris
hankkune@educore.nl

2. Energizing Urban Ecosystems EUE Research Program 2012–2016

Abstract

*The **Energizing Urban Ecosystems** (EUE) research program brings together the sharpest edge of the Finnish construction cluster. All-in-one solutions to build future city ecosystems will be investigated, tested and piloted with a total budget of 20M euros in the years 2012–2016. The research approach selected is based on a shared vision of the factors essential for impacting the regional innovation ecosystem. In addition to traditional research, the methods used include the following demonstrations and prototypes:*

1. *Action research methods for engaging users in research design and processes, e.g. piloting, rapid prototyping, testing; choice navigation and simulations; innovation camps, co-creation factories and open innovation platforms,*
2. *Regional information and digital modeling for effective simulations, visualizations and life-cycle analyses of regional urban infrastructures and their functionalities,*
3. *Solution co-development processes and tools in empirical settings, e.g. learning-by-doing on various Living Lab sites, feasibility studies, and proof of concept studies of emerging product/service combinations.*

The EUE program enriches the entire extent of innovation activities in Espoo—described here as a Mega-Endeavour. Orchestration is a key concept for the success of activities within the Mega-Endeavour, and within the innovation ecosystem as a whole.

The focus of this article is on the concepts and processes developed and tested by the actors within the overall frame of the ***regional innovation ecosystem.*** *The EUE methods have also included the use of parallel research, development and innovation RDI activities to co-create the EU pioneering concept: the Espoo Innovation Garden as a global lighthouse, working as the icebreaker, pathfinder, and prototyper of innovative solutions for business, regional and societal challenges.*



KEYWORDS: Regional innovation ecosystem, Orchestration, Mega-Endeavour, Urban design

1. Introduction

The EUE research program extends over a period of four years and receives 20M euros in funding. The program is primarily focused on the Otaniemi-Keilaniemi-Tapiola region, which at the start of the program was referred to by the working title T3 (an acronym of the Finnish words for science (**tiede**), art (**taide**), and economy (**talous**). More recently the City and its partners adopted the name Espoo Innovation Garden to describe the area and the strong developments there. According to City policy, the region is designed explicitly as a development and demonstration environment for new products and services, and the latest research knowledge and innovations.

The program partners from the very beginning have included RYM Ltd as the Strategic Centre for Science, Technology and Innovation for the built environment in Finland, the Finnish Funding Agency for Innovation Tekes, Aalto University Properties Ltd, Adminotech Ltd, DigiEcoCity Ltd, Fortum Plc, Espoo City, Kone Plc, Ramboll Finland Ltd and SRV Group together with Aalto University. Based on the mid-term review, some changes in the set of partners were needed.

The program is closely tied to the national innovation policy of Finland, and it is a significant part of implementing the Europe 2020 Strategy. The general goal is to create a multidisciplinary centre of top expertise for city planning and design. The conspicuousness of the Otaniemi-Keilaniemi-Tapiola region as the most significant innovation hub in northern Europe provides a solid foundation for such a centre. The region is inhabited by 44,000 citizens 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 can also be found in the area. 200 of the local companies are foreign. A mix of 110 nationalities live and work in the area. Internationally speaking, the region represents the most metropolitan area in Finland.

The potential to benefit from the EUE program outcomes depends on the joint and synergic impact of the following factors:

- The program consortium involves key actors from business sectors as well as multidisciplinary research, both related to the forerunner developers of the urban environment.

- The program outcomes have potential for both corporate **and** public sector applications.
- The program outcomes provide cities with answers regarding the expectations of the new and renovated city areas, and companies with answers regarding how these solutions can be supplied in the future.
- In addition to the research and development of new key enabling technologies, industry needs to adopt existing technologies to benefit more from the program results.
- The program integrates various disciplines when pursuing a network of expertise to support urban planning.

2. EUE Research Plan

2.1 Research program for building energizing urban future

The Energizing Urban Ecosystems (EUE) research program advocates a fundamentally new approach to address the comprehensive challenge of planning, designing and managing future urban ecosystems. It is built on progressive visions of the development of future urban ecosystems, enabling the proactive and effective planning, designing and management of ecologically sustainable, digitalised and innovative living environments with respect to local conditions, values and culture.

The EUE has focused on creating an evidence-based concept of a globally leading regional innovation ecosystem. The main research has been conducted in the T3 area, a European pioneering region for innovation ecosystems and test-beds. It demonstrates how the key enabling factors and elements for applying the EU2020 Strategy can effectively be implemented in an area. It also shows how to modernize the Triple Helix model by enhancing the collaboration between the city, universities, research institutes and enterprises, based on the Knowledge Triangle approach.

The program focuses on studying the core elements of pioneering urban ecosystems, which combine advanced technical solutions (engineering, digital, mobile and processes) and complementary social systems (for innovation, learning and accumulation of knowledge) in order to create competitive business models and solutions.

Consequently, the EUE program aims to 1) build a solid foundation for the comprehensive understanding of how to plan, design and manage future urban ecosystems, and 2) turn this accumulating intellectual capital and know-how into successful global business processes.

2.2 Finding solutions for urban ecosystem challenges

The built environment is the core arena for the diverse activities of society. It provides the scene and setting for human interaction, offering the necessary framework for economic activities (competitiveness, infrastructures, marketplaces, product

and service development platforms and forums for interaction). In this context, it is broadly recognized that urban development (the construction of urban infrastructures, buildings and networks) and urban lifestyles (urban activities and processes, as well as patterns of city living) are the main factors for global environmental impact.

Consequently, the Espoo experience and the experience of other pioneering Living Labs in Europe show that 21st century urban ecosystems will be the future testbeds, living laboratories and co-creation platforms for addressing our joint global development challenges. Accordingly, future urban ecosystems must undergo a facilitated transformation process in accordance with the principles of sustainable development.

The future urban ecosystems are seen as combinatory assemblies of intelligent sub-systems and architectures (e.g. housing, mobility, energy, water, services, community, security), which can be put together in different ways to create a functional, urban whole. They function as mutually complementary ecosystems, where actors collaborate to discover the optimal balance in 1) urban economic activities, 2) comfortable, invigorating and human-scale living environments, and 3) synergistic innovation processes for continuous renewal. In this way, future urban ecosystems can be seen in a much broader context than before: as orchestrated platforms for testing emerging concepts and technological solutions for a sustainable tomorrow. Essentially, the key question we must answer is 'how to develop novel, holistic concepts, solutions and architectures that meet future urban living needs and requirements, in an ecologically sustainable and digitally empowered way?' Furthermore, we need to investigate how to turn the accumulating know-how into competitive and successful business models, processes and operations.

The EUE program integrates theory and practice for the creation of energizing urban ecosystems that attract talent and business. Its core activities develop, demonstrate, and implement new urban design strategies and business-driven innovative solutions. They prototype the service concepts of the future—concepts that draw on cutting-edge knowledge and technologies such as digitalisation, regional information modeling, and visualized virtual reality. The program's Regional Innovation Ecosystems (RIE) work package is seen as the methodological engine for the whole EUE program, as well as for other complementary research streams. It runs orchestrated activities in which innovation concepts, tools, methods and workspaces (supporting physical and virtual Ba and flow) can be used in other EUE work packages. These activities can also be utilized for knowledge co-creation and knowledge sharing in other national R&D programs such as 6AIKA and INKA that operate in parallel with the EUE.

Consequently, EUE research approach promotes several interdisciplinary themes: mixed-use urban systems and communities; urban infrastructure asset management and value development; sustainable lifestyles, work-life balance and people flows; and finally, smart, emission-free regional energy and communication systems. Future urban ecosystems are seen as core platforms for synergistic innovation activities and processes, which can develop regional competitiveness and provide pioneer-

ing competencies for complementary product/solution development in the global markets.

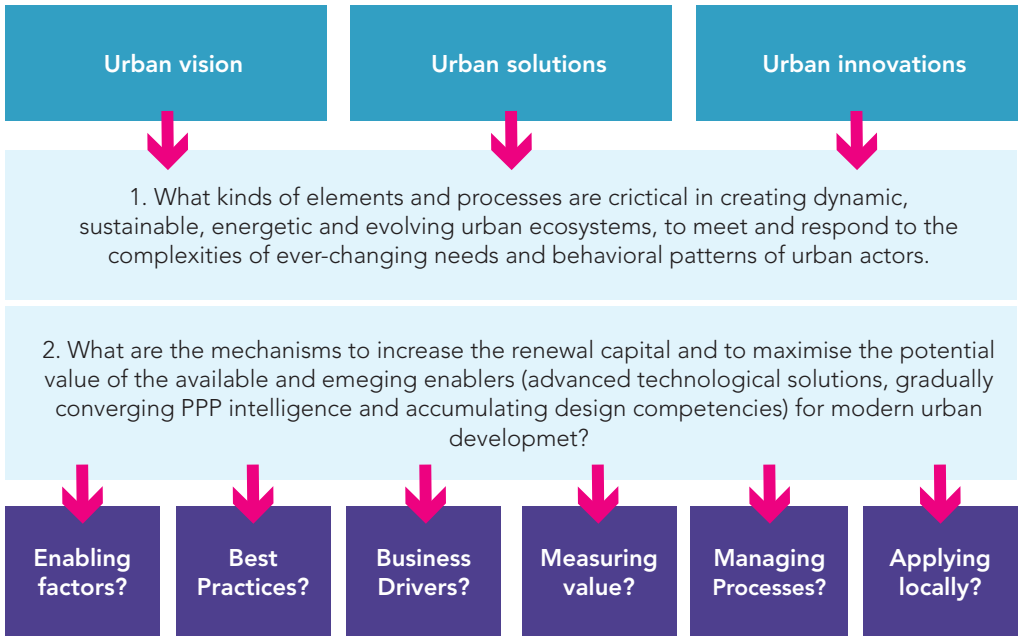


Figure 1. The EUE research drivers and key research questions. Based on the description of the overall program structure, the key program-level research questions have been defined as shown in this figure (EUE, 2012).

2.3 Three-layered program structure divided into four complementary work packages

The EUE program structure has been systemized into three mutually reinforcing layers of Urban Visions, Urban Solutions and Urban Innovations, and a closely interlinked ensemble of four complementary work packages.

The Urban Visions layer examines the urban ecosystems from a holistic, birds-eye perspective that provides strategic vision, an overall conceptual framework and alternative architectures, both for the whole program and for the individual work packages, to be applied in all the individual research processes.

The Urban Solutions layer focuses on identifying the main urban planning components in the context of a given program. These components, or intelligent assemblies, could be called the Smart Building Blocks of the future urban ecosystems: e.g. for living, working, mobile life, wellbeing, and security.

The Urban Innovations layer takes the thinking explained above closer to everyday practice by focusing on demonstrating and testing of emerging hypotheses. The research activities in this layer are aimed at modeling, piloting and rapidly prototyping all emerging innovation processes, development practices and Smart Building Blocks (e.g. technologies, components, products, and solutions) in a real-life context. Each work package is then internally organized to match this program structure.

According to the original project plan, the EUE research program creates "a permanent knowledge cluster on digitalised, sustainable urban issues, while improving private companies' capacity to export comprehensive product/service/solution combinations to the global markets".[1] During the first two years, the joint interests in the EUE program were mainly focused on research and integration of the research conducted by the different work packages. Due to the changes in the interests of the industrial partners, the work package structure needed to be changed for the two last years. In addition, the focus moved from research to innovation as shown in Figure 2.

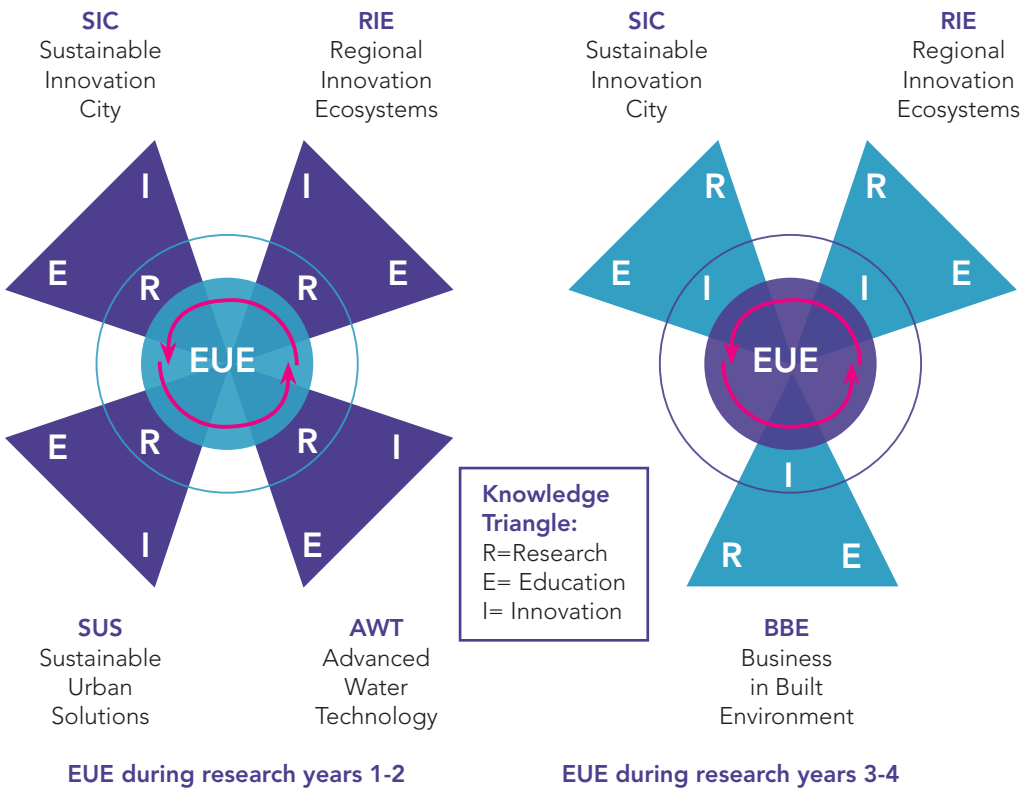


Figure 2. The work package structure and also the focus of the EUE research program have changed as defined in the figure.

The original project plan also defines that "the main research is conducted in the T3 Area, as the European pioneer of the innovation ecosystem test-bed, demonstrating how the key enabling success factors and application elements of the Europe 2020 Strategy can effectively be implemented in the area. Its core activities will demonstrate, prototype and implement new urban design strategies and business-driven innovative solutions, as well as service concepts of the future, benefiting from cut-

[1] This and the other similar quotations in the article refer to the original EUE research program project plan approved by all the partners. The plan is not publicly available.

ting-edge knowledge and technologies (especially digitalisation, regional information modeling, visualized virtual reality)."

The concepts developed within the EUE program will be modelled, simulated and tested, particularly in the Espoo Innovation Garden area, accelerating the changes that turn the area into a unique global operating and development environment for universities and research institutes, companies, and the public and the third sectors. The program provides an excellent foundation to design future built environments, in collaboration with the diverse local endeavours. In addition, new business activities will emerge as old operating models cease to function. The area offers a special opportunity to implement an innovative, sustainable and internationally attractive living and working environment.

The program has defined the mental basis for the urban vision: "We believe in a human-driven and service-oriented living environment worthy of human inhabitants, in which shared value is created through interaction, participation and learning, and in which the needs and opportunities of a sustainable and enriching city are understood."

The target of the program is to define the vision, the solutions and the innovation demonstrations of successful urban ecosystem through research: "the solid foundations for the comprehensive understanding of the planning, design and management of the future urban ecosystems, and turning this accumulating intellectual capital and know-how into successful, global business processes."

The research program examines the functionality of

- diverse technologies, and technological platforms (e.g. building, transportation, mobile platforms, ICT and virtual solutions)
- social systems (e.g. innovation activities, learning, management, accumulating knowledge, and technology transfer), and
- interfaces in relation to the development of the city structure.

At the same time, the functionality of new business models and technological solutions are tested, demonstrated and piloted in the developing Espoo city target areas.

3. Orchestrating the EUE as a Mega-Endeavour

The management and cooperation activities of the EUE program have provided experiences and evidence on how to operate successfully within a complex, multi-actor regional innovation ecosystem. The strategic target is a common one for all the major actors: to develop the Otaniemi-Keilaniemi-Tapiola area (originally called T3) into a high-quality living and working environment, which is able to hold its place at the forefront of global-level innovation hubs by maintaining a rapid pace of development. To achieve this target, it is important to integrate the EUE with other on-going activities with synergic relevance at strategic and operational level. This

large set of activities is called the Espoo Innovation Garden Mega-Endeavour, or more compactly, a Mega-Endeavour.

The major challenges in achieving high-level improvements stem from the varied interests of public and private stakeholders: the city, the diverse educational and research institutes, the many companies operating in different business fields and industrial clusters. Further complexity comes from the concrete specific targets of each project partner, some of which are based on short-term and some on long-term needs. Another cause of increased complexity is the diverse personal interests of the researchers. This means that the measures required to manage this 20M euro research program differ greatly from typical large-scale research projects. From the points of view of the project partners in their different roles, daily management of the program must be efficient and flexible. Additionally, the activities funded by the program need to be integrated with many other parallel activities, which are in turn financed by other sources. The key competence to master has proven to be the orchestration of the diverse activities: orchestrating EUE activities along with the many projects and regular work targeted to serve the same interests: i.e. co-creating synergy. Figures 3, 4 and 5 illustrate the applicable principles and practices.

The success of such an initiative depends on a deep understanding of how innovative urban environments work, how they encourage creative collaboration and how the initiative affects city planning and structures. Critical issues include how the pilots and demonstrations promote the targeted changes, and how a deep collaboration can be created between the EUE research program and other activities.

The theoretical orchestration frame, as well as many analytical applications of the concept Mega-Endeavour, is based on a long-term collaboration between Markku Markkula and professor Ikujiro Nonaka. Important phases of this collaboration have included

a) 1999–2003: developing knowledge management concepts in the Parliament of Finland (Suurla et al., 2002), and

b) 2009–2014: developing knowledge management concepts at Aalto University, supported by three Aalto-Nonaka workshops in the years 2009, 2012 and 2014 (Aalto, 2010)

A Mega-Endeavour is a concept that integrates several synergistic activities into a coherent set of projects. Again, the key word is orchestration. Where people and organizations have the potential for motivated, synergistic co-operation, the activities can range from basic RDI activities and ongoing or completed projects, to organizing expert workshops and seminars to create new things. A considerable portion of this work consists of things that participants would have to do even without the Mega-Endeavour. Each part is managed according to its respective financial and administrative regulations. Activities or parts of these activities can also be organized as project portfolios.

The successful orchestration of a Mega-Endeavour has four requirements:

1. an accurate understanding of the state of the field;
2. robust networks with all the potential actors;
3. proficiency with the potential financial instruments; and finally,
4. the ability to motivate the best possible people and organizations to work together.

The interrelation between the principles driving the working culture is illustrated in Figure 3, which is developed based on the ideas of professor Nonaka. Figures 4 and 5 illustrate the whole concept in more detail.

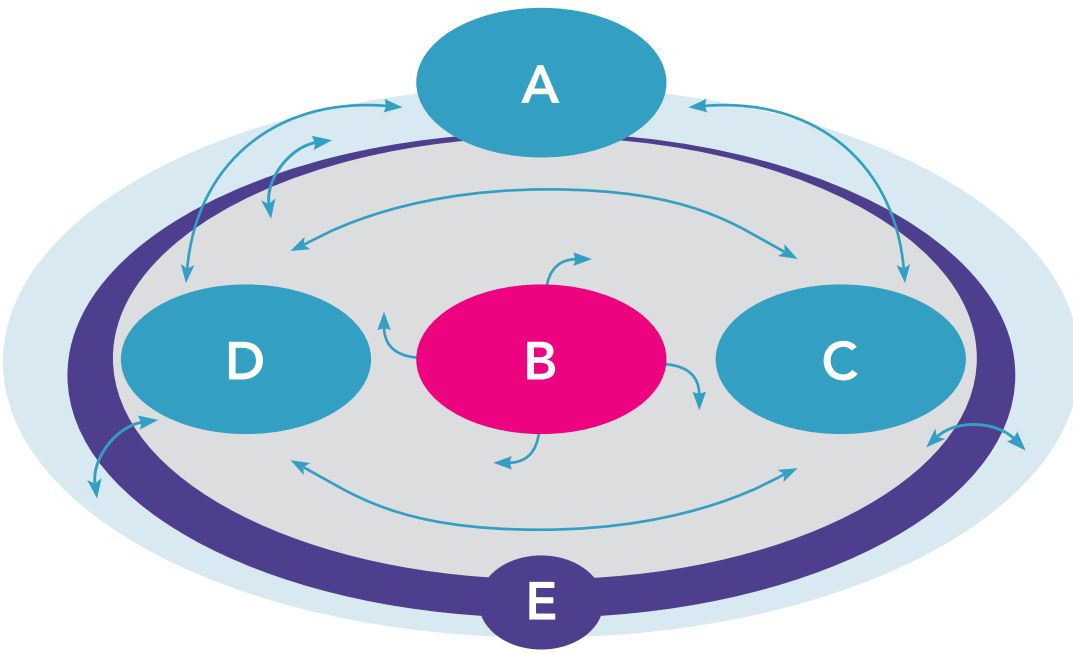


Figure 3. The implementation culture of the Mega-Endeavour. (Nonaka et al., 2008)

Figure 3 consists of the following elements: A) a shared vision of the regional innovation ecosystem; B) research basis; C) dialog between society and science; D) application in practice; E) the Knowledge Triangle concepts and methods.

The content of this Mega-Endeavour originates back to 2005 when the Otaniemi Vision was drafted and approved by the City Planning Board, in an effort to integrate urban planning interests with the targets and plans of the major stakeholders in Otaniemi.

The Mega-Endeavour is steered by an integrated vision: the EUE vision combined with visioning processes focusing on the Otaniemi Campus and actualizing the potential of the Espoo Innovation Garden. To this end, many parallel processes involving other major stakeholders have been organised by Aalto University and the City of Espoo. Essential to the success of the Mega-Endeavour is that it has simultaneously promoted all the work towards achieving the targets of Mission Finland,

Helsinki Smart Region and Espoo Innovation Garden. All these concepts are utilized in the EUE from the T3 perspective, and are related to the theory and practice of the Regional Innovation Ecosystem as developed in the EUE.

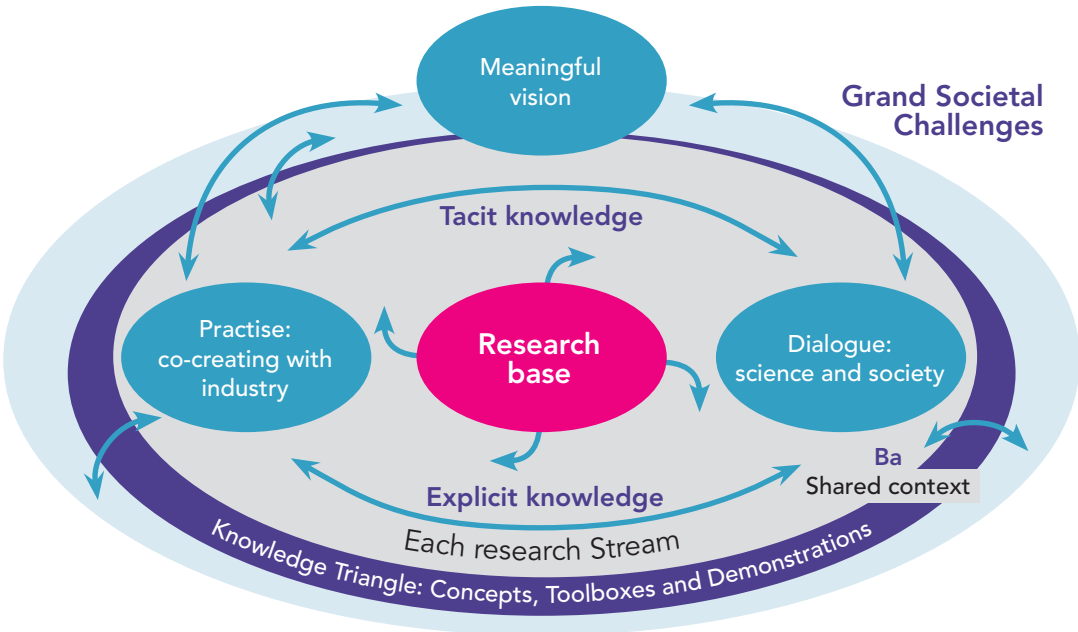


Figure 4. The implementation culture of the Mega-Endeavour in more detail.

The frame in the Mega-Endeavour, as described in Figure 4, integrates short-term and long-term targets and creates the mentality of commitment and shared ownership between all major actors. Activities are based on professionally organized and orchestrated processes and efficient facilitation in the university-industry interface. Combining the latest scientific achievements and innovation activities, the research process examines both specific and general phenomena in society. At the core are Aalto University's subject-related research and the internal and external value networks of the University.

Top-quality research is a core activity of the Mega-Endeavour. The research is primarily organized by themes or **research flows.** Reviewing these flows and their outcomes, the following four themes have proved to be crucial to the regional innovation ecosystem:

1. Creating the RIE concepts based on experiments with societal innovations and Learning Society demonstrations,
2. Integrating urban planning and urban design with a deeper understanding of the practices of Sustainable Everyday Life,
3. Co-creating new experiments and pilot programs to achieve the desired changes in the physical and social environments,

4. Integrating all of the above in both real and virtual working environments with the help of Regional Information Modeling.

A research target shared by all the four research themes is the development of different interaction spaces and concepts that are further applied in the EUE research, and at Aalto and in Espoo in general. There are a number of these university-industry interaction spaces—for example Open Innovation House, Aalto Digital Design Laboratory and Learning Centers—with the aim of involving stakeholders effectively and creatively in the design and implementation of spatial solutions. The defining product of this focus is Urban Mill, a public-private co-working and co-creation platform for Urban Innovations. In addition to the co-creation spaces, EUE results include digital interaction spaces that are used as learning environments in the T3 region.

An essential part of the Mega-Endeavour is to encourage societal decision-making that looks for innovative solutions to meet grand societal challenges. This requires practices where the future solutions to support knowledge society development are actually demonstrated as wide-scale societal applications, instead of simply smaller or theoretical ones.

The European Union has given increasing the synergies between research, education and innovation a central role in educational reform, and the Espoo Innovation Garden Mega-Endeavour develops and applies the principles of the Knowledge Triangle to do this. The Knowledge Triangle directs work practices at universities, and emphasizes the need to solve societal problems. The research conducted by universities provides the needed concepts and methods for these challenge-driven initiatives. Multi-disciplinary real-life and real-case approaches are emphasized. Because of this, the Mega-Endeavour is recognized both regionally and internationally for its application of Knowledge Triangle principles. The concepts developed by the Mega-Endeavour, such as Urban Mill, will ensure that hundreds of students from Aalto University and other educational institutes have the chance to become involved in Mega-Endeavour activities, thus forming the significant resource for the initiatives.

The orchestration of the whole requires the development and application of different orchestration methods both **between** different groups of stakeholders (enterprises, research organizations, public sector) and **within** them. This enables the interaction and development of different working cultures, while promoting the commitment of the stakeholder groups to the creation of a common, collaborative culture; this empowers the entire innovation ecosystem. To accomplish these goals, several stakeholder parties must be created (e.g. an orchestrating enterprise party, an orchestrating research party, or an orchestrating public party), and they must be able to work together well.

This orchestration is the methodological engine of the Mega-Endeavour. It creates concepts and methods for tailored operations and strong cultural interaction within the research program (Figure 5). The orchestration concept is characterized by a definition of the shared knowledge reality and a shared understanding of interdependence—both needed to create new knowledge and new innovations. The

time of the partners is spent on developing content, not on administration and management.

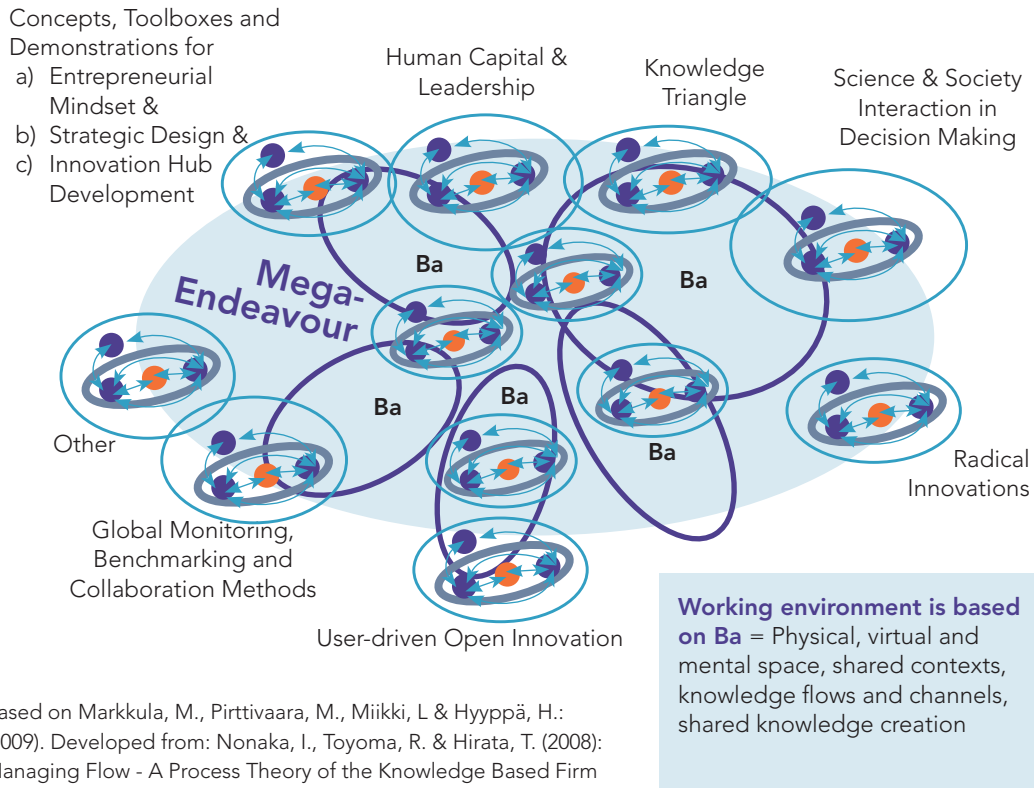


Figure 5. The integration of the different parts of the Mega-Endeavour as part of the implementation culture.

4. Mid-Term Review and Plans for the Third and Fourth Years

Aalto University's internationally high-quality research and networks form the core of EUE operations for the third and fourth years. The research and demonstrations in the region focus on Espoo Innovation Garden as a test-bed and forerunner innovation ecosystem, which implements new applications in regional information modeling, visualized virtual reality and other smart city solutions (see Figure 6).

4.1 Lessons learnt during the first two EUE years

According to the EUE experiences—in comparing its many research results with other parallel activities—the new type of working culture is promoted through many parallel bottom-up practices, and in particular those at the most successful innovation hubs: Urban Mill, Design Factory. These practices have been developed and

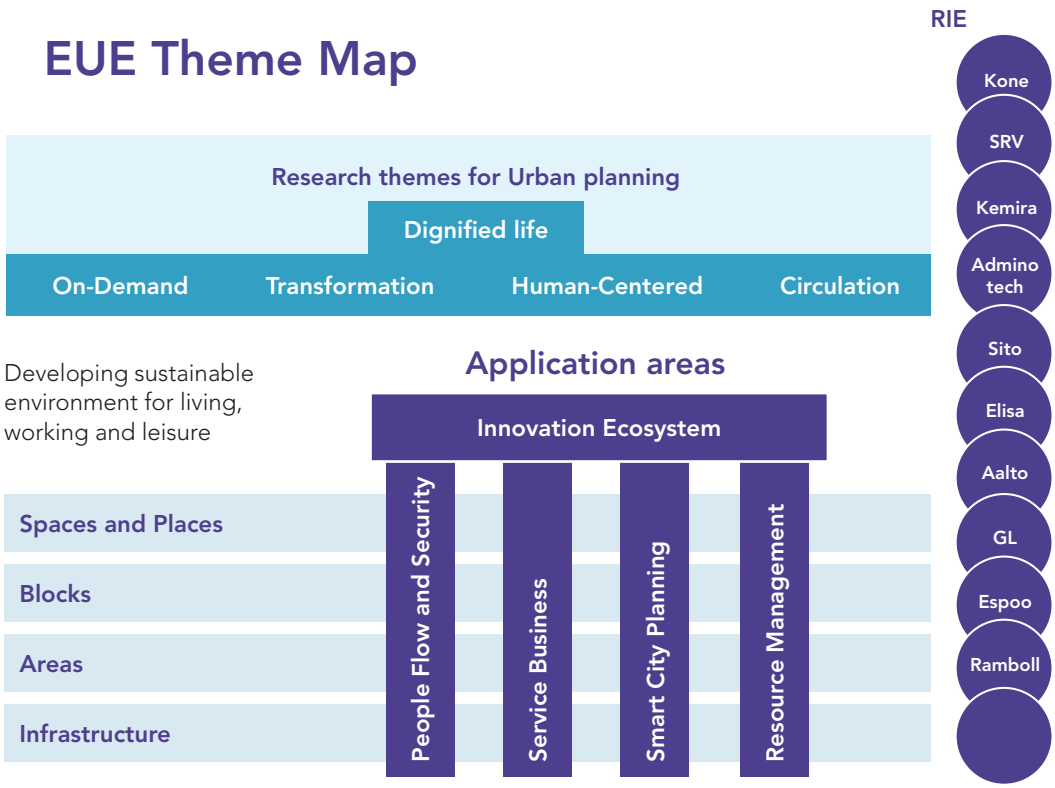


Figure 6. The EUE research program themes for the third year based on the researchers' workshop in 2014.

deployed across the Aalto University campus, and many of these have been experimented with and analyzed in EUE research.

The role of the EUE RIE work package includes organizing and orchestrating European networking collaboration in such a way that all EUE work packages (and other parallel activities) can use it, both to enhance their productivity, and to create innovative outcomes and value for all Espoo Innovation Garden (EIG) stakeholders.

The role of the RIE work package has been very international, not just through traditional university research contacts, but also by additional contacts made through the EU Committee of the Regions, the New Club of Paris, the European Network of Living Labs, and the European Learning Industry Group. These relationships have opened new perspectives on innovation and learning in ecosystems, and played a major role in creating the regional mind-set for collaborative action, shaping the development of pioneering concepts for the regional innovation ecosystem.

The analysis of the activities and outcomes of the first two years of the program, as well as the changes in the operating environment, led to a mid-term review in 2014. The results of the review necessitated changes in the program structure and partnering, but the initial idea of the program was reaffirmed: the consortium partners believe that "the development of the city structure will in the future rely strongly on sustainable development, digitalisation and user-orientation, which to-

gether form the foundation for the development of a vital, innovative and stimulating milieu."

The review led to recommendations for a number of changes in the second half of the program. The three most important content changes for the 3rd and 4th years are:

- More focus on innovations as the outcomes of research,
- Adding the Business in Built Environment BBE work package, which monitors changes in regional development, to the program,
- Strengthening the digitalisation perspective of the original plan.

At the same time, the structure of the program work package was inspected. SITO Ltd, Elisa Plc, Fira Ltd, A-Insinöörit Ltd, and LocalTapiola Real Estate Asset Management Ltd were accepted as new members to the consortium in spring 2014.

4.2 Changes for the EUE third and fourth years

For the third and fourth research years, we have shifted the focus to the integration of Smart Digitalisation and Smart Urban Design. This shift is aimed at co-creating the Espoo Innovation Garden as the forerunner in the EU. The research activities will be organized through three work packages:

- SIC – Sustainable Innovation City
- RIE – Regional Innovation Ecosystems
- BBE – Business in Built Environment

within the following strategic research areas:

1. Description and visualization of the processes of smart city planning and development.
2. Recognizing and understanding the profiles of different areas and user groups in sustainable service production and decision-making.
3. Development of services and service architecture, by service and experience design methods.
4. Recognition and creation of innovative resources and the development of methods for resource sharing and management.
5. Analysis and development of new business logics and opportunities for value creation over the life cycles of investments in the built environment.
6. Openness, trust and genuine co-learning in an innovation ecosystem within the on-going trans-disciplinary program.

A special target for the final EUE phase is to attract other international partners with similar interests to collaborate and initiate new top-level projects, in which EU contacts and funding are essential enablers. In addition, reaching the ambitious targets set for the EUE program requires that the results of separate research projects be

integrated, so that together they become a **systemic** change process. This means that in addressing deeper implications of strategic and policy decisions on regional, national and international levels, a more profound understanding of both governance issues and clear perspectives, either as part of the EUE or within an auxiliary project, must be fostered.

5 Pioneering in Finland and the European Union

The potential impact of the EUE activities has increased remarkably during the program. One major environmental change that challenges all EUE partners is the construction of the Metro line, which integrates downtown Helsinki with the T3 area. The new Metro line will be operational by the end of 2016. Furthermore, the Government of Finland and the City of Espoo have made decisions to continue the metro extension to the west, which will lead to the construction of new housing for 70,000 inhabitants, and offices and other buildings—with up to 20,000 work places—along the metro within the next 40 years.

Integrated to these decisions, the City has initiated a planning process called The West Metro Growth and Development Corridor. This will be carried out jointly with Tekes, local industry, universities, and other stakeholders. Their interests strongly target experimenting and testing new smart city business solutions, not only in the construction phase but in the provision of services and maintenance as well. Special focus is on global level start-ups, digitalisation, and other entrepreneurial developments.

This means that the EUE, together with other related projects and activities, needs to focus on further developing the concept for Finland's and T3's global role as an **icebreaker, pathfinder,** and **prototyper.** These three roles, described briefly in the original EUE project plan, are essential to the entrepreneurial, pioneering spirit needed for spearheading innovation culture in Europe.

Icebreaking means opening new space for energizing society and enhancing regional innovation. It is the process of clearing a space for practical action. When the way forward seems blocked, there is a need for breaking through barriers to create new possibilities for thinking and acting. In situations where people see more difficulties than opportunities, icebreaking creates space for experimenting, new thinking, and moving forward.

Pathfinding is the process of discovering and exploring new ways forward. Innovation is often unknown territory, and explorers and guides are needed to move people, projects and organizations in useful directions—towards quality-of-life improvements that are attractive, practical, and scalable. There is relevant science, technology, good practice and knowledge available everywhere in the world, but how to access it quickly and apply it where and when it matters? The complex world knows many difficult places and dead-ends, and pathfinders seeking new ways to stimulate societal innovation impact make the journey easier.

Prototyping is the process of co-creating promising solutions and testing them in practice. It is an iterative process of learning-through-doing, where demonstrations of work-in-progress lead to deeper insight into what really works and what people really need. New products and services, but also policies and possible futures can be prototyped effectively. It is essential to embrace working hands-on with new ideas, sometimes failing our way forward anlearnd always focusing on continuous improvement. Prototyping is the key to innovation acceleration.

Applying these conceptual metaphors in practice make the results and lessons learned in the EUE interesting and accessible for all regions in Europe. EUE, in its third and fourth years, is working on describing the 'how' behind the metaphors and the reality behind the roles.

How, within its role as **icebreaker,** does a region create new space—physical, mental, political and organisational space—for energizing society? What role does a concept such as 'innovativeness'—the broadly-held innovative spirit of the people and organisations in a region, the readiness to quickly adopt and use new ideas, products and service, improving their beta-versions through actual use—play in this? What about 'resourcefulness'—the capacity to discover and make use of resources wherever they are, even if not in plain view? What is the role of individuals—leaders, politicians, orchestrators, and individual citizens—in creating breakthroughs?

How does a region practice **pathfinding?** What can be learned from the professional expertise of explorers, scouts, trend watchers, and visionaries in other areas and professions? Does this rely on good pioneering leadership alone, or is excellent fellowship just as important? What is the role of the extended networks and knowledge communities of regional residents? Is it an entrepreneurial discovery process, open to all? Should everyone in the region—including its housefathers and housewives, immigrant populations, it senior citizens, its primary school teachers and schoolchildren—be engaged? And how can we engage them?

Prototyping is recognised as a key concept for accelerating innovation. The word is on everyone's lips—but far less often actualized in practice. And what are the differences between prototyping, experimenting, demonstrating, and piloting? What are the active instruments of prototyping, and what is the mind-set required?

Through the example of orchestrated EUE research, demonstrations and experiments, Espoo's T3 has started to fulfill these roles in a number of ways. There is much happening in Finland; Espoo is not the only innovation hotspot in the country, and integrating the learning from EUE with lessons learned from relevant programs throughout the country will enhance Finland's position as innovation pioneer. Europe is starting to look closer at what is happening here. There are still many questions to ask and much to learn, which is why the work on actualizing these roles will continue. We need to use **icebreaking, pathfinding** and **prototyping** as lenses to codify the lessons learned in EUE. Assessing the importance of EUE research, and the practical results of applying this research, will go a long way to enhance the region's role as exemplar, pioneer, European good practice, and global lighthouse.

6. Conclusions: Espoo Innovation Garden as a Global Lighthouse

Perhaps the most important outcome of the EUE can be described with the metaphor of a **lighthouse:** a source of illumination for the regional innovation ecosystem and a source of direction, learning and energy for society. This lighthouse shows the safe havens for innovative work and marks the dangerous places in the uncertain seas of the 21st century; it helps us navigate amidst the risks and opportunities.

Consider Espoo Innovation Garden as a lighthouse: what we first see is the source of light at the top of the lighthouse, where energy streams forth to help people and organizations understand and actualize their capacity to change the world—this represents the regional innovation ecosystem. Every actor, each activity, all the ambitions, actions and interventions play a role. In this systemic approach to innovation, the **region** is not only T3 but also the entire Helsinki Smart Region. Here people live and work together; this is where the infrastructure supports them as they strive to face today's challenges—local, regional, and grand—and create a sustainable, caring and multicultural society.

This will only be successful if built on a strong foundation—a foundation that provides the **facilitating and enabling factors** to empower innovation in practice: process tools, physical spaces, knowledge concepts, working methodologies, mindset and attitude, the culture of creativity, new values and business models and more. These are the interactive, interdependent facilities that belong to the entire ecosystem, and are available to all participants to use, learn from, add to and improve.

A lighthouse must be able to withstand the force of the elements and all the challenges of the environment; it must be built on solid rock. The strong foundation of the Innovation Garden lighthouse is based on the **open, entrepreneurial mindset** of the people (this can be described as entrepreneurial discovery) and the **Knowledge Triangle as the collaboration culture** (this can be described as the processes increasing synergy between research, education and innovation). The methodologies of the ACSI Camp for Societal Innovation—itself a co-creation of Aalto University and the New Club of Paris, pioneered and prototyped in the T3 area—play an important role here.

Espoo Innovation Garden (EIG) needs systemic innovation. Connecting people and ideas is at its core. **Synergies** are important, but how do we realize them? When people work in projects they tend to be project-focused—how do we work with them to surface the synergies their projects actually need? How do we find and connect interesting people and relevant ideas to feed individual projects and the system as a whole, creating the synergetic effects on which innovation thrives?

Older lighthouses use wires, tubes and pipes to connect the various floors and bring energy, water and waste where it is needed. But now we are building something new—a lighthouse 2.0—and our means and metaphors should also belong to modern interactive media and virtual worlds, where our synergies work through GPS and the Cloud Computing network.

The **GPS** locates interesting people and relevant ideas wherever they are in our ecosystem; it creates the initial connection. It also captures strong and weak signals from the rest of the world and feeds them into the system. Once connected, **where** do the people meet? Here we can use a **cloud computing network:** meeting on knowledge-sharing clouds, brainstorm-clouds, and experiential workshop spaces in augmented reality. They will meet in real-time and virtual time to share, apply and co-create new knowledge essential to their projects. The projects in the ecosystem obtain the immediate benefit, and other **knowledge stakeholders** in the region—for example, in the many projects not directly part of EIG or EUE—and elsewhere in the world will also benefit from these creative encounters.

Of course, the importance of physical meeting spaces and prototyping together in actual **places** has both clearly demonstrated in case after case—think of EIG's Urban Mill and Espoo's Metro line project, just as two examples. So our Lighthouse 2.0 has been physical and digital dimensions which complement, reinforce and multiply their power to support and enable change. And the third dimension to our next generation Lighthouse is the metaphor itself—the lighthouse as one of mankind's early innovations, widely used all around the world for its real-world importance, and its powerful capacity to help us know where we are and where we are going, indicate safety and warn of danger, facilitate movement and flow, and enlighten and energize progress.

Within the lighthouse structure of EUE and Espoo Innovation Garden, what happens on each project platform is proprietary—once ideas are tested and applied in the T3 ecosystem, the business consortia driving the projects are free to exploit the innovations they develop in the broader world. What is created within the ecosystem program as a whole, however—the facilitators and enablers, the mindset and methodologies, the process tools and knowledge concepts—belong to the ecosystem as a whole.

Espoo Innovation Garden provides us with the **how** and the **where** of societal innovation. Many documents tell us **what** needs to be done—with goals described in diverse local, national and European documents, often in inspiring and compelling language: think of Europe's Flagship initiatives **Innovation Union** and **Digital Agenda for Europe,** just to name two. However, in daily life it seems increasingly more difficult to realize these excellent intentions in a practical and systemic manner. This is where Espoo Innovation Garden, with the help of EUE, and its strong emphasis on **how,** will make its most powerful contribution.

Both the EUE and Espoo Innovation Garden see Finland's role in Europe as an ice-breaker, pathfinder, and prototyper. This Lighthouse is Finland's first, but we foresee it will be part of a series of linked regional innovation ecosystems, a network of lighthouses across Europe. In this way, our Innovation Garden will add light, innovation culture and energy to people not only in the south of Finland but throughout the world, creating breakthroughs in complex challenges, finding paths forward where many can follow, and testing prototypes for new global and local centers of systemic innovation.

Looking at developments to date, we see how major stakeholders in the region have embraced the EUE program in order to help realize mutual objectives and ambitions. Research projects are providing new insight in how to apply digital solutions to address local challenges; and concrete initiatives like Urban Mill and ACSI have contributed to the rapid development of the region.

Feasibility and proof of concept studies of emerging product/service combinations have made it easier for both business and government to assess risks and weigh the potential for investment. Regional information and digital modeling, visualizations and life cycle analyses of the functionality of regional urban infrastructures have resulted in new insights in regional development.

Action research methods like piloting, rapid prototyping, simulations, innovation camps, co-creation factories and open innovation platforms have actively engaged users in research, urban design and participative processes. Solution co-development processes and tools like learning-by-doing at various Living Lab sites have helped engage ever-increasing numbers of people in improving the services they use daily.

The lighthouse function is working. The region is embracing its role as icebreaker and pathfinder. The future is open, and promising. The first scaling to other regions in Finland and Europe is underway, and in the coming period is likely to invite enhanced co-learning, participation and partnering with the rest of the world.

References

Aalto annual publication (2010), Towards Innovation and Creativity

EUE (2012), Research program project plan, not publicly available

Nonaka, I., Toyoma, R. & Hirata, T. (2008): Managing Flow—A Process Theory of the Knowledge Based Firm

Otaniemi Visio (2006), Espoo City Planning Board, published in Finnish

Suurla R., Markkula M., Mustajärvi O. (2002): Developing and Implementing Knowledge Management in the Parliament of Finland

About the authors

Markku Markkula is the President of the EU Committee of the Regions (CoR) since 12.2.2015. He has been a member of CoR from 2010, being the Rapporteur on several opinions related to topics such as Europe 2020, digitalisation, single market, as well as research and innovation. His experience includes memberships of several High Level Expert Groups. He is a member of the EU Smart Specialisation Mirror Group.

Mr Markkula works within Aalto University as the Advisor to Aalto Presidents, focusing on European Union strategy affairs. His previous work experience includes Directorship of the Lifelong Learning Institute Dipoli and the Secretary General of the International Association for Continuing Engineering Education IACEE. He is a former member of the Finnish Parliament (1995–2003). As an MP his international role included the Presidency of EPTA Council, European Parliamentary Technology Assessment Network.

In the Helsinki Region, he is a Board member of the Regional Council, and the chair of the Steering Board making decisions on the use of Structural Funds. He is a longstanding Espoo City Council member, as well as the chair of the City Planning Board.

Hank Kune works with diverse corporate and government organizations in projects about societal innovation and renewal, with a special emphasis on hands-on problem solving in complex social, societal and organizational situations. He is director of Educore BV, Founding Partner and member of the governing board of the Future Center Alliance, and an active member of the New Club of Paris, a global network organization working as agenda developer for knowledge societies, where his focus is on entrepreneurial initiatives and societal innovation coaching.

Kristiina Heiniemi-Pulkkinen
Innovation Advisor
Helsinki-Uusimaa Region
kristiina.heiniemi-pulkkinen@uudenmaanliitto.fi

3. Helsinki Regional Development: RIS3 as the Process Instrument

Abstract

The strategy 'Smart Specialisation (RIS3) in the Helsinki Region, Research and Innovation Strategy for Regional Development 2014–2020' was accepted by the Board of Uusimaa Regional Council in December 2014. In the beginning of 2015 the implementation of the strategy is in the first phase, activating and motivating the actors and building up the overall coordination. The priority areas of Helsinki Uusimaa Region for this RIS3-period are Urban Cleantech, Human Health Tech, Digitalising Industry, Welfare City and Smart Citizen.

The aim of RIS3 Uusimaa is to achieve significant improvements in impact and productivity by focusing on spearheads. The RIS3 is a frame and within it we will develop concrete goals and projects. This will be achieved in close cooperation with the innovation actors in the region. Among the key actors are universities and research institutes as companies and municipalities. RIS work will be organized on joint thematic platforms and be based project portfolios within each spearhead, as well as on systemic orchestration of the actors. Reaching the set goals and renewing and strengthening the economy of Uusimaa (and Finland) is only possible through determined and synergetic co-operation of all the involved parties.

KEYWORDS: RIS3, Smart Specialisation, Regional development, Helsinki Region

1. Introduction

In Finland regional councils are formed by municipalities. The councils have two main functions regulated by law: regional development and regional land use planning. In their planning, the regional councils must take national targets set by the Government and ministries into consideration. The plans and programmes of regional councils have mandatory legal consequences. Local and national government authorities must take account of the councils' plans and programmes in their own action.

Regional development is intersectoral by nature. The better the cooperation between different administrative sectors is, the more effective the measures employed. This is also true with smart specialisation. At the moment the Uusimaa Regional Council follows two strategies. The regional strategy called Uusimaa-Programme, and research and innovation strategy based on smart specialisation for regional development complement each other.

2. The First Phases in Developing Smart Specialisation Strategy for Helsinki-Uusimaa Region

The process of determining the strategic priorities and goals of development has proceeded in several phases. The 26 municipalities in Uusimaa have all decided on their priorities and drawn up their local strategies. The Helsinki Metropolitan Region (which is part of the Helsinki-Uusimaa region and consists of 14 municipalities) has drawn up a joint competitiveness strategy, which stresses the internal cooperation within the region, strong commitment to pursuing common goals and international cooperation.

To identify the future possibilities and challenges, the Centre for Economic Development, Transport and the Environment for Uusimaa led a scenario planning process together with the Regional Council. This was followed by a future analysis in collaboration with three regions: Häme, Päijät-Häme and Uusimaa. The implementation of the analysis involved wide-scale participation by different regions and parties. Crowdsourcing was also adopted as a working method.

Preparing the participation in the national Innovative Cities Programme INKA has played an important role in identifying the common strengths and priorities of Helsinki-Uusimaa. During the process, discussions have taken place between the specialists of research institutes, universities, companies and municipalities. The chosen themes were tested and edited on a three-day seminar, with 41 workshops and 280 participants. Applying all these strategies and choices as background, the Uusimaa Regional Council and the Centre for Economic Development, Transport and the Environment for Uusimaa have drawn up the Helsinki-Uusimaa Regional Programme (later Uusimaa Programme). It has been completed in open interaction between municipal decision makers, regional development companies, educational institutes, companies, the third sector and citizens.

Table 1 demonstrates how EU 2020 strategic objectives are linked to municipal strategies, growth agreements and the first-phase themes of the Helsinki-Uusimaa region in the national Innovative Cities Programme.

Municipalities	Competitiviness Strategy of the Metropolitan Area	Growth agreements and INKA	EU Flagship Initiatives	EU 2020
WELLBEING AND SERVICES, SENSE OF COMMUNITY AND PARTICIPATION	Wellbeing and tolerance	Healthy individual Intelligent services	Agenda for new skills and jobs European Platform Against Poverty and Social Exclusion	Inclusive growth
GROWTH AND ATTRACTIVITY	Accessibility Fluency Experimentation	Added value and business opportunities throuhght technical creativity Technological solutions and services	Digital Agenda for Europe Innovation Union Youth on the Move	Smart growth
COMMUNITY STRUCTURE AND ENVIRONMENT	Sustainability	Environmentally wise metropolis	Resource efficient Europe Industrial Policy for the globalisation era	Sustainable growth

Table 1. Smart Specialisation of Helsinki-Uusimaa Region (Heiniemi-Pulkkinen et al. 2014).

The Uusimaa Programme includes a vision and a strategy 2040 as well as strategic choices for 2014–2017. As a part of the programme, the Regional Council has drawn up the regional implementation plan, which describes the spearhead projects in implementing the process.

The plans and programmes of regional councils have mandatory legal consequences. Local and national government authorities must consider the council's plans and programmes in their own action.

The Smart Specialisation strategy is the next step of regional strategies. It goes deeper and defines more specifically the regional priorities and the implementation process. It also addresses more international aspects.

3. RIS3 in Helsinki-Uusimaa Region

The strategy "Smart Specialisation (RIS3) in the Helsinki-Uusimaa Region, Research and Innovation Strategy for Regional Development 2014–2020" was accepted by the Board of Helsinki-Uusimaa Regional Council in December 2014. In the beginning of 2015, the implementation of the strategy is in its first phase, activating and motivating the actors and building up the overall coordination.

In the Uusimaa programme and in the preparation process of RIS3, several also internationally significant growth creating strengths were identified:

- strong technological know-how
- strong expertise in the well-being sector
- strong citizen and user perspective as well as reliable processes
- the ability to develop practical solutions both in service and technology innovations
- the ability to develop responsible pioneering solutions

Based on the work and cooperation of Uusimaa programme, the identified strengths of the region and additional discussions with different stakeholders, the key areas of smart specialisation of Helsinki-Uusimaa Region were defined as technological solutions and services, wellness technology and services and cleantech. Intelligent services and digitalisation constitute the crosscutting themes in all these.

The strengths and priorities to be focused on in the RIS3 period were chosen based on spearhead industries (smart specialisation and enabling knowledge and

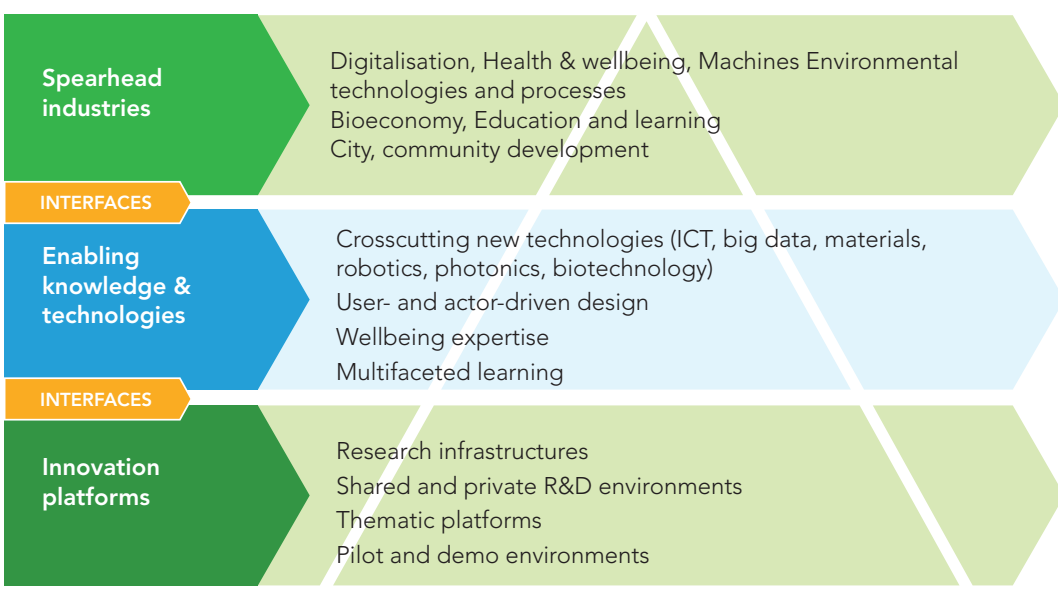


Figure 1. The concept of Helsinki Region RIS3 is based on systemic orchestration of all the key innovation policy actors in the region. (Smart Specialisation in the Helsinki Region, Research and Innovation Strategy in Regional Development 2014–2020)

technologies (smart value), the objective being to intensify the strengths (= potential for excellence). The needs for change during the RIS3 period are presented based on the operation of innovation platforms and the targets of innovation support, the objective being doubling the impact.

The priority areas of Helsinki Uusimaa Region for this RIS3 period include Urban Cleantech, Human Health Tech, Digitalising Industry, Welfare City and Smart Citizen. Their linkage to RIS3 as a system can be seen in the Figure 1.

The chosen priority areas represent the main objectives of RIS3:

- breakthroughs of strong innovation hubs on the international level
- better application of know-how in the region and directing it to innovation activities
- stronger impact of networking
- the productivity of research and innovation environments and the predictability and perseverance of connecting business environments

In the priority of Urban Cleantech, the ongoing and planned research and development projects are consolidated to provide a functional and compatible model to solve environmental challenges in urban regions.

The priority of Human Health Tech is based on innovative combinations of Finnish medicine, bio and health technology and health care knowledge, the point of view being useroriented wellbeing technologies are seen as a part of human-oriented healthcare. The aim is to bring together clinical medicine and nursing science expertise and modern technology solutions of the entire health care sector. At the same time, new solutions will be sought for preventive health care and the active promotion of wellbeing.

In the priority of Digitalising Industry, the renewal of industry is supported by adopting the new possibilities of digitalisation. The key focus areas include industrial internet, the internet of things, and analyzing and applying the data from machines and devices for process optimization as well as growing the service business by employing the previous. The aim is to strengthen industrial competitiveness in the internet-economy by recognizing and benefiting from the possibilities of ICT and digitalisation.

The priority of Welfare City is combining the urban development of the metropolitan region with service solutions, which the new technology makes possible. Solutions bringing added value to everyday life are being planned and built in the project portfolios. New projects in urban development are connected to developing and implementing everyday systems in which the city is seen as an ecosystem of different kind of systems and as a platform for development.

In the priority of Smart Citizens, the focus is on regional, national and international projects developing customer-oriented service systems and public administration in the areas of traffic, infrastructure, consumer data, environmental data learning and research, and decision making. The strength of innovation in Helsinki-Uusimaa

Region is an open and user-oriented model based on real-life living labs and supporting service concepts and projects of the digital era.

4. Implementing and Evaluating RIS3

In implementing the RIS3 strategy, we focus on three complementary functions:

- Developing an innovation ecosystem for Helsinki-Uusimaa based on open and facilitated co-operation. In this work, innovation platforms and living labs will play a key role.
- Supporting renewing and growth-oriented companies and developing business services for the region.
- Implementing the above-mentioned themes and models in all the five priority areas.

The implementation will be accomplished in the interfaces between the spearhead industries, enabling knowledge and technologies, and innovation platforms as described in Figure 2.

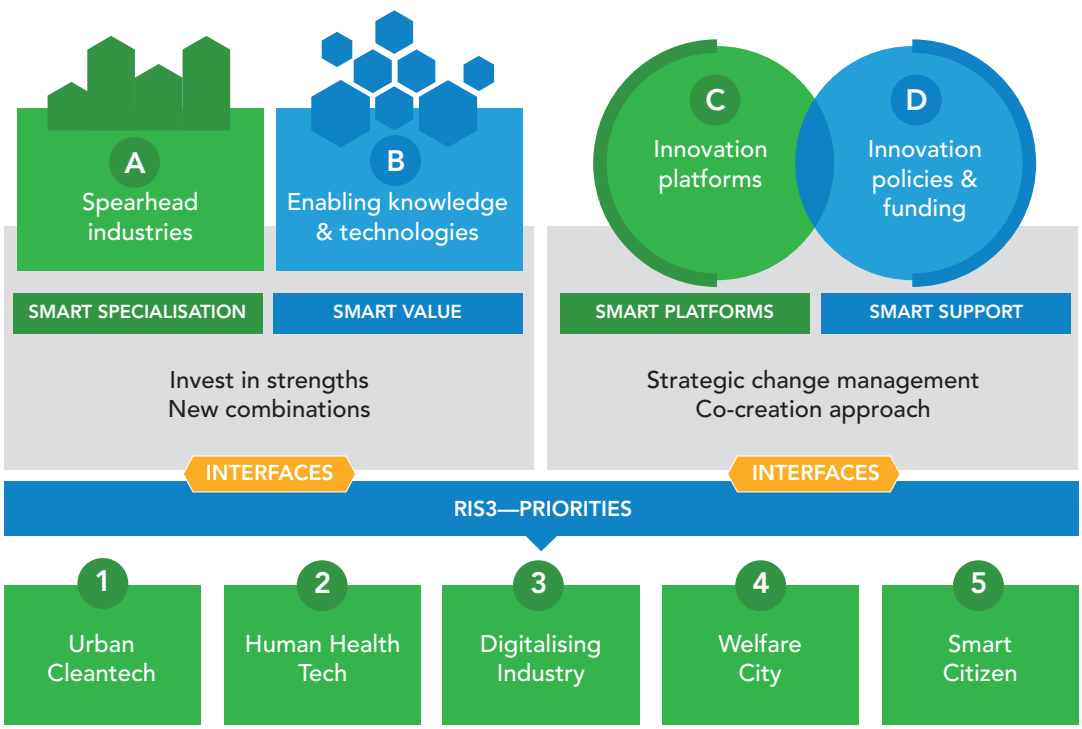


Figure 2. The concept of Helsinki Region RIS3 is based on systemic orchestration of all the key innovation policy actors in the region. (Smart Specialisation in the Helsinki Region, Research and Innovation Strategy in Regional Development 2014–2020)

In the implementation, the main tasks will constitute coordination and facilitation. This work will be performed on a general level but also in each spearhead specifically. Building up the networks and activity groups is the main task at the moment. We need to motivate the actors and build win-win situations. The content focus will need to be defined in each spearhead. This will open up the possibility to better and wider co-operation, to new projects and also to unexpected partnerships.

The RIS3 strategy guides the regional financing granted by the Helsinki-Uusimaa Regional Council. It is also a precondition to obtain financing from structural funds. In implementing RIS3, different projects will additionally use other national financing as well as different instruments of EU-financing.

The Regional Cooperation Committee MYR follows up the projects fulfilling the Uusimaa Programme and the regional RIS3 strategy. MYR also evaluates and gives opinions on the proposals for projects to be financed by the Council. This way it controls and promotes the fulfillment of the Uusimaa Programme and the regional RIS3. At the same time, MYR stays alert to the needs to refine the RIS3 strategy, making it an ongoing process. The exact evaluation systems and methods are yet to be defined more specifically.

References

The Helsinki-Uusimaa Regional Programme, Vision and Strategy 2040, Strategic priorities 2014–2017 Publication of the Uusimaa Regional Council A31-2014 http://www.uudenmaanliitto.fi/files/13281/Helsinki-Uusimaa_Regional_Programme_A31-2014.pdf.

Heiniemi-Pulkkinen, K., Eskelinen, J., Venäläinen, E., Tikkanen, I., Hatanpää, O-P., Vihavainen, R. (2014) Smart Specialisation of Helsinki-Uusimaa Region http://www.uudenmaanliitto.fi/files/14791/Smart_Specialisation_in_Uusimaa_Region.pdf.

Smart Specialisation in the Helsinki Region. Research and Innovation Strategy in Regional Development 2014–2020 Approved_8.12.2014.

About the author

Kristiina Heiniemi-Pulkkinen works as an Innovation Advisor in Uusimaa Regional Council. Implementing RIS3 in one of her key responsibilities. Ms Heiniemi-Pulkkinen's previous experience is in university innovations, IPR and technology transfer.

Markku Markkula
Advisor to the Aalto Presidents
Aalto University
markku.markkula@aalto.fi

Hank Kune
Societal Innovation Coach
New Club of Paris
hankkune@educore.nl

4. Towards Smart Regions: Highlighting the Role of Universities

Abstract

The Helsinki Region experiences stress the importance of societal renewal capital. The EU Committee of the Regions (CoR) activities share the same need on a broader scale: Europe needs to increase its renewal capital. Europe needs pioneering regions to do this. The EU Smart Specialisation policy aims to tackle the challenge of turning the outcomes of thousands of small development projects, involving the same topics in different parts of Europe, into well-documented concepts, methodologies and tools.

The notions of knowledge creation and transfer of knowledge into practice have taken new forms. In the interfaces between universities, industry, public authorities and citizens, knowledge exploitation and capacity-building processes constitute important concepts, as do opportunity exploration and knowledge co-creation as. A good regional innovation policy meets these challenges. Its practices need to integrate top-down policy with bottom-up self-renewing activities, taking into account the characteristics described in this article.

For a change to happen, people need new mindsets, effective toolboxes and new competences for knowledge co-creation and collaborative knowledge management. Collaboration is important in every activity. In all this, regions and cities should be the drivers of the targeted transformation. Joint learning is a cornerstone of the collaboration. This article describes the contributions universities make to smart regions highlighting experiences in upgrading European cooperation to the level of benchlearning, and the importance of successful partnering between regions.

KEYWORDS: Smart specialisation, Societal innovation, Triple Helix, Smart cities and regions

1. Introduction

Europe and the whole world are facing Grand Societal Challenges, which are characterized by extreme complexity. Globalization and digitalisation have brought these challenges and their underlying cultural factors to everyone's attention. Mere market forces cannot deal with these challenges, and in many cases they actually increase societal problems. More than ever, the key success factors in regional policy focus on creating new opportunities. The role of universities and the importance of scientific research in tackling these challenges are increasing. The question of how to quickly and effectively transform research knowledge into practical applications poses a major concern. The individual's ability to learn, the practice of organizational learning, and the ability to conduct research and innovation in multi-dimensional co-creative teams and networks are basic characteristics—and requirements—of modern societies. Both the importance and the difficulty of learning increase significantly in large innovation ecosystems.

Where should we direct our attention? The notions of knowledge creation and translation of knowledge into practice have taken new forms. In the interfaces between universities, industry, public authorities and citizens, knowledge exploitation and capacity-building processes constitute important concepts, as do exploration and knowledge co-creation. The regional innovation policy must tackle these challenges. Its practices need to integrate top-down policy with bottom-up self-renewing activities, taking into account the characteristics described in this article.

For the new European 2014–2020 programme period, the EU has actively embraced the concept of regional research and innovation strategies based on smart specialisation (RIS3). The following policy dimensions are of special relevance, as defined in the EU RIS3 Guide (JRC S3 Platform 2011 b):

- Making innovation a policy priority for all regions: provide incentives to regions to invest more Structural Funds (SF) in strengthening their knowledge and competence base and in upgrading their innovation systems.
- Focusing investments and creating synergies: RIS3 to concentrate SF investments on areas of relative strength, economic opportunity, emerging trends and growth-enhancing measures.
- Improving the innovation strategy process: RIS3 to require smart, strategic choices and evidence-based policy making: priority-setting on the basis of evidence/strategic intelligence about a region's capabilities, competences, competitive advantages and potential for excellence.
- Strengthening governance and stakeholder involvement: RIS3 to foster stakeholder engagement under a shared vision, link small-, medium- and large-sized firms, encourage multi-level governance, and help build creative and social capital at the community level.

Smart specialisation strategies provide a regional policy framework and basis for innovation-driven growth. RIS3 is a process highlighting **entrepreneurial discovery:** an interactive and innovative process in which market forces and the private sector, together with universities, discover and produce information about new activities, after which the government assesses the outcomes and empowers those players most capable of realising the potential. RIS3 strategies are much more bottom-up than traditional industrial policies.

The basic structures of collaborative research in Europe have also been modified for the programme period 2014–2020. The new research framework, Horizon 2020, is based on three pillars: Excellent Science, Industrial Leadership, and Societal Challenges. It examines R&D activities in a much broader, societal context than the earlier FP programmes.

To achieve the intended high-level societal impact, activities based on Horizon pillar (1) Scientific Excellence need to be multidisciplinary and integrated with the other two pillars. In relation to Smart Cities and Regions, both Horizon pillars (2) Industrial Leadership (in particular leadership for enabling technologies and for supporting SMEs) and (3) Societal Challenges, are highly relevant.

How does this translate into practice? The following general themes relevant to Smart Regions are prominently represented in the Horizon 2020 Work Programme (2014–2015) (Helsinki Smart Region 2014):

- Smart applications in areas such as energy efficiency, sustainable urban mobility and transport, smart governance.
- Smart and sustainable digital infrastructures based on Future Internet enablers and technologies such as cloud computing.
- Social innovation in regions, cities and neighbourhoods enabled by collaboration- and community-based platforms.
- Connected innovation infrastructures such as Future Internet experimentation and testbed facilities, Living Labs and other resources as the backbone for 2020-connected innovation ecosystems across Europe.

2. Towards Smart Regions

2.1 Regional renewal to be based on ecosystems

International competitive edge is increasingly based on a shared intent of the key regional actors to turn the area into a significant innovation hub, and creating forerunner innovation activities in specific thematic areas. All innovation hubs are also innovation ecosystems and have four factors in common. First of all, they have globally valued special expertise and corporate activities based on this expertise. Secondly, they create new knowledge that is applied on a global scale. Thirdly, the hub attracts international expertise, competence-driven business and investments. Finally, they have companies of excellence that operate globally.

Both the EU as a whole, and its diverse regions, should significantly raise the level of their innovation activities. To ensure the targeted leap, it is essential to recognize and involve top regional experts who are also ready to commit to implementing the measures. Similarly, one should recognize the potential collaboration forums and organizational needs that are required to enable producing the needed quality. Diverse ongoing projects and measures are connected to the implementation of spearhead endeavours, and planning must continue to tie new projects together to implement the strategy. In the Helsinki Region, the common criteria for all the actions and spearheads were already defined in 2010 in the Helsinki Region in a participatory stakeholder project involving intensive expert analysis and three workshops. These common criteria include the following (Markkula et al., 2010):

1. The measures are characterized simultaneously by strategic top-down leadership and a user-driven bottom-up approach.
2. The measures enhance productivity. Collaboration is intensified and impact increases between diverse actors. As a result, a new and effective networked culture is created, and collaboration and joy of working and learning increase.
3. The measures typically relate to the acquisition, application, refining and sharing of the latest research knowledge.
4. The measures generate new expertise and innovations. The expertise generates new competence and innovations. The competence spreads and roots in individuals, companies, universities and society.
5. The measures draw on the Finnish strengths and the global pull of Aalto University. The potential success factors of Finland should be prioritized and strengthened.
6. The measures are increasingly implemented by not only Finnish operators but as an international network endeavour.
7. The measures have global impact and they promote pioneering in the EU. The measures and their impacts are steered by means of goals and measurements.

These aims and criteria drive regional actors to direct their competence to regional projects. The level of competence required from companies, universities and societal operators must be identified for each effort. This also means modernizing the Triple Helix concept by focusing more than ever on the active engagement of citizens as innovation developers and users.

2.2 Modernizing the Triple Helix collaboration

Many EU member states and regions in Europe have a long tradition in using the Triple Helix, a concept comprising three actor groups: industry, cities and other public-sector organisations, and universities (and other research-oriented institutions). Initially, in-

dustry operates in the Triple Helix as the locus of product development and production, government as the source of contractual relations that guarantee stable interactions and exchange, and the university as a source of new knowledge and technology. However, the roles and responsibilities of these institutional spheres are changing.

Strengthening the collaboration (and related concrete measures) between these groups constitutes the key challenge for present development efforts, as highlighted in the reports describing Helsinki Region development over the past ten years. When the status of collaboration is evaluated and new collaboration methods are developed, the following principles underlying the Triple Helix must be considered:

1. **Actors:** How does the cooperation between universities, industry and public administration function in the region?
2. **Structures:** Structures, networks, research groups and jointly steered organizations emerge at the interfaces of collaboration. What is their status?
3. **Premises:** What premises are available for physical, virtual and social development?
4. **New organizations:** New actors often represent hybrids that integrate elements from different institutions, e.g. science parks and corporate and technology incubators. Have new actors emerged in the region?
5. **Knowledge and technology transfer and co-creation:** How do the different innovation, invention and patent services within universities and research institutes, knowledge-intensive business services (KIBS), incubators and investor activities function?
6. **Policies:** Are new financing instruments, collaboration support, IPR right measures and reforms, taxation or regulation in place?

These factors—or a complex mix of factors—form the basis of a regional innovation ecosystem. The evolution of recent years can be described as a systemic change that accentuates the following factors and characteristics (Markkula, 2014):

1. More systemic strategic thinking in defining and implementing regional innovation strategies based on smart specialisation:
    a) Increasing smart city & smart region initiatives;
    b) Prioritising the regional activities and strengthening the base for focused activities;
    c) Building critical mass based on European-wide strategic partnerships.

2. Focusing more on societal challenges and as a result, broadening the innovation base:
    a) Increasing a general motivation towards innovation;
    b) Stressing the importance of the real-life & real-case approach;
    c) Moving towards Open Innovation 2.0.

3. Recognising the crucial role of regional innovation ecosystems based on the co-creation culture and the network of innovation hubs:
    a) Creating living labs and innovation testbeds for knowledge co-creation;
    b) Encouraging bottom-up activities by creating new arenas as innovation hotspots;
    c) Moving towards experiments, demonstrations and rapid prototyping.

In light of these, each region has its own renewal needs and challenges when developing as an innovation ecosystem. A few examples from the summaries created for regional master planning of the Helsinki Region illustrate these challenges. There is no doubt that the region hosts plenty of internationally valued special expertise (e.g. ICT, nanotechnology, brain research, game industry, cleantech). In other words, there is much potential. Businesses benefiting from the expertise abound and the number of start-ups is on the rise. Even though the trends in these activities are positive, far more globally operating companies are needed. Despite the many universities in the region that develop new technologies in collaboration with companies, it has been difficult to successfully communicate these messages to the international markets.

The Triple Helix model is no longer enough in the context of smart specialisation. The Quadruple Helix allows for a variety of innovations other than the ones strongly based on technology or science, in the spirit of the broad concept of innovation at the foundation of RIS3. This requires significant flexibility, adaptation of processes, acquisition of new skills, and potential re-distribution of power among organizations (JRC S3 Platform, 2012).

3. RIS3 in the Helsinki Region

As a policy instrument, RIS3 is a continuous process. Some perspective on where the Helsinki Region wishes to focus its RIS3 strategy can be obtained by examining the estimations and alignments drawn up five years ago. The municipal plan for 2033 approved by the Helsinki-Uusimaa Regional Council in December 2009 set "Helsinki-Uusimaa is the international and attractive metropolitan area of thriving citizens" as its goal. The points of departure of the plan include:

- The aim is to grow more international and attractive. More investments than today are needed from abroad, as well as a significant increase in labor immigration.
- A creative and versatile cultural platform needs to be developed, in which business based on creative expertise strengthens the regional economic structure and employment.

For each region, RIS3 should be a continuous process, not just an important document. In the Helsinki Region we drew the following conclusions from EU-level definitions as the foundation of our work:

- RIS3 is an economic transformation agenda. RIS3 is a dynamic and evolutionary process (not a structure) deeply grounded in an entrepreneurial discovery process (not a one-off action) where governments are facilitators rather than in a position to command and control. RIS3 is for innovation leaders and for those lagging behind.
- The smart specialisation approach is not just about a more focused and limited approach to cluster funding. RIS3 is a structural reform to upgrade the entire business environment and innovation ecosystem in the region.
- Smart specialisation is opening up important opportunities for joining forces, matching roadmaps and building more world-class clusters.

Smart Specialisation Strategies should be iterative, tailor-made policy processes	
Step 1:	Regional Policy Programme: Scenarios & SWOT & Audit ➜ Spearheads
Step 2:	Stakeholder commitment & culture of collaboration ➜ Shared ownership
Step 3:	Use the best global knowledge ➜ Strategic alliances
Step 4:	Strong links with Europe 2020 ➜ European Partnerships
Step 5:	Define a coherent policy mix and action plan ➜ Experimenting and Rapid prototyping
Step 6:	Integrate monitoring and evaluation mechanisms ➜ On-going process of renewal

Table 1. The EU defined six RIS3 steps as applied in the process for the Helsinki Region (Markkula Triple Helix (2014).

The EU has defined six steps as guidelines for the regional RIS3 processes. During the last few years, the Helsinki Region's RIS3 program has included the following points of action (most are already completed, some are still underway):

1. A collaborative scenario process was carried out 2012–2013 within the Greater Helsinki Region.
2. The main targets up to 2040 were defined by the Helsinki Regional Council in cooperation with the municipalities.
3. The process for the Helsinki Region policy programme was organised in 2013 with stakeholder hearings and open consultation. The outcomes including the vision and strategy 2040, as well as the strategic priorities for 2014–2017 were approved by the Regional Council in December 2013.
4. The implementation plan with the spearhead mega-endeavours was approved.
5. The changes are going on in re-organising the operational base of the Steering Board for using structural funds and running the RIS3 process.

6. The on-going process phase aims to define in more detail the ecosystems and roadmaps for each spearhead mega-endeavour (project portfolio). All stakeholders are engaged. Universities and other innovation key actors play a major role in this.
7. The most challenging activity is integrating points 5 and 6 targeted to new RIS3 governance concepts, which are based on orchestration and synergic implementation processes.

In the Helsinki Region, the RIS3 process, as well as other activities closely linked to it, is carried out using the S3 Platform guidebooks. Finland has a long tradition in effectively implementing the Triple Helix model, and citizens are actively engaged in public-sector processes, Quadruple Helix thinking and operations—adding citizens as a fourth actor group alongside business, government, and academia—so these are natural means to speed up innovation. Here in the Helsinki Region, modernising the Triple Helix in RIS3 processes means going one step further, focusing on regional innovation ecosystems and the use of ecosystem thinking to consider which actor groups are relevant in societal change processes.

The aim of the Helsinki Region's smart specialisation strategy is to promote sustainable development by means of new value creation stemming from research and innovation activities. The Helsinki-Uusimaa Regional Council set the following goals for 2020:

- The Helsinki-Uusimaa region serves as an international innovation hub and forerunner in deploying innovative products and services.
- The regional impact of research and innovation activities will double its value compared to today.

These goals are pursued through four objectives related to a change in the working culture:

- International breakthroughs emerge from strong innovation hubs.
- The regional expertise is more effectively applied in innovation activities.
- A networked operating mode is better structured and has more impact.
- Research and innovation activities are more productive and their operating mode more persistent.

To implement the strategy, three complementary targets of development are defined:

1. The development of an innovation ecosystem, based on open and facilitated collaboration that considers the entire region as a whole. To achieve this, the strategy describes on a general level the RIS3 operating mode and, in particular, the required innovation platforms and the new culture of innovation policy.

2. Supporting new and renewing business and developing business services from the viewpoint of the entire region. Strategy here refers to the development model devised in 2013 for the metropolitan area and other corporate services.
3. The implementation of the themes and operating modes presented in the spearhead entities (priorities). The strategy proposes spearhead themes built on the region's strengths and growth opportunities, to enable the local research and innovation activities to benefit from RIS3 funding and collaboration.

Smart specialisation brings together the goals of public administration and different sectors' perspectives as well as the versatile, value-creating expertise of the region (Smart Value). Research and innovation activities are developed in collaboration platforms (Smart Platforms) and promoted with policy and financing instruments (Smart Support). The Smart Specialisation strategy helps to focus the Uusimaa research and innovation activities to the endeavours within the selected theme, and to support both local and European partnerships. The key success factors are based on the new working culture: orchestration, and mobilising key actors to operate on digitalised open innovation platforms (see Figure 1). In practice, one or several project portfolios will be formed for each spearhead theme. Thus each spearhead consists of many activities orchestrated as a synergic endeavour.

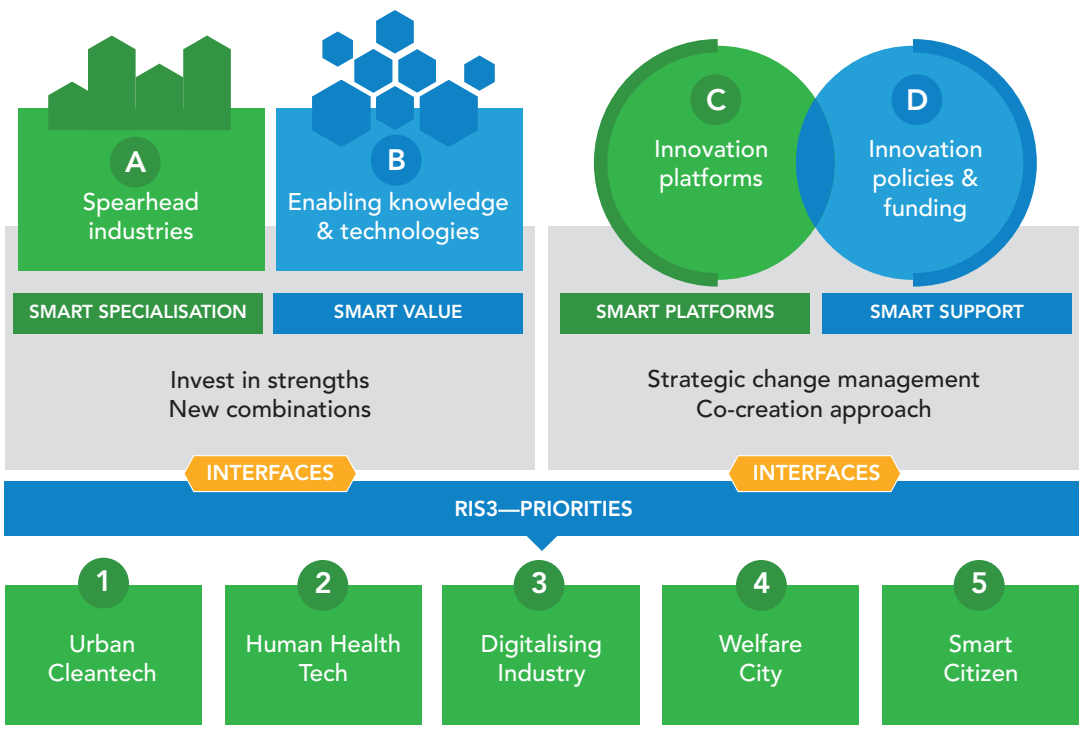


Figure 1. The concept of Helsinki Region RIS3 is based on systemic orchestration of all the key innovation policy actors in the region. (Smart Specialisation in the Helsinki Region 2014)

4. The Active Role of Universities

4.1 Guidelines for university—region cooperation

The active regional contributions by universities can be broken down into four areas—business innovation which is closely linked, although not exclusively, to the research function of the university; human capital development linked to the teaching function; and community development linked to the public service role of universities. The fourth area is the contribution of the university to the institutional capacity of the region through engagement of its management and members in local civil society. Where these four domains are integrated, the university can be seen to be taking a "proactive" and not just "passive" role in the regional development process (JRC S3 Platform, 2011 a). Espoo Innovation Garden activities provide much evidence of operating in all four domains. The evidence is strong: a globally connected university acts as a 'window' in the region, and builds and enhances the image and reputation of the region to the wider world.

The S3 Platform Guide has indicated a direction for universities and regional authorities to work together to achieve the desired targets. The following actions are recommended (JRC S3 Platform, 2011 a):

- There should be an active attempt to a shift from **transactional** to **transformational** interventions with a greater emphasis on programmes rather than one-off discrete projects.
- A partnership is established in the region to specifically address the issues of engagement between universities and regions and particular attention is given to ensuring the sustainability of partnerships in the longer term, independently of funding cycles.
- Managing Authorities should assign funds from their technical assistance budgets to support capacity building within the partnership. Universities, business communities and other public sector authorities should demonstrate their commitment to the process by investing in their own development.
- Regional Partnerships should consider participating in the OECD programme of regional reviews in order to help identify their current strengths and areas that may require capacity building and carefully consider the findings of EUIMA (European Universities Implementing their Modernisation Agenda) and other related programmes.
- Some simplification and flexibility in implementing Cohesion Policy Regulations is considered and Managing Authorities are actively encouraged to adopt a more flexible approach.

- The managing authorities and universities adopt a broader definition of innovation to acknowledge the role that arts, humanities and social sciences can play, especially in responding to the 'grand challenges' and develop mechanisms that draw on the expertise and contribution e.g. from the arts and creative industries.

4.2 Universities and the EU smart specialisation policy

The European University Association EUA has organized several workshops and conferences, as well as diverse statements, on the role of universities in the European Smart Specialisation policy. The all-permeating EUA guideline can be simply stated as this: universities and regional authorities have a unique opportunity to form close partnerships that, together with industry and other stakeholders, can maximize the use of EU Structural Funds for research and innovation to deliver economic and social development. (European University Association EUA 2014),

The EU unit S3 Platform is in charge of the support activities within the Commission's Smart Specialisation policy. One of the guidebooks "Connecting Universities to Regional Growth" bridges three knowledge and policy domains—education, research and innovation—the so called "knowledge triangle". The guide also stresses that enhancing the universities' capacity to reach out to regional business and the community will fail if sufficient capacity for innovation is not in place within the region. This is a particularly acute challenge in less favored regions, where the necessary preconditions for growth and success can only be created by increasing the innovation capacity of the region, i.e. by involving all the major innovation policy actors including regional authorities and business life.

Realising this potential will require a regional higher education system that is part of a broadly based ecology of innovation. At a very practical level, universities should be actively involved in shaping and managing the implementation of regional smart specialisation strategies.

How universities can be a part of the European wide smart specialisation policy was the topic highlighted at a joint Commission and EUA conference on 20 June 2014. Commissioner Geoghegan-Quinn called for universities "to act as strategic institutions pulling together all their know-how to create bigger economic and social impacts". Some "trailblazers," she said, have shown that this is possible, but many more universities have the potential to play this strategic role, building upon their 'core' activities of teaching and research. The Commissioner stated that "Smart specialisation calls on universities to do more: they should become strategic institutions".

Director General Walter Deffaa (DG for Regional and Urban Policy) called for universities to play a more active role in society, emphasizing that:

1. Universities are the **knowledge base** of strategies (e.g. analysis of SWOT, relevant trends)

2. Universities are the **service base** for regions and clusters (e.g. targeted research, advice to regional authorities)
3. Universities are the **skills base** for realizing the strategy (e.g. entrepreneurial skills)

There is much to learn from how regions integrate the potential of universities in their development processes, and how universities actively choose to manage their resources. Universities constitute a cornerstone of the Knowledge Society, and most of them cultivate the competences of researchers and students to actively fulfil their traditional roles as knowledge creators (research) and knowledge disseminators (learning/teaching) in different ways. Moreover, with respect to the societal role of universities, old-fashioned island models of ivy leagues and ivory towers have given way to collaborative models recognizing the important third mission or third role of universities: civic engagement and societal participation to assist societies in tackling their diverse societal challenges.

4.3 The three strategic contributions of universities

This third role recognises the interconnectedness and interdependence of all players in the ecosystem. Universities create and maintain knowledge resources and can contribute these resources in three ways. The first contribution is driven by **a new understanding of the importance of applying research in practice.**

As the Committee of the Regions (CoR) Opinion on **Closing the Innovation Divide** indicates, it is "Scientific and technological research, and the active application of ideas based on that research, [that] make it possible to be pioneering." [CoR 2013, page 15]. This requires an active science-society dialogue, in which universities, the local government, NGO's and industry become aware of and alert to each other's needs and potential contributions. On the one hand, regional development projects with specific challenges and problems are looking for answers, and relevant research may well exist which addresses the potential solutions. On the other hand, researchers looking for suitable issues to address can draw on the needs of local practitioners in the ecosystem.

The CoR emphasizes the importance of bridging the gap between science and society: "The focused translation of research into practice requires a good understanding on both sides of what research there is, what issues are being discussed, and how relevant research can impact local and regional issues. A new kind of knowledge triangle is needed for this, linking the world of research and science with the world of business and government through a kind of two-way mediating service. This requires further development and active implementation of the EU Knowledge Triangle concept in strengthening the societal role of universities... all parties concerned to actively engage in science-society dialogues that explore and underscore how to translate the results of research into real-life practice. All societal challenges have a strong local dimension, which can be of benefit when scientists become

aware of issues and societal stakeholders understand what science can offer… All target groups in different regions and cultural environments — scientists, civil servants, SMEs, and students — need to be coached in understanding and actively complementing each others' perspectives, and in how to apply relevant ideas in practice. Schools and all educational bodies play a particularly crucial role here." (CoR 2013, pages 14, 21)

This coaching is an extension of what universities always do, and extends their coaching mandate more broadly throughout the ecosystem. Initiating and maintaining this dialogue takes academics out into society, and brings societal stakeholders into the university, enriching the urban experience of all parties. Moreover, it contributes to realizing the deeper intention behind the three pillars of Europe's Horizon 2020 programme: the utilization of Excellent Science and Industrial Leadership to address Societal Challenges.

The second contribution universities make in their third role reflects **the importance of entrepreneurship and entrepreneurial discovery in feeding regional development.** The spirit of entrepreneurial discovery drives innovation in the regional ecosystem, creating conditions in which researchers, students, civil servants and SMEs can all become more alert to promising possibilities, developing or discovering new ideas or opportunities for the purpose of creating value, whether economic, social, or even political. It is a mindset characterized by curiosity, creativity, courage, and direct practice, discovering how to act in improving quality of life. Entrepreneurial discovery means experimentation, risk-taking, and this can also mean failing. It requires people and organizations to work together in ways that strengthen the ecosystem. The many examples of entrepreneurial discovery by students and researchers in Espoo Innovation Garden illustrate the importance of this contribution.

The third contribution of universities to Smart Regions relates to **the Universities' roles as knowledge creators and disseminators.** Universities educate people and prepare them for taking part in society, for actively engaging and contributing their talents and qualities to building smarter regions, and for understanding, adopting and using the many innovative products and services these regions need in order to prosper. Smart regions need smart citizens—smart in the deeper sense of knowing things, having and showing intelligence, understanding and applying knowledge, being able to think sharply and quickly in difficult situations. Open minds are a precondition for innovation. To paraphrase OISPG (The EU Open Innovation Strategy and Policy Group) member Gohar Saragsyan, "there can be no smart regions without smart citizens". Adding this kind of intelligence to Smart Regions is a fundamental requirement of modern universities—and indeed, of all educational institutions. This reflects the true intention of education, be it primary, secondary, tertiary, or lifelong learning.

Together, these three contributions to smart regions are a powerful expression of good governance in the 21st century.

4.4 Implementation: what next?

It is clear from Helsinki Region experience that for the implementation of RIS3, and especially for realizing its role in changing the mentality towards discovery and experimenting, the region needs to:

- Create prerequisites for and actively promote regional collaboration to promote breakthroughs on an international level.
- Combine and apply the capability accumulating in the region to form a foundation for shared innovation activities.
- Bring together different actors to the open innovation collaborative platforms by integrating top expertise, opportunities offered by technology solutions, and key resources to solve commonly recognized problems.
- Increase the productivity, predictability and persistence of research and innovation activity, in this way adding clarity and impact to the networked way of working.
- Direct collaboration on the thematic spearhead entities, in which solutions are sought directly for the everyday and business challenges of the region's actors.

The ecosystem of each RIS3 spearhead theme must be documented based on shared ownership. To bolster collaboration, new types of incentives and attractions must be created. The leap towards the implementation of shared endeavours and larger entities requires high-level orchestration and facilitation. This is how the Helsinki Region intends to fulfill its pioneering role as a leading global innovation hub, where the knowledge triangle (research, education and innovation activities) is integrated in practice, and where both entrepreneurial discovery and startup mentality are visible throughout university-industry collaboration. This induced synergy helps achieve a far greater impact than ordinary development measures would allow.

5. Conclusions: Infusing the Region with Knowledge

Accepting the intention of Horizon 2020 to realize the integration of its three pillars (Excellence Science, Industrial Leadership, Societal Challenges) means giving universities every opportunity to be full partners in regional innovation processes. Developments in Espoo Innovation Garden show how this is possible.

In pioneering regions across Europe, universities are active players in their communities, contributing to the quality of life and regional well-being, adding value to regional development processes, and anchoring the importance of knowledge in the regional innovation ecosystem. Ideally, this is a co-creation process producing regional services in collaboration with industry, public authorities and citizens.

The universities and research centres operating actively within the Espoo Innovation Garden development—especially Aalto University, Helsinki University, VTT Technical Research Centre of Finland, Laurea University of Applied Sciences, and Metropolia University of Applied Sciences—are good examples of this. In practice, however, the role of universities across Europe differs from region to region. No one would argue that the university is still the elitist stronghold of yesterday, although in some instances universities are hesitant to commit to this co-creation process of renewal.

Thinking beyond the three roles universities now play and anticipating what regions require for the near future, we can take inspiration from what innovative regions are pioneering in the present. This includes the active practice of:

- **Connection:** Connecting generations (students, lifelong learners and schoolchildren, by reaching out to work more closely with primary and secondary schools in developing competences in discovery learning); connecting people to processes (encouraging engagement and active contribution to societal processes); connecting knowledge to processes (regional, social and societal learning processes); and connecting ecosystem partners to each other;
- **Knowledge:** Infusing the region with knowledge and understanding, and enhancing smartness and intelligence in the older senses of thinking and knowing.
- **Learning:** Not simply curriculum-based, but learning from practice, learning in the ecosystem (and also about the ecosystem), and making this learning accessible throughout the ecosystem.
- **Anticipating:** We need facilities to deal with problems and issues before they become acute. Most regional challenges of today (could) have been anticipated in the past and addressed earlier. Universities should maintain proactive foresight, fore-search and early warning facilities for the regions and the communities they serve.
- **Generations of the future:** Helping young people to prepare for the possibilities of many possible futures as they are emerging: through guiding, coaching, condition-creating, competence-enhancing, capacity building.

To conclude, a few words about the future. It is a well-known bromide that we **can't know the future.** Of course this is true, but it is also not the point. We already recognise the high predictive value of trend analysis, pattern-recognition, scenarios, systems thinking, technology assessment, and the algorithms driving today's big data economy. There are diverse societal-dynamic models with a reasonable predictive value. It is clear that universities can help regions make effective use of these models in improving their development processes and their societal services. By working together with other players in the regional ecosystem, everyone can use

the research and innovation base of universities in producing services and other products that societies need. Regions require the development of attractive places to work and live—and the first enabling factor is drafting and experimenting with regional concepts of innovation platforms. Through this, many avenues will be created for co-creation and inventing the future we desire.

References

CoR (2013), Committee of the Regions, Opinion "Closing the Innovation Divide" CdR 2414/2012 final, (Official Journal of the European Union, 30.7.2013)

European University Association EUA. (2014). The role of universities in Smart Specialisation Strategies, Report on joint EUA-REGIO/JRC Smart Specialisation Platform expert workshop.

Helsinki Smart Region. (2014). Pioneering for Europe 2020, Second Edition,(4.6.2014), Helsinki-Uusimaa Regional Council.

JRC S3 Platform. (2011 a). Connecting Universities to Regional Growth: A Practical Guide.

JRC S3 Platform. (2011 b). RIS3 Guide, 12.12.2011.

JRC S3 Platform. (2012). Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3).

Markkula M., Miikki L., Pirttivaara M. (2010). Helsinki-Uusimaa Regional Council, Uudenmaan liiton strategian toinen aalto (published in Finnish).

Markkula, M. (2014). Triple Helix. Renewing the Triple Helix in a context of Smart Specialisation, The Triple Helix Association: Special Report of the Triple Helix 11 Conference on 8–10 July 2013, Helice, 3(8), http://www.triplehelixassociation.org/helice/.

Smart Specialisation in the Helsinki Region (2014). Research and Innovation Strategy in Regional Development 2014–2020 Approved_8.12.2014.

About the authors

Markku Markkula is the President of the EU Committee of the Regions (CoR) since 12.2.2015. He has been a member of CoR from 2010 being the Rapporteur on several opinions related to topics such as Europe 2020, digitalisation, single market, as well as research and innovation. His experience includes memberships of several High Level Expert Groups. He is the member of the EU Smart Specialisation Mirror Group.

Mr Markkula works within Aalto University as the Advisor to Aalto Presidents, focusing on European Union strategy affairs. His previous work experience includes Directorship of the Lifelong Learning Institute Dipoli and the Secretary General of the International Association for Continuing Engineering Education IACEE. He is a former member of the Finnish Parliament (1995–2003). As an MP, his international role included the Presidency of EPTA Council, European Parliamentary Technology Assessment Network.

In the Helsinki Region, he is the Board member of the Regional Council, and the chair of the Steering Board making decisions on the use of Structural Funds. He is a longstanding Espoo City Council member, as well as the chair of the City Planning Board.

Hank Kune works with diverse corporate and government organizations in projects about societal innovation and renewal, with a special emphasis on hands-on problem solving in complex social, societal and organizational situations. He is director of Educore BV, Founding Partner and member of the governing board of the Future Center Alliance, and an active member of the New Club of Paris, a global network organization working as agenda developer for knowledge societies, where his focus is on entrepreneurial initiatives and societal innovation coaching.



THE HOT SPOT FOR ENTREPRENEURIAL DISCOVERY

THE ECONOMY OF the Keilaniemi Business Hub together with the Aalto University Campus can create a magnificent Powerload in the middle of the area. This new center will energize the surroundings by combining an international mix of residents, startups, scientists and business executives.

THE POWERLOAD will form the new center and be the hottest platform of this dynamic ecosystem.

MAXIMIZING THE WATERFRONT EXPERIENCE

THE SHORELINE WILL be expanded by creating so-called fingers with different themes. This will exponentially increase the multitude of the waterfront route. Especially pedestrians will benefit from this feature. New waterfront high-rise housing connected to office towers and horizontal startup alleys will create an optimized surrounding for an ecosystem to flourish. The Fingerplan will empower the already man-made shoreline to become a potential driver for designing the future.



II
THE HUMAN PERSPECTIVE ON INNOVATION ECOSYSTEMS



Value creation in organizations has traditionally focused on intensifying the application of tangible assets. The emergence of research knowledge has, however, evidenced the close association between human capital and organizational productivity especially in terms of innovation potential and creativity. This has shifted the operative development attention to intangible assets, especially governance and leadership, also in education.

In this chapter, **TIMO HÄMÄLÄINEN** examines ways in which policy making attempts to solve the global wicked policy problems, and proposes the sustainable well-being strategy as a solution. Similarly, **ANTTI HAUTAMÄKI** and **KAISA OKSANEN** address the grand societal challenges and examine sustainable well-being as a condition of innovation activity that helps meet these challenges. **KIM SMITH, ANNA MAARIA NUUTINEN** and **CHARLES HOPKINS** promote the collective impact for a more sustainable future by showing how self-interests can be synchronized with societal awareness through cultural paradigm shifts and collaborative models in education. In their case study, **MARKKU LAPPALAINEN** and **PIA LAPPALAINEN** propose leadership as leverage in rooting an operating mode that encourages multidisciplinarity and innovation activity and share developments in Aalto University curricula that nurture creativity in the classroom. To continue with innovation initiatives, **KRISTIINA ERKKILÄ** and **LARS MIIKKI** present the Aalto Camp for Societal Impact (ACSI) as an inspiring new platform for co-creating processes and methodologies tackling societal challenges. **ELMAR HUSMANN** concludes this chapter by describing how the Aalto Design Factory model has inspired the European Classrooms of the Future school initiative on creativity, entrepreneurial discovery and experiential learning.

Timo J. Hämäläinen
Sitra Fellow, Ph.D., Dos. (international business)
The Finnish Innovation Fund, Sitra
timo.hamalainen@sitra.fi

5. Governance Solutions to Wicked Problems: Cities and Sustainable Well-Being

Abstract

The growing specialisation and interdependence of societies as well as their rapid technological and economic transformation have increased the level of uncertainty and complexity in decision making and the role of wicked problems in policy making. This article analyzes the nature and evolution of wicked problems and argues that they stem from the gap between the complexity of the policy problem and the variety of the corresponding governance arrangements. This **complexity gap** *can be closed with new governance solutions that include participation, interaction and cooperation among stakeholders, collective learning processes, coordination by mutual adjustment and clear systemic direction, decentralization, diversity and experimentation, and effective measures to overcome system rigidities and development bottlenecks. For several reasons, cities and metropolitan areas are ideal environments for addressing wicked problems. They have the* **variety advantage** *of sufficient resources, capabilities and services, physical proximity that facilitates rich face-to-face communication, learning and cooperation, and the right scope for producing and experimenting with the necessary public goods and services.*

The article concludes by arguing that Finland, the Helsinki metropolitan area and the City of Espoo could become global frontrunners in solving the world's wicked policy problems by adopting a strategy of **sustainable well-being.** *This would build on the world-class knowledge of the Finnish welfare state and the rapidly growing research on subjective well-being.*

KEYWORDS: Complexity, Wicked problem, Sustainability, Governance, Cities

1. Introduction

The industrialized world is undergoing a historical transformation. The current phase of the economic crisis that started in 2008 is a part of a deeper and longer-term structural crisis of the 20th century societal paradigm (Freeman and Perez, 1988; Hämäläinen, 2003). This structural crisis results from the maturity and negative spill-over effects of the energy- and material-intensive mass-production and mass consumption model that spread throughout the industrialized world during the past century. This economic model benefited from the opening of the world trade and the development of welfare state institutions, which channeled resources to individuals with higher propensity to consume. These developments created new demand for the growing production capacity of industrialized countries. However, the accumulating problems of this socio-economic model have become increasingly evident since the late 1960s when the baby-boomers first rebelled against the established values of industrialized societies.

The problems of the established socio-economic model stem from various sources, such as the globalization of production systems and accelerated structural change in national and local economies, changing skill requirements of new technologies, unsustainable use of natural resources, aging of population, decision making and governance problems in the face of increased uncertainty and economic complexity, changing values and demand patterns of citizens, as well as outdated regulatory frameworks. These problems have made the current societal model of industrialized countries unsustainable economically, socially, ecologically and in terms of individual well-being.

The accumulating problems of industrialized societies have reinforced the interest in sustainable development (SD). However, the current discourse on SD is still largely based on the work of the Brundtland Commission in the late 1980s. It defined SD as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). Although the Commission offered no definition of needs, they did refer to basic material necessities, such as food, water, and shelter. In the subsequent SD work, this has led to an emphasis on economic and equity issues, in addition to environmental concerns. The lack of clear definition of needs has made the concept of SD rather difficult to implement in practice (Rauschmayer et al., 2011).

Today, many people feel that SD policies and the associated drive towards more sustainable life styles tend to restrict their freedom of choice and subjective well-being. They feel that they would have to sacrifice their usual life style in order to live in a more sustainable way. However, a more holistic understanding of human needs and well-being opens up new policy and behavioral options that can achieve the same sustainability benefits while maintaining or improving individual well-being. This is possible if the restrictions on individual freedom and resource use are compensated for with improvements in the other determinants of individual well-being.[1] Such improvements can be an effective motivator for sustainable behavior.

The traditional perspective to sustainable development emphasizes a society's resilience against downside risks. If we expand this perspective into a more holistic view of well-being, it leads to a more positive concept of **sustainable well-being.** This new concept means that societies should aim to foster (all) well-being needs of the present generation without compromising the ability of future generations to meet their needs. Thus, SD policies should build on a deep understanding of the various determinants of human well-being in the changing natural and socio-economic environment.

As a result, the traditional economic, social and ecological sustainability considerations of SD need to be supplemented with the **subjective well-being** and **responsibility of individuals** (Figure 1). The subjective well-being needs to be included because mental well-being problems have become a serious problem in industrialized countries during the past few decades (Hämäläinen, 2014; O'Hara & Lyon, 2014). The individual responsibility must be included because sustainability cannot be reached in a complex society without responsible individual choices.

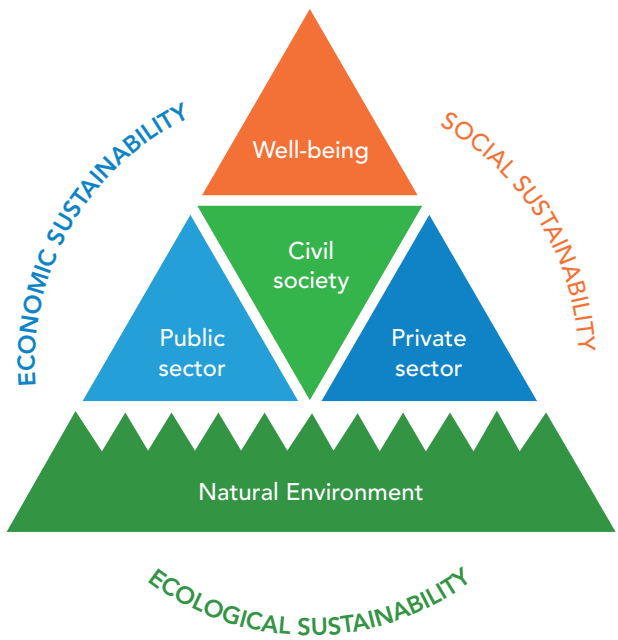


Figure 1. The sustainable well-being framework. Source: Hämäläinen (2013)

Citizens are generally well aware of the most important sustainability problems. However, there is much less consensus about the appropriate solutions to these problems. Sustainability experts are typically specialised in different dimensions of these problems (e.g. economic, social, ecological) and they do not typically attempt to integrate their various specialised solutions into a more holistic and coherent vision. This is unfortunate since the key sustainability challenges—such as climate

[1] The satisfaction of many human needs requires scarce natural resources. The growing importance of social and psychological needs in affluent societies is an important trend from the sustainability perspective.

change, structural unemployment, persistent fiscal deficits and lifestyle diseases—are **wicked problems** (Rittel & Webber, 1973) which cannot be solved with the traditional compartmentalized policy and governance approaches. New governance solutions are clearly needed.

This article analyzes the nature and evolution of wicked policy problems and suggests new governance solutions to them (Sections 2 and 3). It argues that cities and metropolitan areas (metros) have special advantages in developing the solutions that can match the increased complexity and uncertainty of contemporary economies and societies (Section 4). The final section argues that the City of Espoo and the Helsinki metro area, to which it belongs, could become a global frontrunner in the move towards **sustainable well-being society** (see Hämäläinen, 2013).

2. Wicked Policy Problems

Unlike **tame problems,** which can be solved by established professions and experts in a routine way, the characteristics of wicked problems make their solution very difficult with traditional governance arrangements, such as markets or public-sector hierarchies (Rittel & Webber, 1973; Grint, 2005; Berkes, 2007; Ho, 2012). These characteristics induce the following:

- Wicked problems involve **multiple stakeholders,** each with their own cognitive frames, values, norms and interests.
- There are no **definitive definitions** for wicked problems; each definition depends on the perspective taken. The preferred solution is linked to the chosen perspective and definition.
- There are **no optimum or correct solutions** for wicked problems, only good, satisfactory or bad ones.
- Wicked problems have **no stopping rule.** There are no criteria for a sufficient understanding of wicked problems or the length of their causal chains in an open system.
- Wicked problems tend to involve **threshold effects.** Passing the threshold can cause a regime shift.
- Wicked problems **involve fundamental uncertainty and unpredictability.** They cannot be solved without collective learning and reframing processes that reduce this uncertainty to a manageable level.
- Every wicked problem is essentially **unique.** They require customized solutions. Moreover, there is **no natural level** at which a wicked problem should be analyzed or solved.
- Every attempt to solve a wicked problem has **significant consequences.** In addition, these attempts tend to have **unintended consequences.**

- There are no **immediate or ultimate tests of the solutions** to wicked problems. The full consequences of a solution cannot be appraised until all repercussions have completely run out, and no one knows when they have.

Despite their widely acknowledged importance, the discourse on wicked policy problems has so far been more descriptive than analytical. Their nature and evolution have received scant theoretical attention.

Three fundamental reasons account for the increasing prominence of wicked policy problems in the recent decades (Figure 2). Two of them have increased the **cognitive** and **relational complexity**[2] of individual, organizational and policy making environments, while the third has limited decision makers' capacity to adapt to the increased complexity. The wicked problems result from this growing **adaptive tension or complexity gap** (Boisot & McKelvey, 2010; Casti, 2012).

First, the improved communication technologies, globalization of markets and long-term economic growth have facilitated increasing specialisation and division of labor in production systems. This has led to an increasing geographical and functional interdependence of economic activities (Wallis & North, 1986; Hämäläinen & Schienstock, 2001; Geyer & Rihani, 2010). The more numerous and tightly-interdependent economic activities have created growing relational complexity and coordination problems in industrialized societies. At the same time, these societies have become culturally and cognitively more differentiated, individualistic and complex.

Second, the rapid techno-economic change of recent decades and the current socio-institutional transformation of industrialized societies have created fundamental economic uncertainty and cognitive complexity (Hämäläinen, 2003). The established socio-economic arrangements and institutions are changing in unpredictable ways, which makes long-term planning extremely difficult. This uncertainty does not so much stem from the lack of data, the availability of which has exploded in recent decades, but from the insufficiency of the established cognitive frames, theories and routines with which decision makers try to make sense of all the incoming data (Beer, 1973; Boisot, 1994). The **big data revolution** or narrow **evidence-based policy making** will not be of much help to decision makers struggling with making sense of wicked problems. Moreover, reactive and unpredictable policy making will only add to the systemic uncertainty.

Third, the long-term evolution and specialisation of socio-economic systems tend to create various cognitive, economic and social rigidities and coordination problems that reduce the behavioral and strategic options available to decision makers (Olson, 1982; Hämäläinen, 2007a; Weber & Rochracher, 2012; Fukuyama, 2014). These systemic failures and rigidities produce path-dependent behavior and resource lock-ins, which make structural changes difficult and increase the adaptive tension between the system and its increasingly complex environment.

[2] Cognitive complexity refers to the **density** and **variability** (quality) of interactions that take place among interdependent agents. Relational complexity, in turn, refers to the number (quantity) of **parts** in the system and the **links** between them (Boisot & Child 1999).

As a result of these three factors, the established governance arrangements in industrialized societies suffer from a growing complexity gap and adaptive tension—a mismatch between the ever-more-complex environment and the limited capacity of the existing governance arrangements to cope with it (Ashby, 1958; Geyer & Rihani, 2010; IBM, 2010; Ho, 2012). This complexity gap can be found at all levels of the society: individuals suffer from growing life management problems (Schwartz, 2005; Hämäläinen, 2014), corporations and governments struggle with the rigidities of large bureaucracies (Hamel, 2007; Doz & Kosonen, 2007, 2014; Fukuyama, 2014), and multinational institutions cannot find sustainable solutions to global wicked problems.

3. How to Build Requisite Variety for Solving Wicked Problems

There are basically two strategies for closing the complexity gap: **complexity reduction** and **complexity absorption** (Boisot & McKelvey, 2010). The complexity reduction strategy aims at simplifying the incoming data by **codification** and **abstraction** (e.g. theories, models and accounting ratios) or by simplifying the system's environment by reducing the number of interacting elements and their interdependencies (e.g. modularization and standardization). This strategy is likely to work best in relatively stable and highly-institutionalized environments (Boisot & Child, 1999). The complexity absorption strategy, in turn, is more appropriate for highly complex and uncertain environments which involve plenty of context-specific and tacit knowledge. This strategy builds requisite variety and new strategic options by diversifying and combining the cognitive frames of key decision makers and increasing the number of system participants and their interdependencies.

The governance of complex systems and wicked problems has been studied by scholars in **cybernetics** (Beer, 1973; Espejo, 2003), **resilience studies** (Berkes, 2007; Ho, 2012) and **organizational management** (Heifetz & Laurie, 1997; Grint, 2005; Boisot & McKelvey, 2010; Hagel et al., 2013). The policy implications of their research are consistent with the complexity absorption strategy. This research suggests that governments should adopt a new **stewardship role** towards wicked problems in which they support the (see Figure 2):

- participation, interaction and cooperation of all key stakeholders (requisite variety),
- collective learning processes to create more diverse collective mental frames,
- coordination by mutual adjustment and a clear overall direction,
- growing diversity and experimentation in governance arrangements, and
- effective measures to overcome systemic rigidities and bottlenecks.

The solutions to wicked problems demand the participation and contribution of all key stakeholders who, initially, have their own specific worldviews, values, goals and interests. They need to build trust and a more holistic, shared understanding of the



Figure 2. Evolution and governance of wicked problems.

problem before a satisfactory and sustainable solution can emerge. The interaction and cooperation of key stakeholders can be facilitated by creating specific platforms and processes that bring them together for shared dialogues and co-development activities (Berkes, 2007; Klijn, 2008). For example, customized foresight, strategy or training processes as well as regular social events and gatherings can be used for this purpose.

Collective learning processes require deep dialogue that supports the development of shared understandings, language and trust. Ho (2012, 6) describes the experience of the Singaporean government:

"Developing policies and plans to deal with…wicked problems requires the integration of diverse insights, experience and expertise. People from different organizations, both from within and outside of government, have to come together and pool their knowledge in order to discover potential solutions. Cooperative mechanisms need to be set up to enable the sharing of information and to strengthen collective action."

The collective learning processes can be motivated by creating **cognitive dissonance** in the minds of stakeholders (Festinger, 1957; Heifetz & Laurie, 1997; Hämäläinen, 2007b). Useful tools for this purpose include small-scale experiments, strategic intelligence activities (foresight, benchmarking, evaluation), critical research inputs and measurement and feedback systems which challenge the established truths and mental models (Heifetz & Laurie, 1997; Hämäläinen, 2007b; Hagel et al., 2013).

The success of collective learning processes tends to require delicate **adaptive leadership** in which the leader (Heifetz & Laurie, 1997; Grint, 2005):

- understands the true wickedness and extent of the problem,
- facilitates and participates in the social interaction and collective learning process,
- does not provide all the answers but frames the key questions and issues,
- makes the participants face the difficult problems and their responsibilities,
- protects dissident voices from lower levels of the organization,
- exposes conflicts, viewing them as engines of creativity and learning,
- manages the rate of change to protect the participants from excessive (paralyzing) uncertainty,
- exerts the **soft power** of persuasion, ideological legitimacy and attractive values rather than command and control, and
- challenges unproductive norms and orients people to new behavior and roles.

Friedrich Hayek (1945) argued that the key problem in economic organization is the effective application of the dispersed local knowledge of economic actors while, at the same time, facilitating their efficient coordination. Highly complex and uncertain systems cannot be efficiently governed by either markets or hierarchical organization. It requires **mutual adjustment** among decentralized but interdependent actors, guided by a **shared vision, goals and values** (Hämäläinen & Schienstock, 2001). The overall direction for the system can be reinforced by **key performance indicators, administrative guidance** and **multilevel partnerships** that link actors at different levels of the system (Espejo, 2003; Berkes, 2007; Klijn, 2008).

Collective learning and mutual adjustment can be facilitated with the same policy tools: open and rich communication, cross-functional teams and knowledge diffusion. Mutual adjustment can also be supported with multi-purpose resources, decentralized decision making, liberal or flexible regulatory environments as well by standardization of key interfaces in the value-adding system (Baldwin & Clark, 1997).

As suggested above, the complexity gap can also be reduced by increasing the variety and complexity of the governance arrangements. Practical examples of this include collaborative networking, partnerships and other hybrid organizations, open innovation, co-design and co-production with customers, matrix structures, public-private-people partnerships, whole-of-government approach, decentralization and devolution of decision making as well as task forces and other contingent organizations that are formed on demand (Heifetz & Laurie, 1997; Espejo, 2003; Berkes, 2007; Ho, 2012; Hagel et al., 2013). Due the growing complexity gap, it is not surprising that most new organizational trends seem to move towards increasing variety and complexity.

Finally, wicked problems can rarely be solved without strong support from public authorities in overcoming systemic rigidities and bottlenecks. Their tailored interventions are needed for encouraging the reallocation of productive resources towards new solutions through the provision of appropriate incentives, necessary public goods and services, and appropriate institutional rules (Weber & Rochracher, 2012). The new governance solutions may need a safe **niche** to develop and show their potential without the interference of established interests or market pressures (Geels & Raven, 2006).

4. Governance Advantages of Cities and Metropolitan Areas

The economic advantages of cities and metropolitan areas are well-known. The agglomeration of people and resources facilitates high levels of specialisation, interaction and complexity, which leads to higher productivity, income and growth (Bettencourt et al., 2007; Glaeser & Joshi-Ghani, 2013). However, as Glaeser and Joshi-Ghani argue, cities and metros can also become "the engines of transformative change toward inclusive, people-centered, and sustainable development" (p.2). There are seven reasons to believe that they are ideally placed to develop sustainable solutions to wicked policy problems.

First, as dense agglomerations of people and organizations, cities and metro areas produce many negative externalities and wicked problems, which **demand** innovative new solutions. But they also have a specific **variety advantage,** i.e. the requisite variety of different resources, capabilities, specialised services and overlapping networks to develop innovative solutions to these complex problems.[3] In addition, cities and metros have a wide variety of job, partnering and leisure time opportunities, which attract more people with all kinds of skills to move to them, further increasing their diversity. The interaction of the various actors and resources is intensified by low transportation and communication costs (Bettencourt 2013). As

[3] Over half of the world's population already lives in cities (Bettencourt et al. 2007). Cities and metros offer the highest possible **easily available** variety of any geographical location or jurisdiction for firms and individuals trying to meet their complex needs. Moreover, the bigger the city, the more variety and complexity it has. This is likely to explain a large part of the global urbanization trend.

Katz and Bradley (2013, 6) emphasize: "[m]etros have emerged as the uber-network: interlinked firms, institutions, and individuals working together across sectors, disciplines, jurisdictions, artificial political borders, and…even political parties".

Second, metros and cities can provide the close physical proximity for collective learning, sense-making and innovation processes that require face-to-face interaction and dialogue as well as plenty of tacit, context-specific information and knowledge (Boisot & Cox, 1999). In addition, the innovativeness of cities grows more rapidly than their population as they become larger (Bettencourt et al., 2007). The physical proximity is also important for the mutual adjustment and coordination of complex networks of interdependent actors. "Metros are integrated rather than compartmentalized. Multiple public, private, and civic actors are empowered to look across challenges, naturally connecting the dots between related issues (Katz & Bradley, 2013, 8)".

Third, metros and cities also have advantages in mobilizing the necessary cooperation. The established local relationships and personal networks provide a good basis for trust-building and cooperation. The similarities in context and daily experiences provide cognitive overlap that facilitates interaction. Key stakeholders are also easier to convene together locally than on a national or international scale. As Glaeser and Joshi-Ghani (2013) conclude, "proximity is valuable precisely because it makes connections easier".

Bettencourt (2014, 18) underlines the efficient information processing that underlies the above governance advantages:

"Developed cities today are social and technical complex systems characterized by historically unprecedented levels of diversity and temporal and functional integration. This growing individual specialisation and interdependence makes large cities extremely diverse and culturally relies on fine temporal and spatial integration and on faster and more information flows. The informational processes lie at the core of what makes cities the economic and cultural engines of all human societies."

Fourth, since metros and cities are concentrated action networks or **natural economic areas,** the governance solutions for wicked problems are often best aligned with their boundaries. The nature of these problems and citizen preferences for their solution are likely to be more homogenous within particular metro areas and cities than among them. This is also consistent with the principle of **fiscal federalism,** which recommends that the boundaries of jurisdictions should match the benefiting areas of the public good and services that they provide (Oates, 1999). The local efforts to solve wicked problems are also likely to produce more committed and responsible behavior among citizens when they can participate and see the results of their own contributions. These are their "own challenges" (Katz & Bradley 2013, 9).

Fifth, the smaller organizations of local governments can also make them more agile than large national ministries and bureaucracies in responding to local development and cooperation needs. Moreover, the local officials and politicians have better contextual knowledge and information, they are directly responsible to their local constituencies and do not have to commit themselves to rigid equality and universalism principles of national governments (Oates, 1999).

Sixth, the geographical concentration of people provides ecological sustainability benefits to cities and metros. The same physical infrastructure can serve more people (Bettencourt et al., 2007), commuting and transportation distances are shorter and housing arrangements are less energy-intensive per capita than in less densely-populated regions.

Finally, the local experimentation of metros and cities is also welcome from the national policy perspective because parallel local experimentation increases the pace of collective learning and innovation while, at the same time, reducing the risks of systemic change compared to full-blown national reforms. However, this requires an appropriate systemic governance arrangement that collects, combines and shares the lessons learned from successful local governance solutions (Heilmann, 2008; Sabel & Zeitlin, 2012).

5. Espoo as a Frontrunner in Sustainable Well-Being

The transition towards a sustainable well-being society needs frontrunners. Finland is well-placed to become a global frontrunner in sustainable well-being and development. Building competitive advantage in sustainable well-being would provide multiple benefits (see Hämäläinen, 2013). However, Finland needs its own frontrunners that demonstrate the feasibility of the transition to sustainable well-being in practice. We conclude this article by arguing that Espoo and the Helsinki metropolitan area have the potential to become a global leader in sustainable well-being. Let us begin with the Finnish society.

The transition towards sustainable well-being requires fundamental changes in life styles, public policies, and institutional structures. Such changes must be supported by cultural beliefs, values, and norms in order to be sustainable. Fortunately, Finland has cultural value-orientation that supports a shift towards sustainable well-being. First of all, its value system emphasizes **intellectual autonomy, equality,** and **harmony.** Intellectual autonomy includes independent reflective capacity, holistic worldview, curiosity, and creativity. Equality refers to the concern for the natural environment and the well-being of others. It also emphasizes social justice, responsibility, helpfulness, and honesty. Harmony, in turn, underlines the importance of adapting oneself to the social and natural worlds. It puts a high value on world peace, conservation and unity with nature, and the acceptance of one's part in the world (Schwartz, 2011).

Secondly, the Finnish culture also emphasizes **secular-rational** and **self-expression** values (World Value Survey, 2013). The secular-rational value orientation rejects religious, authoritarian, absolutist, and traditional family values, while accepting e.g. divorce, abortion, euthanasia and suicide. The self-expression values, in turn, underline **subjective well-being, self-actualization,** and **quality of life.** This value-orientation is typical in affluent societies which have already satisfied their economic and physical security needs. Such societies tend to move from materialistic to post-materialistic values, which give high priority to environmental protection, tolerance of diversity,

interpersonal trust, and rising demands for participation in decision making in economic and political lives.

The actual quality of life and well-being are also high in Finland. In the 2012 **European quality of life survey,** Finland ranked second after Denmark both in happiness and the perceived quality of life. The same survey revealed that the citizens of these two countries were also the most successful in balancing work and family lives. The Finnish welfare state provides equal educational and health care opportunities for all. The high quality of Finnish education and health care systems is known worldwide. The well-educated and reliable public authorities maintain well-functioning institutions and safe infrastructures. There is also plenty of space and nature for everyone to enjoy. Finns have a close relationship with nature, which is an important determinant of personal well-being (Basu et al., 2014). So far, these national advantages have not been strategically leveraged to boost Finland's transition to sustainable well-being or to build its attractiveness as a business location and living environment.

Sitra, the Finnish Innovation Fund, has argued that Finland should adopt a national strategy that builds on a state-of-the-art understanding of well-being. This would yield several benefits (Hämäläinen, 2013):

- It would help individuals, organizations, and policy makers make better-informed decisions about improving well-being and living environments. This includes targeting the scarce public resources in a way that most effectively promotes the well-being of citizens.
- It would support and motivate sustainable lifestyle changes.
- It would help firms develop more competitive products and services with higher value-added and large international markets.
- It would attract international investors and experts looking for world-class well-being knowledge, innovation networks, and living environments.

The economic benefits of a national well-being advantage would be particularly attractive. With high costs and living standards, Finland can only succeed with a high value-added strategy in international competition. Since all value ultimately stems from contributions to individual well-being, a sophisticated understanding of well-being is crucial for the development of economic strategies in high-cost countries. Instead of trying to export the existing welfare services, a national strategy oriented to well-being would focus on understanding and serving the changing well-being needs of individuals and communities. World-class well-being knowledge could be applied to create better and more sustainable products, services, policies, institutions, and living environments. This human-centric approach would create a new high value-added advantage for Finland in the rapidly changing international division of labor.

Espoo epitomizes the Finnish sustainable well-being advantage in many ways. Its high level of subjective well-being, well-educated workforce, multiple city centers surrounded by nature, well-functioning public transportation, proximity to work

places, strong research and education infrastructure, and a dynamic local economy provide a strong basis for an ambitious strategy of sustainable well-being. Indeed, the new sustainability-oriented strategy of Espoo and its active participation in the global Regional Centres of Expertise network of sustainable education provide the city with an excellent starting place for becoming a hub of sustainable well-being in Finland and a true frontrunner in developing more sustainable solutions to the wicked problems of other industrialized societies.

As we have described in this article, this will require visionary goal-setting, increased experimentation and cooperation among the key stakeholders (private, public, civic, citizens) around wicked policy problems, platforms and processes for collective sense making and coordination as well as more proactive and entrepreneurial local officials. These activities should not be limited to Espoo's boundaries if they could benefit from wider cooperation in the Helsinki metropolitan area. As the first practical step towards this vision, the enthusiastic start-up entrepreneurs in Espoo could be challenged to develop solutions for the new well-being problems of advanced societies identified in the rapidly expanding research on subjective well-being (see e.g. Hämäläinen & Michaelson, 2014) and practical well-being services. This would not require more than arranging platforms and processes where well-being experts (practical and academic) and entrepreneurs could meet to discuss the well-being problems and potential solutions. Such an exposure would give the entrepreneurs a common and meaningful goal that could help society solve some of its wicked well-being problems. If successful, the same collaborative approach could be adopted with social and ecological problems.

References

Ashby, R. (1958). Requisite variety and its implications for the control of complex systems. Cybernetica. 1:2, 83–99.

Balwin, C. & Clark, K. (1997). Managing in an Age of Modularity. Harvard Business Review. September-October, 84–93.

Basu, A., Kaplan, R. & Kaplan, S. (2014). Creating supportive environments to foster reasonableness and achieve sustainable well-being, in (Eds.). Hämäläinen, T. & Michaelson, J. (2014). Well-being and Beyond: Broadening the Public and Policy Discourse. Edward Elgar.

Beer, S. (1973). Designing freedom. Massey Lectures. Canadian Broadcasting Corporation.

Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. National Hazards. 41, 283–295.

Bettencourt, L. (2013). The kind of problem city is. SFI Working Paper. 2013-03-008. Santa Fe Institute.

Bettencourt, L. (2014). The Uses of Big data in Cities. Big Data. March, 12–22.

Bettencourt, L., Lobo, J., Helbing, D., Kuhnert, C. & West, G. (2007), Growth, innovation, scaling, and the pace of life in cities. Proceedings of the National Academy of Sciences. Vol.104. No. 17. April. http://www.pnas.org/content/104/17/7301.full

Boisot, M. (1994). Information, economics, and evolution; What scope for a menage a trois? World Futures: The Journal of New Paradigm Research. Vol. 41, 227–256.

Boisot, M. & Child, J. (1999). Organizations as adaptive systems in complex environments: The case of China. Organization Science. 10(3), May-June, 237–252.

Boisot, M. & Cox, B. (1999), The I-Space: a framework for analyzing the evolution of social computing. Technovation. 19, 525–536.

Boisot, M. & McKelvey, B. (2010). Integrating modernist and postmodernist perspectives on organizations: A complexity science bridge. Academy of Management Review. 35, (3), 415–433.

Casti, J. (2012). X-Events: The Collapse of Everything. Harper Collins/Morrow.

Doz, Y. & Kosonen, M. (2007). Fast strategy: How strategic agility will help you stay ahead of the game. Wharton School Publishing.

Doz, Y. & Kosonen, M. (2014). Governments for the future: Building the strategic and agile state. Sitra studies 80. Sitra.

Espejo, R. (2003). Social systems and the embodiment of organizational learning. in (ed.). Mitleton-Kelly, E. Complex Systems and Evolutionary Perspectives on Organizations: The Application of Complexity Theory to Organizations. Elsevier Science.

Festinger, L. (1957). A Theory of Cognitive Dissonance. Row, Peterson and Company.

Freeman, C. & Louca, F. (2002). As times go by: From the industrial revolutions to the information revolution. Oxford University Press.

Freeman, C. & Perez, C. (1988). Structural crises and adjustment, business cycles and investment behavior. in (Eds.) Dosi, G. , Christopher F., Richard N., Silverberg, G. & Soete, L. Technical Change and Economic Theory. Pinter Publishers.

Fukuyama, F. (2014). America in decay. Foreign Affairs, September/October, retrieved Dec. 8., 2014, retrieved from http://www.foreignaffairs.com/articles/141729/francis-fukuyama/america-in-decay.

Geels, F. & Raven, R. (2006). Non-Linearity and Expectations in Niche-Development Trajectories: Ups and Downs in Dutch Biogas development (1973–2003). Technology Analysis & Strategic Management. 18: 3–4, 375–392

Geyer, R. & Rihani, S. (2010). Complexity and Public Policy: A New Approach to 21st Century Politics, Policy & Society. Routledge.

Grint, K. (2005). Problems, Problems, Problems: The Social Constructions of Leadership. Human Relations. 58(11), 1467–1494.

Hagel, J., Brown, J.S., Samoylova, T. & Arkenberg, C. (2013). Coherency in Contradiction: Report 5 of the 2013 Shift Index series. Deloitte University Press.

Hamel, G. (2007). The Future of Management. Harvard Business School Press.

Hayek, F. A. (1945). The Use of Knowledge in Society. American Economic Review. 35, 4, 519–530.

Heifetz, R. & Laurie, D. (1997). The Work of Leadership. Harvard Business Review. 75(1), 124–134

Heilmann, S. (2008). From Local Experiments to National Policy: The Origins of China's Distinctive Policy Process. The China Journal. 59(Jan), 1–30.

Ho, P. (2012). Governing for the Future: What governments can do? No. 248. S. Rajaratnam School of International Studies. Singapore.

Hämäläinen, T. (2003). National Competitiveness and Economic Growth: The Changing Determinants of Economic Performance in the World Economy, Edward Elgar.

Hämäläinen, T. (2007a). Social innovation, structural adjustment and economic performance. Ch. 2 in Hämäläinen, T. & Heiskala, R. (Eds.). Social innovations, institutional change and economic performance: Making sense of structural adjustment processes in industrial sectors, regions and societies. Edward Elgar.

Hämäläinen, T. (2007b). Policy implications: How to facilitate the structural adjustment and renewal of advanced societies? Ch. 5 in Hämäläinen, T. & Heiskala, R. (Eds.). Social innovations, institutional change and economic performance: Making sense of structural adjustment processes in industrial sectors, regions and societies. Edward Elgar.

Hämäläinen, T. (2013). Towards a sustainable well-being society: Building blocks for a new socio-economic model, Version 1.0, April.

Hämäläinen, T. (2014). In search of coherence: sketching a theory of sustainable well-being. in (Eds.). Hämäläinen, T. & Michaelson, J. (2014). Well-being and Beyond: Broadening the Public and Policy Discourse. Edward Elgar, 17–67.

Hämäläinen, T. & Michaelson, J. (2014). Well-being and Beyond: Broadening the Public and Policy Discourse. Edward Elgar.

Hämäläinen, T. & Schienstock, G. (2001). The comparative advantage of networks in economic organization: efficiency and innovation in highly specialized and uncertain environments. in Innovative Networks: Co-operation in national innovation systems, OECD.

IBM (2010). Capitalizing on complexity: Insights from the global chief executive officer survey. available at: http://www-935.ibm.com/services/us/ceo/ceostudy2010/index.html.

Katz, B. & Bradley, J. (2013). The Metropolitan Revolution: How Cities and Metros Are Fixing Our Broken Politics and Fragile Economy. Brookings Institution Press.

Klijn, E-H (2008), Complexity Theory and Public Administration: What's New? Public Management Review. 10(3), 299–317.

Oates, W. (1999). An Essay on Fiscal Federalism. Journal of Economic Literature. XXXVII (Sept), 1120–1149.

O'Hara, M. & Lyon, A. (2014). Well-being and well-becoming: reauthorizing the subject in incoherent times. in (Eds.). Hämäläinen, T. & Michaelson, J. (2014). Well-being and Beyond: Broadening the Public and Policy Discourse. Edward Elgar.

Olson, M. (1982). The Rise and Decline of Nations, Yale University Press.

Rauschmayer, Omann & Fruhmann (2011). Needs, capabilities, and quality of life: Re-focusing sustainable development", in (Eds.). Rauschmayer, F., Omann, I. & Fruhmann, J. Sustainable Development: Capabilities, Needs, and Well-being, Routledge.

Rittel, H., & Webber, M. (1973). Dilemmas in a General Theory of Planning. Policy Sciences. 4, 155–169.

Sabel, C. & Zeitlin, J. (2012). Experimentalist Governance. in (Ed.) Levi-Faur, D. The Oxford Handbook of Governance.

Schwartz, B. (2005). The Paradox of Choice: Why More is Less. Harper Perennial.

Schwartz, S. (2011). Kulttuuriset arvo-orientaatiot: kansallisten erojen luonne ja seuraukset. Limor Kustannus.

Wallis, J. & North, D. (1986). Measuring the transaction sector in the American economy, 1870–1970. in Engerman, S. & Galman, R. (Eds.). Long-term Factors in American Economic Growth, University of Chicago Press.

Weber & Rochracher (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. Research Policy, 46(6), 1037–1047.

WCED (1987). Our common future. Report of the World Commission on Environment and Development. United Nations.

World Values Survey (2013). http://www.worldvaluessurvey.org/wvs.jsp

About the Author

Sitra Fellow, PhD, Dos. **Timo Hämäläinen**'s research has focused on organizational strategy and theory, institutional economics, long socio-economic cycles, social and institutional innovation, everyday life and well-being, public-sector governance, as well as innovation and industrial policy. His most recent research projects have centered on the changing nature of well-being in advanced societies, sustainable socio-economic model and the development of new business ecosystems. His two most recent publications are **Towards a sustainable well-being society: Building blocks for a new socio-economic model** (Sitra) and **Well-Being and Beyond: Broadening the Public and Policy Discourse** (co-ed. with Juliet Michaelson, Edward Elgar). Dr. Hämäläinen has also published books on social innovation (2007), national competitiveness (2003), transformation of the Finnish innovation system (2001) and society (1997), and industrial policy (1996). He has written several articles on business strategy, organization theory, innovation and industrial policy, social and institutional innovation, public management, systemic change processes, and well-being. Timo Hämäläinen has a M.Sc. in marketing from Aalto University (Helsinki School of Economics) and an MBA and a Ph.D. in international business from Rutgers University, New Jersey, U.S.A. He is a Docent (adjunct professor) of international business in the University of Eastern Finland. He has been a visiting scholar in the OECD, Paris and the Wilson Center, Washington, D.C.

Antti Hautamäki
Professor emeritus, PhD (philosophy)
University of Jyväskylä, Finland
antti.hautamaki@kolumbus.fi

Kaisa Oksanen
Senior Scientist, PhD
VTT Technical Research Centre of Finland
kaisa.oksanen@vtt.fi

6. Sustainable Innovation: Competitive Advantage for Knowledge Hubs

Abstract

The purpose of this article is twofold. On the one hand, we elaborate the emerging concept of sustainable innovation and analyze the relevance of innovation to solving wicked problems and to enhancing sustainable well-being. On the other hand, we examine the changing conditions for innovation creation: building global knowledge hubs and local innovation ecosystems.

As a result, the drivers of innovation are diverse and possibilities to utilize the untapped innovation potential of people outside traditional innovation actions are expanded. Ultimately, the success of sustainable innovation constitutes its impact on the well-being of people and vice versa: sustainable well-being is an important source for innovation and growth. This paper also argues that innovations require a special ecosystem where innovations emerge when different actors collaborate and co-create. World-class innovation ecosystems and hubs are built on deep cooperation among local, regional, national and global actors.

KEYWORDS: Innovation ecosystem, Innovation hub, Regional development, Sustainable innovation, Sustainable well-being, Wicked problems

1. Knowledge Hubs as Nodes in Global Networks

Both the national innovation systems and regional developers are struggling to meet the demands of the constantly changing global competitive environment. Countries, regions and cities all over the world undergo major structural changes as the economy shifts from manufacturing towards services and as the waves of socio-technical development shape the innovation landscape. To manage the structural change and to support innovations as efficiently as possible, the local innovation environments need to be developed and strengthened.

Innovation tends to cluster to certain sectors or areas, which grow faster and often require structural changes (Fagerberg, 2006). Similarly the regional development is shifting towards large clusters, cities and metropolitan areas and most of the value creation, R&D activities, and patenting takes place in the global level innovation hubs.

Creative hubs in the global economy produce considerable value for global value networks. They are well known and attract talent, firms and investments. They are capable of reinventing themselves in the changing environment. In them, we can find a dynamic innovation ecosystem where innovations emerge when different actors collaborate. We have argued that innovations require a special ecosystem that has top-level universities and research institutions, sufficient financing and a local market, skilled labor force, specialisation and cooperation among companies and global networking (Hautamäki & Oksanen, 2012; Oksanen & Hautamäki, 2014). Based on this, there is a need to build up world-class innovation hubs that combine high quality of life and excellent business possibilities. This is achieved through intensive cooperation among local, regional, and national actors. The forces and resources must be gathered around local strengths and recombine them into new industries. However, in reality, relatively few regions have exhibited this kind of renewing capabilities (Etzkowitz & Klofsten, 2005).

An innovation hub, or innovation center, usually refers to a region or a place with an extraordinary amount of cumulated knowledge and innovativeness. The term emphasizes the utilization of local knowledge and competences. Another more demanding criterion for innovation hub is its connection to global value networks and its ability to create value in the global economy (Prahalad &Krishnan, 2008). The definitions often reflect the models of regional innovation system such as the Triple Helix (Etzkowitz & Leydesdorff, 2000) or learning regions (Asheim, 2001), but the logic behind constructing regional innovation systems varies from the localized, path-dependent inter-firm learning processes to a regionalized national innovation systems, where R&D and scientific research have taken a much more prominent position (Asheim & Coenen, 2005). However, all ideal models and types emphasize strong regional networking. Our definition for innovation hubs is that they **are local, creative centers in the global economy.**

The basic features of an innovation hub include (Hautamäki, 2010; Vasara et al., 2009) the following:

- They have globally recognized competences and business based on them. These features form the competence profile of the innovation hub.
- In them, new knowledge and technologies are created. The created knowledge is recognized and applied.
- They attract both talents and investments.
- They have globally operating companies based on the competence profile of the hub.
- They are versatile enough to secure the region's success in constantly changing markets.
- Their innovation ecosystem is world class and provides excellent conditions for innovation and entrepreneurship.

Where innovation hubs act as nodes in the global economy, the innovation ecosystem is linked to a local innovation and business environment (Moore, 2006). In developing regional innovation ecosystems, one of the key questions is what kind of conditions the ecosystem offers to the development of entrepreneurship based on the local competences.

2. Innovation Ecosystems Breed Innovation

Innovation ecosystem means a dynamic, interactive network that breeds innovation. In practice, it can refer to local hubs, global networks or technology platforms; it also has roots in industry and business clusters (Porter 1998; Estrin 2009). This article mainly emphasizes local, regional ecosystems and their development. From the beginning of the industrial era, the culture of innovation has been developing especially in growing cities and metropolitan areas (Kim & Short 2008). The first industrial cities, such as Manchester in the United Kingdom, were also the first true innovation milieus (Hall 1998).Today, Silicon Valley is one of the most important and best-known innovation ecosystems, and its experiences are emulated all over the world, for example in Tel Aviv, Israel and in Bangalore, India (see e.g. Kenney 2000; Christensen et al. 2004; Munroe 2009). In Finland, the Helsinki metropolitan area is a globally recognized innovation ecosystem (Kao, 2009). At the policy level, EU's Smart Specialisation is a key principle providing a regional policy and innovation framework.

An innovation ecosystem consists of a group of local actors and dynamic processes, which together produce solutions to different challenges. The main features of the ecosystem include the following (Hautamäki, 2010):

- Top-level universities and research institutions
- Sufficient financing for new companies and research plans
- Symbiotic combination of large established companies and new companies (start-ups)
- Specialisation of and cooperation among companies

- Service companies specialised in the needs of local companies
- Sufficient local markets for new innovative products
- Global networking
- A "community of fate", that is, the actors of the region see that their success is linked to the success of the whole region.

These elements are important but what determines the success of the region is their combination. In addition, of great importance is the risk-taking entrepreneurial culture that makes the ecosystem alive and renewing. Another special feature is the continuous movement of ideas and people, "re-cycling". People move easily between companies and from research institutions to business and vice versa. Interactive, dynamic companies are at the core of the ecosystem; as the most famous example, Silicon Valley has a highly entrepreneurial, radical-thinking and risk-taking culture (Munroe, 2009; Saxenian, 2006). Similarly important are such supporting services as intermediary organizations, which are often local organizations like technology centers, enterprise incubators, and development companies that primarily aim to facilitate the transfer and commercialization of technology and to develop innovation networks (Koskenlinna et al., 2005). Smart specialisation strategies similarly emphasize the interactive and innovative process, in which market forces and the private sector together with universities discover and produce information about new activities, and the government assesses the outcomes and empowers the players most capable of realizing the potential.

In Finland, the metropolitan region has been developed as an innovation ecosystem. The vision of Uusimaa 2040 is to become the most significant innovation concentration in the Baltic Sea Region (e.g. the visions in the Helsinki–Uusimaa Regional Programme and in the Helsinki Smart Region: Pioneering for Europe2020 report). The message from the many reports and fiches conducted in the region is clear (e.g. Ståhle & Oksanen, 2014); the Finnish metropolitan region has a strong, innovation-oriented atmosphere, plenty of collaboration among local actors, a variety of innovative policy instruments and future-oriented projects, and tons of knowledge of innovation tools and approaches but it still needs strengthening in global-level networking and impact, growth, and more innovative companies.

A most viable example of the innovation hub of the Helsinki metropolitan region is the Espoo regional innovation ecosystem (EKA 2014). **Espoo Innovation Garden** is the new concept created to cover multifaceted activities to develop this ecosystem, consisting of 800 companies, 20 R&D centres, and a number of Centres of Excellence (see Markkula's article in this book). It is a living community employing more than 40,000 professionals representing 110 nationalities, and hosting 5,000 research scientists and 16,000 students. Its ecosystem of companies, universities and technology centers accounts for 50% of the R&D value in Finland, and generates 60–80 start-ups a year. Espoo Innovation Garden is a process led by the City of Espoo together with a representative consortium of universities, VTT Technical Research Centre of Finland, The Finnish Innovation Fund Sitra, and the Federation of Finnish Technology Industries.

In this article, we posit solving wicked problems and generating sustainable well-being as prerequisites for innovation. It offers one way of looking beyond regional, municipal or organizational boundaries, and of thinking about the actual impact of innovation.

Thus the perspective of an ecosystem is global and goes across all kinds of borders, but in practice, the approach of an ecosystem emphasizes the position and roles of local actors, especially municipalities, in developing the innovation activity. This implies that the starting point of the transformation process towards innovation economy is the identification and recognition of local know-how. Especially for smaller regions and urban areas it is essential to identify and support the full innovation potential of the area. In order to stand out in the global networks of innovation, sustainable innovation provides an interesting and important mindset to consider. Let us next elaborate the changes in the concept of innovation towards sustainable innovation.

3. Wicked Problems

The changing drivers of innovation provide the sparks needed for new policies and processes worldwide to tap undiscovered innovation potential. Because innovation is associated with problem solving, the special innovation challenges of today are related to wicked problems, those challenges in life and society that are particularly complex, multi-faceted, and that require creative approaches.

One common denominator of wicked problems is sustainable development. The World Commission on Environment and Development (WCED 1987) defines sustainable development as follows:

"Sustainable development is development which meets the need of the present without compromising the ability of future generation to meet their own needs".

Sustainable development has three dimensions: economic, environmental and social (Harris et al., 2001). Following these definitions, we will call the new emerging concept **sustainable innovation.**

Wicked problems (see Rittel & Webber, 1984) are complex issues where the solution requires extensive cooperation and many actors, but when managed successfully, the solutions provide a means to tap into a significant, long-term innovation potential. The role of innovation in solving great challenges such as climate change or water scarcity is indeed becoming increasingly important (Kao, 2007). Similarly the business models are changing together with innovation (Carlson & Wilmot, 2006). Pioneering entrepreneurs introduce new products and services, expand the range of global knowledge networks, and most importantly, challenge established business and innovation interests with new approaches (Auerswald, 2012). What is important for the solutions is the systemic nature of wicked problems. Therefore **sustainable innovations must be holistic** and avoid partial optimization.

The nature of innovation is shifting from the application of new technology to the delivery of meanings, values and solutions (Lockwood, 2010). Today's innova-

tors need to develop new capabilities covering the entire innovation chain, from basic research to products, services and markets. Solving wicked problems through innovation further enhances the need for new capabilities, because innovation is not grounded in convention, but it challenges the existing mindsets and ways of operating. Both innovation and wicked problems have to be dealt with in a context of uncertainty and risk, and both require collective actions (van Buere et al., 2003).

In the last decades, wicked problems have been a hot topic especially within public administration and policy research circles (Weber & Khademian, 2008). As public organizations, companies, NGO's and citizens are all interested in creating solutions to wicked problems, more efficient identification of problems and more collaborative solution creation are needed. Similarly, innovations are often produced in co-creation among diverse individuals and groups, not by institutions alone. Problem solvers often possess conflicting views of the problem, of solution methods and of the legitimacy of possible solutions (Wexler, 2009). Thus, we argue that the best solutions are created if all stakeholders are able to find their role within the problem-solving network; this requires an **inclusive approach to innovation.**

Ideation and discussions should take place in shared arenas, where organizations together with opinion leaders and other central figures guide the innovation processes and meaning creation (Luoma-Aho & Vos, 2010). Finally, we argue for inclusive innovation policy. It starts from the principle that all people should have the opportunity to develop their skills and look for creative solutions to the challenges they see important.

4. Sustainable Innovation

Innovation is described as a life cycle ranging from a concept to practice (Crossan & Apaydin, 2010; Narayanan, 2001). In fact, there are four elements in the life cycle of innovation: idea, invention, implementation, and impact (Hautamäki & Oksanen, 2012). We call this approach the 4i-model of innovation (Figure 1).

The innovation formula for this model is:
Idea ➜ Invention ➜ Implementation ➜ Impact

What keep the 4i-circle moving are the flow of ideas and the ongoing identification of wicked problems. In innovation practices, much emphasis is laid on the organizations' capability to gather ideas, to network, and to collaborate (Medina et al., 2005; Laird, 2005). However, ideation and networks do not produce innovation without motivation. Wicked problems are an important motivational source because, ultimately, innovation provides a solution to a problem worth solving. This point is often overlooked when discussing creativity or idea generation. Pure ideation rarely creates successful products; it takes a real, persistent problem, a genuine need that requires resolution. Real solutions also have real impacts on the environment and users.

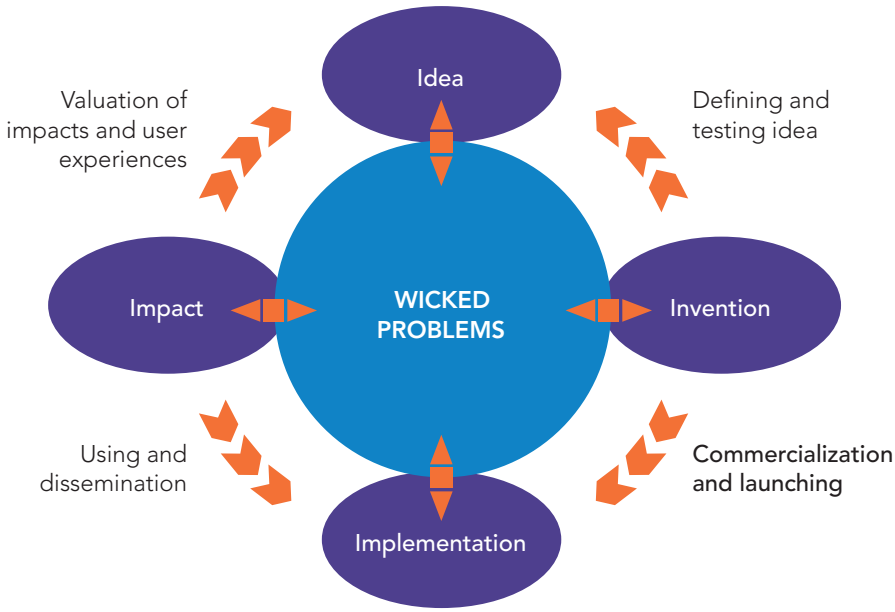


Figure 1. The 4i-Model of Innovation (Hautamäki & Oksanen, 2012).

Innovation creates new practices, and leads to changes in the structures of organizations and in the actions of people. The impact stage is often ignored in the innovation research, because innovation is considered ready when it is implemented. In addition, there is the general assumption that innovations are always useful, valuable and good in nature. These qualities are impossible to verify without considering the impacts of innovation. Innovation could be an economic success, but socially a disaster, because of its impact on social practices, as in the case of excessive marketing of infant formula in developing countries (Sethi, 1994). However, the goodness of innovation has not been widely studied. Some researchers have pointed out that it is possible that innovation is harmful or uneconomical from the point of view of an individual or a social system (Rogers, 2003; Rogers & Schoemaker, 1971), but the given nature of innovation needs further investigating (Simula, 2012).

One direction giver to innovation has been sustainable development. Nidumolu et al. (2009) have argued that there is no alternative to sustainable development, and the principle has challenged companies to develop products and services for e.g. new clean-tech markets, for better control over the life cycles of products and services, for the use of recycled materials, for energy efficiency, and for attention to quality of life.

Sustainable innovation has roots in sustainable development, and it is based on ethically, socially, economically and environmentally sustainable principles. Similar principles can be seen in **eco-innovation** (Hall & Clark, 2003; Boons & Lüdeke-Freund, 2013), in frugal innovation and engineering (Bhatti & Ventresca, 2012), **in jugaad innovation** (Radjou et al. 2012) and in the rise of **shared-value** mindset (Porter

& Kramer, 2011), but the wider concept of sustainable innovation needs to be thoroughly elaborated.

In business, innovation has been motivated by the need to create superior competitiveness in the market place. Traditionally, this has been accomplished through two basic strategies: cutting costs or creating products superior to those of one's competitors (cost leadership or differentiation strategies; see Porter, 1980). Sustainable innovation, however, offers a third competitive strategy: to create products or processes with market-desirable features, such as durability, locality, or material or energy efficiency.

The motivation for sustainable innovation lies in combining competitiveness, the well-being of people, and sustainable solutions. Emphasizing well-being as a strategy means not only addressing the specific needs of people but also creating future-oriented and sustainable solutions. Since consumers are demanding sustainable products and services and are willing to pay more for them, the market for sustainable innovation is growing. Sustainable innovation assists customers and citizens in managing their lifestyles by enabling them to live happier lives in ways that support sustainable development. Sustainable innovation provides the foundation for future business; it does not simply reflect ethical responsibility. The tasks that sustainable innovation is geared towards—the wicked problems—have global significance.

5. Inclusion and Systemic Change

An innovation or its impact is difficult to predict, although favorable conditions can be created to encourage their emergence. Leaders at national, regional, and organizational levels are often challenged by this reality because establishing such conditions typically requires long-term, widespread systemic changes (e.g. Geels & Schot, 2007). Similarly, solving wicked problems in a sustainable way requires a systemic view.

We face systemic change and systemic innovations in many challenges and wicked problems of the modern society: energy issues, transportation systems, health care systems, reforms in agriculture, waste systems, to name a few. Systemic innovations are related to changes in socio-technical systems and are often described as leaps or transitions. It is important that systemic innovations are related not only to technological change but also to societal and cultural changes: changes in user contexts and symbolic meanings. In addition, systemic innovation often forms the core of a national innovation strategy. However, these strategies lack practical measures and guidelines.

It is important to understand that the acceptance of the system is affected by the general values of society and the development of national and international trends, such as awareness of climate change and sustainable development. As a whole, systemic innovation includes changes in the market, in consumer behavior, in politics, and in the culture (Geels, 2010; Geels & Schot, 2007).

One defining attribute of sustainable innovation is **inclusivity,** reflecting the fact that innovations emerge from a synthesis of different types of knowledge. In the first decade of the 21st century, innovation researchers have emphasized networked, open, and diverse forms of innovation (Chesbrough, 2003; von Hippel, 2005). Inclusive innovation implies that all individuals should have the opportunity to use their potential to seek creative solutions to the challenges they deem important. A background for this argument is the notion that the most important resources of innovation are creative, skilled people, both in the workplace and in everyday life. Inclusive innovation could be summarized by the principle "innovation for all". This means not only that all people must have some opportunities to innovate but also that innovation must serve and benefit all people.

Inclusive innovation supports collective wisdom and the crowdsourcing of problems (Surowiecki, 2004; Weinberger, 2011). This kind of development and other forms of mass collaboration have a deep impact on the economy, business and the government. In a deeper sense, sustainable and inclusive innovation promotes new forms of democracy, where citizens have the right and the opportunity to be creative and to contribute to improvements in services, products and the structure of public organizations like municipalities, schools and hospitals (Benkler, 2006; von Hippel, 2005).

As an example, Central Finland faced a structural crisis in 2008 and 2009 when Nokia closed its research center and many other high tech firms fired their experts as a result of the financial crisis. The region lost about a thousand high tech jobs and about one billion euros of export income. One proposal to overcome the crisis was to build a world-class innovation ecosystem in the Jyväskylä region. We took part in this process and created a new model for transforming regions into innovation ecosystems (Oksanen & Hautamäki 2014). The model consists of four important elements,

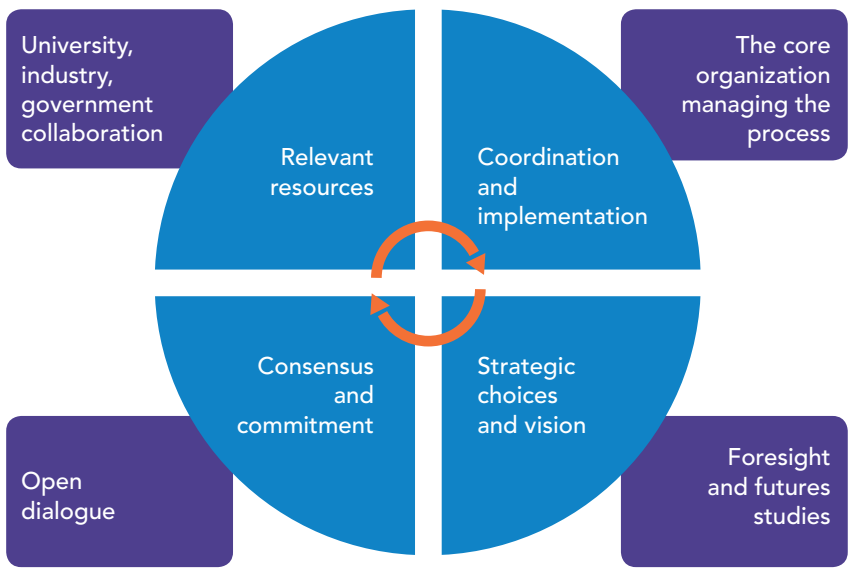


Figure 2. Model for building innovation ecosystems.

which are based on the Triple Helix cooperation (Etzkowitz, 2008), on the method of authentic dialogue (Innes and Booher, 2010), on the concept of core organization, and on foresight and futures studies. Figure 2 sums up the methodology.

The basic challenge for this model is to create an environment in which resources in companies, among citizens and in the public sphere are put to good use to create genuine synergies. Competitiveness will be built on what is called a PPP partnership equation: **resources of a region = people + public resources + private resources** (Alanen et al., 2010).

In addition, in the transformation process we learned that pilots, experiments and follow-up projects should be started as soon as possible. The key is not the methods, but a multi-step process: identification, interpretation and action. Therefore establishing the core organization from the beginning is one of the crucial steps in the building process.

6. Sustainable Well-Being

When considering sustainable innovation, it is useful to understand also the concept of sustainable well-being. Basically, sustainable innovations are evaluated according to their impact on sustainable well-being. We elaborated the concepts of sustainable well-being and innovation when studying the competitive advantages of the Helsinki Metropolitan region with Demos Helsinki (Alanen et al., 2010). In that research we turned around the standard economistic doctrine in which competitiveness is a pre-requirement for citizen well-being. Our analysis was that the well-being of people creates competitive advantage for the regions and cities, not vice-versa. This conclusion is built-in in themes addressed in this article, namely that in the new global economy, dynamic innovation ecosystems, which mobilize all resources, could renew themselves and concentrate on producing innovative solutions to wicked problems.

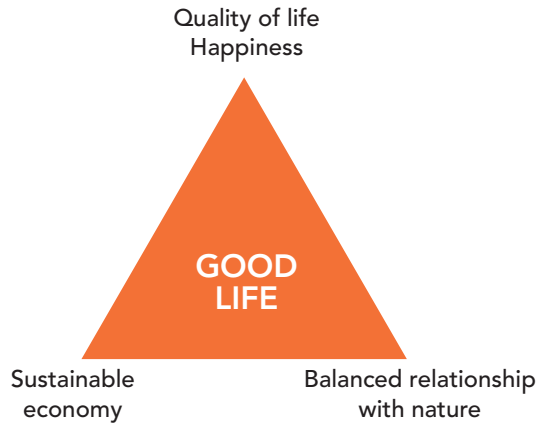


Figure 3. Elements of sustainable well-being.

The three basic elements of sustainable well-being are the quality of life (including happiness), sustainable economy (or **housekeeping**) and balanced relationship with the nature (sustainable development) (Figure 3). These are modern aspects of Aristotelian good life (see also Castells & Himanen, 2014).

It is important to emphasize the difference between this new concept of sustainable well-being and the traditional Nordic welfare. The welfare refers to **objective** well-being like health and economic security, whereas sustainable well-being is related also to the subjective experience of well-being. The other difference is that well-being is an active concept and contains capability to act in society. Traditional welfare means **compensating for handicaps** and it is a passive concept. In our analysis of the competiveness of the Helsinki Metropolitan region we state that the sustainable well-being of citizens is the real competitive advantage of the region.

7. Conclusions: Towards Cooperation

Sustainable innovation policy takes sustainable well-being and sustainable development as the basic values, leaving economic growth with instrumental value. It also shifts the dominance and focus in the discussion from a national level to both local and global levels when the basic field of innovation activities is the innovation ecosystem and not the national innovation system. It takes culture and creativity as an essential part of innovation environment and aims for spontaneous processes and radical innovations. Finally, there is a need to move from the national level to places where people work together, in other words, to local ecosystems, where sustainable innovation policy is localized and where people and their networks serve as the primary sources for innovation activities. Understanding people and the flow of ideas as a basis of innovation activities challenges the traditional innovation policy, and requires a systemic approach and deep institutional cooperation and interaction (Chesbrough, 2003; Seshadri & Shapira, 2003; Pentland, 2014).

In a global economy, human resources tend to cluster into attractive knowledge hubs. The major reason for clustering is that concentration of talents accelerates creativity and innovation. To realize the innovative potential at the regional level, regions must have an innovation ecosystem, which consists of dense networks connecting enterprises, funders, universities, labor force, and service providers. Although knowledge hubs have many success factors, a common factor is innovativeness and increasingly also the capability to solve wicked problems.

We have argued that producing human-centered solutions for wicked problems is impossible if the majority of people are out of reach of innovation activities. In the sustainable innovation policy, all innovation activities are considered in terms of how they contribute to good life and to solving wicked problems such as climate change, poverty, aging society, polarization or illiteracy. Sustainable innovation outlines significant changes in mindsets: all the effects of innovation must be evaluated according to their contribution to sustainable well-being.

In sum, innovation ecosystem is a descriptive concept for understanding the structure and dynamics of today's business environment. Ecosystems are not created through top-down steering or traditional industrial policies. They are self-regulating systems of interacting elements like start-ups, incumbent firms, universities, financing institutions, specialised services and talented people. It is said that an innovation ecosystem is like a rain forest, where new species continuously emerge by mutation. An ecosystem is a complex experimentation field of ideas and business.

However, ecosystems are part of much larger environments including municipalities, governmental organizations, legislation, and regulation. Although the dynamics of ecosystems refers mostly to networks and creative cultures, public agencies could build an enabling platform for the ecosystem. This presupposes a **cross-functional cooperation** between all partners and shareholders (Hautamäki, 2006). Especially important is the cooperation between firms, universities, venture capitalists and other financiers, municipalities, and citizens.

References

Alanen, O., Hautamäki, A., Kaskinen, T., Kuittinen, O., Laitio, T., Mokka, R., Neuvonen, A., Oksanen, K., Onnela, S., Rissanen, M., Vassinen, S. & Viljanen, V. (2010). The Well-Being of Metropolis. The City of Esbo. Retrieved 10.10.2014 from http://www.hel.fi/hel2/helsinginseutu/seutuselvitykset/kilpailukykytutkimus/20110328-Metropolia-report-final.pdf.

Asheim, B.T. (2000). Industrial districts: the contributions of Marshal and beyond. In G. L. Clark, M. P. Feldman, M. S. Gertler (Eds.), The Oxford Handbook of Economic Geography, 413–431. Oxford University Press.

Asheim, B. T. & Coenen, L. (2005). Knowledge bases and regional innovation systems: Comparing Nordic clusters. Research Policy, 34(8), 1173–1190.

Auerswald, P. (2012). The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy. Oxford University Press.

Benkler, Y. (2006). The Wealth of Networks. How Social Production Transforms Markets and Freedom. Yale University Press.

Bhatti, Y. A. & Ventresca, M. (2012). The Emerging Market for Frugal Innovation: Fad, Fashion, or Fit? Retrieved 10.10.2014 from http://dx.doi.org/10.2139/ssrn.2005983.

Boons, F. & Lüdeke-Freund, F. (2013). Business Models for Sustainable Innovation: State of the Art and Steps Towards a Research Agenda, Journal of Cleaner Production, 45, 9–19.

van Bueren, E., Klijn, E., & Koppenjan. J. F. M. (2003). Dealing with wicked problems in networks: analyzing an environmental debate from a network perspective. Journal of Public Administration Research and Theory, 13, 193–212.

Carlson, C. R., & Wilmot, W. W. (2006). Innovation: The five disciplines for creating what customers want. Crown Business.

Castells, M. & Himanen, P. (Eds.) (2014). Reconceptualizing development in the global information age. Oxford University Press.

Chesbrough, H. (2003). Open Innovation, The new Imperative for Creating and Profiting from Technology. Harvard Business School Press.

Christensen, C. M., Anthony, S. D. & Roth, E. A. (2004). Seeing What's Next: Using the Theories of Innovation to Predict Industry Change. Harvard Business School Press.

Crossan, M.M & Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. Journal of Management Studies, 4(6), 1154–1191.

EKA (2014). Helsinki Innovation Region, Pioneering For Europe 2020, Second Edition. Authored by EKA B project.

Estrin, J. (2009). Closing the Innovation Gap. Reigniting the Spark of Creativity in a Global Economy. McGrow Hill.

Etzkowitz, H. (2008). The Triple Helix: University-Industry-Government Innovation in Action. Routledge.

Etzkowitz, H. & Klofsten, M. (2005). The innovating region: toward a theory of knowledge-based regional development. R&D Management, 35(3), 243–255.

Etzkowitz, H. & Leyersdorf, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. Research Policy, 29(2), 109–123.

Fagerberg, J. (2006). Innovation. A Guide to the Literature. In Fagerberg J., Mowery D.C. & Nelson R.R. (Eds.) The Oxford Handbook of Innovation, 1–27. Oxford University Press.

Geels, F.W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. Research Policy, 39(4), 495–510.

Geels, F.W. and Schot, J.W. (2007). Typology of sociotechnical transition pathways. Research Policy, 36(3), 399–417.

Hall, P. (1998). Cities in Civilization: Culture, Technology, and Urban Order. Weidenfeld & Nicolson.

Hall, J. & Clark, W. (2003). Introduction to the special issue on environmental innovation. Journal of Cleaner Production. 11, 343–346.

Harris, J.M., Wise, T.A., Gallagher, K.P. & Goodwin, N.R. (2001). A Survey of Sustainable Development. Island Press.

Hautamäki, A. (2006). Innovation ecosystem in city policy: the case of Helsinki. Helsinki Quarterly 4/2006, 17–21.

Hautamäki, A. (2010). Sustainable Innovation. A New Age of Innovation and Finland's Innovation Policy. Sitra Reports 87.

Hautamäki, A. & Oksanen, K. (2012). Suuntana innovaatiokeskittymä. [In Finnish, Towards the Innovation Center] Jyväskylä University Press.

von Hippel, E. (2005). Democratizing Innovation. The MIT Press.

Innes, J.E. & Booher, D.E. (2010). Planning with Complexity, An Introduction to collaborative rationality for public policy. Routledge.

Kao, J. (2007). Innovation Nation, How America is Losing Its Innovation Edge, Why That Matters, and What We Can Do to Get It Back. Free Press.

Kao J. (2009). Tapping the World's Innovation Hot Spots. Harvard Business Review, March 2009, 209–114.

Kim, Y-H. & Short, J. R. (2008). Cities and Economies. Routledge.

Koskenlinna, M., Smedlund, A., Ståhle, P., Köppä. L., Niinikoski. M-L., Valovirta. V., Halme, K., Saapunki, J. & Leskinen, J. 2005. Välittäjäorganisaatiot – moniottelijat innovaatioita edistämässä [in Finnish, Intermediary organizations—all-rounders of innovation]. Teknologiakatsaus 168, Tekes.

Laird, D.M. (2005). Organizational Culture's Influence on Creativity and Innovation: A Review of the Literature and Implications for Human Resource Development. Advances in Developing Human Resources, 7, 226–246.

Lockwood, T. (Ed.) (2010). Design Thinking. Integrating Innovation, Customer Experience, and Brand Value. Allworth.

Luoma-Aho, V. & Vos, M. (2010). Towards a more dynamic stakeholder model: Acknowledging multiple issue arenas. Corporate Communications: An International Journal, 15(3), 315–331.

Medina, C.C., Lavado, A.C. and Cabrera, R.V. (2005). Characteristics of Innovative Companies: A Case Study of Companies in Different Sectors. Creativity and Innovation Management, 14, 272–287.

Moore, J.F. (2006). Business ecosystems and the view from the firm. The Antitrust Bulletin, 51(1), 31–75.

Munroe, T. (2009). What makes Silicon Valley tick? The Ecology of Innovation at Work. Nova Vista Publishing.

Narayanan, V.K. (2001). Managing technology and innovation for competitive advantage. Prentice-Hall Inc.

Nidumolu, R., Prahalad, C.K. & Rangaswami, M.R. (2009). Why Sustainability Is Now the Key Driver of Innovation. Harvard Business Review, September 2009. Retrieved 10.10.2014 from http://hbr.org/2009/09/why-sustainability-is-now-the-key-driver-of-innovation/ar/5.

Oksanen, K. & Hautamäki, A. (2014). Transforming regions into innovation ecosystems—A model for renewing local industrial structure. The Innovation Journal: The Public Sector Innovation Journal, 19(2), article 5.

Pentland, A. (2014). Social physics. How good ideas spread—The lessons from a new science. The Penguin Press.

Porter, M.E. (1980). Competitive Strategy. Free Press.

Porter, M.E. (1998). Clusters and the new economics of competition. Harvard Business Review, 76(6), 77–90.

Porter, M. & Kramer, M. (2011). Creating Shared Value. How to reinvent capitalism—and unleash the wave of innovation and growth. Harvard Business Review, 89(1/2), 62–77.

Prahalad, C.K. & Krishnan, M.S. (2008). The New Age of Innovation, Driving cocreated value through global networks. McGrew Hill.

Radjou, N., Prabhu, J. & Ahuja, S. (2012). Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth. Jossey-Bass.

Rittel, H.W.J., & Webber, M.M. (1984). Planning problems are wicked problems. In N. Cross (Ed.), Developments in design methodology, 135–144. John Wiley & Sons.

Rogers, E.M. (2003). Diffusion of Innovations, 5th ed. The Free Press.

Rogers, E.M. & Shoemaker, F.F. (1971). Communication of Innovations. A Cross-Cultural Approach, 2nd ed. The Free Press.

Saxenian, A. (2006). The New Argonauts. Regional Advantage in a Global Economy. Harvard University Press.

Seshadri, S. & Shapira, Z. (2003). The flow of ideas and timing of evaluation as determinants of knowledge creation. Industrial and Corporate Change, 12(5), 1099–1124.

Sethi, S.P. (1994). Multinational corporations and the impact of public advocacy on corporate strategy: Nestle and the infant formula controversy. Issues in business ethics. Kluwer Academic.

Simula, H. (2011). Management of Commercialization. Case Studies of Industrial, Business-to-Business Product Innovations. Aalto University School of Science, Department of Industrial Engineering and Management, Doctoral Dissertation Series.

Ståhle, P. & Oksanen, K. (2014). Uusimaa innovaatio-ekosysteeminä – kehittämisen painoalueet. Uudenmaan liitto. Retrieved 29.10.2014 from http://www.uudenmaanliitto.fi/files/14420/Uusimaa_innovaatio-ekosysteemina_-raportti.pdf.

Surowiecki, J. (2004). The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations. Doubleday.

Vasara, P., Hautamäki, A., Bergroth, K., Lehtinen, H., Nilsson, P. & Peuhkuri, L. (2009). Suuri siirtymä. Uusia lähestymistapoja tietämysverkostojen kehittämiseen [in Finnish, The great transition. New approaches for developing knowledge networks]. Sitra reports 79.

Weber, E.P. & Khademian, A.M. (2008). Wicked Problems, Knowledge Challenges, and Collaborative Capacity Builders in Network Settings. Public Administration Review, 68(2), 334–349.

Weinberger, D. (2011). Too Big to Know. Basic Books.

Wexler, M.N. (2009). Exploring the moral dimension of wicked problems. International Journal of Sociology and Social Policy, 29(9/10), 531–542.

About the authors

Antti Hautamäki, Ph.D., now a professor emeritus, was in years 2009–2013 a research professor of service innovation and the director of Agora Center at the University of Jyväskylä. He is also an adjunct professor of philosophy at the University of Helsinki. Hautamäki has published and edited about thirty books and published two hundred articles about philosophy, cognitive science and innovation. His latest books include **Sustainable Innovation, A New Age of Innovation and Finland's Innovation Policy,** 2010, and **Towards Innovation Center** (in Finnish, 2012) together with Kaisa Oksanen. Currently Antti Hautamäki works in his firm Consulting Sustainable Innovation.

Kaisa Oksanen, Ph.D., is a senior scientist at VTT Technical Research Centre of Finland. Currently her research is related to foresight and transition to bio-economy. Her background is in social and political sciences and her expertise in systemic innovation, foresight, science and innovation policy, innovation ecosystems, service innovation and well-being. Before VTT she has worked as a research coordinator and innovation researcher in Agora Center, University of Jyväskylä, in Finland Futures Research Centre, University of Turku and in Aalto University.

Kim Smith
Coordinator
RCE Greater Portland
kdsmith@pcc.edu

Anna Maaria Nuutinen
Contact
RCE Espoo
annamaaria.nuutinen@espoo.fi

Charles Hopkins
RCE Advisor for the Americas
chopkins@edu.yorku.ca

7. The Promise of RCEs: Collaborative Models for Innovation, Sustainability, and Well-Being

Abstract

As we reflect on the state of the world, we must find a balance between focusing on the disheartening challenges we face and the inspiring and innovative solutions possible, at individual, regional, and global levels. With considerations of the key drivers of sustainability and well-being, such as environmental stewardship, social justice, and quality of life, it is critical that we define what it means to live in sustainable ways and how we, independently and interdependently, can make a difference. This chapter explores how self-interest can be combined with greater awareness, higher purpose, and wisdom through cultural paradigm shifts and collaborative models, based in education for sustainable development (ESD). Specific case studies of Regional Centres of Expertise on ESD in Espoo, Finland, and Portland, Oregon, will demonstrate the potential for increasing our collective impact for a more sustainable future.

KEYWORDS: Education, Sustainability, Well-being, Regional Centres of Expertise (RCE), Societal Innovation

1. Introduction

As scientists debate whether we have entered the Anthropocene Era, we recognize the rapidly increasing anthropogenic effects that humans are having on ecosystems, the biosphere, institutions, and each other. Such human domination of the planet is remarkably rapid in evolutionary terms. For example, the oldest continuous living organism, the Siberian Actinobacteria, is estimated to be 600,000 years old, yet, in spite of its longevity, remains in a small ecological niche without dominating its habitat. Humans, however, with a much shorter presence and relatively lower reproductive rate, continue to exponentially impact the globe through its speed and ferocity of production and consumption. From changing the atmosphere and eliminating species to controlling the economy and altering the very bedrock of our planet in an unquenchable search for energy, humans have amplified these effects since the beginning of the Industrial Revolution (Stromberg 2013). The age of the human and its subsequent environmental, economic, and social changes pose daunting challenges that strain our communities and institutions and hinder our abilities to adapt.

Such consequences, however, do not require misanthropic responses. One can assume that humans are not inherently evil, but rather simply unwise in our beliefs in infinite resources and assumptions that our individual actions have minimal short-term and large-scale impacts. Examining these patterns of unsustainable development and recognizing that our collective well-being are embedded in interdependent systems are paramount in addressing current social and environmental problems.

Indeed, now is the time for societal innovations, when humans wake up and react with thoughtful and informed social, economic, environmental, and educational policies and practices. Fortunately, many are building upon existing foundations and traditions and creating new models for change. Communities are recognizing their shared destinies and developing relationships that allow them to address regional, national, and international challenges. Opportunities for working together, across sectors, to increase our collective impact are particularly promising. These efforts are exemplified by the Regional Centres of Expertise (RCE) on Education for Sustainable Development (ESD), which are acknowledged by the United Nations University Institute for the Advanced Study of Sustainability. Such collaborative models require new ways of thinking, communicating, and organizing, at cultural and structural levels, with formal and nonformal educational efforts that can help us create thriving, healthy, and just communities for present and future generations.

2. Sustainable Development

The concept of sustainable development was generally agreed upon by nations, in Rio de Janeiro, at the United Nations Conference on Environment and Development in 1992, with a definition of "meeting the needs of the present without compromis-

ing the ability of future generations to meet their needs" (World Commission on Environment and Development, 1987). Nations reaffirmed this concept twice, in 2002 and 2012, recognizing that there is a need for purposeful and innovative systemic designs in our institutions and policies to achieve the sustainable future we want and need. To do so requires democratically developing policies and practices that are ready for international implementation.

Unfortunately, tackling sustainability on the global scale has emerged, so far, as overwhelming in scope and difficulty. Negotiating between countries has invoked conflicts over development, an underlying perception of winners and losers, and fears of significant cut-backs. To date, between powerful messaging by the power elite and mainstream media and the ineffectiveness of articulating clear and achievable pathways to a sustainable future, the concept of sustainable development itself has become a political impediment.

2.1 Well-being

Well-being is increasingly used as an alternative and arguably more resonant term than sustainability. The concept of well-being is not new, however. In fact, while not clearly defined from a practical perspective, it was a national goal of the Government of Canada in 1970s (Laszlo, 1977). Thanks to further research clarifying its various dimensions, well-being is now seen as a more concrete and meaningful societal objective, especially in Europe. When fully developed, it holds much promise for new economic and environmental models (Hämäläinen, 2014). As described in an African proverb, the new definition of sustainability thus becomes "Well-being, for all, forever." This is accompanied by the conditions that "All" is not limited to humans but all life forms and, thus, is proving to be a powerful metaphor for community interdependence. The emergence of the well-being model, combined with engagement tools, such as social media and applied learning, offers powerful resources upon which innovators can build.

This is particularly important for educational institutions. The recognition of daunting sustainability issues such as climate change and the collapse of the oceans has drawn funding for important research within the physical sciences, while neglecting the role that the social sciences and humanities can play in supporting cultural and behavioral change and community development. Deep scientific understanding of the physical causes of environmental problems is needed, along with the innovative solutions offered by the science, technology, engineering and math (STEM) fields, but we also need to understand Why these issues matter, through social-psychological terms that bring meaning and purpose to our actions. The idea of well-being links these disciplines together and helps inform both why public awareness and action are needed and how such paradigm shifts can occur.

To honor the human spirit, Suni and Nuutinen believe that well-being rests on the individual sense of comprehension, manageability and competence in one's life as well as a sense of autonomy, meaningfulness and relatedness (2012). The sense of meaningfulness of one's undertakings and the experience of relatedness in one's

dealings with others are of primary importance; therefore, they declare that sustainability itself equals well-being.

Emphasizing the need for well-being is especially important in this time of critical problems which can lead to fear and demoralization. To counterbalance this, it is essential to share and frame information through a lens of hope and empowerment, inspiring engagement and identifying effective pathways for problem-solving. To activate hope and engage the public on a broader scale requires tools and insights that expand our appreciation and understanding of the value of individuals and the interdependent needs of communities.

2.2 Collective impact

One path to achieve these goals can be guided by research on collective impact. According to Kania and Kramer (2011), there are five core variables that allow communities to increase their success:

- Common agenda/shared initiatives
- Shared measurement systems
- Mutually reinforcing activities
- Continuous communication
- Backbone support organizations

In collaboration with each other, such findings suggest that stakeholders are able to work together by stepping outside of their silos and away from competition and discovering common sustainability missions that allow them to align goals and advocate for shared initiatives and policies. These efforts must be based on reliable data, thereby encouraging shared research projects, collective measurement systems, and comparative models, which can increase efficiency, accuracy, and relevancy. Recognizing that many communities and organizations face tight budgets, working together offers opportunities to leverage resources and develop collaborative value-added programs. Whether these efforts include co-hosted events, shared trainings, or partnering in grant proposals, the research suggests that they will achieve greater collective impact by working together on mutually reinforcing activities. This is further supported through communication and transparency, plus paradigm shifts based on trust, caring, respect, and shared knowledge that foster community dialogue and engagement. These efforts require a common network, a governance model that can serve as a backbone organization that facilitates partnership building, data collection, programming, and outreach.

The goal of collective impact sounds encouraging, but can be challenging in practice. Even the best-intentioned organization may flounder when facing obstacles, such as cultural values, institutional practices based in competition rather than collaboration, and limitations in funding and staff capacity. While not all projects may benefit from working together, concepts such as sustainable development and well-being offer present generations to explore ways to recognize and nurture interdependence.

3. Community Engagement

While we face international crises, it is difficult to negotiate at the global scale, due to systemic competition. Such sustainability efforts might find greater success at local and regional levels, where efforts are typically more collaborative, have manageable scales, and offer visible mutual benefits and tangible actions. For example, one can see the impact of serving meals to the homeless or restoring natural areas. The proportional scale at the local level also allows many to be engaged and have their voices heard. With focused educational efforts, facilitated dialogues, and opportunities to participate in local actions, we can develop a citizenry who feels represented. This will help national leaders negotiate on their behalf on the international stage. Such informed citizens should be able to see the needs of their communities, understand the long-term thinking involved, comprehend the wisdom of preventative strategies, and help in their implementation.

Societal innovations that build public support and motivate engagement in policies, programs, and practices are emerging. Yet, while we have public awareness campaigns, they have not been effective enough in mobilizing sufficient individual action or collective impact in most communities. Mainstream media, linking excessive consumption with happiness and status, overwhelm alternative narratives that strive to align sustainability and well-being with social acceptability, environmental and personal health, and new economic models. Social change is largely unfunded and politically sensitive in many communities. To date, these discussions are not part of most mainstream discussions, but rather are relegated to higher education, NGOs, or public policy think tanks. Therefore, the emergence of innovative approaches that educate, empower, and engage the public are crucial. Educational programs, social media, community learning centres, faith-based study circles, and multi-sector collaborative networks provide powerful alternative models worthy of further exploration and support.

3.1 Regional Centres of Expertise

One pioneering approach are Regional Centres of Expertise (RCE) on Education for Sustainable Development (ESD), which were created to help support the UN's Decade of Education for Sustainable Development (DESD), from 2005–2014. The United Nations University, a global think tank and postgraduate teaching organization committed "to contribute, through collaborative research and education, to efforts to resolve the pressing global problems of human survival, development and welfare that are the concern of the United Nations, its Peoples and Member States" (UNU, 2015) formally acknowledge RCEs. Through the support of the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), RCEs strive to develop grassroots, multi-stakeholder networks that promote formal, nonformal and informal education, public awareness and understanding, and training through flagship initiatives and projects.

With UNU envisioning learning across the local-global space as its strategic core, while keeping communities at centre stage, Regional Centres of Expertise on ESD (RCEs) were introduced as a multi-stakeholder initiative of learning for change, with higher education and school communities as the lead actors. Thus what began as a modest story of a small network of seven acknowledged RCEs, soon picked up momentum across regions to become, in a decade, a large network of 129 [now 135] RCEs (Fadeeva et al., 2014).



Figure 1. Global RCE Map.

To support the DESD, RCEs are required to have clearly defined action plans, with the development of a vision, measurable short and long-term objectives, and strategies for achievement. They are expected to foster collaboration, support outreach, nurture transformative education and research, and set examples of participatory governance that engage individuals and communities to increase their collective impact through ESD. As regionally-based, yet globally-connected networks, RCEs form a global learning space on ESD, working to ensure that all individuals have the opportunity to learn the values, behaviors and lifestyles required for a sustainable future and for positive social transformation (Tongyeong Declaration on RCEs and ESD, 2012).

The RCEs' emphasis on transformative learning is a new educational form that allows for deep learning which can be measured in terms of well-being and everyday engagement with others (Suni & Nuutinen, 2012). It promotes learning in which individuals are facilitated rather than taught and involves examining one's own men-

tal models, including "sustainability" in one's own life context and well-being. This idea of transformative learning places a greater responsibility on the learner and the facilitator since the mere transmission and retention of information is no longer adequate.

Thus, solving problems involving traditional notions of intelligence is no longer adequate. Through transformative learning, the central problem becomes the question of one's orientation towards what one cares about and the capacity needed to address sustainability issues. Suni and Nuutinen propose that transformative learning is "facilitated learning through caring for one's own thinking, feeling and willing [and] is the natural path to a sustainable future. Learning to care is natural and transformational. It changes who and what we are and arises from within us naturally under all life's circumstances" (2012).

From individual self-reflection to systems-level thinking, the UNESCO Decade on ESD Final Report suggests that ESD made a difference across sectors. Formal education, from pre-school to higher education institutions around the world, made huge strides in curriculum and teacher trainings. Plus, the private sector has invoked workforce training programs and the nonformal education world of government departments, NGOs, and faith-based groups have made great progress in offering sustainability programs, developing community centres, and offering life-long learning opportunities. Specifically, the report shows that ESD contributes in the following ten key ways (UNESCO, 2014):

- ESD is an enabler for sustainable development
- Education systems are addressing sustainability issues
- Sustainable development agendas and education agendas are converging
- Importance of stakeholder engagement for ESD
- Political leadership has proven instrumental
- Multi-stakeholder partnerships are particularly effective
- Local commitments are growing
- ESD is galvanizing pedagogical innovation
- Whole-institution approaches practice ESD
- ESD facilitates interactive, learner-driven pedagogies
- ESD has spread across all levels and areas of education
- ESD is being integrated into formal education
- Nonformal and informal ESD is increasing
- Technical and vocational education and training advances sustainable development

Encouraged by the achievements of the DESD, UNESCO has launched a follow-up effort called the Global Action Programme on Education for Sustainable Development (GAP-ESD), which targets five priority action areas:

- Advancing policy
- Transforming learning and training environments

- Building capacities of educators and trainers
- Empowering and mobilizing youth
- Accelerating sustainable solutions at the local level.

The emphasis on the local level focuses on education, public awareness and training for sustainable development to create more sustainable communities and, hence, links directly to the existing global RCE initiative. Given the success of the RCE model, UNESCO has invited RCEs to help implement the GAP, thus RCEs around the world are preparing new commitments to reach these targets. The following examples demonstrate two different award-winning RCE models and how they have helped move the ESD mission forward through various innovative programs.

3.2 RCE Espoo—Building Well-being and a Sustainable City

RCE Espoo is the first Finnish actor to have been approved in the UNU's global RCE network, bringing together institutions in the Espoo region to jointly promote well-being and sustainability. Started in 2011, the RCE Espoo network is an innovative platform that shares information and experiences and promotes dialogue and actions among stakeholders through partnerships for sustainable development.

3.2.1 Challenges

"They started by looking for the sustainable development and well-being challenges in the Espoo area" (Immonen & Nuutinen, 2010). In the beginning, according to Education Authorities, "we didn´t know about the United Nations Decade of Education for Sustainable Development (UNDESD). We had no existing ESD plans or programmes or organized in-service training for teachers or lecturers or trainers on ESD." However, city data, research, and interviews revealed sustainability challenges such as the following.

Based on data from the Social and Health Authorities:
Promoting sustainable social development requires learning new kind of cooperation forms which increase the involvement. In promoting sustainable development, the social and healthcare services have two different roles. Firstly, they have to actively participate in the discussions and activities that promote sustainable development in Espoo. For this purpose, they must be supported by the network in carrying out observations, researches and evaluations. Secondly, the organization's own personnel (3,500 employees) must know how to make decisions at their own workplace in favor of sustainable development. This calls for raising awareness and organizing training for the personnel, where the network can be of help.

According to Technical and Environmental Authorities:
Climate change mitigation is a major challenge in Espoo and in the Helsinki Metropolitan area. More sustainable community structure needs to be developed, and

also more sustainable ways for transport and mobility. Especially, the use of public transport should be promoted. Nutrient loadings, for example to the Baltic Sea and lakes, can be further decreased. The nature in Espoo is characterized by rich biodiversity. Special attention has to be paid to protection.

According to citizens:
Sustainable lifestyles are not seen in practice in the City of Espoo. Although sustainable development is a value of Espoo and many different SD projects have seen daylight, there are no implementation plans based on these projects.

3.2.2 Vision and objectives

The stakeholders of RCE Espoo were asked to join due to their earlier contributions (collaboration, publications, etc.) to well-being, sustainable development and education for sustainable development (Figure 2). Together, they created the vision: **"A sustainable future is an active choice and we will reach it together!"**

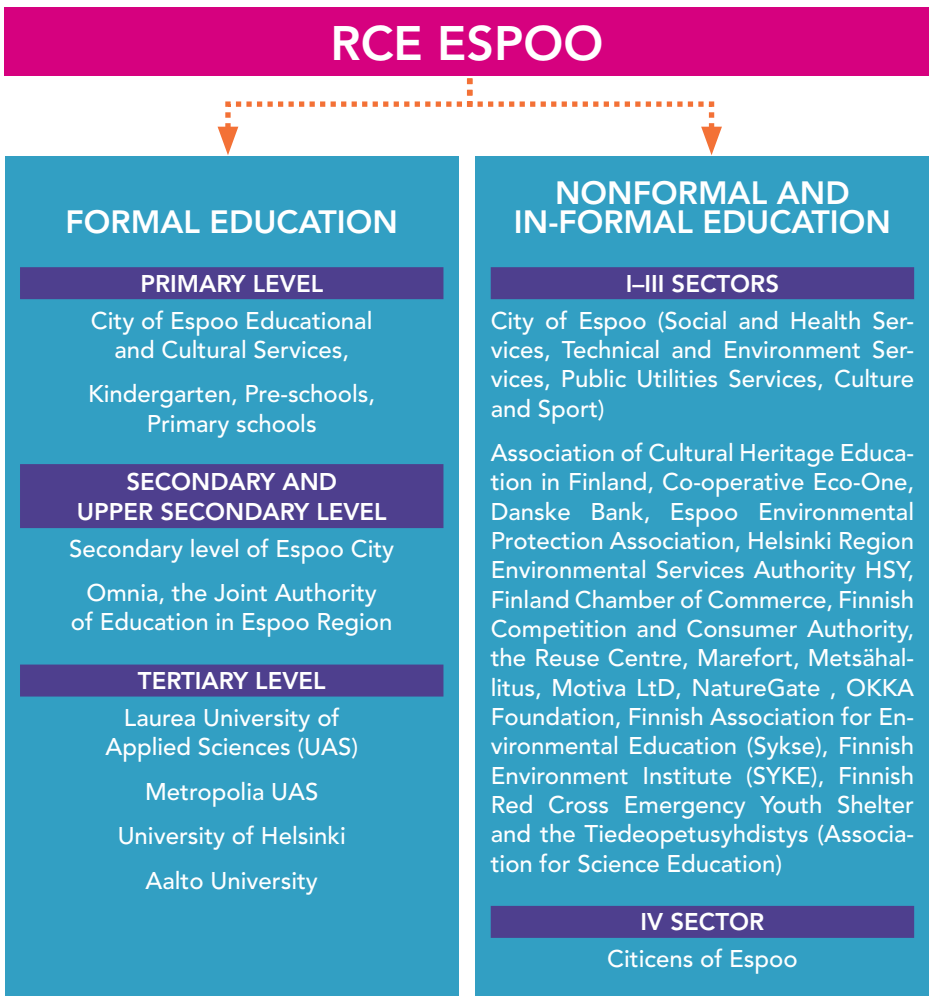


Figure 2. Identification of RCE Espoo stakeholders

They named four goals or Work Packages (WP), based on the challenges they found in the Espoo area.

1. Sustainable development is incorporated into the plans for early childhood education and care as well as the curricula of schools, educational establishments and units of higher education.
2. Education and training for all. It all starts from teachers, educators and trainers who are aware of the challenges and understand the importance and value of sustainable development.
3. Promoting Public Awareness and Understanding of well-being, SD and sustainable lifestyle. Production of environmentally friendly services and products that increase the well-being of inhabitants is promoted.
4. Understanding the value of nature and smart city planning, developing less burdening services and products and cherishing cultural values.

They planned strategies on how to gain these objectives and chose the criteria for monitoring the quality and quantity of their achievements. Every year they collect data in an Annual RCE Espoo Report, to assess where they are and to create a new action plan based on the data.

3.2.3 Governance and management structure

RCE Espoo agreed on a governance and management structure among its stakeholders, allowing the RCE to truly function as a multi-stakeholder network. The structure includes a:

- Management Team, which supervises the strategic guidelines for the progress of RCE and meets twice a year
- Steering Group, which is an advisory group consisting of representatives of key organizations and partners. It reports to the Management team, directs committees, sets new targets for the committees within the strategic guidelines, prepares required reports, and meets at least three times a year
- Working/Interest/Project groups consisting of all organizations, institutions and businesses committed to implementing Work Packages

3.2.4. RCE Espoo achievements and actions

Since RCE Espoo began in 2011, they have achieved a number of core goals. ESD runs through all levels, from early education to higher education. For example, every day care centre and school has ESD plans and they each have at least one educated eco-supporter. Some schools and day care centres apply the Green Flag programme, in which students and children take part in decision making and change their daily practices to be more sustainable. In Omnia, the Joint Authority of Education in Espoo Region, sustainable development has been integrated in curriculum

and is one of the evaluation subjects of vocational skills. Omnia received the certification from the OKKA Foundation, which is responsible for maintaining and developing the certification system, with criteria for integrating sustainability issues in the management, teaching, and maintenance activities of educational establishments. Omnia received the Ministry of Education and Culture Quality Award in 2013, in addition to recognition for being the most innovative learning environment, and is a forerunner in national and international education development projects focusing on systemic, sustainable solutions.

There are a variety of ESD programs in higher education, as well. For example, the Laurea University of Applied Science's Ethical Guidelines promotes social, economic, and ecological sustainable development. In Helsinki Metropolia University of Applied Sciences, Environmental Knowledge and Sustainable Development offers 30 credits of minor subjects approved as part of 68 degrees. Aalto University has developed material about sustainable campuses. Plus, the University of Helsinki hosts an R&D Program for RCE Espoo.

In relation to promoting public awareness and understanding of well-being, sustainable development, and sustainable lifestyles, the City of Espoo has trained eco-support staff among its personnel. These people encourage and instruct their work communities in energy saving, reducing waste and making environmentally-friendly procurement and transport choices. The training began in 2009 and so far, more than 500 people from different services have qualified in this field.

On the community level, the Espoo Liberal Adult Education Centre has sustainable education plans and programs as well, along with certification from the OKKA Foundation. Espoo's nature trails, Nature House Villa Elfvik, and Haltia Nature Centre all offer resources in promoting well-being. Nature House Villa Elfvik promotes sustainable lifestyles by offering its visitors ideas on how to behave in more sustainable manners and sustainable practices are demonstrated in the everyday activities of the Nature House. Plus, during the year, The Gulf of Finland 2014 promoted a cleaner Gulf of Finland, through a variety of events, including coordinated litter collection on beaches, nature schools and camps on the marine environment, photo exhibitions, and excursions to the archipelago. More than 23,000 Espoo residents participated in various events and campaigns.

Societal innovation is demonstrated by students of Laurea: with the Active Friend project. As a part of their studies, students of physical therapy are working in service homes, hospitals, and PT departments, analyzing sustainable development factors in the real world. While walking with the elderly, many who are often house-bound, they can go to gardens and swimming halls, where they can breathe fresh air, be active with friends, and promote their health. The Active Friend project has also developed a client-driven service counselling / eCounselling system in the Espoo City, engaging clients, professionals, and students to help them find appropriate physical activity groups, like SeniorSportClub 65+. Thus, it is now possible for all Espoo residents to get online health checks and receive health training online.

To promote public awareness and understanding of ESD, RCE Espoo arranges RCE seminars twice a year. They also host events around the year, including Well-

being day, Tree plantings and projects related to climate change and energy saving (Annual RCE Report 2011–1014). Their planning meetings are open to all stakeholders to take part in, share ideas for events, and lead new kinds of activities and actions. They believe that it is important to respect each other, learn from others and be ready for collaborative knowledge building.

3.2.5. Future

RCE Espoo's new challenge is to implement eco-social education within the educational culture. This will include multi- and transdisciplinary work and a new attitude and understanding on a planetary level: we have only one planet EARTH.

According to Jukka Mäkelä, the Mayor of Espoo, "Espoo offers training to its employees and inhabitants in how to make sustainable choices. If 14,000 employees and 250,000 inhabitants change their attitudes and ways of doing things, a remarkable change is possible."

For the members of RCE Espoo, every life is precious, claiming "Help others and pay it forward!"

3.3 RCE Greater Portland

RCE Greater Portland is a growing network of regional educators, students, nonprofits, political and industry leaders, organizations, and community members collaborating to promote sustainability education in the Portland Metro region, in four counties in Oregon and Washington, in the United States. While only acknowledged by the UNU-IAS in 2013, they have grown quickly, connecting over 110 diverse organizations and close to 300 individual members in a collaborative network that multiplies their collective capacity to educate for a more sustainable future. Given the scale of Portland and the many existing organizations and coalitions already dedicated to environmental education and social justice, it is both a challenge and an opportunity to create a network large enough to engage all of the stakeholders. To do so, they are committed to creating a progressive, egalitarian governance model that reflects their values, supports collaboration among partners, facilitates implementation of their objectives, distributes authority and decision-making across the network, and honors the volunteer efforts of their members.

3.3.1 Vision and goals and objectives

RCE Greater Portland envisions a healthy, just, and thriving region where sustainability education is prioritized and integrated across sectors and where everyone has opportunities to shape a more sustainable future. They have four core goals, which are supported through specific objectives and projects:

1. Build a vibrant and diverse regional cross-sector network of individuals and organizations advancing sustainability education together

2. Advance the development of lifelong sustainability learning opportunities in formal, nonformal, and informal contexts

3. Increase public awareness about regional sustainability issues and the role of ESD in shaping a healthy, just, and thriving future
4. Support capacity building to develop Citizen Leaders who will steward our region for generations to come

3.3.2 Governance Structure

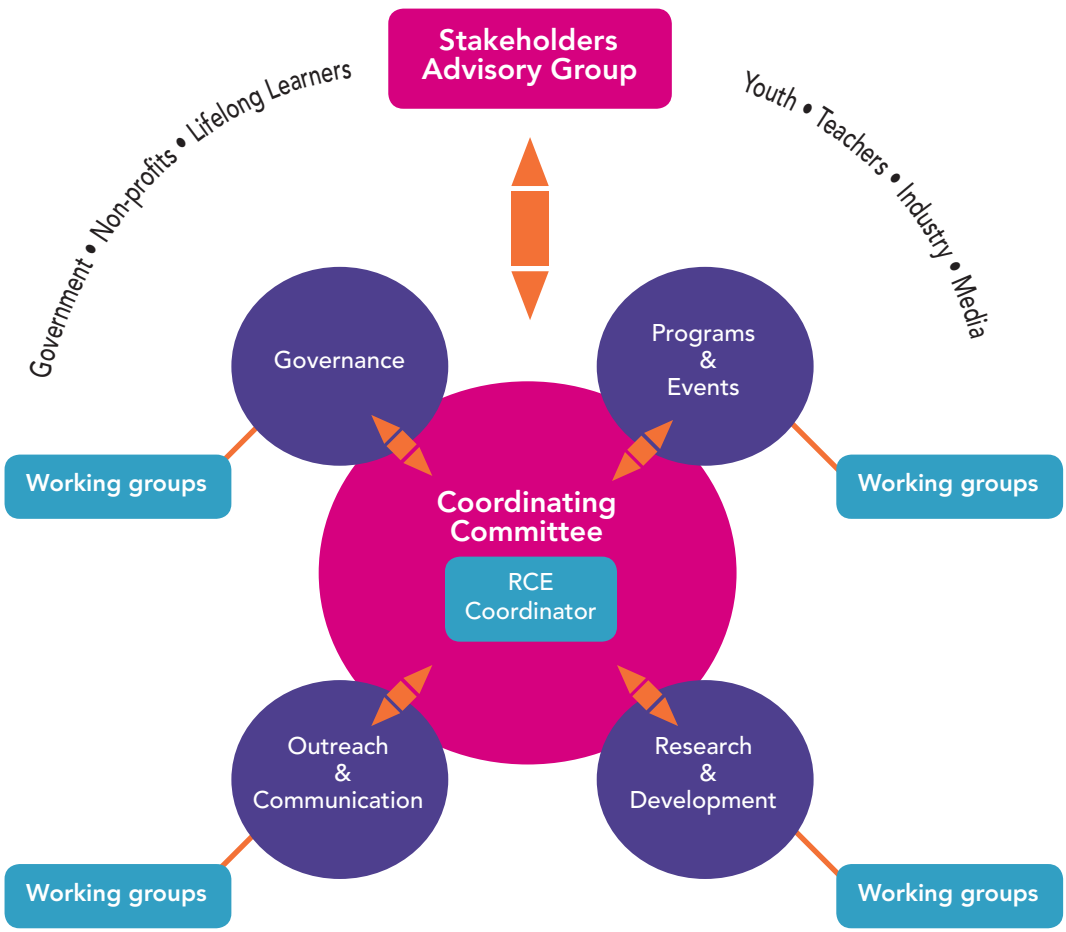


Figure 3. RCE Greater Portland's Governance Structure.

The governance structure of RCE Greater Portland, illustrated in Figure 3, is focused on a Coordinating Committee, which is responsible for the management of the RCE, including approving governance policies, bylaws, and funding models and the creation and evaluation of an annual plan. They meet monthly to complete RCE

business and host quarterly stakeholder meetings to discuss regional initiatives and highlight community partners. Their efforts are supported by subcommittees and working groups that focus on: policies and funding, programs and planning, outreach, partnership and social media, and research and development, including curriculum development and trainings.

3.3.3 Annual projects and achievements

RCE Greater Portland works with partners throughout the region to develop programs and trainings, with twelve formal events and programs submitted to the UNU-IAS in their 2014 report. A sample of these include networking socials, the Coalition for a Livable Future's Regional Equity Atlas Training and Stories Exhibit, the Center for Civic Participation's Social Equity and Justice Forum, a variety of Earth Week events, films, art, and presentations, the International Virtual Youth Conference, and their official Launch party in June, 2014.

Known locally as the Greater Portland Sustainability Education Network (GPSEN), they focus on outreach to develop partnerships, offer presentations on ESD across the sectors, and support event and resource promotion, through their website, listservs, monthly newsletter, Facebook, and Twitter. Partners are linked through a GIS map when they submit a partner form and engagement pledge.

The research and development committee has focused on seeking grant funding to create a searchable ESD resource database, with curricula, research, literature, professional development providers, and program evaluation tools. A grant through



Figure 4. TeamWorks Team serving meals at Potluck in the Park.

the regional government supports an asset-mapping project of sustainability education providers in the region. This committee also works with students to support research projects and develop internships for professional development.

RCE Greater Portland received the global RCE Civic Engagement award for their Hands on Greater Portland's E4 TeamWorks project, in which twelve students and community members participated in a series of events focused on the four "Es" of sustainability: Education; Environment; Economy; and Equity. They served meals to the hungry, viewed films on indigenous knowledge and climate change, attended a lecture on sustainable development, beautified an elementary school, and reclaimed building materials. Reflection exercises were embedded in the projects to help participants explore local sustainability challenges, identify and assess existing initiatives, and recognize the benefits of their actions.

Given the success of the project, as indicated through the positive evaluations from participants and the high number of people served, they plan to continue to offer TeamWorks teams in the future.

3.3.5. Future Plans

RCE Greater Portland, aka GPSEN, is committed to supporting collaborative partnerships in the region in order to advance ESD, facilitate engagement, increase their collective impact, and help nurture their community. With a commitment to life-long learning, they hope to strengthen the foundation and capacity of the network and welcome individuals and partners who believe in the value of working across sectors in order to create a more sustainable future.

4. Conclusion

Arthur Miller wrote "an era can be said to end when its basic illusions are exhausted." The current era of our planet, portrayed as limitless and independent from human activity is apparently over. Whether we proclaim this to be the Anthropocene Era or not, we must focus on the bigger picture and work in a cohesive, concerted manner to address the crises we face.

Working together, in multi-sector networks, is an important way to start. RCE Espoo and RCE Greater Portland have demonstrated these efforts and have been recognized, along with other RCEs, for their innovative approaches in civic engagement. Joining over 130 RCEs operating in a loosely networked Global Learning Space, they demonstrate how to address regional and international challenges by supporting collaboration between individuals and communities through education for sustainable development. This innovative approach engages a wide cross section of society as opposed to isolated like-minded subsets of a region, thereby increasing engagement, dialogue, and diverse representation. The sharing of their expertise and innovative approaches across the global community allows the RCEs to test and replicate programs and increase their effectiveness over time. While both RCEs struggle with the staff capacity and resources needed to be able to achieve all



Figure 5. UNU Regional Center of Expertise Community Engagement Awards.

of their goals, their networks continue to help their regions address issues of sustainability, well-being, and collective impact.

When one combines such regional, collaborative practices with broader paradigm shifts, the potential for massive cultural and structural change is possible. This was exemplified at the end of the Second World War, with the very creation of the United Nations itself and its various agencies. The Charter of the United Nations Educational, Scientific and Cultural Organization (UNESCO) states "That since wars begin in the minds of men, it is in the minds of men that the defenses of peace must be constructed." It is our hope that these examples help one envision the steps needed to create a better, more interdependent world and that collaborative models like the RCE movement can play an important innovative role in the solutions to come.

References

Fadeeva, Z, Payyappallimana, U., Tabucanon, M, and Chhokar, K. (2014). Building a Resilient Future through Multistakeholder Learning and Action: Ten Years of Regional Centres of Expertise on Education for Sustainable Development, United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS).

Hämäläinen, T & Michaelson, J. (2014). Well-being and Beyond. Edward Elgar Publishing Limited.

Immonen, P. & Nuutinen, A. M. (2010). Candidate RCE Espoo, Finland application to UNU-IAS for RCE Status.

Kania, J. and Kramer, M. (2011). Collective Impact. Stanford Social Innovation Review.

Laszlo, E. (1977). Goals for Mankind: A Report to the Club of Rome on the New Horizons of Global Community. New American Library.

Stromberg, J. (2013). What is the anthropocene and are we in it? Smithsonian Magazine, January. Retrieved January 3, 2015, from http://www.smithsonianmag.com/science-nature/what-is-the-anthropocene-and-are-we-in-it-164801414/?no-ist

Suni, P. & Nuutinen, A.M. (2012). Connecting Care, Well-being and Transformative Learning in Education: A Response to the 2012 Tongyeong Declaration (draft).

Tongyeong Delegation. (2012). Tongyeong Declaration on RCEs and ESD.

UNESCO. (2014). Roadmap for Implement the Global Action Programme on Education for Sustainable Development. UNESCO.

UNESCO. (2014). Shaping the Future We Want: UN Decade of Education for Sustainable Development (2005–2014) Final Report. UNESCO.

United Nations University. (2015). "About UNU." United Nations University Website. Retrieved January 20, 2015, http://unu.edu/about/unu.

World Commission on Environment and Development. (1987). Our Common Future. Oxford University Press.

About the authors

Kim Smith received her Ph.D. in sociology from Indiana University in 2000. She is the Coordinator of RCE Greater Portland and has taught sociology at Portland Community College (PCC) since 1996, specialising in environmental sociology and social movements. She served as PCC's Service-Learning Coordinator, Teaching Learning Center Co-Director, and Training Coordinator for PCC's Summer Sustainability Institute. She works closely with many non-profits, including the Northwest Earth Institute and Hands on Greater Portland, where she served on the board for six years. She represented the Association for the Advancement of Sustainability in Higher Education (AASHE) at the United Nations Rio+20 Earth Summit, led the U.S. delegation to the UNESCO World Conference on ESD, and serves on AASHE's Board of Directors.

Anna Maaria Nuutinen has a Master of Science in Education and is a primary and special school teacher. She is the RCE Espoo contact person and a member of the UNU IAS R&D Group for Sustainability in the Department of Teacher Education (University of Helsinki). She is interested in collaborative knowledge building and the promotion of inquiry-based learning that is directed to transform education and improve community collaboration for SD.

Charles Hopkins is currently a UNESCO Chair in education for sustainable development (ESD) at York University in Toronto, Canada. He is also the United Nations University RCE Regional Coordinator for the Americas. He was a teacher, school principal and regional school superintendent before entering the university world. His long involvement with ESD began with a presentation to the Brundtland Commission followed by a role as a drafter of Chapter 36 of Agenda 21, **Education, Public Awareness and Training.** Hopkins is an adviser to both UNESCO and UNU as well as several ministries of education.

Markku Lappalainen
Research Fellow, PhD (Tech) and Architect (MSc)
Aalto University, Finland
markku.lappalainen@aalto.fi

Pia Lappalainen
Lecturer, PhD (Tech) and MA (English)
Aalto University, Finland
pia.lappalainen@aalto.fi

8. Nurturing Multidisciplinarity to Promote Espoo Innovation Garden

Abstract

New types of alliances, regional innovation ecosystems, are evading today's economy as a means of securing survival and prosperity. These systems are founded on the principles of the Triple Helix along with the expertise of its three cornerstones, research, education and industry. Despite its emphasis on research knowledge, the system needs a certain type of a cultural environment to foster innovation from the bottom up.

This article discusses systems thinking as a cultural trait and an instrument of institutional evolution through case Aalto, which was founded to foster innovation and multidisciplinarity. We argue that innovation potential can most effectively be unleashed by focusing on such intangible assets as leadership and the emotional reservoir in the organization and its members. As concrete examples of innovative implementations within the University classrooms, two student endeavours are described: the Creative Sustainability Programme and the Development Cooperation Project.

KEYWORDS: Creativity, Emotional reactivity, Innovation, Leadership, Curriculum design

1. Introduction

"If we only reaffirm what already is, we have failed."
Aalto Rector **Tuula Teeri**

Aalto University, also known as the Innovation University in Finland, strives to prime innovation and entrepreneurship as all-permeating traits of its culture, sparked by multidisciplinarity and the coexistence of science and art. As President of Aalto Tuula Teeri has asserted, "multidisciplinarity manifests itself in various ways, e.g. it can be interwoven into a study program or the study experience". The format no longer matters, as long as the education equips the students with the ability to change our society. (Teeri interview 13.10.2014)

This article sets off reviewing some trends urging for innovativeness in the institutional settings of Aalto University. It then polemicizes the straightforward divide between analytical and emotions-driven thinking, arguing that the emotional reservoir should not be ignored in the academic set-up but rather viewed as an intangible assets bolstering rationality. We conclude with two concrete examples showcasing how Aalto materializes multidisciplinarity as classroom reality that promotes students' innovative thinking, generic skills and working life competences.

2. Innovation in the Postmodern World

Today's operating environments and business dynamics have pushed for the advent of a new type of a research alliance, one that opens unprecedented opportunities for small businesses. In their risk aversion, larger businesses easily dismiss high-risk technology R&D endeavours, allowing smaller companies to step in and take the role of innovation engines in these new ecosystems. Innovation ecosystems are collaborative arrangements that benefit from a mix of different organizations, each enriching the joint venture with their unique strengths, while offering benefits that the partners would not have access to alone. (Spivack, 2013) These partnerships often involve also cooperation with universities, traditionally regarded as the cradles of innovation. As a whole, innovation ecosystems materialize the principles and objectives of the Triple Helix, integrating expertise from research, education and industry, and effectively promoting new knowledge creation, knowledge dissemination and innovation.

Mere membership in an ecosystem guarantees no targeted gains, neither does it ensure survival. Industrial success in the postmodern era is increasingly seen as dependent also on adaptation to dynamic markets, consideration of customer needs, financing of innovations, service orientation, highly educated workforce, and opening up of technological policies. Business logics are moving from goods-dominance to service-dominance, turning service-mindedness and innovation ability the competitive factors of tomorrow. These trends naturally necessitate new types of mind-

sets and multidisciplinary competences, such as socio-economic, social-emotional and socio-cultural ones, that complement the traditional and narrow technical or domain-specific skills. (Niitamo, 1999) Such a new configuration of personal capabilities allows individuals not only to develop themselves as human beings but also to build up a society that meets the requirements of the economy, ecology, and ethics. (Sydänmaanlakka, 2003; Glavic et al., 2009)

Inclusion of these three considerations in organizational operations has challenged also innovation activities in a new way. Instead of merely pursuing more effective production processes, more feasible technologies, more viable products, larger market shares and higher profits, innovation activities should also take into account the mental and social wellbeing of the ecosystem. This article takes a closer look at the socio-emotive aspects intervening in innovation, with the aim of promoting the role of the emotional capital in innovating alliances.

3. Socio-Emotive Factors in Innovative Teams

Technological innovation calls for individuals who can cross the boundaries between disciplines and visualize the broader context, that of society. Innovators should therefore focus both on the specialised domain-specific content, and on the broader implications for the surrounding ecosystem. (Akay, 2008)

The build-up of these cross-disciplinary capabilities requires a change of foci in the education system and industrial operating mode, calling for more holistic development of individuals into global citizens. Essentially, it calls for understanding of the role of emotions for the wellbeing and productivity of individuals, teams and societies, as a healthy and supportive socio-cultural environment with its social structures and mechanisms is more likely to foster creativity and innovation (Hautamäki, 1998).

Creative intelligence is pivotal for the formulation of extraordinary ideas and problem-solving. (Moller et al., 2000) Innovativeness in work communities builds largely on group diversity if the members are highly oriented towards common goals. Appreciation of diversity and criticism are instrumental in reducing unnecessary group conformity or groupthink and in giving a boost to group performance and creative thinking. (Korhonen-Yrjänheikki, 2011)

On a general level, increased levels of emotional competence have been reported to result in improved quality of social relationships in a work team, known to enhance creativity and innovation. (Kotsou et al., 2011) Positive emotions tie people together and bolster a sense of togetherness. Emotions are biological and present, not only in individuals but in entire communities, and as they are such an integral and unavoidable element of innovative teams, they deserve closer examination in the next section.

3.1 Reasoning vs emotional reactivity

In the human mind, there are two different thinking systems, the intuitive System 1, which drives the fast thinking, and slower system 2, which drives the slow thinking. The attentive System 2 is who we think we are. System 2 articulates judgments and makes choices, but often rationalizes ideas and feelings that were generated by System 1. (Kahnemann, 2011)

The two-mind hypothesis has arisen from the proposal of numerous dual-process theories in cognitive and social psychology. System 1 processes are fast, automatic and high in processing capacity. System 2 processes are slow, intentional and limited in processing capacity. There is broad consensus that the two systems (or minds) might include the set of features listed in Table 1 (Evans, 2010).

Starting an emotional message implements many important processes. The message **marks** the choices and the results as either positive or negative, which makes the space of decisions smaller and enhances the probability that the chosen action will be in harmony with the experiences of the past. An emotional message has a complementary task and it precipitates and increases the effectiveness of the reasoning process. Occasionally it renders the reasoning process nearly dispensable, for example, when we immediately reject an alternative that would lead us to ruin, or conversely leap at an opportunity that will most likely make us successful.

INTUITIVE MIND	REFLECTIVE MIND
Evolutionary old	Evolutionary recent
Unconscious, preconscious	Conscious
High capacity	Low capacity
Fast	Slow
Automatic	Controlled or volitional
Low effort	High effort
Parallel	Sequential
Implicit knowledge	Explicit knowledge
Belief based, contextualised	Abstract, decontextualised
Linked with emotion	No link with emotion

Table 1. Attributes often associated with dual systems theories of cognition (Evans, 2010).

The YES/NO system works as a distinct divide between the unacceptable and the acceptable, or wrong or right. It is entirely possible to create a continuous scale, reaching from the absolute right to the absolute wrong. The humorous aspect about it is that if we want to prevent others from attacking our thinking and using NO, we always have to be right.

The brain is designed to learn through repeated exposure. The patterns form gradually and are then used on future occasions. The choice of the appropriate pattern is based on a person's decision. A flip-flop system characterizes the brain's activities extremely well. The activated nerves flip into A or flop into B state. There is no transitional form. In fact, the brain does pretty much what Aristotle wanted it to do: making sharp and firm decisions. In the brain, there is no natural mechanism for creative, constructive or design-related thinking. We want to know **what is** so that we can respond to it with a tried and known routine pattern (de Bono, 1999).

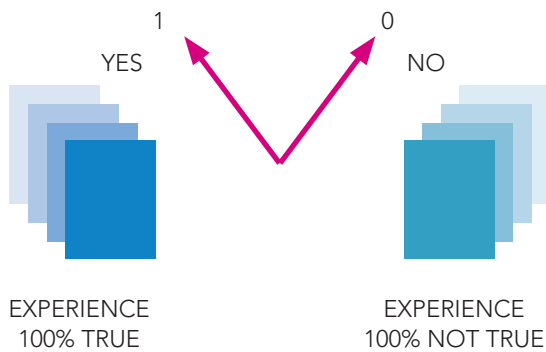


Figure 1. The brain works as a "yes/no"-system, to which the experiences are recorded either as positive or negative images. Reacting according to memories, rather than thinking, is the priority. (Lappalainen, 2009)

When leading innovations, managers should appreciate the interplay and roles of the dual functions or the human brain, or System 1 and System 2, that constantly compete for action. As a factor impacting the unconscious and nonconscious, organizational emotions also challenge today's managers, often more than they realize. This is why they should take particular responsibility for the team's atmosphere and operating mode, acknowledging their role in organizational mood contagion, which refers to the capacity of mirror neurons to reproduce or mimic what other beings do. Emotional contagion thereby refers to the tendency to mirror and synchronize with the interlocutor's verbal and non-verbal cues, resulting in emotional convergence and an instant sense of shared experience with the other party. Functional magnetic resonance imaging methods indicate that this contagion occurs physically in the brain's limbic areas as a type of empathy. (Goleman et al., 2008; Dashborough et al., 2009)

All individuals have the capacity to catch other people's emotions, but they vary in their tendencies to get swept up in them. Such individual variation results from genetics, personality traits, and gender, contributing to people's susceptibility or resistance to emotional contagion. Those most susceptible to emotional contagion are those who are self-aware and emotionally reactive, pay attention to others, see themselves as inter-related to others, can read others' emotions and can mimic others' emotional expressions. (Wang et al., 2010)

Mood contagion, and in particular, a leader's positive emotional expression induces several consequences, among them the impact on the mood states of the followers, ratings of leader effectiveness, and follower attraction to the leader, eventually influencing behavioral outcomes. The connection between a leader's mood and the subsequent mood of his subordinates is grounded on the design of the human brain, and because of this so-called mirroring process, huge expectations are placed on a leader, as his emotions tend to shift into the registers of those in interaction with him. (Bono et al., 2006)

What is noteworthy is that moods can be transmitted also nonverbally, because emotions can be conveyed even in silence, through body language. Although every participant in a culture adds his own touch to the mixture of personal footprints, those of leaders have the strongest impact, since their messages bear most weight because of the role assigned to them. They manage meaning and interpretations for the entire organization, even when not expressing their thoughts out loud. Their responses and bodily conduct are followed closely and modelled on, and this is how they set the emotional standard and color and organizational atmosphere either with security or fear, playful trial and error or bureaucratic conformity to rules. (Dashborough et al., 2009)

4. The Renaissance of Thinking

We know that progress is the result of inventions, innovations and design. We can promote almost endlessly the use of creativity and innovations in industry, buildings and even university education. This kind of holistic thinking could be called enabling thinking, structural thinking, creative thinking or the renaissance of thinking.

The thinking methods of an innovation ecosystem have to be based on how the human brain works, and especially on how observations are created in the brain. The renaissance of thinking cannot be based on philosophical word games or belief systems.

The brain does not automatically think creatively. It is a data recording system that systematically encodes the information coming from the environment. When a certain order and patterns have formed, the brain only has to identify the pattern, follow it and repeat the old routine. Brain is a data recording system—not a thinking system. With the help of these established data recording routines, we are able to navigate in this complex world.

We see what we are prepared to see. We see what we are used to seeing. We see what our emotions are attuned to see. Evaluation is always subjective, unless part of scientific or objective measurement and calculation. (Lappalainen, 2009)

Renaissance of thinking means thinking of new possibilities instead of always being reactive to others' ideas. Renaissance of thinking is about not thinking against others but first trying to understand perfectly what the other one is saying and after that thinking how we could further develop that idea.

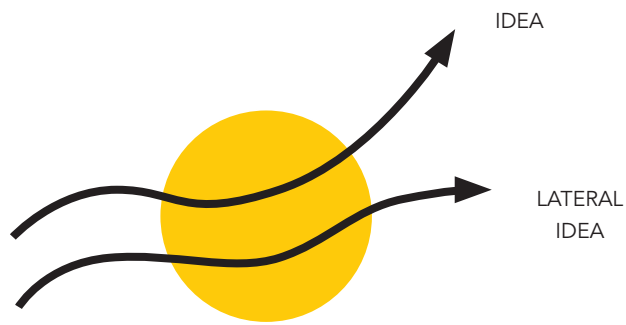


Figure 2. Lateral thinking means that we do not think against others, but parallel with others. Lateral thinking does not mean that we agree with others (de Bono, 2005).

4.1 Resistance to change

It is rewarding to resist something. It gives a direction and a mission to our behaviour, feeling and thinking. There may be others who share your feelings. The simplicity of this sort of behaviour is tempting. To be able to resist something, we do not necessarily even have to understand what it is that we are resisting. Your observations are enough, even if they might be incorrect or inaccurate. (Lappalainen, 2009)

The biggest obstacle to dynamic development is resistance to change. Every time a person is forced to move away from his or her comfort zone, he or she begins to resist. Resistance to change is partly a question of age, because with ageing comes the tendency to a slightly slower work rhythm and a routine to accomplish tasks in a certain way. At the same time, ageing can naturally provide extensive understanding and wisdom.

Resistance to change can be easily disguised with well-founded arguments, such as: "We should let others make the mistakes first". In Finland, this clichéd saying has its basis in the careful undertone of Finnish culture. In reality, the result of this negative attitude is that a person does not have to use his/her own brain or do anything. Resistance to change is mainly based on an individual's desire for comfort. (Lappalainen, 2009)

Negative thinking comes naturally to a human and sometimes it is even acceptable. Negativity can be seen also as a source of energy, if it leads to substantiated choices and solutions. It has been proposed that the development of positive states of mind, such as kindness and sympathy, would pave the way for mental health and happiness.

In this current atmosphere of rapid change of surroundings, organizations need to adjust to continuous change. Managing of change can easily be compared with managing a war situation. There is a need for continuous real-time information, although the situations meander and are hardly ever in complete control. The best way to control a chaotically inconsistent reality is to be constantly active.

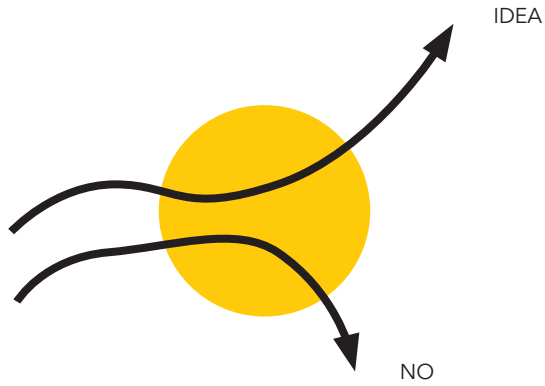


Figure 3. Opposition or NO impression in interpersonal communication cut off the motion and thought (de Bono, 2005).

What is required is ground-breaking, creative innovation and development of completely new products and services, as the old selection of ways and means is insufficient.

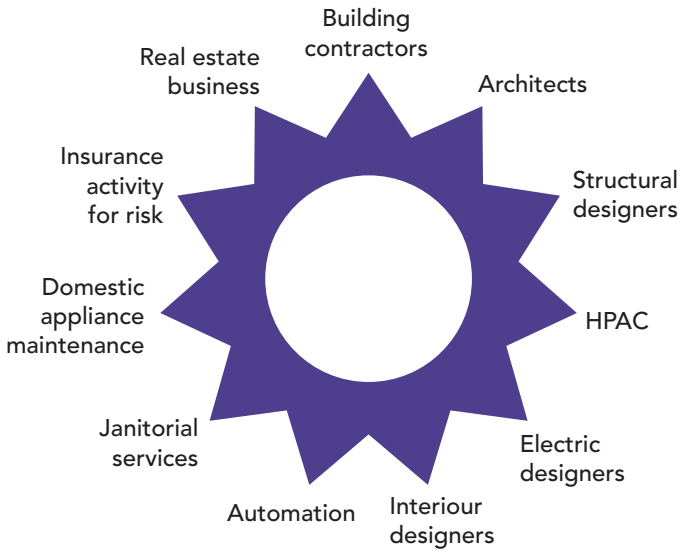


Figure 4. The development of technology and the specialisation of different occupations cause language problems in society, because, in the different fields of technology, the language becomes a jargon of a particular field.

It is presently becoming more and more difficult to see the overall picture of, for example, the activity of automation, building technology and IT equipment in a particular building. Even though a buyer of an apartment is a paying customer, that buyer is at the mercy of various professionals from different fields. (Lappalainen, 2009)

4.2 Creativity driving innovations

Creativity has to do with new concepts, new ideas, new plans and new observations. Creativity is a process in which new and usable ideas are developed. Creativity can manifest itself in unforeseen ways, but it is not induced by itself. Creativity and innovations emerge from long-term experiences, which can take over 10 years to develop. Intuition works best when a person´s experience is long and focused.

Creative groups also require the creativity of beginners; new recruits always know how to ask good questions. In everyday activities, innovations can come about when customers have requests and questions that require immediate responses.

A creative person never stops asking questions. He or she tries to find answers to questions and test his or her own ideas. Creative people have much mental and physical energy. They work hard. Their subconscious works without cease.

A creative person is often not necessarily very social, nor interested in a routine job. Such an individual may have the need to achieve something creative, for example paint or busy him- or herself with different tasks. A creative person can also be self-centred. Typically he or she is open to new experiences, and has the courage to take risks in issues of importance.

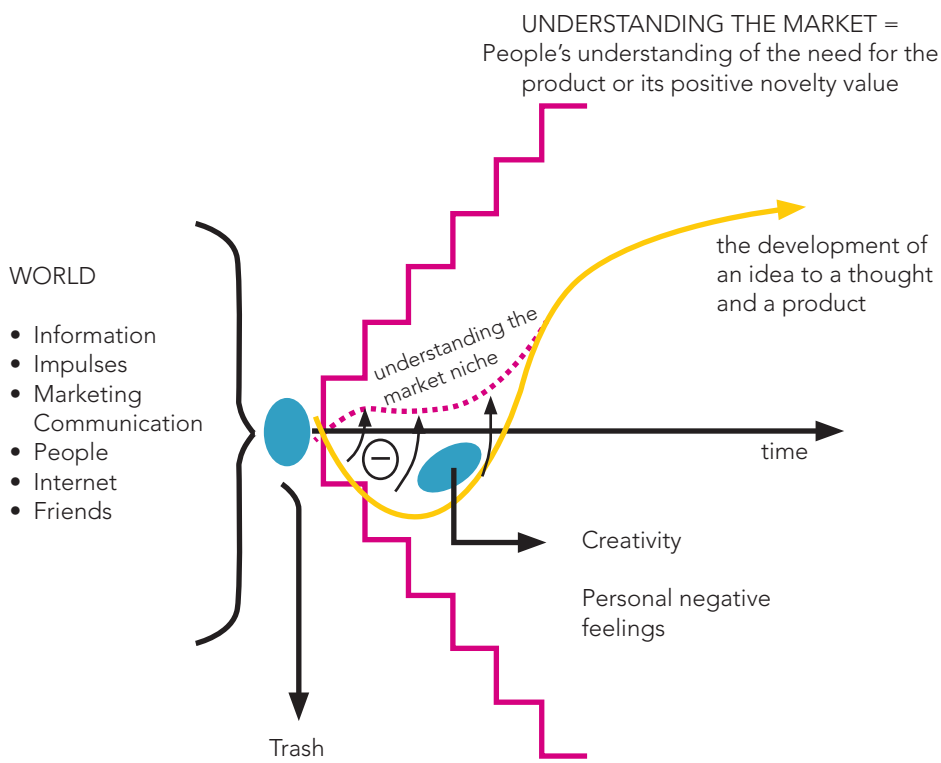


Figure 5. Creativity: Developing an idea inside the human brain into a thought and a product, through understanding the impulses of the environment, our own personal feelings and motives, and through intuitive understanding of the market niche (Lappalainen, 2009).

Deviations build the core of evolution. The same applies to innovation, which requires experiments, trials and errors, and breaking old rules. The need to standardise within a company chases away creativity and creative people. Creative individuals often pose a threat to the prevailing order of things: in schools and other organizations, innovative people and ideas are often considered too threatening, and as a result of that, people often try to silence them.

The creativity of an organization is affected by a positive, constant flow of ideas and the co-operation of professionals from different fields. In a creative job, the problems and options have to be looked at from new perspectives.

To promote innovations, leaders must support creativity. A leader can manage innovation but not creativity. However, leaders can promote creativity, giving the subordinates the freedom to fail. We learn much more from our mistakes than we do from our successes.

Nourishing creativity also means that we understand the way of thinking of the people who are involved in the creative process. We can express the doubts that surround all new ideas. Creative leaders must learn to be bold but in a well-founded way. At Aalto University, the challenge is to create a system that combines the worlds of artists, scientists, designers and engineers. The task of the leaders and the superiors is to facilitate the interaction.

A new idea may be promoted with the help of lateral thinking where the idea is copied from another person. A new idea may have emerged as a result of logical analysis. If the idea has been proved good elsewhere, there is only a small risk. If the idea is entirely new, the risk is higher. When the idea is new, there is more resistance towards it than towards the old idea. All good new ideas will always be logical to the ones who are wise in hindsight.

Too often people believe that a creative idea will be sufficient. The weakness in this approach is that others may not see the novelty itself as something intriguing. The creator of the idea should really make an effort to show the value of the idea. Benefits, rather than the novelty value, will lure other people into trying and applying the new idea. Before a new idea is truly implemented, the idea must show some benefits that overcome the risks (Lappalainen, 2009).



Figure 6. Innovative activity: creativity feeds the emergence of new ideas and some ideas become new innovative products or services. Innovativeness is the ability to produce new ideas and innovations.

Creativity is a similar process to the one that makes us laugh. A joke is generally a short story that proceeds slowly at first. Then, some other concept is unexpectedly connected with the story. The break or the collision of the concepts evokes a reaction: laughter. When we discuss individual creativity we refer to the entity that is formed by sensory perceptions, thinking, emotions and intuition that comes from experience.

Innovations stand for novelties or reforms that are created as a result of activity. Innovativeness stems from the ability to think and produce new ideas and innovations. Innovativeness can also be described in terms of the likelihood with which the individual will produce a novelty before the others.

Soft innovations may create discussion topics—purple cows. These types of soft innovations can be called free rewards, because they yield many profits and require little investment. The problem is not in creating with these soft innovations but rather in making the organizations appreciate the inventors of these soft innovations. (Godin, 2004)

5. Promoting Multidisciplinary—Two Cases from Aalto

5.1 The programme Creative Sustainability

In 2010, Aalto University founded A Programme of Creative Sustainability to thoroughly understand the problems of built environment and construction sector. It is a multidisciplinary learning platform in the fields of architecture, real estate, business, design, landscape architecture and urban planning. Creative Sustainability is a joint Master's Degree program at School of Arts, Design and Architecture, at the School of Engineering and at the School of Business.

The Creative Sustainability program brings together students from different fields of study in multidisciplinary teams, increasing understanding of different disciplines and enables adapting a holistic approach. This activates students to create new sustainable solutions for human environments to build a socially responsible and sustainable future.

The Creative Sustainability program provides the graduates with knowledge and skills in several competence areas:

- Multidisciplinary approach to reach collaborative solutions based on ecological, economical and socio-cultural sustainability.
- Systems thinking into organizational problem solving to understand complex situations in a society.
- Design thinking to generate new ideas and solutions.
- Project management to promote multidisciplinary teamwork.
- Business management to create sustainable business models and to promote corporate responsibility.

5.2 The Development Cooperation project

President of Aalto Tuula Teeri has accentuated the importance of multidisciplinary learning experiences. As one of the endeavours aiming to promote multidisciplinary thinking, innovativeness, entrepreneurship and working life competences, Aalto University experimented with a real-life project to respond to today's industrial competence needs. The Development Cooperation project was conducted at Aalto University to create new types of learning contents and educational practices. Instead of teaching the various language-related aspects typically pertinent to degree-fulfilling language courses, this English and communications course in question strove to build an integrated learning environment that allowed students to activate and apply their language and communication skills in a real-life context. Such an approach was chosen to promote project management skills, sustainability, self-leadership, ethical integrity, networking, social competence, and global and social responsibility, while engaging the students in goodwork to aid some local community in a developing country. Multidisciplinarity stemmed naturally from the group make-up: more than half of the students were international exchange students, and as the course was open to all Aalto students, almost all departments and schools were represented.

The 29 (20 international and 9 Finnish) students participating in the course operated in cross-disciplinary teams to supplement the expertise their group held. Together they brainstormed ways of benefiting some third-world community in a sustainable and socially responsible way. The students were offered plenty of latitude in designing their solutions in order to welcome ideas ranging from knowledge transfer to more concrete products or services or even fund raising. The aim was to encourage students to invest their substantive knowledge and personal abilities in the development of a community in need, in alliance with any already operating non-profit organization.

In the Project in question the students competed in five groups for the most feasible third-world development cooperation idea. The evaluation criteria constituted 1) attendance in lectures, which covered topics on cross-cultural skills, innovative engineering, environmental accountability, goodwork, and future success factors in work communities; 2) contribution to an academic article produced in a small group, published in a book released in connection with the Project; 3) oral and written progress reporting conducted in small groups, with mid-term and final status deliverables; and 4) a final presentation, where the students presented their competition ideas to a jury and an audience. The winning group delivered the idea of assisting Egyptian NGO operations by designing ICT-platforms. The prize constituted a trip to their target location to implement the idea but unfortunately the trip had to be cancelled due to the unstable political situation in the country at the time of students' departure.

The written and oral deliverables of the Development Cooperation Project were not merely rated for language proficiency but rather for communicational aptitude, that is, audience focus, assertion, coherence, and overall message delivery. Student

products were also rated for the novelty and creativity of brainstorming outcomes, as well as perceived effort and concrete project feasibility.

On the surface, the Project served outcomes pertinent to university language education: students earned study credits, enhanced their language proficiency, and activated their communications skills. Additionally, thanks to the nature of the course, they established contacts with industrial stakeholders, built networks, and developed project management skills—all of these desired by-products of the university curriculum.

But ultimately, there were motivations and lessons learned that extended beyond study credits and formal learning outcomes: the affective rewards outweighed by far the more concrete gains. The opportunity for goodwork not only opened the students' eyes to the channels available for societal impact, but it also pushed the university staff to pursue self-renewal and more up-to-date, relevant, and topical education.

6. Conclusion: Leading Regional Innovation Ecosystems

The laboratories for innovation are no more traditional university facilities, but rather regional innovation ecosystems (RIEs) operating as test-beds for rapid prototypes of new products, services, processes, structures and systems. Aalto University wishes to be the leading edge of the development, which is why Aalto´s incentives need to be focused on co-creation, targeted knowledge and foresight.

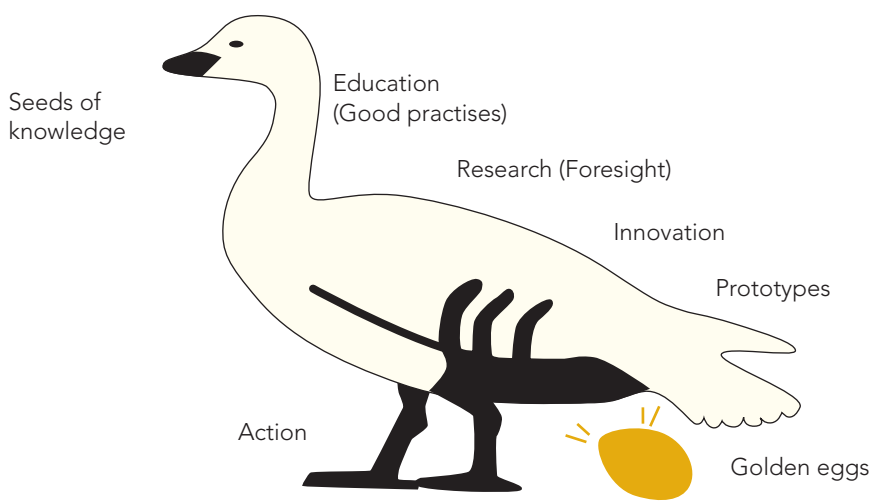


Figure 7. Universities play often the drivers´ role in Regional Innovation Ecosystems (RIEs). The various RIE actors can be researcher networks, developer networks, user networks and producer networks, which aim to produce and spread competitive products, innovations and services into markets (Lappalainen, 2014).

The new Aalto University is created for strategic research towards global innovation. At the top of Aalto strategy, there are four tasks: top-level research, pioneering teaching work, trendsetting art, and cooperation to regenerate society. The main and most distinctive strength of Aalto University is the interaction and cooperation with industry.

Orchestration refers to the capability to mobilize and integrate resources to create value for the customer. Through orchestration the networking, the actors strengthen their resource allocation. In orchestration, the diverse projects are not implemented separately but all activities are planned and managed by optimizing the benefits of the whole.

Leaders should be able to offer by orchestrating a complex network of employees, customers and suppliers a single learning experience. Customers of such orchestration can include information acquirers, explorers, performers and inventors. Orchestrators can be conductors, architects, promoters and auctioneers (Wallin, 2002).

Orchestration of knowledge, skills, competencies and activities is needed to coordinate complex projects and create new innovation capabilities. This clearly opens a new challenging role for universities taking a key position in orchestrating such projects.

Creative people create the core of innovation hubs. The aim of orchestration is to motivate individuals´ core interests and increase interaction for knowledge creation. Instead of motivating, today´s managers too often foster the four sins undermining creativity; supervision, control, patronizing and haste.

Traditional management does not ensure enough co-creation to tackle the complex ecosystem interaction. Orchestration means systemic but at the same time flexible ecosystem management. The rigid administrative systems must be loosened to allow more latitude for creativity. Private-sector actors target maximum commercial benefits with their innovative processes, but they need reminding that financial gains can best be pursued by accentuating ecological, societal and ethical considerations.

References

Akay, A. (2008). A renaissance in engineering PhD education. European Journal of Engineering Education, 33(4), 403–13.

Byrge, C. & Hansen, S. (2009). The creative platform: a didactic approach for unlimited application of knowledge in interdisciplinary and intercultural groups. European Journal of Engineering Education, 34(3), 235–250.

Couger, J. (1995). Creative Problem Solving and Opportunity Finding. Boyd 6 Fraser.

de Bono, E. (1992). I Am Right, You Are Wrong. Penguin Books.

de Bono, E. (1999). The New Thinking for the New Milleneum. Penguin Books.

de Bono, E. (2005). ASTD—conference lectures. Orlando, U.S.A.

Evans, J. (2010). Thinking Twice—two minds in one brain. Oxford University Press.

Filipkowski, A. (2011). Introducing future engineers to sustainable ecology problems: a case study. European Journal of Engineering Education, 36(6), 537–546.

Glavic, P.; Lukman, R.; Lozano, R. (2009). Engineering education: environmental and chemical engineering or technology curricula—a European perspective. European Journal of Engineering Education, 34(1), 47–61.

Godin, S. (2004). Free Prize Inside.

Hamel, G. & Breen, B. (2007). The Future of Management. Harvard Business School Publishing, Boston, Massachusetts.

Hassard, J; Teoh, K.; Cox, T.; Dewe, P.; Cosmar, M.; Grundler, R.; Flemming, D.; Cosemans, B.; Van den Broek, K. (2014). Calculating the cost of work-related stress and psychosocial risks. European Agency for Safety and Health at Work, European Risk Observatory, Literature Review, ISSN 1831-9351.

Hautamäki, A. (1998). Innovaatiot ja sosiaalinen pääoma (Translated by P.L.: Innovation and social capital). Published in Kajanoja, J. Simpura, J. (Eds.). Helsinki,Government Institute for Economic Research, 89–92.

Kahneman, D. (2011). Thinking Fast and Slow. Penguin Books.

Kaplan, R. & Norton, D. (2004). Strategy Maps. Boston, Harvard University School Press, 2004.

Kotsou, I.; Nelis, D.; Grégoire, J.; Mikolajczak,M. (2011). Emotional Plasticity: Conditions and Effects of Improving Emotional Competence in Adulthood. Journal of Applied Psychology, 96(4), 827–839.

Korhonen-Yrjänheikki, K.; Takala, A.; Mielityinen, I. (2011). Values and Attitudes in Engineering Education. Published in Lappalainen, P. (ed.): People with People—Views of Corporate Social Responsibility. Aalto University, crossover publication series, 65–83.

Lappalainen, M. (2014). Orchestration of Regional Innovation Ecosystems—Focus on Sustainable Urban Design and Digitalization. Aalto University, School of Art, Design and Architecture.

Lappalainen, M. (2009). The Renaissance Thinking—The Natural Forces inside of You. Firene Ltd.

Lappalainen M. (2010). Renaissance Knowledge—Truth is Taking Action. Firenze Ltd.

Niitamo, P. (1999). Evaluation for cross-cultural work: Assessment center methods in Finland. Cross-Cultural Psychology Bulletin, 1999, 14–21.

Oksanen, T. (2009). Workplace Social Capital and Employee Health. University of Turku, Annales Universitatis Turkuensis, Series D, 876.

Spivack, R. (2013). Small business participation in the advanced technology program research alliances. Journal of Innovation and Entrepreneurship, 2:19, 1–21.

Sternberg, R. (1997). Managerial Intelligence. Why IQ Isn't Enough. Journal of Management, 23(3), 473–493.

Sydänmaanlakka, P. (2003). Intelligent Leadership and Leadership Competencies. Developing a Leadership Framework for Intelligent Organizations. Helsinki University of Technology, Dissertation series.

Wallin, J. (2002). Business Orchestration. Strategic Leadership on the Era of Digital Convergence. John Wiley & Sons Ltd.

Åhman, H. (2003). Oman mielen johtaminen (In Finnish, Self-leadership). Helsinki University of Technology, Dissertation Series.

About the authors

Markku Lappalainen is an architect and a Doctor of Technology. He has worked over 20 years as the editor-in-chief and the manager of foreign affairs of Building Information Ltd in Finland. In this role he has written several books on sustainable building design and export of building products. Markku Lappalainen has also worked as an architect designer and realizes the important role of creativity in business. During his career Markku has also gained knowledge of the functions of human brain. The brain does not function primarily through thinking, but reactions based on memory. Markku Lappalainen works nowadays as a lecturer of Sustainable Building Design and Green Urbanism in Aalto University. Systems thinking is a part of his teaching philosophy.

Pia Lappalainen holds a PhD in Science (Technology) and an M.A in English and French philology, Communications and Pedagogics. Currently a lecturer at Aalto University in Finland, she pursues ways of integrating social skills into university curriculum to help engineering graduates better meet industrial needs upon entrance to working life. In 2010 she won a prize in the Aalto Pedagogical Innovations Competition for the project described in this article, in which engineering students enhanced their ethics and innovative thinking by engaging in development cooperation. Before her academic pursuits, Dr Lappalainen provided communication consultancy as an entrepreneur, and managed communication and training coordination at LM Ericsson Plc.

Kristiina Erkkilä
Director of Development
City of Espoo, Finland
Education and Cultural services
kristiina.erkkila@espoo.fi

Lars Miikki
Senior Consultant at Järvelin Design Ltd
Urban Miller and co-producer of Urban Mill Innovation Accelerator Platform
lars.miikki@jarvelin.fi, lars.miikki@urbanmill.fi

9. Aalto Camp for Societal Innovations ACSI

Abstract

Aalto Camp for Societal Innovation (ACSI) is a new-generation innovation process, which started in the Aalto University campus in Otaniemi, Espoo, in 2010. The constantly renewing innovation community of ACSI offers an inspiring platform for co-creating processes and methodologies focusing on solutions tackling societal challenges.

ACSI is much more than an annual innovation camp. ACSI activates collaboration between different stakeholders to foster innovations. It connects the users, promoters and enablers of societal innovations. The core operating mode of ACSI is self-organization, which enables the buildup of trust-based co-creation networks and enriched interaction between the actors, aiming to design concepts that can be adopted globally.

Already from the beginning, the City of Espoo has wanted to use ACSI as a tool to boost innovations in its so-called T3 area, Otaniemi, Keilaniemi and Tapiola, which is the the largest technology, innovation and business hub in Northern Europe. Within the ACSI-community, the co-creation of ideas has led the T3 evolution into Espoo Innovation Garden, which is now a concept for the innovation ecosystem that hosts a lot of the development work related to the City of Espoo. Another practical example of ACSI accelerated innovations is the public-private urban innovation platform Urban Mill, the start-up phase of which was launched in Espoo Innovation Garden in January 2013.

KEYWORDS: Societal innovation, Urban development, Innovation platform, Knowledge Triangle, Quadruple Helix

1. Preparation and Assembly of ACSI

The most visible manifestation of ACSI is the summertime innovation camps that serve as the base for creating new solutions and designing new prototypes matching grand societal challenges. The energizing environment of the ACSI camp gathers together experts, researchers, artists and students from different parts of the world to collaborate in self-directed groups.

ACSI planning starts from the definition of the key themes. The underlying main topic has traditionally involved grand societal challenges. The themes have often, one way or the other, touched on the creation of new innovations and sustainable development, including ecological, financial and social sustainability. Once the mainstreams have been sketched, operators interested in bringing to the camp their own challenge or case related to the main theme are invited to take part. The parties involved have represented public administration, cities and regions, universities and universities or applied sciences from Finland and other countries, large and medium-sized companies and other communities and organizations.

The themes introduced by the organizations have primarily covered societal issues, including city planning and eco-system development, support for peacekeeping, societal participation of the ageing population, and new models of learning in working life and schools. Background research is conducted for each societal topic and prepared in collaboration with top experts from organizations in the field.

2. Operating Mode at ACSI Camps

The organizations introducing their challenges to be tackled at ACSI send their representatives to the camps. The number of representatives has, however, been limited, and they cannot all participate in their own organization's case development and may therefore be allocated to another group. This is a way of increasing the added value for their organizations, through versatile and comprehensive participant experiences. In this way, ACSI serves also as an excellent mode of human resource development. Additionally, international and multi-disciplinary participants are selected or invited through an open web search. Particular attention is paid to group diversity: the aim is to gather members from different backgrounds to each group, from the academic world, public administration, the business sector and from different career stages. Further, both female and male participants, and as many different nationalities as possible are allocated to the groups. A student of architecture from Shanghai can develop ideas together with an Italian artist, a Finnish politician, and a Swedish civil servant.

Every challenge has a dedicated case owner from the organization that brings the challenge. The person is responsible for introducing the case to his or her group. After having described the case and its background, the owner mostly fades into the background when the group starts to process the case. Groups operate in a



Figure 1. A tangible networking exercise at the ACSI 2012 camp.
(CC BY-NC) Kari Mikkelä, Urban Mill.

self-organizing mode, following the principle that each participant inputs his or her competence and is open to suggestions from other members. Everyone can draw upon his or her experiences or something he or she has seen, heard or read. It is essential that by integrating the capabilities and insights of different individuals, the groups create added value in solving the challenge. Co-working, co-creating and co-learning constitute the main ways of working at ASCI, allowing testing of promising ideas in practice already at an early stage and further development based on the testing phase. If only possible, the aim is to turn ideas into physical prototypes, which facilitates communication about the challenges and their possible solutions and implementations.

3. ACSI Encourages New Mindsets

The ACSI method is characterized by new angles to routines or challenges and by critical questioning and problem redesign. Such new approaches sometimes serve as the key or they can lead to new ways of examining and developing. The experiments conducted already during the camp enrich the original ideas, and groups may even work on several parallel and competing ideas which are refined into new insights.

Working together on the challenges with individuals from different backgrounds and with different experiences is not always easy. Sometimes participants are not fa-

miliar with intensive and spontaneous engagement in self-organizing activities and free ideation, due to their own culture and background, which poses challenges in exceeding one's own comfort zone. Further, the treatment of a new, previously unknown topic from a new angle, in a foreign language, and with a strange method may cause discomfort. The first steps in the path of a self-organized team may be shaky, before the members establish trust and attune to co-working. The ACSI method pays particular attention to group formation, providing much support to the groups in their development process. An experienced member from the ACSI organizing committee assists the groups, providing consultation and counseling and can also intervene in difficult situations. Sometimes a director in theatrical expression has been involved, engaging the group in exercises. Shared, often non-verbal exercises can facilitate communication and help solve dilemmas.

Also the role of the case owner from the organization presenting the challenge requires adaptation. Many in a managerial or developer role in their organization find it painful to step aside from the case development and not to perform in full force at the forefront, as in their daily lives. In addition, the representative of the organization may feel accountable for the organization's ACSI investment and this way also for the results. But despite the difficulties, the role can be rewarding, too. It teaches one not only self-awareness in a leadership position but also to take other perspectives into account and to open up to unconventional methods of reaching unpredictable results. Especially those accustomed to the public-sector culture are challenged by the fact that the camp participants are driven by diverse motivations and the commitment of all members to challenge development and solution cannot be compared. Some would appreciate more discipline, whereas others participate out of a private interest and wish to experience the camp as an adventurous part of their vacation. Furthermore, many of the participants may lack experience in ideation and development work or they do not know the challenge holder organizations wellenough and their possibilities to implement the results, for example due to the national legislation, resourcing, or the limitations set by the development path started prior to ACSI.

One practical challenge stems from some of the participants not accepting or benefiting from the development work already conducted as the point of departure for the teamwork. Especially those from the academia prefer to begin with a thorough background research and question everything already accomplished. On the other hand, this could be seen as willingness to personally become acquainted with the topic and as an effort to understand the challenge in a context. It is often these critical voices that have opened new avenues and perspectives to finding new types of solutions. Group build-up of individuals with different motivations and background knowledge, in fact, reflects the working life situations of today. Learning to operate in such a context increasingly promotes finding multi-form solutions to more and more complex problems.

4. Results from the ACSI Camp

During the ACSI camp, the groups build and test prototypes that could meet their challenges and that signal in which direction the solution should be taken. The actual solution is not typically completed during the camp as the problems sent to be solved are complex—otherwise they would already have been tackled in their own organizations. They were not necessarily meant to be solved during the camp, either, but rather, the ACSI camp boosts development work within one's own organization or networks. The members of the ACSI network can serve as coaching partners also after the camp either virtually, remotely or through visits.

The ACSI camp gathers together individuals from different backgrounds. Perhaps they would otherwise never have met or at least would not be working on the same problem. This way, ACSI serves as a method of extending one's own and one's organization's networks. The shared intensive experience can provide a solid ground for fruitful and long-term partnerships. These contacts must be seen as a valuable outcome as such.

ACSI forces the case owner to formulate his or her challenge in a way that can be comprehended by others. This is not always easy, especially when dealing with complex societal concerns. Presenting the matter to an international multi-disciplinary group differs entirely from discussing it with one's peers or close associ-

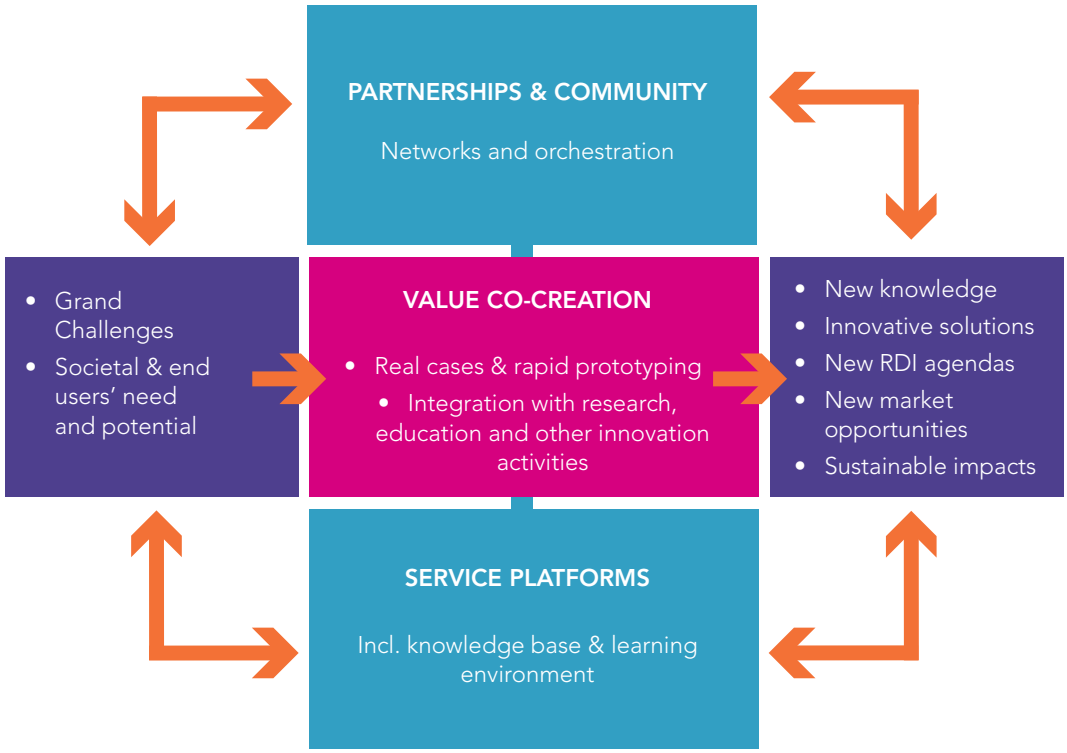


Figure 2. ACSI value system framework (Mika Pirttivaara & Lars Miikki 2010).

ates. It pays off practicing this so that we learn how to present complex issues to political decision-makers in an understandable and convincing manner. The issues are questioned and viewed in different light at the camp. Frequently the concerns themselves need to be totally rephrased. Such processing may generate new angles to implementation.

5. Accomplishments and Applications of the ACSI Community

Below we briefly introduce two concrete examples that showcase how ideas generated in ACSI have been concretized in Espoo. The examples include the public-private urban innovation platform **Urban Mill,** the start-up phase of which was launched in January 2013, and **Espoo Innovation Garden,** which ranked sixth in the 2014 EU Innovation Capital competition. The latter concept refers to an innovative operational model that encourages a culture of collaboration. Espoo Innovation Garden is a growing and developing city garden and innovation hub in the area that includes Otaniemi, Keilaniemi and Tapiola (earlier known as the T3 area).

The ACSI community and camps have, in many ways, speeded up the development of both Urban Mill and Espoo Innovation Garden. In 2011 and 2012 the ACSI

ACSI 2011 Case Group 9 "Knowledge Triangle" Recommendations for Next Steps
A Garden is a good metaphor for different people and things in an innovation ecosystem. It is a scalable solution for the modernization of the Triple Helix model. Everyone and everything grows and develops based on the growth conditions. Gardeners are needed to facilitate the processes and working models. They have to be systematically educated and prepared for their tasks. Value creation in the Garden would be based on transforming opportunities into values through sharing and collaboration.
The Garden should be piloted in the T3 context, as a joint Aalto-Espoo effort to turn the larger university campus area into one of the leading and most attractive innovation hubs by 2020. The Garden project could be called the Future **Innovation Garden** plan for the Aalto campus area. It is important to recognize the current knowledge, activities, and tools, and build on them.
The Garden should be built with the help of rapid prototypes integrating existing networks and potential. Building an action network and establishing a flow of events for building the Garden are necessary first steps.
New kind of collaboration contracts are needed between the university, the city, and interested companies. For instance, the city can provide real-life thesis topics and other exercises to the faculties. It should be the target of the university to get students, researchers, and teachers interested in societal problem solving.
People have to meet physically, which means that **energizing services and joint working spaces** are needed. Also a virtual working space, "external intranet" has to be developed. As ICT is a key enabler, using social and open platforms is useful. Spaces and process for demonstrating prototypes and results have to be created.

Table 1. ACSI 2011 Camp recommendations for the development of Innovation Garden.

camps hosted thematic groups that strove to seek new solutions strengthening the T3 innovation ecosystem.

The 2011 camp had two thematic groups with a task to create new collaborative solutions to strengthen the collaboration in the T3 innovation ecosystem: "Increasing Innovation Practice in City Environment" and "The Knowledge Triangle" (refers to the synergy between research, teaching and innovation activities). Both groups ended up recommending new types of meeting points, spaces and services supporting collaborative work and the adoption of the Innovation Garden metaphor to describe the T3 innovation ecosystem. The table 1 lists the ACSI 2011 Knowledge Triangle group's recommendations for the next steps.

The two case groups at the ACSI 2012 camp, "T3 as the Societal Innovation Test Bed" and "T3 Innovation Demonstrations in Real and Virtual Reality", further developed the ideas and proposed measures generated at the ACSI 2011 camp to strengthen the T3 innovation ecosystem. The groups, among others, reflected the models on smart spaces, created based on the previous ACSI, in practice by walking in different parts of the area to interview people. The groups built physical and virtual prototypes for the final exhibition to demonstrate the T3 area as a network of thematic and smart spaces feeding innovations. One of these prototypes is shown in Figure 3.

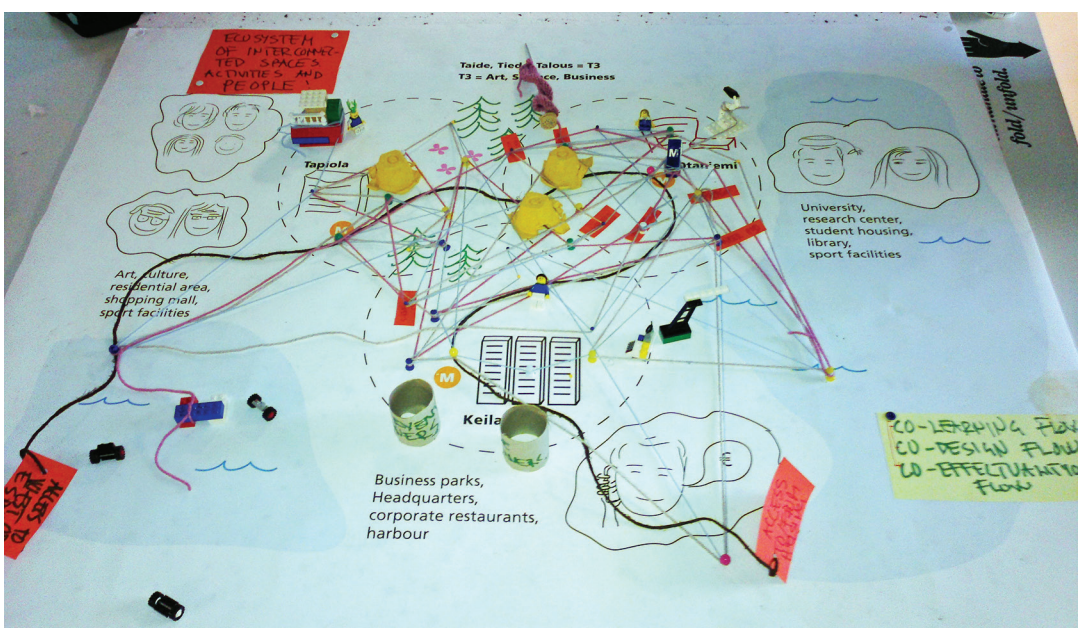


Figure 3. T3 Space Network Prototype, composed by ACSI 2012 Case Group T3 as the Societal Innovation Test Bed. (CC BY-NC) Lars Miikki.

The ACSI 2013 camp was organized in Malmö. The previous ACSI camp outcomes from the T3 area, the Innovation Garden concept and Urban Mill frameworks and models served as source material for the campers. The Espoo case allowed the participants to consider at full speed how operators of the city and the area's different educational organizations and the actors on their campuses could be net-

worked for collaboration. The aim of the collaboration was to find new innovative solutions meeting the city's central challenges. The Helsinki-Uusimaa Region case correspondingly exploited the same material and examined more extensively the networking of the innovation hubs in a larger regional context.

5.1 Urban Mill

Urban Mill, founded in 2013, is a thematic focal point and open innovation platform service for global urban innovators. It is a co-working space, an innovation community, as well as a change orchestration tool for urban development. It aims to redefine the way in which people accomplish joint innovation work, and aims to make societal impact in a global urban context.

It brings together the urban environment, life, services and ubiquitous information technology researchers, innovators and users. Among them can be found also civil servants working for the city, political decision makers, corporate representatives, entrepreneurs, teachers, students, alumni, and citizens of the built environment. The outcomes of the work accomplished together are displayed either physically or virtually.

The former lab hall of the VTT Technical Research Center of Finland is a 1,300m2 space reserved for events, courses, team building, prototypes, experiments and demonstrations, all centering on the development of a more human-driven and innovative built environment. Particular attention is paid to the surrounding area, which partly boosted by ACSI and Urban Mill, has now started transforming into Espoo Innovation Garden. In addition to a space for collaboration, Urban Mill is also a community and a service. Contrary to many other development platforms, it is an active operator in its thematic area, and additionally aims to actively network with other thematic hubs and platforms from other fields both nationally and internationally.

Urban Mill aims to help create user-driven, competitive solutions and concepts that are applicable to both existing and new areas. For example, solutions to mobility and energy usage are integrated into built environment planning, from land use to ecosystems providing services. Also, joint ventures promoting well-being services, food ecosystems, organic food production, and smart networked spaces are being prepared. Students from different fields are connected to the activities through multi-disciplinary courses.

The main partners of Urban Mill include the City of Espoo and Aalto University, which in 2012 launched the hub-development within the built environment research programme called Energizing Urban Ecosystems (EUE), hosted by the Strategic Centre for Science, Technology and Innovation of built environment in Finland RYM Ltd. The actual operations were initiated in spring 2013 when one of the companies working in the EUE-project, Järvelin Design Ltd, gathered together a pioneering community in a start-up spirit. The development work is orchestrated and the space operated by Järvelin Design Ltd. During the Pilot year 2013, the Thematic Space-enabled Innovation Service model of Urban Mill was co-created and tested within the EUE Community.

The numbers summing together the Urban Mill start-up phase 2013 and pilot phase 2014 are impressive: the concept is verified by 25,000 users, 5,000 stories, 4,000 visitors from Finland and abroad, 1,000 registered events, 500 pioneers, 300 organizations, 100 digitests, 50 teams/protos/demos during 2013–2014 in real life and business context.

The results from the pilot show that the area needs this type of an effectively orchestrated, joint innovation platform for multiple actors and that it can be built in collaboration with different stakeholders.

Urban Mill has also become a focal point for themes emerged from ACSI camps. The work started in many ACSI cases has continued in tens of workshops (see examples in Figure 4) and other events arranged in Urban Mill by several regional actors.



Figure 4. City Planning workshop and Regional Innovation Ecosystem Workshop in Urban Mill. (CC BY-NC) Lars Miikki, Urban Mill

.

5.2. From T3 to Espoo Innovation Garden

The passage above describes how ACSI 2011 ended up proposing the Innovation Garden metaphor for the innovation ecosystem in the T3 area. The concept has spread widely during and between the ACSI camps. After the ACSI 2012 camp, the Innovation Garden theme got a boost especially during the build-up of the Urban Mill prototype in Otaniemi. In spring 2013, insights were gathered into implementation preferences regarding the central part of Innovation Garden, the "old town", from users of Urban Mill, Design Factory, Startup Sauna and other residents in the vicinity of Otaniemi. The dreams were turned into visualized stories around the theme of integrating the old and the new (Figure 5). At this stage, this co-working and co-creation area was named **Innovation Garden.** After the City of Espoo adapted the name for the concept describing the whole city as a garden of innovation and adventurous experiences, the common yards and activities of Urban Mill, Design Factory and Startup Sauna were re-named as **Innovation Alley,** see the text in the box for details.

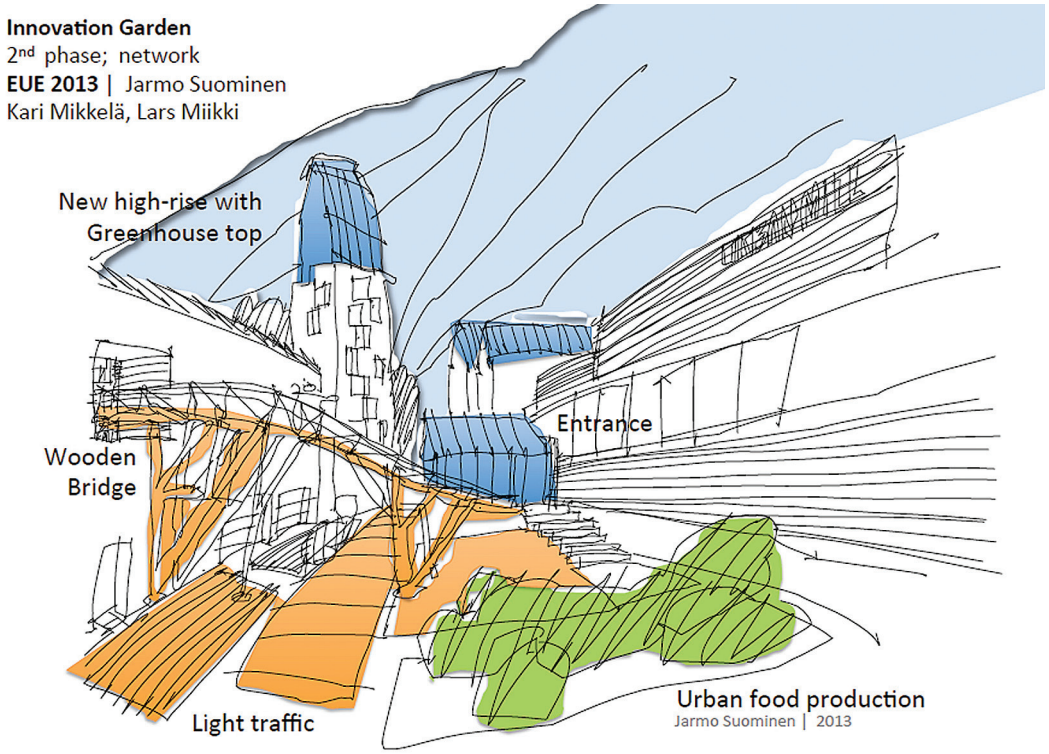


Figure 5. Alternative future, based on ideas collected from the Innovation Alley communities.

Innovation Alley in the heart of Espoo Innovation Garden

Situated in the heart of Espoo Innovation Garden, Innovation Alley is the focal point of innovation buzz on the Aalto University campus. Its core activities pivot around Aalto Design Factory, Startup Sauna and Urban Mill. Together these three co-working and co-creation platforms and their common yards, form a networked physical, virtual and social Knowledge Triangle with its nodes focused on learning (main responsibility Design Factory), systemic innovation (main responsibility Urban Mill) and new business creation (main responsibility Startup Sauna). These three multi-disciplinary communities of practice work daily and closely together. Activities are mainly self-organized and collaboration is facilitated through shared boundary objects. The human-centered innovation orchestration approaches in use challenge the traditional institution-centered practices. Innovation Alley attracts yearly thousands of international visitors (e.g. scholars, businessmen and investors) and the exchange with its global co-location networks is intensive.

Aalto Design Factory (founded 2008) is an experimental co-creation platform for education, research and application of product design—where design has a broad meaning. Design Factory aims to develop a passion-based student-centric learning culture for Aalto University. Startup Sauna (founded 2010) is a non-profit space, organization and community for startups and aspiring entrepreneurs in Northern and Eastern Europe and Russia. The aim is to implement a blooming startup ecosystem



Figure 6. Urban Mill and Espoo Innovation Garden key areas on the map.

and a pay-it-forward culture into the region in order to make it the best place for startups. Urban Mill (founded 2013) is a thematic focal point and open innovation platform service for global urban innovators. It is a co-working space, an innovation community, as well as a change orchestration tool for urban development. It aims to re-define the way in which people accomplish joint innovation work, and aims to make societal impact in a global urban context.

In the fall of 2013, the City of Espoo took part in the European Innovation Capital competition launched by the EU Commission. During the preparation of the competition application, the T3 area became crystallized as Espoo Innovation Garden. Open workshops for preparation of the application were held in Urban Mill. Among the 58 cities, Espoo ranked among top six and the best Nordic area. Clearly the community emerging from ACSI, during and between the camps, has significantly bolstered the development of the T3 concept into Espoo Innovation Garden.

This is how the city describes Espoo Innovation Garden

"Espoo is a garden of innovation and adventurous experiences—Espoo Innovation Garden. This refers to an innovative operational model that encourages a culture of collaboration; it's the Espoo way of thinking and acting. Espoo Innovation Garden shares and enriches the Espoo story.

Espoo Innovation Garden is a growing and developing city garden that offers diverse services in the area that includes Otaniemi, Keilaniemi and Tapiola. It's the home of the largest innovation hub in Northern Europe with thriving international companies, the hottest start-up sauna on the planet, various cultural activities and sports clubs as well as a renowned community of scientists and researchers. Science, financial activities and arts all make the Garden flourish.

Several world class companies have their global HQ's, local or regional HQ's or R&D units in Espoo Innovation Garden. These include Rovio, Kone, Nokia, Samsung, Microsoft, Bayer, Aalto University, VTT Research, EIT ICT Labs.

A total of 5,000 researchers, 25 research and development organizations and a number of Finnish listed companies operate in the area. The fact that there are people of 110 different nationalities working in the area is a clear reflection of its international character. The active centre of science and finance is enriched by abundant offering of arts and cultural events.

Espoo's success in the European Commission's 2014 search for the European Capital of Innovation inspired our gardeners to continue to work with the Espoo soil to make it even more of a fertile ground for growth and innovation. Espoo managed to get onto the shortlist of six prominent cities from among 58 applicant cities.

Encounters—planned or random—between people are a source of innovation and new experiences. The garden will grow and flourish the more gardeners that tend to it. Everyone is welcome to do some gardening, make it bloom and create new innovation and experiences."

6. The ACSI-mindset transfers to everyday working life

The ACSI community spreads the together-acquired and experimented ways of coworking to their own organizations and work cultures. One of the most significant impacts of ACSI is the transmission of these modes to workplaces through ACSI networks. The more people start to trust the power of bottom-up self-organization, the more we can expect positive results when unleashing the full potential of individuals in working life. This largely poses a challenge to the work culture, which is why ACSI in its faith in the real potential of a person chooses to question the prevalent, administrative top-down culture that rarely allows individuals to grow and benefit fully from their capacity in working life.

The ACSI process is active all throughout the year, thanks to the alumni and the ACSI-ecosystem, searching for new challenges and expanding its network and community. ACSI's role as a networker of different ecosystems is of particular importance. The most essential ACSI output to individual participants is the connection to different ecosystems and networks. The personal contacts established through ACSI provide valuable social capital both for the individual and for his or her organization. Participants have also valued the opportunity to widen their horizons beyond their own comfort zone and to develop sensitivity to understand different perspectives.

7. The Future of ACSI

The future of ACSI is open and can be influenced. It seems that the seeds sown by ACSI have started to bear fruit also outside the core-ACSI. Many of those involved

in ACSI activities have implemented their applications in their own countries. One could see that in the future, ACSI will increasingly serve as a platform for societal innovations, and as an umbrella and networker of numerous local ACSIs. Espoo Innovation Garden could easily foster all-year-round Espoo Camp for Societal Innovation activities focused on local or larger-scale Espoo challenges. Urban Mill could provide a physical and virtual platform for such ACSI activities. This could be tested with some well-defined theme even quite speedily in the spirit of rapid prototyping following ACSI principles. As new ACSI applications emerge and evolve, Aalto University would be clever to claim the role as the original platform of ACSI. This could promote the stature and international recognition of Aalto, as well as its role as a local, national and international network weaver. Furthermore, other similar hubs can be recognized or founded in strategic parts of Espoo and they could all be connected operationally to each other and also on a virtual platform and feed results to Espoo Innovation Garden.

References

Case Espoo Innovation Garden
http://www.espoo.fi/en-US/Jobs_and_enterprise/Innovation_Garden

Case Urban Mill: Context, Platform, Co-creation & Orchestration, Presentation for EUE workshop 27.11.2014, Järvelin Design Oy. See also http://urbanmill.org/2014/08/22/urban-mill-open-innovation-platform-orchestration-model and http://urbanmill.org/

Erkkilä, K. and Miikki, L. (2015). ACSI yhteiskunnallisten innovaatioiden vauhdittajana. In Ståhle, P. & Pirttivaara, M. (Eds.). Innovatiivisuus uudistamaan yhteiskuntaa. Tekes publications (in prep).

Miikki, L. and Mikkelä, K., Innovation Alley, handout. (9.5.2014). Text also published in: Helsinki Smart Region: Pioneering for Europe 2020, 2nd edition (4.6.2014), Helsinki-Uusimaa Regional Council.

Mikkelä, K. and Miikki, L. (2014). A Framework for Innovation Orchestration Research.

About the authors

Dr. **Kristiina Erkkilä** holds a PhD in Administrative and Policy Studies in Education from University of Pittsburgh inUnited States. She is currently Director of Development for the Education and Cultural Services in Espoo. Her background is in teaching and teacher education. Before working for the City of Espoo, she was Director of the International Centre in Mikkeli University of Applied Sciences. Her own research interest is in Entrepreneurial Education, in which she has published internationally, and her new research and development theme is Learning Ecosystems. Dr. Erkkilä has visited educational institutions around the world and been an invited speaker in many international conferences.

Lars Miikki, Senior Consultant M.Sc. (Tech.) at Järvelin Design Ltd operates as Urban Miller and co-producer of Urban Mill Innovation Accelerator Platform in Espoo Innovation Garden. He has also been operating in several regional research and development projects and initiatives developing and promoting the Espoo Innovation Garden concept in the City of Espoo as one of the leading innovation hubs. Recent positions include Task coordinator in the Energizing Urban Ecosystem program, work package Regional Innovation Ecosystem T3 Ba & Flow 2012–2016, Project manager at Culminatum Innovation Ltd in the EKA Forerunner area Helsinki Region project work package B 2012–2014, Project Researcher at the Department of Real Estate, Planning and Geoinformatics, Aalto University 2012–2013, and case owner role in 2011 and 2012 Aalto Camp for Societal Innovation case groups focusing on the development of the T3 area into Innovation Garden.

Elmar Husmann
Deputy Secretary General
ELIG.org
elmar.husmann@elig.org

10. Entrepreneurial Discovery: we.learn.it

Abstract

we.learn.it is a European school initiative on creativity, entrepreneurial discovery and explorative learning. Initially inspired by the model of the Aalto Design Factory, we.learn.it supports the launch and conduction of learning expeditions in diverse areas such as literature, history, storytelling, robotics, or on environmental challenges. Since its launch in 2012, thousands of school children and young adults have already participated in we.learn.it expeditions. The expeditions are gathered in an open bottom-up process and receive multiple forms of guidance and support—i.e. from a large group of individual facilitators and organizational partners. As part of the initiative, a vision for European Classrooms of the Future has been developed which has already been piloted in large scale events.



KEYWORDS: K12 schools, Creativity, Exploration, Entrepreneurial skills, Project-based learning

1. A European School Initiative Inspired by Espoo

In October 2011, members of the European Learning Group (ELIG.org) gathered together for their annual meeting in the **Design Factory** of Aalto University in Espoo, Finland. Design Factory had recently been created as a 3000 sqm flexible space in old factory buildings on campus to offer students from all faculties of the university opportunities for creative projects and sharing of knowledge and ideas.

The learning experience in these new environments is complementary to the more traditional forms that take place in nearby university seminars, classrooms and lecture halls on the same campus. Design Factory, however, demonstrates the impor-

tance of some qualities of learning environments that tend to be easily overlooked: architectural inspiration, flexibility, opportunities for creation and team work, entrepreneurial thinking and clever leverage of digital and other maker technologies. It also demonstrates the importance of continuous innovation within the pedagogical framework in which learning takes place. This implies a fruitful interplay between newer approaches such as design-based thinking, open education or maker labs with such well-known principles from the educational reform movement of the 1960s and 70s as workshop, explorative and project-based learning.

The we.learn.it[1] initiative was started based on this inspiration from Finland and has been set up to explore on the European scale how similar new learning environments could be created within K12 school education. Particular attention has been given in this context to develop a fresh approach to integrating digital technologies into the learning experience.

Officially started in November 2012, we.learn.it has since then reached thousands of school children and young adults in many countries throughout Europe and beyond.

2. From Class Lectures to Learning Expeditions

we.learn.it is built around **learning expeditions** that relate to different school curriculum topics such as history, geography, arts or languages. Further topics have also included scientific, nature and technical exploration.

The term **learning expeditions** has been chosen to express a number of characteristics such as exploring unknown knowledge territories, team-based learning and going beyond the typical boundaries of the classroom. Expeditions challenge the individual and the team, while learning is a by-product of solving the implicit challenges of a particular expedition.

This has so far included a joint learning expedition of German and Chinese schools on the Transsibirian railway, an expedition on exploring local food while walking over the Alps, documentary filmmaking in London, explorative projects in the Nobel Museum and the Technical Museum in Stockholm, a smart city game in Helsinki, the examination of the impacts of climate change in Bavaria or on Alpine glaciers with the German Space Agency[2] as well as environmental projects in France on areas such as forests or sea pollution. The list could go on further with technical expedition topics such as programming robots or coding apps, scientific methodology topics including student-created social statistics or learning expeditions on creative techniques such as storytelling, character design in comics, creating stories with everyday objects and many more.

---

[1] we.learn.it has been created by a consortium of partners involving Aalto University (coord.), Stockholm University, ELIG.org, OECD, the London Institute of Education, the Commonwealth Telecommunication Organization and INTEL It has received funding by the European Union via the 7th Framework Programme.

[2] This learning expedition was a collaboration between we.learn.it, the University of Munich, the Bavarian Realschulnetzwerk and the German Space Agency (DLR) School Labs

While we.learn.it has sometimes provided initial ideas and inspiration for learning expeditions, all of these topics have been generated through an open process that involved schools, external content partners and facilitators. Therefore, we.learn.it is an open accelerator environment for learning expeditions in contrast to a closed pool of learning content or methods.



Figure 1. we.learn.it Climate Explorers expedition. Transsibirian railway as classroom in an intercultural project on drinking water.

we.learn.it has further supported the forming of partnerships to realize a particular learning expedition, the organization of in-kind support (i.e. technical equipment) and financial support based on a European pool of seed funding. All learning expeditions are evaluated for their learning impact in a joint effort of the OECD and the London Institute of Education employing a blended qualitative and quantitative method that includes interviews, site visits by researchers and pre/post online questionnaires.

3. Creating a New Learning Culture of Innovation, Explorative Spirit and Creativity

The current learning content for schools is predominantly curriculum centric, while we.learn.it expeditions have in most cases only an indirect connection to the curriculum. In this sense, they have served to apply previously acquired knowledge to practice as well as to deepen existing knowledge and rehearse previously acquired

skills. The learning experience in expeditions can also relate to richer effects such as fostering meta- and social skills as well as intensifying motivation and sparking interest to further explore a knowledge area.

The effects here resemble the predominantly intuitive and implicit learning that is known from learning-on-the-job or other forms of deep immersion into practice as part of the learning process. Teaching is still important in this process, but in many learning expeditions, the role of the teachers has been transformed towards helping to prepare the expedition and coaching the team or guiding individual learners rather than primarily transferring knowledge. Significant parts of learning expeditions have also been conducted in the physical absence of teachers building on the autonomy of learners. Teams of student peers had e.g. to organize themselves in city or museum learning situations while teachers have guided these only from a distance with the help of mobile technology.

we.learn.it does not claim that these forms of learning will replace or make more traditional forms of school learning obsolete, rather they provide a modern extension in the same way as universities have already created new learning spaces such as Aalto University's Design Factory or the Stanford d.school. They further contribute to a learning culture based on innovation, exploration and creativity—capabilities typically considered difficult to teach in traditional settings, while at the same time in increasingly high societal demand.



Figure 2. Changing roles: Teachers explaining their we.learn.it expedition ideas to students at Aalto Design Factory in a workshop format resembling the UK TV Show Dragon's Den (where entrepreneurs pitch ideas to investors).

4. An Open Method and Toolkit

To help create and conduct learning expeditions, we.learn.it has developed an open method and related tools. These guide the expedition team through phases of observation and idea gathering to actual development and execution of the expedition and finally to sharing the results and reflecting on the outcomes.

For sharing outcomes, different digital means have been adopted, i.e. videos, pictures, ebooks or blog posts. All this is produced by the students themselves, often in parallel with the actual expeditions. we.learn.it has involved journalists and media producers to help guide this process.

we.learn.it has provided further support for its method in the form of an open toolkit. This includes the method itself, as well as other necessary elements such as planning tools for activities and funding, and a collection of recommended technical tools and apps.

The different elements of the method are supported by a web portal for schools, learners and facilitators of learning expeditions. This includes social interaction, protected team storage and collaboration spaces as well as digital means of results sharing while putting a particular emphasis on the privacy requirements for social media in schools and with minors. This addresses the scepticism of schools towards popular commercial platforms such as Facebook, WhatsApp or Youtube that imply at times uncontrolled commercial use or right transfers of user content while simultaneously becoming widely popular among students.

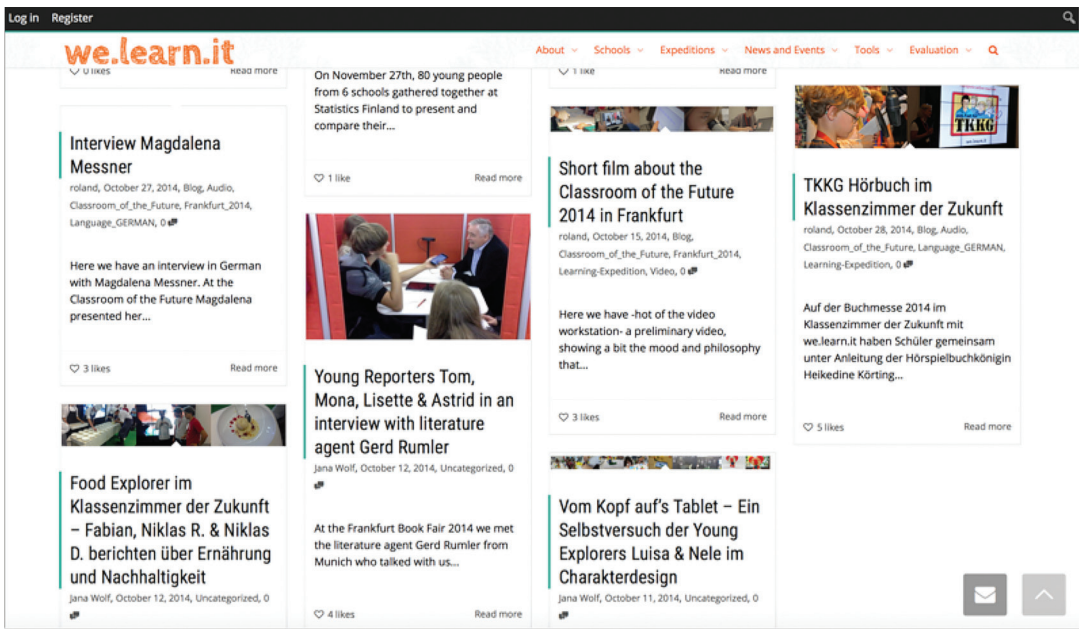


Figure 3. Blog posts on learning expeditions on the we.learn.it portal.

The we.learn.it learning expeditions have shown that digital ways of communicating, collaborating, co-creating and sharing can create entirely new possibilities to organize learning experiences. we.learn.it has therefore partnered with innovative learning technology partners, i.e. with the start-up Smartfeet from Finland that provides a platform for learning games based on geo-location, with LEGO Education, Samsung, Think with Things and others.

Overall, we.learn.it integrates a broad range of technologies into learning expeditions while not following a technology-centric approach or demanding specific learning technologies. Technology is rather adopted to increase human social interaction, and to improve creative production and co-creation as part of learning expeditions. This resembles the way how digital technologies have already pervaded other parts of students' lives and their later professional work. we.learn.it is based on the assumption that schools have to actively embrace this digital transformation if they want to prepare their students for the future.

5. Involving Facilitators

In parallel with nurturing learning expeditions and attracting schools and students, we.learn.it has formed a network of facilitators. This includes individuals (i.e. filmmakers, scientists, nature explorers) as well as diverse supporting organizations with either a content focus in selected domains of learning expeditions or competences in specific technologies or solutions.

we.learn.it has also partnered[3] with foundations or similar funding partners in the financing of expeditions. Overall, we.learn.it applies an open approach to facilitation where each learning expedition has a specific constellation of faciliators.

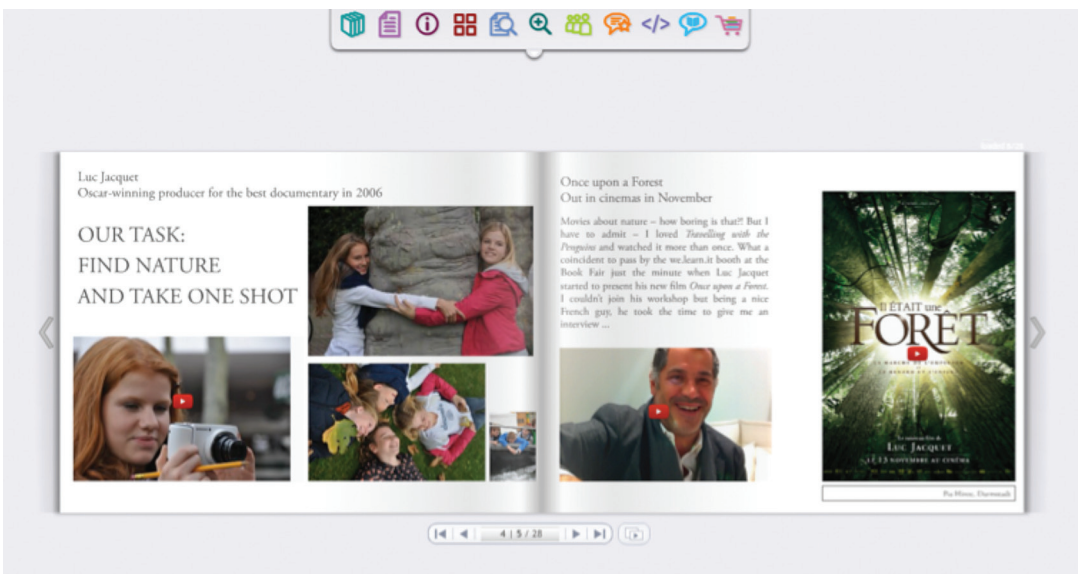


Figure 4. we.learn.it eBook 2013 co-created by over hundred students.
Article about a filmmaking learning expedition with film director Luc Jacquet.

Facilitators can assume different roles in the learning process. They can provide opportunities or equipment but they can also act as coaches and inspiring individuals—in other words, as master explorers. They can support learning expeditions based on their skills, personal ambitions and experiences.

Andreas Schleicher, head of the OECD PISA study team once expressed[4] that "There has been a belief that technology will by-pass teaching. I don't agree, but what we do see is that good technology can leverage good teaching". While this is certainly true, teaching tends sometimes to be confused with the formal position of teachers in the educational system.

The work with the we.learn.it facilitators has indicated a significant but widely hidden potential to engage individuals and external organizations in school education in a way that could be fruitful and inspiring for both sides. As analyzed in more detail in the ELIG book on "Openness and Education",[5] this wider integration of stakeholders—not directly included in the educational system—is an important aspect of education that is opening up. The potential of leveraging good teaching by means of peers or master explorers is also reflected in digital learning developments like peer learning platforms, increased self-produced learning videos or similar open creation of learning content.

Obviously, this implies challenges to quality managementand hence we.learn.it has opted for an approach in which facilitators have to be accepted before becoming active in we.learn.it.

5. Achieving Scale

Much of the creative energy in the we.learn.it approach—i.e. to bring new learning expeditions to life—is based on open bottom-up contributions. And we.learn.it has already demonstrated that these can indeed be activated.

A particular challenge is, however, scaling these to much larger numbers of participants as often learning expeditions have thus far only involved a limited number of schools. Scaling in the we.learn.it approach can be achieved on two dimensions: on the one hand, by growing the overall number and range of learning expeditions—thus stressing the bottom-up dimension of the approach. On the other hand, it can be achieved by growing individual learning expeditions in the number of participating schools and students. The later demands a specific preparation of the expedition content, tools and methods. The preparation of content packages per learning expedition has already been piloted in we.learn.it. This has raised further interest among educational publishers, teachers and schools. The aim is to facilitate

[3] An example for this is the Climate Explorer Expedition on the Transsiberian Railway that we.learn.it facilitated with apps, digital content and analytics capabilites for water probes in addition to funding support.

[4] cited from http://dailyedventures.com/index.php/2012/04/12/you-cant-get-around-the-need-for-great-teaching-france/

[5] Openness and Education; Andreas Meiszner, Lin Squires (editors); Emerald; 2013.

the entry into learning expeditions and spread attractive expedition topics faster to a larger number of interested schools.

6. Creating Classrooms of the Future

A particular successful element of we.learn.it has been a collaboration that started jointly with the organizers of the Frankfurt Bookfair in Germany, a large-scale event with close to 300.000 visitors. In 2013, we.learn.it partnered with the fair to design a Classroom of the Future, an initiative that has been further enlarged in 2014 in collaboration with Finland as guest country of honour of the fair.



Figure 5. Impressions from the Classroom of the Future 2014—Learning expedition on robotics.

The Classroom of the Future has brought together different elements of we.learn.it: collaboration with architects and designers on examplary elements of a flexible and inspiring learning space, organization of multiple small-sized learning expeditions, as well as background logistics of handling hundreds of mobile technology devices. Overall, more than 2000 students, children, families and guests have taken part in expeditions organized in these Classrooms of the Future. The activities have been closely documented by student journalists, leadingeach year to a collaborative ebook with contributions from over a hundred young people, to blog posts, audio books, videos and other collaborative media. The Classroom of the Future events have also been widely featured in public media including TV and radio.

The particular success of the Classroom of the Future underlines that the topics addressed by we.learn.it resonate well with the needs of a wider public. A recurring argument in this context is the need to prepare school kids for a new professional world and for the increasing demand for innovation and creative skills.

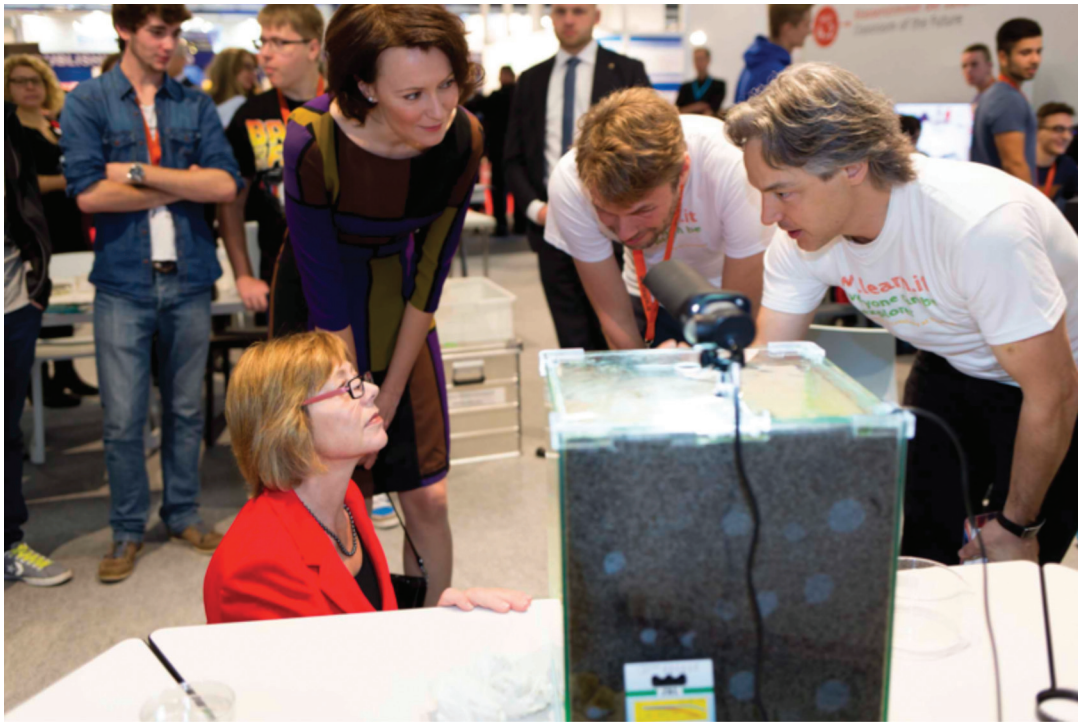


Figure 6. Impressions from the Classroom of the Future 2014—visit of Jenni Haukio and Daniela Schadt (first ladys of Finland and Germany).

7. Energizing New Learning in Regional Ecosystems

we.learn.it has been endorsed and supported by the European Committee of the Regions (Digital Agenda Vanguard Group) and is further aligned via ELIG.org with the Energizing Urban Ecosystems project of the Espoo region. Many political delegations, ministers, city mayors or regional developers have also been in contact with we.learn.it or visited the we.learn.it Classrooms of the Future. we.learn.it was included in the European code week 2014 and partnered with the European Open Education Challenge the same year.

Most learning expeditions have further related to the world outside the classroom, i.e. to the urban, natural or regional environment. One learning expedition has e.g. retraced the growth of a school's home city over the past 30 years based on European open satellite data. Others have looked at regional food chains or water supply. Learning according to the we.learn.it model has the potential to link children and young adults closer to the challenges of our European societies and, in particular, to local and regional challenges.

The idea of we.learn.it is to enable schools to establish a better connection between the knowledge areas they have to teach according to the curriculum and those domains of practical application, innovation and exploration that these areas are linked to, in other words, to real-world challenges and problem solving. Addressing real-world challenges in new and creative ways is essentially linked to creative and entrepreneurial individuals. But in our hyper-connected, modern society, it is also linked to intensive social interaction, to openness and effective co-creation.

we.learn.it demonstrates also that working practices, digital tools and methods as applied by professionals, designers, innovators, explorers, scientists and entrepreneurs can well be applied already in school projects that have a dual purpose: that of a true explorative expedition and that of a new, engaging form of learning.

Therefore the approaches piloted in we.learn.it also relate to regional challenges in nurturing creative talent already at young age. In return, they can also improve each child's and young adult's understanding of why school education is necessary and how it links to their later work lives and lives as an active citizen.

When facilitators are involved in a learning expedition, we.learn.it has typically organized an open discussion between the facilitator (artists, filmmakers, explorers or entrepreneurs) and the students prior to the expedition. Most facilitators reported here to have found the passion for their later field of activity already at school age, while most also report to have found it only outside school. we.learn.it builds on the assumption that creativity, personal fields of passion, inspiration for work, societal challenges and entrepreneurial actions can be much more intensively supported as an integral part of modern school education. At the same time, this can also support social skills, team work and creation of a mutual sense of achievement and purpose.

This will lead to more meaningful and holistic learning. This wider perspective on learning that i.e. includes digital social- and creation-skills is deeply needed to help educate future talents and active citizens for Europe. Innovation in education has already become an important characteristic of innovative regions in our increasingly digital and connected world. However, it can be witnessed that this transformation is mostly addressed in European regions by focusing on higher education and lifelong learning. But ultimately, it should already start at school age.

The city of Munich, together with BMW, the Centre for Innovation and Business Creation at Technical University Munich (also a facilitator in we.learn.it) and the US Maker Space organization TechShop is about to open a large facility[6]—similar to the Aalto Design Factory—that will specifically support university student projects and creativity in the domain of mobility. In London, Pearson (an ELIG member) and Makerversity are opening a similar "learning space for a collaborative community of global makers and problem-solvers".[7]

---

[6] https://www.press.bmwgroup.com/global/pressDetail.html?title=bmw-group-and-unternehmertum-bring-techshop-to-germany&outputChannelId=6&id=T0147984EN&left_menu_item=node__804

[7] https://www.pearson.com/news/announcements/2014/january/pearson-partnerswithmakerversity-tounveilaclassroomofthefutureatl.html

It can certainly be claimed that we.learn.it has already demonstrated that these concepts currently spreading in higher education could much enrich European school education, as well. In particular, innovation-oriented regions will have to look at this very closely. And we.learn.it is already engaged with some regions to turn we.learn.it principles—such as the elements of the Classrooms of the Future—into regional development plans. The first region will again be Espoo in collaboration with the Energizing Urban Ecosystems (EUE) initiative.

References

Bannan, B., Cook, J., Pachler, N. (2015). Reconceptualising design research in the age of mobile learning. In press, 'Technology Enhanced Learning: Creating the Future or Recreating the Past?', Interactive Learning Environments.

Burger, R., Husmann, E., Rizzo, F. 2013. Opening up Education, ELIG White Paper, ELIG Publishing. Available at http://www.elig.org/we-share/publications/.

European Committee of the Regions (Eds.) (2014). Smart Specialisation: Open Innovation 2.0 (Session3). Proceedings of the European Bench-Learning Conference for Pioneering Innovation Regions.

Fishman, B., & Dede, C. (2015). Teaching and technology: New tools for new times. In Gitomer, D. & Bell, C. (Eds.). Handbook of Research on Teaching, 5th Edition (American Educational Research Association). New York, NY, Springer. (forthcoming)

Meiszner, A. & Squires L. (Eds.). 2013. Openness and Education, 1, ELIG Book Series on Advances in Digital Education and Lifelong Learning, Emerald Press.

OECD (2014). Measuring Innovation in Education: A New Perspective, Educational Research and Innovation, OECD Publishing, Paris. Vincent-Lacrin, S.; Kärkkäinen, K.; Pfotenhauer, S.; Atkinson, A.; Jacotin, G.; Rimini, M.

RTL Hessen. (2014). TV Feature on the we.learn.it Classroom of the Future. Available (in German) at http://www.rtl-hessen.de/video/6011/klassenzimmer-der-zukunft.

we.learn.it, Short documentary film on the we.learn.it Classroom of the Future. (2014). Available at http://we.learn.it/blog/2014/10/15/short-film-about-the-classroom-of-the-future-2014-frankfurt/.

Wolf, J. & Jerry, D. (2014). The Classroom as a workshop for the future. Available at http://blog.book-fair.com/2014/11/04/a-workshop-for-the-future/.

About the author

Elmar Husmann has been in leadership roles for PwC and IBM strategy consulting and has extensive experiences in bringing new ventures to life. He was involved in launching a global IBM innovation programme on next generation Cloud and Internet Services and in creating BMW Welt—the customer experience and exhibition facility of BMW AG in Munich. Elmar has a strong passion for innovation in learning and education and is since 2007 Deputy Secretary General of the European Learning Industry Group (ELIG.org). In 2011, he was one of the initiators of the we.learn.it project on creativity and exploration for European schools and is also since 2013 one of the organizers of the **Classroom of the Future** at the Frankfurt Bookfair.

THE NEW CENTER & THE POTENTIAL OF THE FINGERPLAN

SEMI EFFICIENT AREAS offer spaces for housing, offices, waterfront constructions and other pedestrian-oriented urban structures. Open for everyone: unique cafes, restaurants, seaside events …



© Cederqvist & Jäntti Architects



© Helin & Co



SKETCHING THE FUTURE

BOARDWALKS BY the water. A network of lively pedestrian paths and roof gardens on top of the horizontal 100 000 sqm startup village with housing and office towers above. Inside the village throbs the 24/7 SLUSH-event. The urban space between the buildings is as important as the space inside when creating a functioning ecosystem.



III
INCREASING INNOVATION CAPITAL

Many societal operators have learned the hard way that self-sufficiency is not an asset in innovation endeavours. To secure competitiveness in the world of innovation, they have begun to seek partners and collaboration to complement their capabilities and to ensure funding, even outside their own sectors. This chapter presents concrete, unprecedented initiatives that combine, integrate, connect and network actors across borders for a higher, societal purpose.

SEPPO LEMINEN and **MIKA WESTERLUND** offer a framework for harnessing cities as living labs, i.e. communities that involve companies and citizens as prosumers in collaborative innovation activities. **ATSO ANDERSEN, RIINA SUBRA, ANNUKKA JYRÄMÄ** and **HANK KUNE** present the Aalto University open innovation hub, which operates in the context of wider regional networks, building on the University's role as an innovation ecosystem hub. **ERKKI HÄMÄLÄINEN** with both his industrial background and academic career serves as a living example of how Aalto University has bridged the gap between corporate and university worlds by establishing Professor of Practice positions. **PENTTI LAUNONEN** shares new insights into collaborative practices in open innovation networks and innovation orchestration. **TEEMU YLIKOSKI, ELINA OKSANEN-YLIKOSKI** and **LAURA-MAIJA HERO** describe novel ways in which education institutions could be more active in driving innovation and social development. **HEIKKI RANNIKKO, LEENA ALAKOSKI** and **JOHANNA LYYTIKÄINEN** present a pioneering project aiming to increase cooperation between a city and its education institutions. Finally, we hear how **ANIKÓ KÁLMÁN, LÁSZLÓ FARKAS** and **DONÁT DÉKÁNY** have instigated student innovation activities in Budapest, following the Aalto model.

Seppo Leminen
Laurea University of Applied Sciences
seppo.leminen@laurea.fi
Aalto University School of Business, Department of Marketing
seppo.leminen@aalto.fi

Mika Westerlund
Carleton University, Sprott School of Business, Canada
mika.westerlund@carleton.ca

11. Cities as Labs: Towards Collaborative Innovation in Cities

Abstract

This study advances the idea of cities as labs by applying findings and experiences from living labs. In particular, it explores cities as collaborative innovation platforms initiated by citizens and organizations, and uses data from several cities and countries to create a framework for harnessing cities as living labs. Our research contributes to the discussions of open and user innovation from the perspective of cities as communities that involve and integrate citizens as prosumers as well as companies to collaborative innovation activities. Acknowledging the fact that cities are platforms for simultaneous and divergent innovation initiatives, we found four principal types of collaborative innovation. Cities serve as platforms for (i) **improving everyday life conditions,** *(ii)* **creative consumer experiments,** *(iii)* **experimenting and implementing new technologies,** *and (iv)* **creating new economic opportunities.** *The study concludes by suggesting guidelines for making use of the identified types of collaborative innovation in cities.*



KEYWORDS: Living lab, Collaborative innovation, Smart city, Creative consumer, Living laboratory

1. Introduction

Today, Europe is facing not only increased socio-economic challenges such as ageing population and the economic stagnation, but also extraordinary social and market opportunities for emerging technologies. In response to the need for an efficient European model of innovation to adopt these technologies—driven by the progressively popular paradigm of open innovation (cf. Chesbrough, 2003)—the living lab movement was organized at Helsinki Manifesto during the Finnish EU Presidency in 2006. Consequently, this endeavour lead to the formation of the European Network of Living Labs (ENoLL), which has since grown into an umbrella organization for almost 350 living labs worldwide. Given the increased importance of the living lab model and the rapid growth of the number of living labs in Europe and globally, this study focuses on applying the knowledge from living labs to discuss cities as labs. In accordance with the definition put forward in Westerlund and Leminen (2011), we view living labs as **"physical regions or virtual realities, or interaction spaces, in which stakeholders form public-private-people partnerships (4Ps) of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts".**

A living lab is a modern concept but its roots can be traced back to Knight (1749), who was the first to apply the term **living laboratory.** The meaning of living labs has evolved dramatically since the early days and now suggests that organizations should encompass internal and external ideas, technologies and spill-over knowledge to create products and services collaboratively with heterogeneous stakeholders including customers, users and citizens. This is contrary to the conventional innovation development, which grounds on the assumption that companies and their trusted partners have all the necessary knowledge to innovate and ensure intellectual property rights. Thus, living labs make a prominent, emerging form of open and user innovation, and are increasingly used in diverse fields such as agriculture, health care, education, and environmental protection. Consequently, living labs offer an emerging area for interdisciplinary research crossing areas such as information technology, human computer interaction, innovation management, knowledge management, and participatory design. Living labs build on multiple stakeholder participation in real-life environments and acknowledge the particular importance of users, and are characterized by cross-fertilization of knowledge and expertise from different stakeholders in different contexts.

There is an ample body of research on real-life environments ranging from scattered to broader spaces. These spaces include learning environments such as classrooms in schools and universities, as well as homes, various buildings, industrial plants, districts, cities, regions, countries, or even virtual environments. In addition to real-life environments, studies of living labs encompass the role of multiple stakeholders, including commercial and non-commercial organizations, governmental and non-governmental organizations, citizens, customers, users, scholars,

consultants, city developers, policy makers, and financiers. Consequently, previous research argues that living labs can be categorized by their driving stakeholders and labels them as enabler-driven, provider-driven, utilizer-driven, and user-driven living labs (cf. Leminen et al., 2012). The characteristics of these four types of living labs differ, and they rely on different innovation mechanisms in terms of coordination and participation (Leminen, 2013). Finally, prior research suggests various constellations of living labs: a focal point, an intermediary, an innovation arena, and a platform (cf. Lasher et al., 1991; Ballon et al., 2005; Kviselius et al., 2009; Almirall & Wareham, 2008; Almirall & Wareham, 2011). The common aspect is that living labs strive to organize, coordinate and manage innovation activities that differ by their goals, ambitions, and outcomes. This study aims to understand cities as labs, particularly as collaborative innovation platforms based on the living lab model.

After this introduction, the study discusses living labs as a part of a broader network and a system, and proposes a model for understanding collaborative innovations in the context of cities. Then, the study briefly illustrates collaborative innovation in cities with the example of Innovation Garden in Espoo, Finland. Finally, the study concludes with guidelines for collaborative innovation in cities based on living labs.

2. Collaborative Innovation in Cities as Labs

Living labs are argued to offer a variety of benefits for stakeholders, including new business opportunities, more effective innovation processes, and savings in R&D costs. Moreover, living labs integrate scholarly and applied research to empower rural communities, catalyze rural and regional innovation development, and advance smart city operations. As a living lab is by its definition a network, a single living lab network has multiple stakeholders (Feurstein et al., 2008). Consequently, the networked nature of living labs means that living labs can form networks with other living labs (Leminen & Westerlund, 2014), establish cross-border living lab networks (Lievens et al., 2011), and create a global network of living labs (Mavridis et al., 2009; Dutilleul et al., 2010). Only few studies view living labs from the system perspective. For instance, Van der Walt et al. (2009) address systems thinking by describing living labs through interrelationships within systems. Moreover, Liedtke et al. (2012) view a living lab as a techno- and socio-economic system which focuses on the social needs of people paying regard to sustainable development. Fahy et al. (2007) take another perspective and address that living labs are embedded as a part of a wider innovation system. Such living labs provide many services to all their stakeholders. Finally, Dutilleul et al. (2010) refer to the network of living labs as an innovation system.

Studies of living labs increasingly focus on the smart city[1] context, whereas prior studies have focused on embedded technologies in more restricted contexts, such

1 Dameri (2013, p. 2549) defines a Smart City as "a well defined geographical area, in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well being, inclusion and participation, environmental quality, intelligent development; it is governed by a well defined pool of subjects, able to state the rules and policy for the city government and development"

as homes or buildings. For instance, Coenen et al. (2014) put forward that living labs can act particularly well as a methodology that explains the creation of services in smart cities. Subsequently, Sanchez et al. (2014) explain the usage of an Internet of Things (IoT) platform that enables novel services for citizens in smart cities. Moreover, Ballon et al. (2011) argue that smart city initiatives are local activities but as such, they lack the economics of scale and efficiency. Taken together, prior literature on living labs assumes and documents different forms of collaborative innovations in cities. However, Baccarne et al. (2014) point out that there is demand for studies which would show the value being created in Smart Cities. Therefore, this study suggests a conceptual model for understanding collaborative innovation in cities. The model comprises two dimensions; the horizontal axis, **target of collaboration,** reflects whether innovation activities improve current life conditions or create something new. The vertical axis, **initiation,** refers to whether the innovation activities are initiated by companies or by citizens as a grassroots activity.

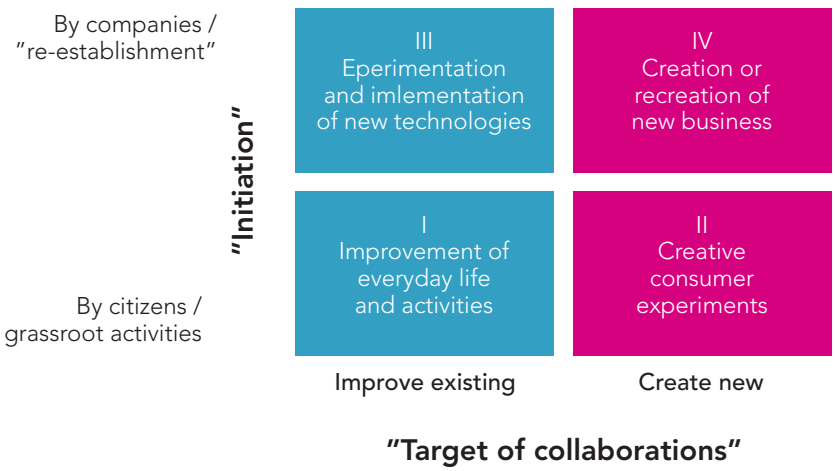


Figure 1. Collaborative innovation in cities.

The framework provides us with four forms of collaborative innovations in cities. First, we identify (i) a city as a platform for **improving everyday activities and life conditions** of citizens by the citizens, including self-employment of citizens in cities. Such initiatives can be identified particularly in living labs in Sweden and South Africa (cf. Nyström et al., 2014; Leminen et al., forthcoming). Improvement of everyday activities or life conditions is increasingly important not only in developing countries such as South-Africa, but also in European countries with high unemployment rate where citizens improve their quality of life through self-employment. The second form considers (ii) a city as a platform for **creative consumer experiments.** Such experiments involve citizens and consumers as prosumers in grassroots creative activities in cities. For instance, Mulder (2012) discusses **living labbing** in urban environments in terms

of co-creation activity in Rotterdam City. Similarly, Leminen et al. (2014) document grassroots creative activities, where users act as content creators, aggregators, and distributors at Citilab Living Lab in Barcelona. Moreover, collaborative innovation suggests many activities, where (iii) **experimenting and implementing new technologies** take place. Manchester Smart City initiative covers many experiments with digital technologies (e.g. use of IoT (Internet of Things) in city lightning) in collaboration with smart citizens.

Finally, form (iv) suggests a city as a platform for **creating/re-creating new economic opportunities.** Silicon Valley is a well-known example of a restricted area characterized by innovativeness and creation of new business opportunities, particularly in the ICT industries. Helsinki metropolitan area is another example of creation of new business opportunities in cities. Such opportunities include the opening of public data,[2] as the extraction and aggregation of open and private data create many business opportunities for emerging and established companies to serve citizens, companies and other organizations. Given the variety of innovation activities in cities as labs, this study proposes that such forms call for different means and initiatives by different stakeholders, particularly when these initiatives are a part of an innovation ecosystem. This study synthesizes various forms of collaborative innovations for organizations, including companies and other organizations (see Table 1). Such synthesis covers guidelines for various forms of collaborative innovation in cities.

Collaborative innovation in cities	Means to participate for collaborative innovation	Innovation outcomes
Improvement of everyday activities and life conditions	Support activities by offering tangible and intangible resources such as tools and knowledge rather than interfering or steering such activities. Citizens are committed to those activities for their own reasons.	Harvest the ideas and knowledge created by citizens and user communities in real-life contexts.
Creative consumer experiments	Support activities by offering tangible and intangible resources such as tools and knowledge, but be involved in the creative activities to learn activities as such but also from novel forms of collaborative activities.	Learn emerging needs and wishes of citizens and customers at the grassroots level, but also as a mechanism to learn novel forms of open collaboration.
Experimentation and implementation of new technologies	Support the experiments and implementations by offering context, knowledge and tools.	Validation of new ideas and prototypes of novel technologies.
Creation or recreation of economic opportunities	Use city as a platform for creating new ideas, where the plurality of stakeholders, knowledge, and ideas smash. The city is a boundless source of ideas but also a collaboration method between and with systems and communities.	New business opportunities.

Table 1. Guidelines for various forms of collaborative innovation.

[2] Accessed December 11th, 2014 Retrieved from http://www.hri.fi/2years/

3. The Case of Innovation Garden

The Helsinki Metropolitan area in Finland is nominated as one of the most innovative regions in Europe. In particular, the Innovation Garden in Espoo[3] enables the four forms of collaborative innovations in a city context, in which living labs and other innovation platforms serve as platforms for collaborative innovation. The City of Espoo orchestrates a network of platforms for the benefit of companies, organizations, citizens, and residents, as well as the city itself (Erkkilä, 2014). Platforms are orchestrated by different bodies in different ways within local universities and their stakeholders, e.g. Aalto University and Laurea University of Applied Sciences. To name just a few, Urban Mill, Design Factory, Otasizzle, and Startup Sauna locate at Aalto University campus area. Conversely, Laurea Living Lab Networks encompasses different living labs at Laurea campuses, where students act as users and developers in various innovation activities together with other stakeholders. 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).

4. Conclusion

Living labs make a prominent and evolving form of open and user innovation. Previous studies of living labs define living labs as networks that include many stakeholders and argue for the importance of users in a broad variety of real-life contexts. This study shares the view but suggest that living lab activities increasingly focus on the context of smart cities. Moreover, the study underlines that living labs are an essential part of an innovation ecosystem in cities rather than being an isolated element of the ecosystem. They offer a mechanism to support collaboration with stakeholders and the emergence of innovation outcomes in cities. Those outcomes range from improving everyday life conditions of citizens to systematic innovations. This study argues that a broad variety of collaborative innovation activities take place in cities. The four forms of collaborative innovations consider cities as platforms for (i) **improving everyday activities and life conditions** of citizens by the citizens, or fostering self-employment in cities, (ii) **creative consumer experiments,** (iii) **experimenting and implementing new technologies,** and (iv) **creating and re-creating new economic opportunities.** This study briefly highlighted the guidelines for participating in collaborative innovation activities.

[3] Accessed December 11th, 2014 Retrieved from http://urbanmill.org/tag/espoo-innovation-garden/

Several scholars (e.g. Ballon et al., 2011) propose the need for creating a pan-European innovation ecosystem incorporating smarter, user-driven, and publicly shared service delivery. Given that living labs are embedded into innovation ecosystems, and, thus, living labs and innovation ecosystems are coupled, this study calls for more research on cities as labs. In particular, living labs exist in the context of innovation ecosystems; there are many questions for future research to investigate that arise from this context. First, what are the forms of systems in living labs and how are these forms coupled in ecosystems? Second, what are the structures and levels of innovation ecosystems in which living labs have an essential role? Third, how can innovation policy support the emergence of collaborative innovation in cities?

References

Almirall, E. & Wareham, J. (2008) Living labs and open innovation: roles and applicability. The Electronic Journal for Virtual Organizations and Networks, 10, 21–26.

Almirall, E. & Wareham, J. (2011). Living Labs: arbiters of mid- and ground-level innovation. Technology Analysis & Strategic Management, 23(1), 87–102.

Baccarne, B., Mechant, P., Schuurman, D. & De Marez L. (2014). Urban Socio-Technical Innovations with and by Citizens. Interdisciplinary Studies Journal, 3(4), 143–156.

Ballon, P., Pierson, J. & Deleare, S. (2005). Test and Experimentation platforms for Broadband Innovation: Examining European Practice. Conference Proceedings of the 16th European Regional Conference, International Telecommunications Society, Portugal, 4–6 September 2005.

Ballon, P, Glidden, J., Kranas, P., Menychtas, A., Ruston, S, & Van der Graaf, S. (2011). Is there a Need for a Cloud Platform for European Smart Cities? eChallenges e-2011 Conference Proceedings, Paul Cunningham and Miriam Cunningham (Eds). IIMC International Information Management Corporation, 2011, 1–7.

Chesbrough, H. (2003). The era of open innovation. MIT Sloan Management Review, 44(3), 35–41.

Coenen, T., van der Graaf, S. & Walravens, N. (2014). Firing Up the City—A Smart City Living Lab Methodology. Interdisciplinary Studies Journal, 3(4), 118–128.

Dameri, R. P. (2013). Searching for Smart City definition: a comprehensive proposal. International Journal of Computers & Technology, 11(5), 2544–2551.

Dutilleul, B., Birrer, F. A. J. & Mensink, W. (2010). Unpacking European Living Labs: Analysing Innovation's Social Dimensions. Central European Journal of Public Policy, 4(1), 60–85.

Erkkilä, K. (2014). Espoo is a smart city through collaboration. Interdisciplinary Studies Journal, 3(4), 218–226.

Fahy, C. & Ponce de Leon, M. (2008). Technology Platform for the ENoLL, A new approach for human centric regional innovation Eds. J. Schumacher & V-P Niitamo. Berlin, Wissenschaftlicher Verlag Berlin, 39–54.

Feurstein, K., Hesmer, K. A., Hribernik, K. D. & Schumacher, J. (2008). Living Labs: A New Development Strategy. In European Living Labs—A new approach for human centric regional innovation, Eds. J. Schumacher & V-P Niitamo. Berlin, Wissenschaftlicher Verlag Berlin, 1–14.

Følstad, A. (2008b). Living labs for innovation and development of communication technology: A literature review. The Electronic Journal for Virtual Organisations and Networks, 10, 99–131.

Fulgencio, H., Le Fever, H. & Katzy, B. (2012). Living Lab: Innovation through Pastiche (a research linking disparate and discorded ontology). eChallenges e-2012 Conference Proceedings Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation, 2012, 1–8.

Knight, T. (1749). Reflections upon catholicons, or universal medicines. Printed for T. Osborne in Gray's-Inn. (Accessed December 2nd, 2013). Retrieved from [http://books.google.fi/books?hl=fi&id=OwFcAAAAQAAJ&q=living#v=snippet&q=laboratory&f=false].

Kviselius, N.Z., Andersson, P., Ozan, H. & Edenius, M. (2009). Living labs as tools for open innovation", Communications and Strategies, 74, 2nd quarter, 490–504.

Lasher, D.R., Ives, B. & Järvenpää, S.L. (1991). USAA-IBM Partnerships in Information Technology: Managing the Image Project", MIS Quarterly, 15(4), 551–565.

Leminen, S., Westerlund, M., Nyström, A.-G. & Kortelainen, M. (forthcoming). The Effect of Network Structure on Radical Innovation in Living Labs. Journal of Business Industrial Marketing (JBIM).

Leminen, S., Westerlund, M., Sánchez, L. & Serra, A. (2014). Users as content creator, aggregator, and distributor at Citilab Living Lab. Robert DeFillippi, and Patrik Wikstrom (Eds.) (2013). Business Innovation and Disruption in Film, Video and Photography Vol. 2 in the Business Innovation and Disruption Book Series. 247–266.

Leminen, S. (2013). Coordination and Participation in Living Lab Networks. Technology Innovation Management Review, 3(11), 5–14.

Leminen, S. (Ed.) (2011). Co-creation with Users and Customers in Living Labs -Integrating users and customers in companies' business processes. Laurea Publications A76 61, Vantaa.

Leminen, S., Westerlund, M. & Nyström A.-G. (2012), Living Labs as Open Innovation Networks. Technology Innovation Management Review, 2(9), 6–11.

Mulder, I. (2012). Living labbing the Rotterdam way: Co-creation as an enabler for urban innovation. Technology Innovation Management Review, 2(9), 39–43.

Liedtke, C., Welfens, J., Rohn, H. & Nordmann, J. (2012). LIVING LAB: user-driven innovation for sustainability. International Journal of Sustainability in Higher Education, 13(2),106–118.

Lievens, B., Schaffers, H., Turkama, P. Ståhlbröst A. & Ballon, P. (2011). Cross Border Living Labs Networks to Support SMEs Accessing New Markets. eChallenges e-2011 Conference Proceedings Paul Cunningham and Miriam Cunningham (Eds). IIMC International Information Management Corporation.

Mavridis, A., Molinari, F., Vontas, A. & Crehan, P. (2009). A practical model for the study of living labs complex environment . Digital Ecosystems and Technologies, 2009. DEST '09. 3rd IEEE International Conference on Digitals and Technologies. Date 1–3 June 2009.

Molinari, F. (2011). Living Labs as Multi-Stakeholder Platforms for the eGovernance of Innovation. ICEGOV2011, September 26–28, 2011, Tallinn, Estonia. 131–140.

Nyström, A-G, Leminen, S., Westerlund, M. & Kortelainen, M. (2014). Actor roles and role patterns influencing innovation in living labs. Industrial Marketing Management, 43(3), 483–495.

Oliveira, A., Fradinho, E., Caires, R., Oliveira, J. & Barbosa, A. (2006) Successful Regional Information Society Strategy to an Advanced Living Lab in Mobile Technologies and Services System Sciences, 2006. HICSS '06. Proceedings of the 39th Annual Hawaii International Conference on System Sciences, 4, 1–8.

Sanchez, L., Gutierrez, V., Galache, J.A., Sotres, P., Santana, J.R. & Muñoz, L. (2014). Engaging Individuals in the Smart City Paradigm: Participatory Sensing and Augmented Reality. Interdisciplinary Studies Journal, 3(4), 129–142.

Schaffers, H. & Turkama. P. (2012). Living Labs for cross-border systemic innovation. Technology Innovation Management Review, 2(9), 25–30.

Schuurman, D., Lievens, B., De Marez, L. & Ballon, P. (2012) . Towards optimal user involvement in innovation processes: A panel-centered Living Lab-approach. Technology Management for Emerging Technologies (PICMET), 2012 Proceedings of PICMET '12. July 29 2012–Aug. 2 2012. Vancouver, BC, 2046–2054.

Ståhlbröst, A. (2008). Forming Future IT—The Living Lab Way of User Involvement, Doctoral Thesis No. 62, Luleå University of Technology Social Informatics, Sweden.

Tang, T., Wu, Z., Karhu, K., Hämäläinen, M. & Ji, Y. (2012). Internationally Distributed Living Labs and Digital Ecosystems for Fostering Local Innovations in Everyday Life. Journal of Emerging Technologies in Web Intelligence, 4(1), 106–115.

van der Walt, J. S., Buitendag, A. A. K., Jan J. Zaaiman, J. J. & van Vuuren, J. C. J. (2009). Community Living Lab as a Collaborative Innovation Environment. Issues in Informing Science and Information Technology, 6, 421–436.

Westerlund, M. & Leminen, S. (2014). The multiplicity of research on innovation through living labs. The XXV ISPIM Conference, Dublin, Ireland, June.

Westerlund, M. & Leminen, S. (2011). Managing the Challenges of Becoming an Open Innovation Company: Experiences from Living Labs. Technology Innovation Management Review, 1(1), 19–25.

About the authors

Dr. **Seppo Leminen** holds positions as Principal Lecturer at the Laurea University of Applied Sciences and Adjunct Professor in the School of Business at Aalto University in Finland. He holds a doctoral degree in Marketing from Hanken School of Economics and a licentiate degree in Information Technology from Helsinki University of Technology, currently School of Electrical Engineering at Aalto University. His research and consulting interests include living labs, value co-creation and capture with users, relationships, services and business models in marketing as well as management models in high-tech and service-intensive industries. Results from his research have been reported e.g. in Industrial Marketing Management, Management Decision, International Journal of Technology Management, International Journal of Product Development, and Technology Innovation Management Review, among many others.

Dr. **Mika Westerlund** is an Assistant Professor at Carleton University's Sprott School of Business. He previously held positions as a Postdoctoral Scholar in the Haas School of Business at the University of California Berkeley and in the School of Economics at Aalto University. His research interests include open and user innovation, business models, and management models in high-tech and service-intensive industries. Results from his research have been reported in numerous scholarly journals including California Management Review, Industrial Marketing Management, and European Journal of Marketing.

Atso Andersen
Head of Institutional Relations
Aalto University
atso.andersen@aalto.fi

Riina Subra
Partnerships Manager
Aalto University
riina.subra@aalto.fi

Annukka Jyrämä
Relations Manager
Aalto University
annukka.jyrama@aalto.fi

Hank Kune
Societal Innovation Coach
New Club of Paris
hankkune@educore.nl

12. Aalto University's Open Innovation Ecosystem in a European Context

Abstract

In this paper we present the open innovation initiative from Aalto University. This initiative builds upon Aalto University's role as an innovation ecosystem hub, operating in the context of wider regional innovation networks. It is a context where industries seek to reinvent themselves and move beyond traditional boundaries, and where stronger multi-disciplinary, multi-stakeholder ecosystems and open innovation practices are needed.

Innovation ecosystems are truly relevant only if they can attract key talent, international engagement and sufficient investments. In this regard we point out the need to foster open innovation networks on a sufficiently ambitious scale in order to spread good practices faster and to create scalable innovations beyond individual success stories. Scaling innovations to other markets also requires in-depth knowledge and connections with other cultures, and an ability to engage in multiple networks.

Ecosystems are anchored in interconnected networks. The Aalto open innovation initiative arises from a Nordic societal model and operates in a cultural context that has allowed for strong open innovation traditions to develop and flourish in Finland. Student-led entrepreneurship activities such

as SLUSH or Start-up Sauna have already had impact and demonstrated an ability to attract sustained interest in the region and beyond. The open innovation initiative fosters stronger linkages between research, facilitation and prototyping. It encourages innovation, brings practice-based perspectives to research, and informs innovation practice with multiple viewpoints that help to better assess and anticipate the societal impacts of innovations.



KEYWORDS: University-industry collaboration, Open innovation, Ecosystem thinking, Entrepreneurship

1. Introduction

This article describes concepts and practices that characterise innovation ecosystems in Finland, and at Aalto University in particular. Taking Aalto University's role as a hub organization in innovation networks as a case, we focus on the ways in which it fosters innovative processes and encourages dialogue from the perspectives of research, learning, industry, entrepreneurship, community and society. The Aalto Open Innovation Initiative aims to facilitate this interaction and shows how the University's innovation strategy can be realized in action. It strives to expand and deepen the ambition of national and international innovation activities linked to the University, contributing to the development of a uniquely attractive open innovation ecosystem in the Otaniemi area.

In this paper we adopt the perspective of innovation within networks, while pointing out the need to identify hub organizations as managers of the network and the innovation process (see for example Möller et al. 2005). A hub organization can actively facilitate innovation processes, integrating the processes of managing both the innovation and the network (Nambisan and Sawhney, 2011).

Regional approaches to innovation ecosystems highlight the role multiple, interconnected networks and nodes play as anchors of sustainable, mutually reinforcing growth across Europe. The focus on regional ecosystems calls for an approach that views innovation as an activity taking place within networks, rather than pertaining to individual actors or companies. To be successful, such an approach calls for more active engagement: for continuous innovating in networking activities, and regular and meaningful interaction between multiple actors.

The challenge for higher education organizations is to complement traditional innovation partnerships with active and open innovation processes—acting as local hubs and leveraging the strengths of research and education to facilitate idea creation and mutual learning across these broad networks. The increased urgency of the open innovation agenda is linked to current economic challenges and the need to improve productivity, employment and sustainable growth across Europe.

We highlight the need for multi-disciplinary, multi-stakeholder ecosystems and open innovation practices in a context where industries seek to reinvent themselves and move beyond traditional boundaries. We also point out the need to foster open

innovation networks on a sufficiently ambitious scale in order to spread good practices faster and to create scalable innovations beyond individual success stories. Thirdly, we stress the need for network support and facilitation to ensure continued openness and meaningful dialogue among stakeholders.

As an example of university efforts to support sustainable growth and innovation, we outline plans to promote open innovation at Aalto University. We shall first reflect on open innovation ecosystems in a broader context, and from a regional perspective. We will then describe Aalto University's open innovation initiative as an example of the role local hubs and higher education institutions can play in facilitating local and regional innovation ecosystems.

2. Open Innovation: The Nordic Way in a European Context

The call for increased innovation and openness resonates throughout Europe. The European Union's Committee of the Regions (CoR) favours a regional approach to innovation ecosystems, which are seen as key drivers of sustainable growth across Europe. The development of strong innovation ecosystems in regions and cities requires taking into consideration the multiple interactions and complementary contributions of local actors. This calls for a new approach, based on seeing innovation occurring within networks rather than pertaining to individual actors or companies; it emphasises collaboration, open innovation and thinking in terms of ecosystems. It also calls for a more active engagement and continuous innovation. According to Mercedes Bresso, First Vice-President of the CoR, local and regional authorities must act as key enablers, bringing together centres of excellence, academia and industry. Policymakers can help create a climate of innovation and growth in an approach that meets the needs of their citizens.

A 2013 review of the European Union's flagship Initiative **Innovation Union** described key progress factors for strengthening European innovation (Committee of the Regions, Proceedings Nov 27, 2013, Brussels):

- Creating shared value for stakeholders and citizens alike
- Going from a closed culture to a sharing culture
- More ecosystem thinking and ecosystem innovators, and more transition from clusters to ecosystems
- Investing in skills and education, and in educational systems
- The need for evidence-based results: clear cases accessible to everyone in the public view, showing what works, how it works, and what not to do.

In its 2013 Opinion **Closing the Innovation Divide,** the CoR stressed that "the key success factor in regional innovation strategies is effectiveness in bridging the gap between existing global research knowledge and actual regional practice. Structures and processes in cities and regions must be developed, even radically changed, in

accordance with the latest research results. To tackle these issues, the CoR believes that… Regions and cities should create pioneering initiatives that are genuinely European in nature: multicultural, human-centered, focused on societal innovations and capabilities to create better structures for the welfare society and lay the groundwork for developing the digital single market… This requires Europe-wide development of regional innovation ecosystems and city innovations." [Committee of the Regions, Official Journal of the European Union, 30.7.2013, page 218/18]

This proposed approach is clearly compatible with what has been described as the **Nordic way,** a reference to the societal model practised by several Northern European countries in recent decades. Cooperation and compromise are cornerstones of the Nordic way: it is itself in essence an excellent example of open innovation, translated to a national context. Social innovation goes hand in hand with business innovation, creating the basis of a national innovation ecosystem. This model is characterised by relatively high taxes, a robust welfare system, wide access to services and benefits, decentralized decision-making and an emphasis on equality amongst citizens. Finland, Sweden and Denmark have consistently performed well, topping various OECD ranking lists, while being "neither more expensive nor less efficient than other OECD countries' systems." These economies have been effective at facing challenges and providing a high quality of life for their citizens: Nordic citizens willingly pay substantial taxes, but "only so long as they are confident that the money will be used effectively to deliver high-quality services." A **flexicurity** approach has been adopted in these Nordic countries, enhancing flexibility and security in the labour market as well as within companies, underpinning their competitiveness (Monday Morning, **The Nordic Model** 2012).

The Rhineland model, as practiced in The Netherlands and western Germany, is another successful European ecosystem approach based on common culture and attention to long-term effects. Like the Nordic way, it emphasises middle- and long-term thinking and the continuity of companies and institutions over short-term financial gains. The environment, spatial development, education and social/societal issues are perceived as important.

The Dutch practice known as **poldering** is an interesting example of a regional cultural concept driving collaborative efforts. It arose as communities strove to reclaim and retain new land from the sea. The model is based on consensus, in which the major players in an ecosystem come together to make decisions for the benefit of society as a whole. Since World War II, the practice has helped link social and business innovation, and contribute to the development of a stable society and highly competitive economy in the Netherlands.

Recent developments in the Netherlands indicate how societal changes challenge the resilience of models like this. The strong influence of ICT and the Internet culture, and the speeding up of everything, are leading to a declining attention to middle- and longer-term objectives. Moreover, criticism of the polder model has stemmed from forces in society typically excluded from consensus making in the past; in an increasingly on-line world there are new challenges for real inclusion and participation in a multicultural society. The recent rise in civic-driven innovation, in

which citizens themselves initiate innovation processes, is both an outcome of society's values and a challenge to its stability. How changes like these will influence quality of life in society is still open.

Finland too will face challenges like these in the coming years, and paying attention to how the polder society, the Rhineland countries, and other Nordic Way practitioners are dealing with them will help Finland to anticipate systemic bottlenecks and provide inspiration for new and needed societal innovations.

3. Recent Drivers for Innovation in Finland

Since the financial crisis of 2008 and the European debt crisis of 2010, the Finnish economy has experienced hard times. Both forest and telecommunication industries are facing profound changes. In the forestry industry, traditional demand for pulp and paper has been in continuous decline due to increasing use of digital media instead of paper-based media. In the telecommunications sector, the sharp shift in the nature of mobile devices rapidly transformed Finland's ecosystem, as Finnish market leader Nokia was not able to meet the requirements of changing demand. This led to the sale of Nokia's mobile device business to Microsoft, forcing Nokia to focus on networks, maps and the patent/intellectual property business. The mobile industry case is an example of the influence a single sector can have on local (and national) ecosystems, and of the dependencies it can bring about.

To an important extent, we now see that the Finnish depression of the 1990's was already rooted in structural challenges to the Finnish economy: the collapse of trade with Russia and forest industry issues. The Nokia phenomenon and the growth of the telecommunication industry offered an immediate solution then, but led to another risky monoculture. The subsequent decline of Nokia has again impacted the Finnish economy as a whole. Finland has not yet been able to diversify sufficiently into a broader range of industries, allowing it to avoid the risks of such strong dependencies.

The early 2010's were disruptive years for the Finnish economy. Traditional monetary policy tools were less readily available within the euro-zone, so instruments to tackle these problems had to be sought in fiscal policy, and most importantly in the form of structural change. New solutions and innovations in previously less prominent sectors are also needed.

Entrepreneurship is seen as one of the emerging solutions to diversify the Finnish economy and support new and emerging business activities. Another solution is to accelerate innovation by fostering new combinations of knowledge, skills and competence. The establishment of Aalto University is one example of recent efforts to promote new innovation through multidisciplinary higher education and research. It remains to be seen to what extent such measures will prove sufficient to positively impact economic development in Finland.

4. Higher Education Institutions Engaging Networks for Open Innovation

Finnish universities and research institutions have a longstanding practice of establishing research projects with partners. Often these research and development projects are based on long-term relationships at an individual level. In the current environment, where innovation actors and leading economic sectors are being reconfigured, more projects have been carried out by adopting flexible and more complex networking models. Local ecosystem actors have increasingly sought the support of universities to develop and promote this type of engagement.

At the same time, global corporations also strive to find opportunities for building a long-lasting presence in Finnish ecosystems. For example, during Nokia's decline, international ICT firms have increased their presence in Finland: Google and Yandex have opened server centers, Intel has several R&D sites in Finland, and Samsung and Huawei have both opened new R&D centers. Such corporations seek collaboration at group and institutional levels. This cooperation with industry takes place on different levels, and plays a strong role in defining both the business sector's and higher education's societal impact and interaction. While scientific inquiry calls for openness, industries often desire to prevent competitors (or customers) from knowing about forthcoming products too early, and call for protection. Finding the right balance between the two is essential.

These challenges are not unfamiliar to universities and networked innovation processes, as pointed out in innovation management literature (see e.g. Rothwell 1992; Dreijer 2002; Dhanaraj and Parkhe, 2006). Nurturing societal interaction and building a culture of innovation in and around universities require efforts that reach beyond individual research projects to engage the university community as a whole. Dialogue with partners and society must take place at all levels and promote the active engagement of student bodies.

Open innovation activities in university ecosystems encompass three main practices: research, facilitation, and prototyping. The key to developing successful ecosystems is to ensure innovation is encouraged and facilitated at every step. Universities are increasingly building platforms and practices to enable co-creation and smooth, meaningful collaboration between actors who share different goals. The innovation process must also include the commercialization/adaptation of the developed products and services, as we cannot speak of innovation without adaptation and use.

5. Aalto Open Innovation Initiative for Innovating in Networks

Aalto University was formed in 2010 by merging three universities: the Helsinki University of Technology, the Helsinki School of Economics and the University of Applied

Arts. Aalto University was established with the expectation that its multi-disciplinary model would help boost innovation in Finland. Societal impact was identified as one of the core drivers of the University's strategy.

The University as an ecosystem acts as a stage, market and newspaper; it is an empowering force for those directly involved in research, art, and learning, with widespread outreach to and influence in the community. Professors, researchers and students provide results that can be combined with the work of others in the ecosystem in new, valuable and often surprising contexts. The common goal for everyone is to discover new ideas, understand their significance, and use this as the basis for innovation (see Figure 1).

Aalto University operates in a cultural context that has allowed for strong open innovation traditions to develop and flourish in Finland. This includes the work and inspiration of pioneers such as Linus Torvalds with Linux, and Mårten Mickos and Monty Widenius with MySQL (and more recently MariaDB). But Finland does much more: through investments in education, a culture of free and open library services (both public and academic), and consistent steps to promote transparency, participation, and open data access and services.

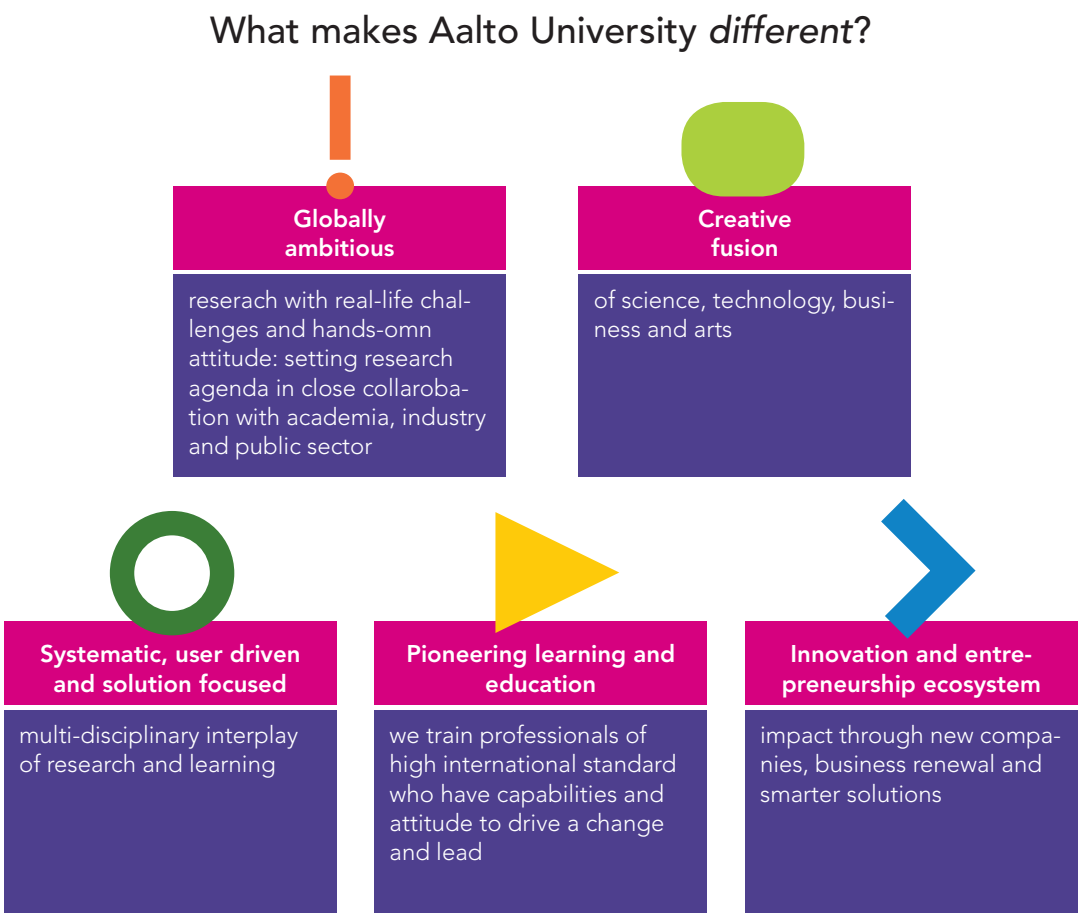


Figure 1. Multiple facets of university engagement.

The Aalto open innovation initiative builds on work done by the university over the course of its early years. It aims to expand the ecosystem created around the university, and support the creation of a vibrant open innovation ecosystem in Finland by 2020. Such an ecosystem will only be successful if it is internationally attractive and able to absorb and facilitate interaction of all kinds, and if global corporations find Finland an interesting location and increase their research and development activities there.

The core of this initiative is to leverage the role of the university as a broker of knowledge and new perspectives, and as a meeting place for stakeholders aiming to reconfigure the current industry landscape both in Finland and globally. Timely access to relevant knowledge and resources, and the opening of opportunities for the many rather than the few, are essential for the achievement of sustainable growth. Facilitating open and multifaceted co-creation between research and practice increases the university's societal impact in several ways. It encourages business and social innovation, brings practice-based perspectives to research, and informs innovation practice with multiple viewpoints that help to better assess and anticipate the societal impacts of innovations.

In addition to developing a vibrant regional ecosystem, the Aalto open innovation initiative aims to scale innovations to other physical locations and different business sectors. This goes beyond the traditional view of managing innovation processes (for example Rothwell, 1992), since the process does not end when the innovation is launched or adopted in a market, but is scaled through networks to other markets or fields.

In practice, the initiative is founded on the use of platforms that are created to allow stakeholders—including both local and global corporations—to actively join in co-creation and dialogue, and to engage in processes that:

- explore societal challenges
- examine research interests
- address corporations' and other organisations' needs for bottom-up projects
- create corporate projects based on new insights from research.

Co-creation occurs both in nation-wide collaboration with Finnish universities, and at European and global levels.

The Aalto open innovation initiative aims to expand and scale up local network activities, and—as pointed out earlier—from the perspective that innovation occurs within networks, it provides the increased support and facilitation required to open up opportunities and provide the required pathways for meaningful stakeholder dialogue. There is a need to identify hub organizations as managers of the networks and innovation processes (see. e.g Möller et al. ,2005). As pointed out in innovation management research, a hub organization can actively facilitate innovation processes, integrating the processes of managing innovation and managing the networks (Nambisan & Sawhney, 2011). Universities can take this role, catalysing and facilitating innovating in networks. (See Figure 2)

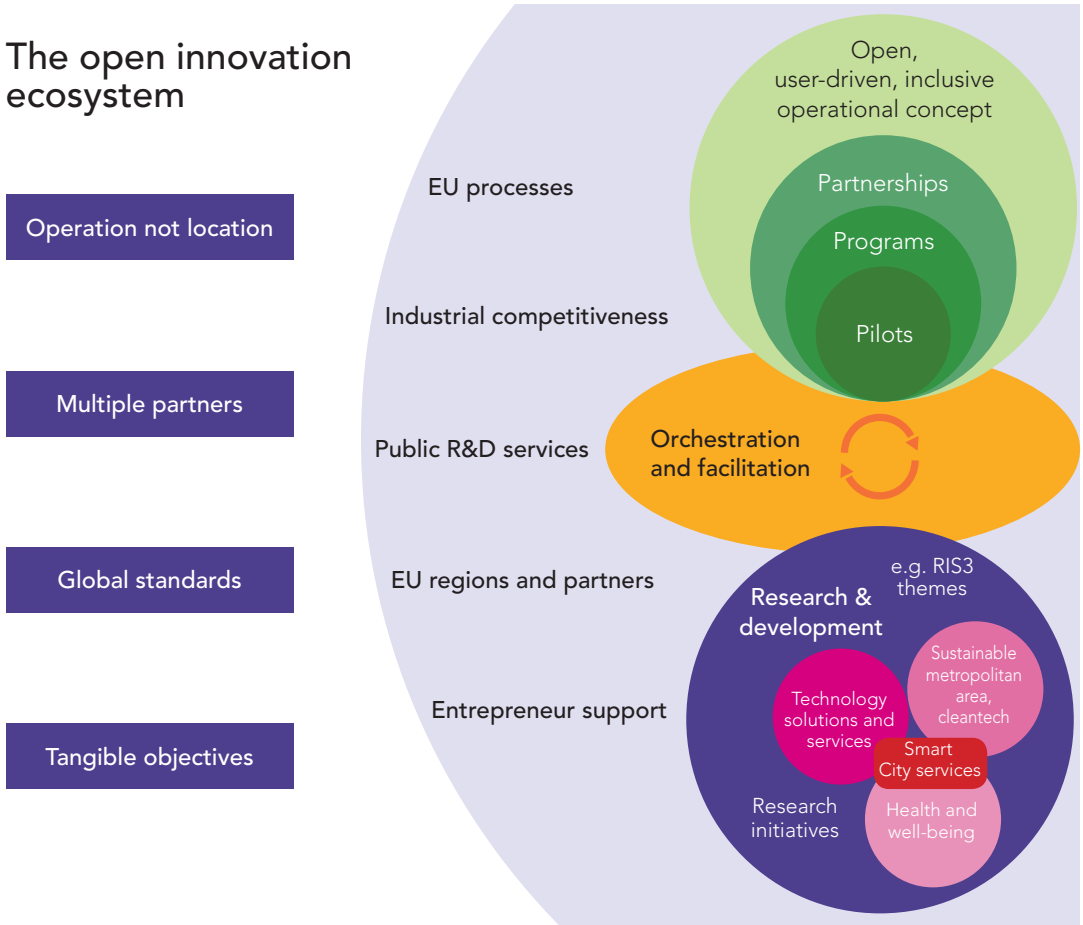


Figure 2. An open innovation ecosystem catalyses and facilitates innovation in networks.

The management of innovation processes is becoming the process of managing networks engaged in the co-creation of new ideas and innovation, both within and outside organizations (see e.g. Poskela ja Martinsuo, 2009; Hellström & Hellström, 2002). In order to enhance and support open innovation within networks, traditional innovation management methods—created mainly for innovation processes in organizations—need to be broadly adopted (e.g. Dhanaraj & Parkhe, 2006).

Although open innovation is sometimes seen as a self-directing activity, orchestration, facilitation and catalysing are required to ensure the engagement of key actors and the achievement of collective objectives. Organizations need new skills and competences to effectively manage innovation in open networks. These are related to the skills identified for network managers in general. Network managers need skills in facilitating, mediating and being a catalyst for activities, rather than for building management through hierarchical structures and control (see e.g. Nykänen & Jyrämä; 2012).

The collaboration practice itself—for example the agreements, governance systems, reporting measures and management—needs to be built on international

standards. Continuous collaboration can only be based on mutual understanding and trust (on the one hand), and tangible and measurable results (on the other). Mediating is also required—for example for interpreting the professional language of diverse parties and translating meaning from one field to one another—for facilitating continuous co-creation activities. The actual creation of an innovative network—and enabling its activities—requires network management skills that are separate from the content, yet essential for the smooth and efficient working of the innovation processes.

6. Roadmap to an Open Innovation Ecosystem

Aalto University follows a roadmap to ramp up open innovation ecosystem activities (see Figure 3). The first two phases are currently underway. In the initial planning phase, a Regional Innovation Strategy process has been co-create with the Helsinki-Uusimaa Regional Council, engaging numerous regional stakeholders, in an effort to build a common vision and to increase shared participation in innovation processes. In the second, strategy phase, more extensive planning and benchmarking are being conducted with researchers and stakeholders, and digital services related to the innovation ecosystem are being prototyped.

In the Ecosystem-phase, location-free innovation services will be developed further, innovation activities will be linked to cities' development activities and more

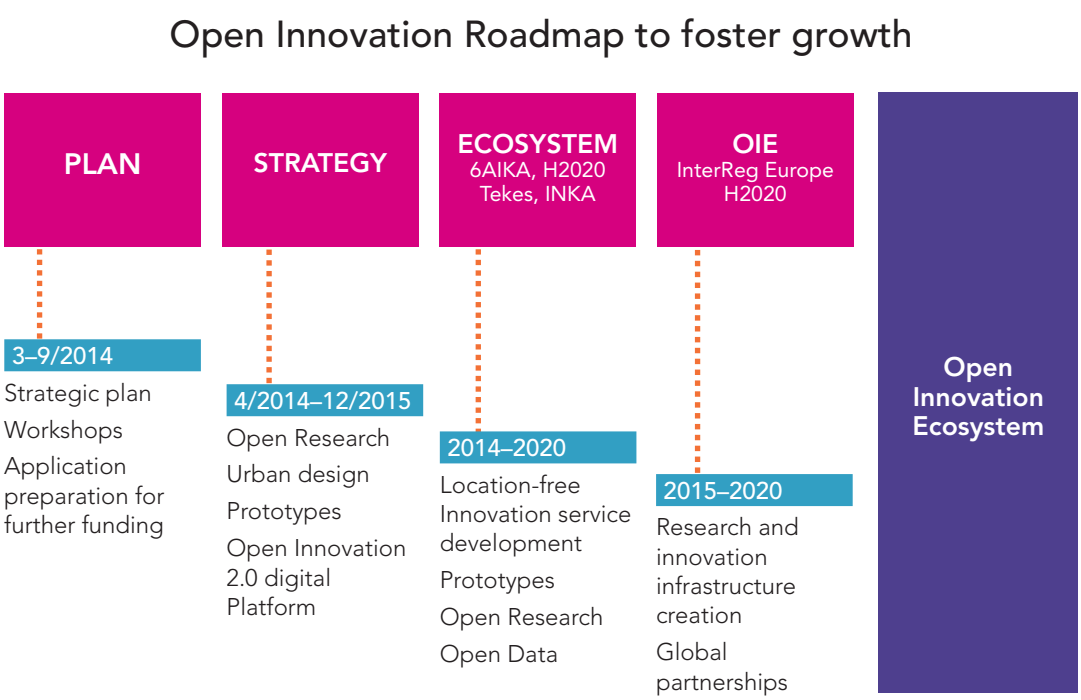


Figure 3. Aalto's Open Innovation Roadmap.

pilots and prototypes will be launched and facilitated. Moreover, an inter-organizational governance system, facilitation models and processes will be established here. In the Open Innovation Ecosystem (OIE) phase, open innovation activities will be scaled up and operations will result in a clear increase in R&D investments in Finland.

Such an ecosystem will only be successful if global corporations and other relevant partners see Finland as an interesting location to increase their research and development activities. Finnish institutions need to develop tools and concepts, as well as skills and competences, to manage innovation networks, increase the volume of collaboration with global partners, and ensure their quality.

7. Encouraging Entrepreneurship

Promoting entrepreneurship, developing the associated commercial skills and supporting the foundation of new knowledge-intensive businesses are essential facets of Aalto University's strategy for enhancing its societal influence. Creating an entrepreneurial spirit and culture forms an inherent element of the university's research and teaching activities. The university invests in championing entrepreneurship based on top-level academic knowledge and expertise. This is achieved by reforming the educational process and by collaborating with financiers to develop flexible systems for supporting the creation and development of growth companies.

Since the creation of Aalto University, the results of promoting entrepreneurship have been encouraging. Alumni companies of Aalto's Start-Up Center have already created more than 2000 jobs, of which more than half have been created in high-growth gazelle companies. New concepts for start-up acceleration, such as Start-Up Sauna, SLUSH and AppCampus, have been launched with unprecedented success. These achievements are possible because of the strong engagement and investments made by networks affiliated to the University and its ecosystem.

Critical Success Factors for an Efficient Entrepreneurial Community

At the 2014 Committee of the Regions conference on Smart Specialisation Strategies, Aalto University Provost Ilkka Niemelä presented a number of critical success factors for entrepreneurial communities. The list, further developed here, indicates the following success factors:

1. A systemic approach to creating regional innovation ecosystems based on the culture of open innovation and knowledge co-creation
2. Experts with an entrepreneurial mindset and multidisciplinary skills
3. A network of partners with diverse complementing competences
4. A tradition of public-private-people partnerships and collaboration

5. Hubs for interaction: a) physical locations to meet, interact, and collaborate integrated with b) virtual collaboration environments and c) facilitation processes to connect the dots and bridge the gaps between partners and phases of interaction
6. An entrepreneurial community-of-practice: start-ups, incubators, accelerators, and investors
7. Basic assets of the community: Open principles and open innovation to encourage entrepreneurial discovery

Many of these factors already characterize Aalto's entrepreneurial ecosystem and indicate that the region's early moves in this direction are ready to bear fruit. Of course, as we have stated earlier, the key is continuous innovating in networks—both established networks and newly emerging ones—and these early steps need to be reinforced through good orchestration and consistent attention.

8. Conclusions

As stressed in the Committee of the Regions' Opinion on **Closing the Innovation Divide,** "Regions need new arenas as hotspots for innovation co-creation. These could be described as 'innovation gardens' and 'challenge platforms', which together form prototype workspaces for inventing the future." Espoo Innovation Garden, with Otaniemi and Aalto's open innovation initiative at its core, is just such an arena for innovative co-creation, and an important driver of regional change.

Looking inward, the region should identify potential weak spots and possible challenges to its further development. It can also learn from other European cultures about anticipating possible social and societal disruption and the problems that might arise from increasing globalisation, migration and multicultural society, and the demands of citizen engagement.

In a broader European context, Finland is capable of playing a major role in open innovation due to its society, culture and traditions. Aalto University has developed an effective entrepreneurial ecosystem model, serving the local community and affecting the innovation capacity of the region, which other European regions can look at and learn from. It can serve as a European best practice for benchmarking and benchlearning the role universities play in regional development. Its embodiment of the Nordic Way in developing a viable innovation ecosystem can help create the basis of a **northern school of management,** becoming an inspiration to other regions looking for insights into improving quality of life in their communities.

All told, the Aalto open innovation initiative is a key driver for creating a forward-thinking, pioneering region that serves the needs of its citizens, and a powerful example to other regions in Europe looking to do the same.

References

Björk, J., Boccardelli, P. and Magnusson, M. (2010). Ideation Capabilities for Continuous Innovation. Creativity and Innovation Management. 19 (4), 385–396.

Chesbrough, H. (2006). Open innovation: the new imperative for creating and profiting from technology. Boston, Massachussetts: Harvard Business School Publishing.

Committee of the Regions (Official Journal of the European Union, 30.7.2013): "Opinion of the Committee of the Regions on 'Closing the Innovation Divide'" (2013/C 218/03). Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012AR2414&from=EN

Committee of the Regions, edited by the Directorate for Communication, Press and Events. (2014). Innovation Union: The Contribution of Europe's regions and cities (Proceedings of the conference of 27 November 2013). Available at: www.cor.europa.eu/europe2020.

Dhanaraj, C., Parkhe, A. (2006). Orchestrating Innovation Networks. Academy of Management Review, 31(3), 659–669.

Drejer, A. (2002). Situations for innovation management: towards a contingency model. European Journal of Innovation Management, 5(1), 4–17

The Economist. The next supermodel Politicians from both right and left could learn from the Nordic countries. February 2, 2013. Available at: http://www.economist.com/news/leaders/21571136-politicians-both-right-and-left-could-learn-nordic-countries-next-supermodel.

European Commission, DG for Research and Innovation (2013). Innovation Union—A pocket guide on a Europe 2020 initiative. Publications Office of the European Union, Luxembourg. Available at: http://ec.europa.eu/eip/agriculture/sites/agri-eip/files/innovation-pocket-book_en.pdf.

Evans, J. St. B.T. (2010). Thinking Twice—two minds in one brain. Oxford University Press.

Hellström, C. and Hellström, T. (2002). Highways, Alleys and By-lanes: Charting the pathways for ideas and innovation in organizations. Creativity and Innovation Management. 11 (2), 107–114.

Järvensivu, T., Nykänen K. and Rajala, R. (2011). Holistic model of innovation network management: Action research in elderly health care, in Harmaakorpi, V. and Melkas, H. (Eds.),Practice-Based Innovation: Insights, Applications, and Policy Implications, Springer.

Juhala M. & Andersen A. (2014). Industry Collaboration Catalysis. FISITA 2014 World Automotive Congress, June 2014.

Möller, K., Rajala, A., Svahn, S. (2005). Strategic Business Nets—Their Type and Management. Journal of Business Research, 58(9), 1274–1284.

Monday Morning: The Nordic Model:—Local government, global competitiveness in Denmark, Finland and Sweden (2012). Available at https://www.mm.dk/pdf.php?id=52289.

Nambisan, S. and Sawhney, M. (2011). Orchestration Processes in Network-Centric Innovation: Evidence From the Field. Academy of Management Perspectives, 25(3), 40–57.

Nykänen, K. & Jyrämä, A. 2013. Functioning network structures: The role of collaboration processes and their management. IMP Conference, Atlanta USA, 30.8–2.9 2013.

Poskela, J. and Martinsuo, M. (2009). Management control and strategic renewal in the front end of innovation. The Journal of Product Innovation Management. 26, 671684.

Ritter, T. & Gemünden, H.G. (2003). Network Competence: Its Impact on Innovation Success and its Antecedents. Journal of Business Research, 56 (9), 745–755.

Rothwell, R. (1992). Successful Industrial Innovation: Critical Factors for the 1990s. R&D Management, 22(3), 221. Available at : www.aalto.fi.

VandenBos, G.; Knapp, S.; Doe, J. (2001). Role of reference elements in the selection of resources by psychology undergraduates. Journal of Bibliographic Research, 5, 117–123. Available at http://jbr.org/articles.html.

About the authors

Atso Andersen, PhD (Economics) is currently a Head of Institutional Relations at Aalto University. Before his transfer to Aalto University four years ago he worked in various roles in the finance industry. Andersen has written several books and articles about industrial organization of the financial markets and operation of stock exchanges.

Riina Subra develops multi-disciplinary research and education partnerships and approaches to promote the longer-term societal impact of university collaborations. She specialised in management, partnerships and strategy design with international organisations, working both in the field and at the global level. She is currently Partnerships Manager in Aalto Institutional Relations and Senior Manager in Aalto Global Impact.

Annukka Jyrämä PhD, Docent, is specialised in city relationships developing collaboration between Aalto University and cities, facilitating multi-disciplinary research and development projects. Her current research interests include knowledge creation processes, social responsibility and the role of mediators from institutional and network theory perspectives. She has conducted studies in such contexts as cultural, city and business. Her research has been published in several journals, e.g. in the International Journal of Arts Management, Marketing Intelligence and Planning, and Management Learning. She is working as Relations Manager, City partnerships at Aalto University.

Hank Kune works with diverse corporate and government organizations in projects about societal innovation and renewal, with a special emphasis on hands-on problem solving in complex social, societal and organizational situations. He is director of Educore BV, Founding Partner and member of the governing board of the Future Center Alliance, and an active member of the New Club of Paris, a global network organization working as agenda developer for knowledge societies, where his focus is on entrepreneurial initiatives and societal innovation coaching.

Erkki Hämäläinen
Professor of Practice Emeritus
Aalto University School of Business
Department of Information and Service Economy
erkki.hamalainen@aalto.fi

13. Experiences of a Professor of Practice at Aalto University

Abstract

Aalto University centers on innovative learning and research. In such a setup, business experience, created in practice, is a unique asset; it means managing turbulence, continuous decision making, hands-on participation in real-time situations, exceptional know-how, and also personal networks. Unfortunately CEOs and the academic world often speak different languages, resulting in a certain gap in understanding between them. A Professor of Practice interacts and contributes substantially to the co-operation between business and academia. Such a role is dominated by practice and managerial performance, which enables new aspects for multidisciplinary research and education. Experiences at Aalto University from the Professor of Practice institution are positive. This article reveals my personal experiences, how these two worlds co-operate and what the role of the Professor of Practice institution could play.

KEYWORDS: Interaction, Business, Academia, Practice

1. Aalto University Professorship

Aalto University was founded to meet a variety of challenging goals. One of the targeted and ambitious aims was and still is the strengthening of the internationally high level of professorship, both quantitatively and qualitatively. To pursue this, a tenure track system was tailored for Aalto (Figure 1). The Aalto tenure track career path consists of three basic levels, and candidates can be recruited to any of the three levels depending on his or her experience and competence: Assistant Professor, Associate Professor, and Full Professor.

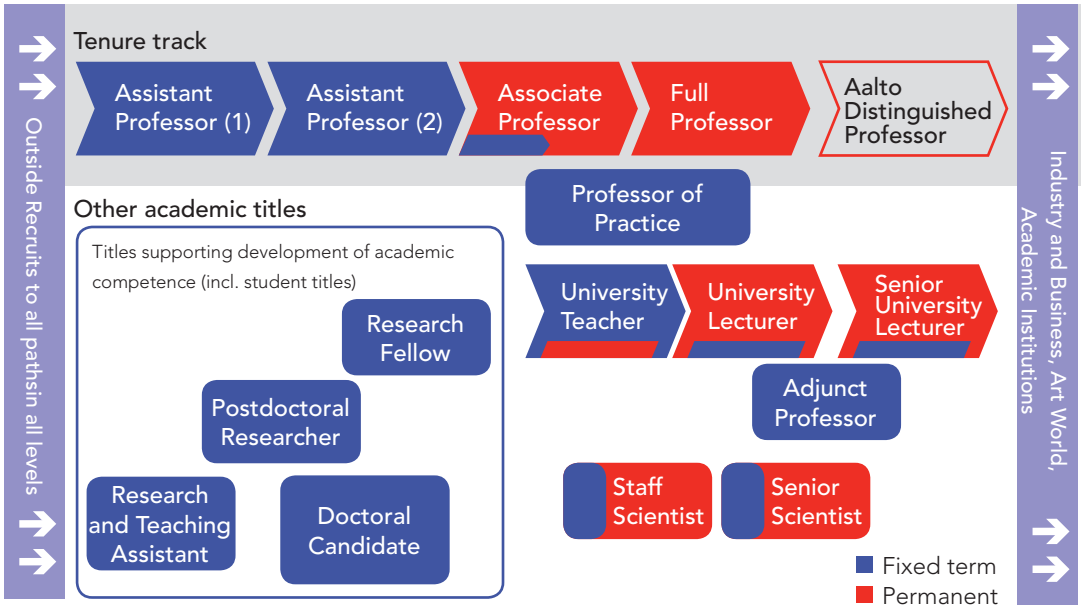


Figure 1. The Aalto Tenure Track System.

Aalto tenure track is based on the commitment of the university and the individual to the academic career; it has clearly defined expectations, incentives, and assistance for personal development. The objective is to reach world class in research and/or artistic and professional work, teaching and activity in scientific community and academic leadership.

Roughly half of the 425 tenure track or tenured professors have been appointed during the short history of Aalto University; the first tenure track positions were opened in fall 2010. Approximately 30% of these professors come from abroad and a good 25% are female. The amount of applicants has been around 20-fold compared to the number of openings and 2/3 of the applicants come from outside the borders of Finland. "We have succeeded in building a well-functioning career system that attracts high-quality professors from different parts of the world," reports Provost Ilkka Niemelä.

In addition to these tenure track and tenured professors, Aalto hosts also other professors, such as fixed-term professors, visiting FiDiPro professors (the Finland Distinguished Professor Programme financed and led by Academy of Finland and Tekes), Adjunct Professors and Professors of Practice so that the total number of professors amounted to 500 at the end of 2014. The different schools have the following amounts of professors: School of Arts, Design and Architecture 76, School of Business 96, School of Chemical Engineering 53, School of Electrical Engineering 65, School of Engineering 80, and School of Science 130. The Professors of Practice that have typically been well-experienced professionals in corporate or public-administration positions have proven particularly significant for the university's activities on private and public-sector innovation ecosystems. They represent a total of 10% of Aalto professors.

2. Helsinki School of Economics (HSE) as a Pathfinder

Helsinki School of Economics (HSE, presently Aalto University School of Business) had for quite some time harnessed ideas about better interaction between business and university education and research. Many HSE professors had experiences from visiting foreign universities, especially US and European business schools. However, many professors lacked experiences from the corporate world. As an attempt to improve the university-business interaction, Rector Eero Kasanen created a new position **Executive in Residence** (EiR) at the HSE in 2008. At the time, this represented innovative thinking.

The first EiR at HSE and the first PoP at Aalto, Dr. Hämäläinen, formulated the following vision for EiR: "foster a close and interactive working relationship between business community, academic world and education". Vice Rectors Olli Ahtola and Timo Saarinen were dynamic resources in exploring and designing this type of a job to enhance the interaction between theory and practice. Multidisciplinarity in the academia opens up new insights into diverse university applications. Vice Rector Ahtola had twenty years of experience from tenure track and EiR in the USA, also designing the people processes and managing the program. The core capabilities of the candidate for the HSE system were accordingly defined as "managerial experiences combined with university needs and thinking and manager with a doctor's degree".

In an interview, Professor Saarinen explains their brainstorming in an HSE team in the early 2000: "We in the university need closer contacts and interaction with the business world for our future education and research. New organizational thinking is necessary. This also implies more 'Rigor and Relevance' in our research and education and a better compliance with business challenges. Business schools, such as Stanford, Berkley, MIT, UNLV and some others in Europe have long since done this. Rector Kasanen's management team developed the HSE Tenure track and designed an additional idea of a 'Clinical Professor' in 2005 with keen co-operation with business life. This title sounded, however, slightly strange to the academia. Vice Rector Ahtola informed his faculty of his positive EiR experiences in the USA, which was also here quite an unknown job. This opened the path to establish 'The Executive in Residence'-position directly reporting to the Rector of the HSE. Administrative steps were taken by Vice Rector Hannu Seristö in 2008."

The first Executive in Residence was Dr. Erkki Hämäläinen, who had more than 25 years of experience from different business cultures as CEO and a wide network within the corporate world. He was also D.Sc. in logistics from HSE, an experienced lecturer, and well connected with the HSE organization and many of the professors.

This job was the first of a kind in Finland, and warmly welcomed to the academic world. It was also an interesting post for Dr. Hämäläinen personally. Otherwise it could have been difficult for a practitioner or former CEO to enter the academic world after a career in business. They seldom have many research publications required for an academic career. The job description for the EiR was in the beginning

fairly open, depending on the needs of the HSE and the EiR. There were many operative and also strategic issues in which the HSE had limited resources and needed creative thinking.

The start for the EiR was quite fast. Erkki Hämäläinen's duties included lecturing in EU logistics, Supply Chain Management, effective board operations, general management, working in teams, small business practices, entrepreneurship, and mentoring. The HSE strove also to intensify its relationship with Russian universities, their education and research. Back then the once active Soviet-Finland collaborative ventures had dried up. The state-of-affairs in HSE-Russia scientific collaboration was weak despite some formal agreements. One of the first new openings took place in St Petersburg and Moscow. Co-operation is currently operative in many fields: CEMS education, professor and student exchange and doctoral research. The HSE experiences motivated the co-ordination also of other interests in Russian co-operation within Aalto University, especially within Arts and Design.

3. Aalto University Continues: PoP and EiR for Diverse Needs

Aalto University aims to be in world class by 2020. In its vision "Business meets technology, arts and design". This is an innovative vision, which aims to foster interaction between business and university. PoP and EiR are presently adopted at Aalto University according to the needs of the schools. The total number of PoPs at Aalto University is about 20. The appointment of PoPs and EiRs continues.

The Professor of Practice (PoP) system is part of the Aalto career structure and additional to professors' Tenure Track system. Especially Arts and Design started actively promoting Professor of Practice positions to attract talent and experience from outside the university. Many engineering schools also found POPs an excellent choice for their departments. Executive in Residence (EiR) is alternatively available as a part-time job. Contracts are typically made for 3–5 years. These positions are organized by the Deans and managed by the departments. Aalto BIZ had ten PoPs (five part-time) and one part-time EiR in 2014.

Both PoP and EiR are currently widely adopted in different departments of Aalto University (Figure 1 Aalto Career Structure). Both have different backgrounds and candidates. Dr. Erkki Hämäläinen is still active in different roles and now as Professor of Practice Emeritus from 2014 onwards in the Department of Information and Service Economy. He does not hesitate to share how often he has received positive comments from corporate CEOs on the roles of PoP and EiR at the university: "This is what universities need. Business and academia are different worlds and they need more interaction. Understanding and co-operation has much improved as a result of these roles". This has been noted also among many international universities, as PoPs actively participate in research as supervisors or researchers or attendees in scientific forums and symposiums.

Experiences at Aalto School of Business convey the intent and willingness of Aalto to make contributions to the traditional university concept. Professors agree on the contribution of PoPs. "Our scope has enlarged from educating bachelor students to higher levels, placing demands on industry-university collaboration. PoPs can play an important role in making our educational programs more attractive and relevant to our students, drawing from real business experiences," explains Professor Jyrki Wallenius, Head of Information and Service Economy at Aalto School of Business and chairman of Professors Council at Aalto University.

Professor of Logistics Markku Kuula continues: "Supply Chain Management is in a core role in global competition, as well as in our teaching and applied research. PoPs have brought to our disposal a wide local and international business network and managerial experiences. We have, among others, benefited from new contacts to CEOs and authorities, learned new customs, enjoyed Dr. Hämäläinen lecturing on EU logistics, created new business networks for professors and researchers, formed contacts to foundations, and research funding, improved our master's thesis supervision—we have, in fact, accomplished quite a lot."

4. PoP is an Asset with Diverse Experiences

Business experience is the real capability of a PoP, stemming from the management of complexities and **learning by doing** in the real world. This capability of understanding the rules of business practices, leadership or management is often lacking in our universities. The tenure track system has a high emphasis on research publications and innovative teaching. Professors or researchers seldom have experience from business life or management, in which constitute the topics they teach or research. PoP has an innovative role in developing societal impact for the university. PoP is regarded as a **neutral** role in the university hierarchy, providing benefits for both research and education. There are many sectors where PoPs contribute, such as:

4.1 Lecturing

Innovative learning needs real-life cases, active participation of students and business executives to comment on the solutions. Students appreciate learning during interactive lessons and group work in real-time-situations. PoPs have a network of corporate CEOs, CIOs, R&D executives, HR directors, and professional associations, which supply lecturers for topics in need. PoPs are also experienced in managing large corporations, SMEs, global race, international co-operation, mergers and acquisitions, business cultures, decision making under uncertainty, but also business failures, which provide an interesting source for lectures, cases and research data. Course development with professors secures operative, real-world substance to teaching materials in master's- and bachelor's -level courses.

4.2 Research

Having completed their own doctoral research, PoPs also have an understanding of academic research and thesis writing. PoPs as supervisors for doctoral students or masters' thesis provides much needed **rigor and relevance** for the research themes. This is useful also for post doc researchers. PoPs attend research seminars or participate in research projects, EU and Finnish Academy projects and international research symposiums, where practice meets academia, which offers a multidisciplinary experience for both parties. PoPs may also open doors or provide useful contacts to researchers or professors.

4.3 Roundtable meetings

Roundtable meetings between business and academia are good forums for identifying future research and innovative teaching. A good example was a recent Roundtable on Supply Chain Thought Leader: Aalto University School of Business/ Logistics invited leading international professors of logistics together with business executives and PoPs to share experiences from teaching and research. They also exchanged ideas for future research areas and topics. A few days of intensive networking, combined with company visits and presentations, provides potential to make an international impact on the business-academia collaboration.

4.4 Mentoring

Mentoring is presently well organized in firms and universities. PoPs have a good opportunity to participate in the mentoring system for junior faculty, doctoral students, or even professors by providing their experiences and ideas for further development to aid individuals in their careers.

4.5 Providing ideas for and coaching university leaders

PoPs have managerial experience, intimate knowledge of business practices in innovative and/or outdated organizations, board work, corporate governance, business ethics, lean management, ways of contributing to societal impact, mergers between companies, and international co-operation. These experiences could be tremendously useful in helping university leadership in its decision making and in applying best practices.

The mentality shift from state-owned university to a foundation-managed university has also induced a change in the managerial culture and governance principles. Changing the culture and adopting more managerial leadership is new for many professors and other university staff. Merging three universities is quite a challenge. Business directors have much experience from best practices, mergers, acquisitions and innovative managerial choices, which could be applicable to university management. Supervision and coaching creates positive energy for the university renewal.

PoPs as an informal supervisor or second opinion reviewer in managerial challenges for university leaders is also valuable. As a case in point, Dr. Erkki Hämäläinen has had countless discussions with Professor Jyrki Wallenius, former Dean of the Aalto School of Business and the current chair of Aalto University Professors Council. Professor Wallenius comments on these discussions as follows: "They have indeed been most useful. They have dealt with all the important aspects of our School and Aalto University, from the formation of the Professors Council to strategy and corporate collaboration, to career paths, leadership issues, and the role of the grown service organization."

5. Conclusions

Business experience and co-creation with university research and education has entered the academia. Business experience has been important from the early days of business education and research at the HSE. Business people established the HSE over a hundred years ago. The managerial and scientific gap is still quite a challenge in spite of the many new ideas, plans and attempts. Aalto University continues what Helsinki School of Economics started.

Aalto University has organized a new tenure track system for multidisciplinary scientific research and creative education, linked with business professionals. There are many alternatives to develop education and **rigor and relevance** in the theoretical or applied research with the business economy. Both Executive in Residence (EiR) and Professor of Practice (PoP) titles are active steps towards innovative education and intelligent learning within the academia. EiRs and PoPs are substantial resources with managerial capabilities and networks which the academia could benefit from in developing its societal impact. Positive experiences seem to continue at Aalto University and also within other prominent Finnish universities.

About the author

D.Sc. (Econ) **Erkki Hämäläinen** has had two careers: one in business, one in academia. He has CEO-and board experience for over 25 years and academic experience for over 10 years. He has corporate experience from different business cultures, international markets, large corporations, SMEs and start-up companies. He has worked with people representing different generations and operates as part of an exceptionally wide social network in the business world. In addition, Dr Hämäläinen has served and still serves in numerous important Finnish Foundations, financing business research. As a Professor of Practice Emeritus, he continues as an entrepreneur in CEO Consulting and unofficially consults university leaders.

Pentti Launonen
Project Manager, M.Sc. (Tech.) and Doctoral Candidate (Econ.)
Aalto University, Finland
pentti.launonen@aalto.fi

14. Determinants for Orchestrating Open Innovation Networks

Abstract

The research on leadership of interorganizational networks appears to be comparatively recent, limited in number and concentrating predominantly on for-profit firms. Also orchestration of innovation networks seems to be a recent phenomenon. Our research advances these areas of research conceptually from public-private networks point of view in dynamic ecosystems and also from a practice point of view, based on an action design research. Literature findings on orchestration of open innovation networks are discussed. These are followed by findings from a Finnish research programme, verifying and expanding the concepts of determinants for innovation orchestration with network properties. The findings help innovation practitioners and researchers within the innovation management community to better understand collaborative practices in open innovation networks.



KEYWORDS: Orchestration, Open innovation, Interorganizational networks, Innovation ecosystem, PPP; Public-private-partnerships, Heterarchical networks

1. Introduction

Innovation in networks cannot always be managed; often orchestration—the process of creating conditions and support infrastructure whereby innovation can emerge and be sustained—is required. Many innovation management processes in organizations, private or public, are well understood and documented, contrary to the processes of orchestrating open innovation networks and innovation ecosystems. This article addresses these processes involved in creating, supporting and maintaining a regional innovation ecosystem in which diverse parties—large industries

and SMEs, local government bodies, knowledge institutions and diverse other actors—participate. Together they form several open innovation networks within a regional innovation ecosystem, for collaboratively creating products and services for local and global markets, addressing issues of social, societal and sustainable innovation. In these networks, the participants are not hierarchically organized around hub firms but form dynamic partnerships on equal basis, coming from private, public and civil sectors.

Müller-Seitz (2011) has found the research on leadership of interorganizational networks comparatively recent, limited in number and concentrating predominantly on for-profit firms. The previous research has been primarily oriented towards the fields of network and public management or business networks but not towards public-private networks, the focus of the present research.

Orchestration of innovation networks seems also to be a recent phenomenon. Dhanaraj and Parkhe (2006) have studied orchestration of innovation networks but only around hub firms. Ritala et al. (2009) have studied individual and organizational determinants for innovation orchestration capability. Our research advances these studies not only conceptually from the public-private network point of view in dynamic ecosystems but also from a practice point of view, based on an action design research. The main research question in this paper is how to orchestrate open innovation networks and ecosystems.

For an innovation ecosystem, we adopt the definition of Mercan et Göktas (2011):

"An innovation ecosystem consists of economic agents and economic relations as well as the non-economic parts such as technology, institutions, sociological interactions and the culture. Non-economic components or innovation structure can enable idea making, introducing innovation and diffusion of them. A highly developed innovation ecosystem helps participants to operate beyond firm boundaries, enable to transformation of knowledge into innovation."

This is close to Henry Chesbrough´s definition of open innovation (2003):

"Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model."

2. Research Methodology

Our research design is abductive. We aim to synthesize the existing theoretical understanding of network orchestration and complement it with our action design research. Sein et al. (2011) propose action design research as a research method for interwoven organizational and IT artefact research where artefacts are ensembles shaped by the organizational context during development and use. We apply this research method to orchestrating our case networks and ecosystem, in physical and virtual environments. Tentative conclusions about methodologies and work process-

es are translated into concrete interventions. Epistemologically our research represents interpretative realism and dialogical action research where both researchers and organizations reflect their everyday practices and aim to increase practical and hermeneutical knowledge (Park, 2006; Maurer & Githens, 2010).

The unit of analysis in our research is organizational but the level of analysis covers network, organizational and individual levels.

3. Case: A Finnish Research Programme

Our research draws conclusions from both the recent literature and from the authors' experience from orchestrating a regional innovation ecosystem during the first year of a Finnish four-year research programme Energizing Urban Ecosystems EUE. The project was financed by Tekes, the Finnish Funding Agency for Technology and Innovation, and by one of the Finnish SHOKs, Strategic Centres for Science, Technology and Innovation (SCSTI) in Finland. Our research case is in the capital area of Finland which has the most significant concentration of innovation activity in the whole country. The research consortium consists of universities and research institutes, cities and private companies.

The research programme seeks to find operational models and solutions to the challenges posed by urbanization. The goal is to create user-centric and competitive urban solution concepts applicable to both existing and new areas. The solutions to innovation activity, energy use and mobility will be integrated with designs of the built environment, land use and ecosystems of service production. The concepts to be developed in the EUE program will be modelled, simulated and tested e.g. in the Espoo T3 area (Tapiola-Otaniemi-Keilaniemi), in conjunction with the development of a pilot area in Helsinki, to be further tested in urban development projects in China. Research and development will also be conducted on water supply and sewerage solutions and improvement of international competitiveness of water technology, e.g. in Mexico. Thus, the research programme aims to create a globally networked platform for co-operation in various R&D projects for urban design and development.

In such Public-Private-People-Partnerships (PPPP), cities act as supporters and substrate for ecosystems and as transition arenas. At the core lie the university's subject-related research and its internal and external value networks. The project activities are based on orchestrated processes and facilitation in the university-industry interface; by combining scientific achievements and innovation activities via the concept of the Knowledge Triangle (Figure 1), the research process examines specified and wide phenomena in society. This orchestration and facilitation has been incorporated into the research programme and its work package Regional Innovation Ecosystem (RIE) already during the planning phase, and it builds on experiences and learnings from previous research programmes as well as on action research, developing methodology for innovation ecosystems.

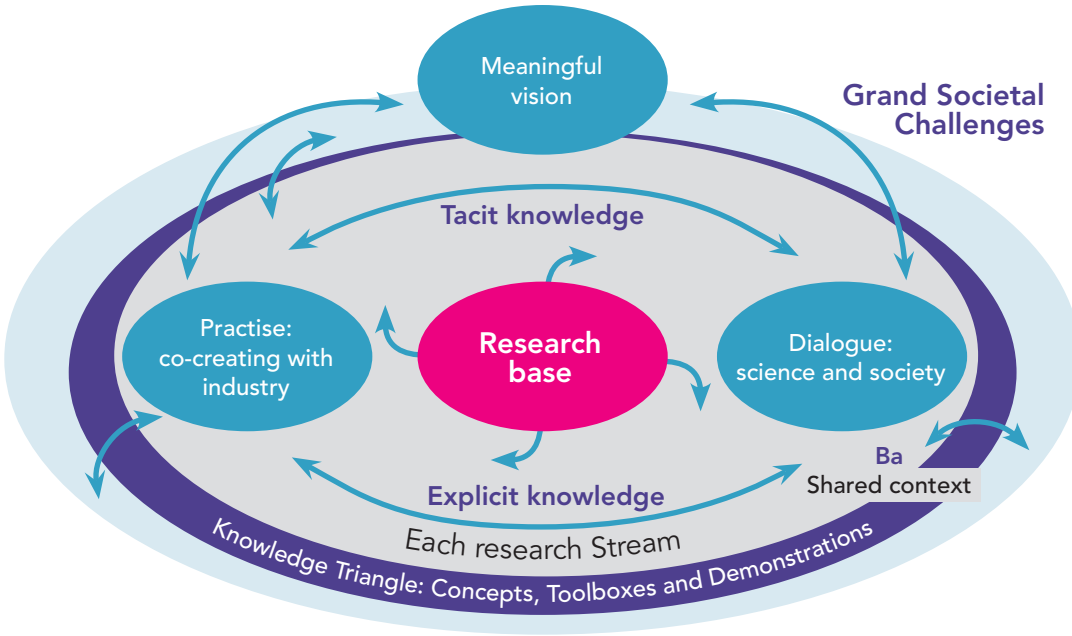


Figure 1. EUE Approach in Implementing the Knowledge Triangle for Public-Private-People-Partnerships (Markkula et al., 2009, 2011). Developed from: Nonaka, I., Toyoma, R. & Hirata, T. (2008): Managing Flow—A Process Theory of the Knowledge Based Firm.

4. Findings

In the following, literature findings on orchestration are discussed first. These are followed by findings from the EUE research programme, verifying and expanding the orchestration concepts.

Dhanaraj and Parkhe (2006) have studied the orchestration of innovation networks around hub firms and conceptualised orchestration to comprise knowledge mobility, innovation appropriability and network stability. By knowledge mobility, Dhanaraj and Parkhe refer to **"the ease with which knowledge is shared, acquired, and deployed within the network"**; by innovation appropriability, they refer to Teece´s definition as **"environmental factors… that govern an innovator´s ability to capture the profits generated by an innovation"** including legal instruments and nature of technology (Teece, 1986), applied to the network level; and by network stability, to dynamic stability aiming for growth while allowing for entry and exit of network members.

Building on this model by Dhanaraj and Parkhe, Ritala et al. (2009) have defined organizational and individual-level determinants for innovation orchestration capability. In the individual skills, they identified interpersonal communication and social skills as belonging to knowledge mobility; balancing, negotiating and entrepreneurial skills as belonging to innovation appropriability; and influencing, visioning and motivating skills as belonging to network stability. In the organizational capabilities, they identified operational, collaboration and competence-leveraging capabilities

as belonging to knowledge mobility; legitimizing, balancing and entrepreneurial capabilities as belonging to innovation appropriability; and visioning and influencing capabilities as belonging to network stability.

Järvenpää and Wernick (2011) have studied tensions in similar open innovation networks as the EUE research programme and highlighted the importance of repertoire of management approaches that include shared problem focus, new collaborative models, paradoxical thinking and transparency.

Hogg, van Knippenberg, and Rast (2012) have conceptually studied intergroup leadership and stress the importance of creating an intergroup relational identity where the self is defined in terms of the relationship between one´s own group and a specific outgroup, arguing for the importance of stimulating effective intergroup collaborations, among others, by rhetorically championing the collaboration, boundary spanning and leadership coalition.

Müller-Seitz (2012) has collected network-level outcomes from leadership at interorganization networks: as formal outcomes, rules / network structure, knowledge transfer and measures / indicators; and as informal outcomes, network vision / agenda, trust and capability / network strategy. In this research, we hypothesize that similarly to organizations that maintain their capabilities even if individuals leave them, so do innovation networks maintain their properties as orchestration outcomes even when individual organizations desert them.

Based on our action research material including reflective dialogues on the EUE research programme, we found support for the presented determinants but also for additional key factors. The following presents and illustrates these new factors, incorporated into Dhanaraj and Parkhe´s model with Ritala et al.´s skills and capabilities and expanded with Müller-Seitz network outcomes as network properties (Table 1).

Factors for individual skills include:

- Facilitation skills for Knowledge Mobility: in EUE, there have been joint workshops, demo days for sharing results and other participatory events, providing possibilities to contribute and to solve problems that have required appropriate facilitation skills; depending on the issue, the facilitation has been either context-neutral or –specific.
- Design and visualising skills for Knowledge Mobility: design thinking with focus on visualization has been utilised in the research, workshops and communications, including also reporting to stakeholders.
- Selling skills for Network Stability: the orchestrator is nominally and resourcing-wise in charge of recruiting new members to the research consortium, especially anticipating future resource allocations and complementing network capabilities; this requires understanding the value proposition and the drivers of potential candidates to join.

- Problem-solving skills for Network Stability: the orchestrator needs to solve issues and tensions arising in the network, both in managerial and leadership levels; one typical topic has been the allocation of a research budget.
- Change management skills for Network Stability: the orchestrator needs to believe in the vision and lead the network with his or her own example; further, when required, changes in the network and its structure need to be carried out, e.g. in a research programme structure and task division.

Factors for organizational capabilities contain:

- Co-learning capability for Knowledge Mobility: the participating organizations should embrace co-learning opportunities, e.g. in the form of joint demonstrations with which we mean rapid research configurations for key research questions, even Research by Design. In EUE, research questions have also been structurally combined into the same research themes, applications and environments where the leadership is shared jointly by industry and research partners; further, regular Demo Days have been arranged for knowledge sharing, joint reflection and learning.
- Prototyping capability for Knowledge Mobility: an iterative prototyping requires a new mindset from companies that are used to traditional detailed design prior to an implementation phase; this transition often requires time but needs to be implemented gradually for faster co-learning.
- Decision-making capability for Innovation Appropriability: representatives of the organizations in steering board need to be authorised to make strategic decisions in their organizations, otherwise the decision-making capability for the entire network is hampered.
- Paradoxical thinking capability for Network Stability: as highlighted by Järvenpää and Wernick, managing tensions using a complex set of behavioral approaches likely increases innovations, by balancing between collaboration and appropriation with dual leadership, fast cycle research and collective accountability.
- Conflict management capability for Network Stability: the orchestrator needs to diffuse tensions in the innovation network and facilitate constructive solutions, e.g. in contractual situations, in budget allocations or conflicts between different personalities.

Factors for network properties cover:

- Marketing / representation properties for Knowledge Mobility: The network needs to have authorised representatives that can market the network outwards, connect to other synergistic networks and recruit new members; in the first year of the EUE, this was not assigned formerly or budgeted and consequently not systematically planned.

- Knowledge transfer for Knowledge Mobility: as Müller-Seitz has reviewed, this means e.g. developing knowledge-sharing routines; in EUE, electronic platforms including groupware systems as well as regular Demo Days have been utilized.
- Forums for interaction for Knowledge Mobility: Both physical and virtual as well as experimental forums enable enriching interaction inside the open innovation network and with external parties. In the EUE programme, such a thematic co-working and co-creation platform called Urban Mill has been opened to facilitate knowledge mobility, with proprietary orchestrators.
- Trust and culture for Innovation Appropriability: Müller-Seitz has highlighted trust as an informal, critical social lubricant and necessary for a joint success; in EUE, trust has been strengthened formally with a consortium agreement, and culture building activities are being planned; culture building activities include further informal social events, value demonstrations, success celebrations and storytelling with metaphors. Nevertheless, one of the companies expressed that they prefer not to develop anything patentable in public research projects but in their own proprietary development programs.
- Rules / network structure for Innovation Appropriability: Müller-Seitz highlights rules and network structures as one of the key formal themes in networks. In EUE, a consortium agreement was signed, defining rules for Intellectual Property Rights and governance mechanisms. To promote participation and responsibility and to foster a common culture, also commons have been implemented, e.g. in operations of the Aalto Urban Mill.
- Focus for Innovation Appropriability: due to the limited resources but wide thematic research area in EUE, choices regarding research area were forced– both in the formation phase of the research programme and during the learning process as the research advanced.
- Ecosystem for Innovation Appropriability: in EUE, the research has been arranged around ecosystems common with the network partners and relevant to the programme vision; furthermore, the ecosystems are often interrelated, force systemic thinking and create natural cooperation among the partners.
- Strategic thinking for Network Stability: both the visioning work and utilization of research and development results require strategic thinking both at network and organization levels.
- Network vision and identity for Network Stability: according to Müller-Seitz, the establishment of a network vision or joint agenda seems to be relevant when setting up interorganization networks; further, Hogg et al. stress the importance of the identities. We agree with these but stress also the importance of the visioning work throughout the life-cycle of the innovation network as co-learning directs and gives focus to the network.

- Capability strategy for Network Stability: Müller-Seitz mentions this as one of the three key informal outcomes. In EUE, the visioning work has resulted in identification of new partner candidates to fulfill the foreseen capability gaps at the network level.
- Measures / indicators for Network Stability: Müller-Seitz highlight this as one of the three central formal leadership outcomes in networks; also in EUE, research and industrial development outputs are measured regularly, and we hypothesize that this becomes ever more important in the later phases of the network.
- Transparency for Network Stability: in heterarchical networks like the EUE, the need for transparency is heightened. This affected e.g. budget allocations and cost structures of coordination fees.

	Knowledge Mobility	Innovation Appropriability	Network Stability
Individual skills	Interpersonal communication and social skills Facilitation skills Design and visualising skills	Balancing skills Negotiating skills Entrepreneurial skills	Influencing skills Visioning skills Motivating skills Selling skills Problemme solving skills Change management skills
Organizational capabilities	Operational capability Collaboration capability Competence leveraging capability Co-learning capability Prototyping capability	Legitimizing capability Balancing capability Entrepreneurial capability Decision-making capability	Visioning capability Influencing capability Paradoxical thinking capability Conflict management capability
Network properties	Marketing / representation Knowledge transfer Forums for interaction	Trust & culture Rules / network structure Focus Ecosystem	Strategic thinking Network vision and identity Capability strategy Measures / indicators Transparency Reflexivity

Table 1. Individual skills, organizational capabilities and network properties of orchestration. Sources: Dhanaraj & Parkhe, 2006; Ritala et al.,2009; Müller-Seitz, 2012; Järvenpää & Wernick, 2011; Launonen, 2012; action research material.

- Reflexivity for Network Stability: the orchestrator together with the steering board need to reflect their leadership and its efficiency; we hypothesize that different phases of the network life-cycle require different leadership styles; e.g. self-organizing did not seem to be effective in the first year of the EUE programme but called for a stronger programme management; further, reflexivity is one of the key elements in transition management and orchestration of public-private-partnerships for societal issues (Launonen, 2012).

5. Discussion and Conclusions

The majority of innovation research focuses on hierarchical networks where hub firms control the ecosystems. Contrary to this, our research focuses on an ecosystem of equal partners, both from public and private sector, and on orchestration of such networks.

The results thus far increase understanding of how to orchestrate and create conditions for fostering innovation within open networks and ecosystems and of the kind of support infrastructure that is required to maintain them. Individual skills, organizational capabilities and network properties of orchestration are described.

The findings will help innovation practitioners and researchers within the innovation management community to better understand collaborative practices in open innovation networks. Politicians, civil servants and entrepreneurs striving to achieve societal innovations will be able to explore insights into what is required to make open innovation networks become effective. As the research advances, we expect that regions aiming to create innovation ecosystems will be able to learn from the EUE experiences as a case study.

References

Chesbrough, H. (2003). Open Innovation: the new imperative for creating and profiting from technology. Harvard Business School Publishing Corporation, Boston, MA, USA.

Dhanaraj, C. and Parkhe, A. (2006). Orchestrating Innovation Networks. Academy of Management Review, 31(3), 659–669.

Jarvenpaa, S. and Wernick, A. (2011). Paradoxical tensions in open innovation networks. European Journal of Innovation Management, 14(4), 521–548.

Launonen, P. (2012). Living Labs for Societal Transformation by Adopting Transition Management Methodology? The XXIII ISPIM Conference: Barcelona, Spain, Action for Innovation: Innovating from Experience, Lappeenranta University of Technology Press, conference proceedings.

Markkula, M., Pirttivaara, M. & Miikki, L. (2009). Knowledge Triangle presentation. Aalto University, Finland.

Markkula, M. (2011). EUE Research Program Process: Orchestration through the Work Package on Regional Innovation Ecosystems RIE. Unpublished EUE implementation plan, Aalto University, Finland.

Maurer, M. & Githens, R.P. (2010). Toward a reframing of action research for human resource and organization development: Moving beyond problem solving and toward dialogue. Action Research, 8(3), 267–292.

Mercan, B & Göktas, D. (2011). Components of Innovation Ecosystems: A Cross-Country Study. International Research Journal of Finance and Economics, 76, 102–112.

Müller-Seitz, G. (2012). Leadership in Interorganizational Networks: A Literature Review and Suggestions for Future Research. International Journal of Management Reviews, 14(4), 428–443 (published online 22 Nov 2011).

Park, P. (2006). Knowledge and participatory research. Published in Reason, P. & Bradbury, H. (Eds.). Handbook of action research, the concise paperback edition, SAGE Publications, London, 83–93.

Ritala, P., Armila, L. and Blomqvist, K. (2009). Innovation Orchestration Capability—Defining the Organizational and Individual Level Determinants. International Journal of Innovation Management, 13(4), 569–591.

Sein, M.K. & Henfridsson, O. & Purao, S. & Rossi, M.I & Lindgren, R. (2011). Action Design Research. MIS Quarterly, 35(1), 37–56.

Teece, D.J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. Research Policy, 15(6), 285–305.

Acknowledgements

This work has been partly co-funded by Tekes—the Finnish Funding Agency for Technology and Innovation. The authors wish to acknowledge Tekes for their support.

The first version of this research paper was presented at The XXIV ISPIM Conference—Innovating in Global Markets: Challenges for Sustainable Growth in Helsinki, Finland on 16–19 June 2013.

About the author

Mr. **Pentti Launonen** works as a Project Manager at the Center of Knowledge and Innovation Research (CKIR), Aalto University School of Business, in several national and European Commission funded projects. He researches orchestration of open innovation networks and ecosystems for his PhD in Information Systems Science at Aalto University. He is a member of the International Society for Innovation Management (ISPIM) and member of its scientific panel. Previously, Launonen has worked at McKinsey & Company, Nokia Networks, Nokia Mobile Phones and Warustamo.

Jari Handelberg
Research Director
Aalto University School of Business Small Business Center (SBC)
jari.handelberg@aalto.fi

Riikka Kuusisto
Project Manager
Aalto University School of Business Small Business Center (SBC)
riikka.kuusisto@aalto.fi

Toni Pienonen
Project Designer
Business Arena Oy
toni.pienonen@businessarena.fi

Mervi Rajahonka
Project Specialist, Researcher
Aalto University School of Business Small Business Center (SBC)
mervi.rajahonka@aalto.fi

15. Co-Creating Synergy: Learning-Driven Regional Development

Abstract

European funding is a crucial development instrument also in Finland. However, the rules of the game have changed due to the requirements of the 2014–2020 programme period, smart specialisation and the ongoing Finnish economic crisis. Higher education institutions (HEIs) are expected to play an increasingly important role in reinventing the country and boosting businesses, but the related implementations are still missing.

The INNOFOKUS project and its Change2020 development programme[1] sought out to do accomplish such improvements in practice. Documenting the views of a dozen Finnish regional developers, this article argues that promoting smart specialisation in Finland requires a continuous learning and participatory process with a totally different manner of approach. To make it

[1] Change2020 development programme was part of the operations carried out by INNOFOKUS project which was funded by European Social Fund, Ministry of Education. INNOFOKUS project was managed by Aalto University School of Business Small Business Center (SBC).

happen, the project culture needs to embrace new agile co-creation methods, supported by the organisational environment. Full material can be found from www.innofokus.fi.

KEYWORDS: Regional development, University-business-cooperation, Experimentation-driven development, Agile project development, Smart specialisation, Learning region

1. Introduction

The dawn of the new EU programme period 2014–2020 coincides with the Finnish economy struggling with the financial crisis. Funding instruments are expected to generate more results with less money. European project funding is one of the most important regional development tools for Finnish HEIs and their networks to tackle this challenge, but the new conditions require a new mindset to questions such as **What makes a good public development project?** and **How can HEIs be more in tune with society via projects?**

At the same time, Finnish regions are at different stages in adopting smart specialisation—others pioneering it with participatory processes, laggards either treating the subject of smart specialisation as business as usual or confused by uncertain expectations.

The INNOFOKUS project and its Change2020 programme developed tools for learning-driven regional development to tackle these questions. Throughout the year 2014, the programme organised several opportunities to create clarity on these issues. Following tens of participatory workshops and bench-learning events for hundreds of participants, we summarized the results under two perspectives that this article attempts to outline:

- Project perspective: Model for high-impact projects
- Thematic perspective: Toolbox—elements(10 themes) for enriching and energizing the project environment

2. Two Perspectives—Tools for Building a Learning-Driven Project Model

These two perspectives provide insight for any project designer, manager, regional developer or financing authority who wishes to plan stronger projects and portfolios with societal impact to meet the new requirements of the 2014–2020 programme period. Together, they are tools promoting and implementing smart specialisation in practice and boosting the creation of new internationally-focused SMEs and start-ups with the support of HEIs.

2.1 Project perspective: model for high-impact projects

The programme members learned that in the past, too many Finnish regional development projects have been planning-driven, rigid and managed in closed systems. Risk-taking has been minimized by rigid planning based on end-results. We documented the views of Change2020 participants into five a)-e) key learning points.

a) Co-creation is where it all begins. Regional development projects must be externally focused, demand-driven and rooted in the needs of the society, co-created together with users and partners, following the principles of open innovation. Society and businesses must be at the core of the projects and their planning phases. They bring out real-life problems, needs, opportunities and wicked problems that are worth solving with the help of HEIs and projects.

- Identify and formulate the need or opportunity
- Co-create the vision
- Co-create the solution
- Share active ownership

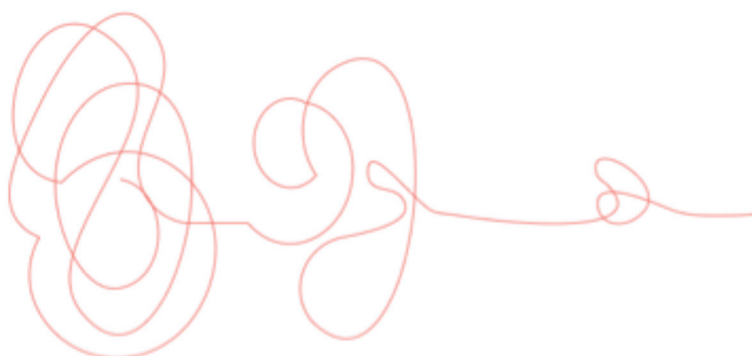


Figure 1. The many iterative loops of co-creation that projects should follow during planning and execution.

b) Projects should attach themselves in the Big Picture. Development projects are just tools to attain a desired level of change in a larger, Bigger Picture. They are always a part of something bigger—organisationally, regionally and activity-wise. Specifically, HEI-managed projects must integrate their outcomes and outputs into the two other missions of university, research and education. Any activity undertaken in the projects must be aligned to leverage and utilize the different types of university-society-cooperation. HEIs should involve teachers, researchers and students in projects as much as possible in project planning and execution. This creates spill-over benefits and integrates the project work results into other missions of the university—research and education. (Goddard & Vallance, 2011; Davey et al, 2011)

- Position the project in the portfolio (organisation's own, regional, national)
- Manage organisational integration

CASE EXAMPLE: *Portfolio thinking. For Finnish HEIs to be able to better reach out for international project possibilities, a sort of investment thinking towards project orchestration is required. Leveraging international funding with domestic funding helps to overcome reduced national funding. Building the portfolio starts with identifying a common theme that brings together different activities and actors. For example, the common theme can be a societal challenge or wicked problem, regional smart specialisation strength, emerging technology or industry / field. Whatever the theme is, a portfolio requires an orchestrator to support and facilitate the activity. However, since portfolios (and smart specialisation in regions) are essentially networks based on collaborative leadership, where leadership is shared and comes in different forms, as opposed to hierarchy and official leadership, the orchestrator needs to adopt a different kind of mindset than what is typical. The orchestrator does not manage the project portfolio, but rather helps different parties in collecting project information into the portfolio. Visualizing the Big Picture helps in defining the current status of development processes as well as in seeing the need for defining next steps.*

c) Create focus and relevance by building on your strengths. Projects should take a careful look at what kind of skills and expertise is required to make plans happen. Typical team-related problems in Finnish projects are often two-fold. Firstly, there is a total lack of a team: one person, the project manager, has to do everything from A to Z. Secondly, the project manager is hired purely on the merit of substantive competence, but projects need a variety of skills—from organising events to sales, productisation, communication and administration (bureaucracy). Furthermore, projects should make use of the specific strengths that are unique to the project organisation and region, making their uniqueness a value proposition for domestic and international partners. The project organisation should remember to outsource missing knowledge and expertise from partners, rather than building everything from scratch. For example, a university of applied sciences can focus on applying the newest technology from Horizon 2020 research to businesses with the help of a regional development agency, instead of developing it themselves.

- Have the right team with individuals with complementary competencies for different tasks.
- Make use of complementary strengths of participating organisations and regions.

CASE EXAMPLE: *Lapland and its smart strengths. During a Change 2020 workshop in Lapland, the participants found out that in addition to the regional specific strategic smart specialisation fields in mining, tourism and bioeconomy, the Finnish Lapland has plenty of other strengths and characteristics that make it a very unique region in Europe and globally. Some of the strengths that outsiders noted include:*

- Global megatrends are likely to promote the Arctic growth drive
- Regional learning: active staff exchange is typical of the daily work of Lapland's regional developers, which makes tacit knowledge transfer easier
- The international aspect is everywhere: three border countries, a long history of cross-border activity and good logistics connections help make "Lapland the most international region in Finland." International experience is one of the assets of the development activity.



- Lapland is the location for applying and testing technology in a unique setting: Lapland and its innovation ecosystem is not necessarily the best-suited place for developing and researching from the scratch, but the location and arctic conditions provide a unique setting for applying and testing new technologies and solutions in practice.

d) Agile experimentation is essential. Finnish project development remains currently too planning-driven. Instead, there should be more experimentation and agile processes. After all, one of the purposes of public development projects is to radically test new solutions that would be deemed too risky or unaffordable otherwise. When developing something entirely new, it is difficult to be certain beforehand where the results lead to. This is why working agile and learning by experimentation—by doing, testing and failing—is needed in projects, as opposed to more planning-driven development. In this mindset, failure is a success; it merely proves that something does not work. An idea is not fixed until it is certain that it works in

practice. In an experimentation-driven project model the key driver is rapid learning in order to create something unique. (Tuulenmäki, 2012)

- Experiment!

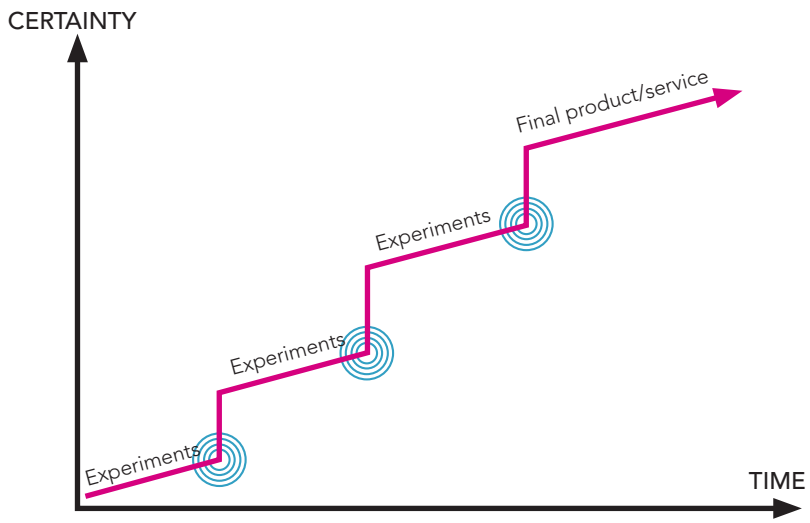


Figure 2. Experimentation-driven development, derived from Tuulenmäki (2012).

e) Learning should be at the core of development projects. By focusing on learning and self-reflection, it would be easier for projects and financing authorities to talk out loud about failures and mishaps without fear of punishment. Projects should reflect what kinds of internal learning processes they apply in practice and continuously ask themselves to what extent results of the experiences are shared with rest of the project organisation, and how aware stakeholders are of what is happening. With project work and its limited time, perfection should not be the goal. To make this happen, all projects should integrate a proper learning process into the project plan and organise time for people to experience it experimentally. (Järvenpää & Kankare, 2012; Markkanen & Pienonen, 2014)

- Keep learning

CASE EXAMPLE: *Kymenlaakso Change 2020 journey. During the programme, the KyAMK University of Applied Sciences became the regional primus motor in the process of setting smart specialisation on track in the region of Kymenlaakso. With the help of national bench-learning examples and common workshops, they learned first hand that smart specialisation is an incremental learning process of discovery and increasing co-creation—unlike many other regional development mechanisms or strategies adopted in Finland so far.*

2.2 Thematic perspective: Toolbox—elements of an enriching project environment

The Toolbox themes (10) are the elementary building blocks in generating and maintaining an innovative, co-creative co-learning environment. Productivity equals with the well-being of people working in organisations. Both the project culture and the values that are truly shared in the organisation are essential for the well-being of people and their productivity, not to mention the tools for working and co-learning that the organisation has to offer. Toolbox elements enable an innovative environment for individual projects, HEIs and other organisations—even companies. The Toolbox was co-created during a previous ESF funded project, Orkesterointi-Inno, and framed by an open innovation camp in Espoo 2011, the Aalto Camp for Societal Innovation ACSI2011 case group under the theme of **Tools for ESF Actors Creating New Collaboration and Networking Models.** The Change2020 programme developed it further on.

Besides the 10 Toolbox themes, three basic themes were identified that build the core and foundation for the co-creative collaboration culture and innovative working and learning environment. These themes cannot be taken for granted, but they call for common values and managing of the organisation's value culture. These three foundation pillars as well as sharing of common values assure an energetic, safe and innovative environment. These foundation pillars are **Trust, Respect and Joy.**

TRUST: Creating and maintaining the atmosphere of Trust as a living thing;
RESPECT: Safe environment created with atmosphere of respecting people: joint rules, positive and constructive thinking and acting, sharing of knowledge
JOY: Joy of and with co-creation.

3. Conclusion

When the two perspectives described above are put together and into practice in projects, organisations and regions, we believe that they enable a learning-driven and energizing bottom-up development environment, leading to a positive circle of change in projects and organisations reaching higher productivity. As it is, the Finnish regional development organisational cultures are perhaps too focused on control, killing creativity and the multidisciplinary approach.

Firstly, participatory learning drives smart specialisation. Change2020 participants learned first hand that smart specialisation is an ongoing process of discovery and learning where everyone learns by doing, experiments and social participation. Smart specialisation should not be a strategy paper that is written once and forgotten in the drawer. This learning process should be supported and facilitated on several levels.

1 CREATING GREAT BEGINNINGS	2 CREATING ART OF PROJECTS
(Always remember facilitation): Creating great beginnings by good facilitation is the most important factor in collaborative work throughout the project and development processes. Facilitation and co-creative collaboration require understanding of their importance by the management level as well as knowhow from the team members. Trust between network players and joy of working together depend on great beginnings along the common journey. • focus first on individuals and build relations • build teams, appreciate individuals • kick-off practices, facilitation methods	(How to break the prison of traditional project management thinking): The theme is about how different projects become more effective through synergy. Artistic methods can be applied to create a space that will help creating and supporting new innovations and human get-togethers, as well as creating trust and respect, and joy of working together. • project management should not be too strong • new language > new thinking • doing things in an energizing and inspiring way, avoiding repetition and routines • prototyping, testing, agility: lean and agile thinking and practices • common acceptance of uncertainty of not knowing the end-result and leaving space for serendipity along the way • not rushing to get the expected end-result but holding back to leave space for the unexpected
3 BUILDING TO LAST AND EXPAND	**4 CREATING NETWORKS FOR TALENT HUNTING**
(Thinking beyond the project life cycle): At the beginning of each project, well-defined objectives should be set concerning the manner in which the outcomes of the project will be distributed and how the results will remain living after the project period. This point has been one of the major development challenges in ESF funded projects. • knowledge and process models, organising future steps along the process • identifying the best tools and models for communication • connection to real life, project as a business pilot, thinking beyond the project • learning from previous projects, not starting always from scratch • thinking about the impacts and who will proceed with the project results	(It´s about recognition of individual competences, appreciation and making connections, knowing people and creating or identifying network of connectors or mediators): Finding the right expertise and networks would help project management. Currently there are no tools, channels or models at the project management level to find expertise. New network-based practices, working models and activities would enhance and improve this. • less focusing on the formal side, i.e. controlling money expenditure • new perspectives, mindset, role or position, system • new role of funding authorities: talent hunters / connectors—not controllers • national and international talent hunting, help internationalization by talent hunting

Table 1. 10 Toolbox themes in brief. These themes can be looked at from several point of views and differently in different environments. Therefore the descriptions below are just examples.

Secondly, each Finnish region needs an orchestrator to facilitate this process and draw the Big Picture with an exciting vision. An orchestrator can be a person or a team of people, who take the role (in an organisation, in a region or nationally) of support the development activity with information, resources and learning—transparently.

5 INVESTING IN NETWORKING

(F2F and virtual forums): Knowledge on how to operate in networks varies greatly among organisations and projects. Coaching, nationwide events, web-tools etc. would help the projects get into contact with different kinds of networks

- reserve time and budgeting for networking
- communication is the heart of networking
- social media, communication technologies
- competent people with open mind and good social skills
- Talent hunters helping in connecting people and looking for right expertise, orchestrating networking

6 CO-CREATIVE COLLABORATIVE THINKING

(Game spirit as part of co-creative work—benefits, interests, continuous communication): Facilitation and using tools and models that support collaboration in everyday project work is important, as well as employing multidisciplinary in research, development and innovation processes.

- knowing, what is important: why are we working in this project: what is the added value that we are creating
- forums and structures to collaborate frequently
- need for accepting uncertainty
- accepting failures as an evident part of common learning processes

7 PROMOTING INFORMAL WAYS OF WORKING

(Collaboration and co-creation, energizing working environment): The theme is about innovative teams and facilities and the physical or virtual environments where we work. The place itself should empower people to be creative and to think freely. This theme is about empowering working environments where control is replaced by trust—both in the organisation structure and the way it works as well as in the physical working environments. Working sessions are arranged where the environment supports the creativity and the productivity of the worker or the group.

- ways of thinking together
- ways of working together
- venues and tools that support creative thinking and co-creative collaboration
- thinking-tools, collaboration tools and non-traditional inspiring and empowering working environments
- virtual collaboration tools

8 PROMOTING TRANSPARENCY

(Sharing and being openly incomplete): This topic raises a question of what transparency is. Communicating incomplete and unfinished things allows learning during the project. Working and continuous learning go hand in hand. Transparency makes information and processes visible and accessible to support the common learning processes .

- creating culture of incompleteness, sharing everything while it is still in progress, thus making learning possible
- possibility and commonly shared permission to make mistakes
- asking for help and giving help is welcome: ROG = return of given (vs. ROI)
- using social media, online tools and methods, and generally best available IT systems to share everything that is possible and useful to share

9 IDENTIFYING ENABLERS

(Seeing problems as challenges and looking at the enablers instead of the barriers, where to find inspiration, how to open the locks of mind): Every working and project team should continuously search for enablers rather than focus on obstacles. This brings new perspectives to the project development.

- success factors so far and in the future
- what can we do differently already now; what prevents us to do The Right Things?

10 BEING VISUAL—WHERE WHATEVER YOU EXPRESS!

Growing knowledge on visual communication and know-how of using tools related to it should be strongly encouraged in in our everyday work and project processes. Visual communication makes it also easier to describe and disseminate the project results and especially to popularize them onto an easily understandable level crystallizing the main points. Each organisation and development project should increase the knowledge and know-how on tools for visualizing and make the use of them as part of the everyday practices in work.

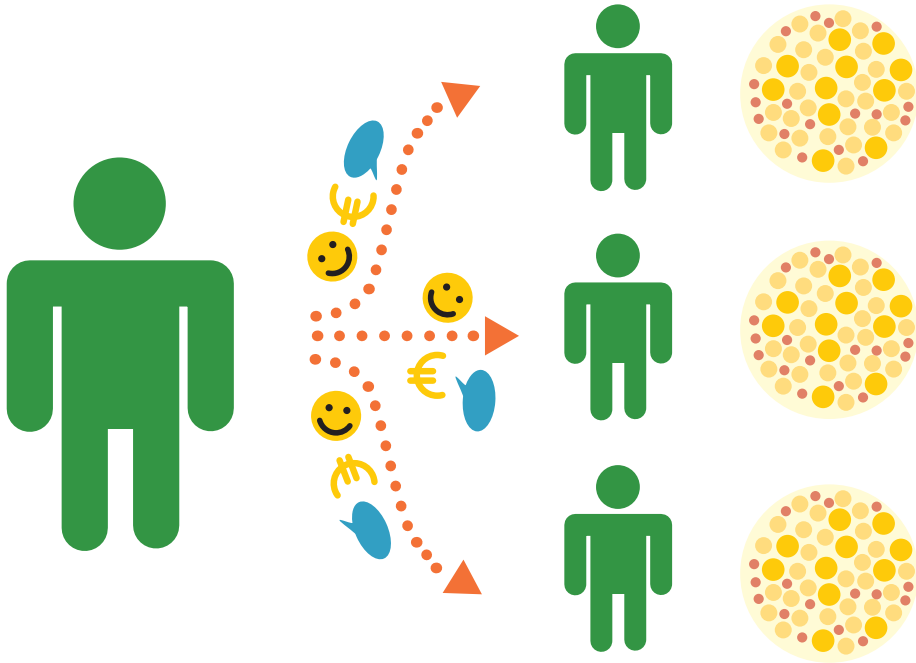


Figure 3. Orchestration ≠ traditional leadership.

Thirdly, more synergy between and in using different funding instruments is needed. Different funding instruments are managed by different funding authorities, often in disaccord and without a plan for the Big Picture. While the official ethos surrounding the new programme period 2014–2020 promises improvements, synergy cannot happen with words alone. Orchestration needs resources to happen.

It became apparent to people working in the Change2020 programme that individuals desire change. The question is, how do we break the control of the system that is actively resisting (and sometimes) fighting back against all attempts to change it? The Open Innovation agenda and its principles have much to give to the Finnish project mindset.

> **CASE EXAMPLE:** *Urban Mill. Espoo Innovation Garden and Uusimaa region are in many ways forerunners in already implementing aforementioned building blocks. For example, the case of Urban Mill (www.urbanmill.org) in Espoo is a real-life example of an open innovation platform that works using the thematic approach and agile orchestration and co-creation methods. The platform has a shared memory. It operates as a private-public partnership—an innovation intermediary as part of the Aalto University ecosystem, but outside the hierarchical governance. Urban Mill and many great other examples that the Change2020 programme encountered across Finland show the direction for future.*

Change2020 material can be found from www.innofokus.fi.

References

Books

Järvenpää, T. & Kankare, I. (2013). Veikö Moolok vallan? Vapauta projektisi tuhlaajakultista. Talentum.

Tuulenmäki, A. (2012). Lupa toimia eri tavalla. Talentum.

Journal articles

Brady, T. & Davies, A. (2004). Building Project Capabilities: From Exploratory to Exploitative Learning, Organization Studies 25(9), 1601–1621.

Etzkowitz, H., Webster, A., Gebhardt, C., Cantisano, T. & Branca, R. (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm, Research Policy 29, 313–330

Rynes, Sara L. (2007). Editor's Afterword, Let's Create A Tipping Point: What Academics And Practitioners Can Do, Alone And Together, Academy of Management Journal, 50(5), 1046–1054.

Online sources

Brennan, J., King R., & Lebeau, Y. (2004). The Role of Universities in the Transformation of Societies, An International Research Project Synthesis Report. http://www.open.ac.uk/cheri/documents/transf-final-report.pdf.

Connecting Universities to Regional Growth: A Practical Guide (2011), European Union Regional Policy. http://ec.europa.eu/regional_policy/sources/docgener/presenta/universities2011/universities2011_en.pdf.

Davey, T., Baaken, T., Galan-Muros, V., & Meerman, A. (2011). The State of European University-Business Cooperation Final Report—Study on the cooperation between Higher Education Institutions and public and private organisations in Europe, Science-to-Business Marketing Research Centre. http://www.ub-cooperation.eu/pdf/final_report.pdf.

EU-Drivers, Universities and Regional Innovation: A Toolkit to assist with building collaborative partnerships (2012), ESMU. http://www.eu-drivers.eu/images/eu-drivers%20toolkit%20building%20collaborative%20partnerships.pdf.

EU Drivers for a Regional Innovation Platform: http://www.eu-drivers.eu/publications.

Empowering people, driving change: Social innovation in the European Union, the Bureau of European Policy Advisers (2010). http://ec.europa.eu/bepa/pdf/publications_pdf/social_innovation.pdf.

Goddard, J. (2009). Reinventing the civic university, Nesta. http://www.nesta.org.uk/library/documents/Reinventing-Civic-Uni-v2.pdf.

Goddard, J., Vallance, P. (2011). The Civic University: Re-uniting the University and the City, Forthcoming in: Higher Education in Cities and Regions: For Stronger, Cleaner and Fairer Regions, OECD, Paris. http://www.eua.be/Libraries/SIRUS_Conference/John_Goddard_Paper_for_Seville.sflb.ashx.

Reichert, S. (2006). The Rise Of Knowledge Regions: Emerging Opportunities And Challenges For Universities, European University Association. http://www.eua.be/fileadmin/user_upload/files/Publications/The_Rise_of_Knowledge_Regions.pdf.

Markkanen, M. & Pienonen, T. (2014). Hankemaailman Skynet ja muita tarinoita kannattavampaan kehittämistyöhön. http://www.businessarena.fi/wp-content/uploads/2014/02/BusinessArena-skynet.pdf.

Pienonen, T., Markkanen, M., Widgren, P., Davey, T. & Galan-Muros, V. (2014), Operaatio Metsonpesä—Korkeakoulujen työelämäyhteistyön tilannekuva haltuun project report. www.businessarena.fi/metsonpesa.

S3-platform Guides: http://s3platform.jrc.ec.europa.eu/guides.

Tutkimustoiminnan vaikuttavuus yliopistojen rahoitusmallissa -selvitys, Tekniikan akateemiset TEK ja Teknologiateollisuus. http://www.tek.fi/cmis/browser?id=workspace%3A//SpacesStore/6c6e50c6-81b3-4b1d-b50b-0c0bae5eab3e&filename=cmisattachments/Tutkimustoiminnan%20vaikuttavuus%20yliopistojen%20rahoitusmallissa_selvitys.pdf.

About the authors

Jari Handelberg from Aalto University School of Business Small Business Center (SBC) is a research director at the Aalto SBC. He has long-term experience in managing EU-funded projects. His research interests focus on entrepreneurship and regional development.

Riikka Kuusisto from, Aalto University School of Business Small Business Center (SBC) works as project manager (BA) of the INNOFOKUS project. Riikka has long-term experience and expertise in managing EU-funded projects that are related to innovation and knowledge systems development. She is a specialist in online collaboration and working models and has been working as a developer and facilitator of online learning courses in the continuing education field for several years. www.innofokus.fi

Toni Pienonen from Business Arena Oy is a project designer at Business Arena Oy working on themes related to university-business-cooperation, entrepreneurship and participatory regional development. www.businessarena.fi

Mervi Rajahonka from Aalto University School of Business Small Business Center (SBC) is a project specialist and a researcher (D.Sc.(Econ) working with various research themes, inter alia innovation, impact evaluation, and business and service models in areas like creative industries, entrepreneurship and logistics services.

Teemu Ylikoski
Director of Regional Services, Ph.D.
Laurea University of Applied Sciences
teemu.ylikoski@laurea.fi

Elina Oksanen-Ylikoski
Director, Communications and Development, Ph.D.
Omnia, the Joint Authority of Education in the Espoo Region
elina.oksanen-ylikoski@omnia.fi

Laura-Maija Hero
Senior Lecturer, Innovation and Project Manager, M.Sc.
Metropolia University of Applied Sciences
laura-maija.hero@metropolia.fi

16. Educational Organizations as Co-Developers in the Helsinki Region

Abstract

Cooperation between education and the world of work is in a flux. Economic and societal pressures call for new types of cooperation and a transformation towards knowledge-producing communities. Educational institutions need to be more active in driving innovations and social development. These diverse innovative outputs to the regional economies demand going beyond traditional ways of collaboration.

Omnia (the Joint Authority of Education in the Espoo Region), Metropolia University of Applied Sciences, and Laurea University of Applied Sciences have piloted numerous projects that address the varying needs of regional innovation capability, youth employability, and entrepreneurial outlook.

This article presents cases of new types of knowledge-based cooperation that challenge the conventional roles of education, business and the public sector in the Helsinki Region. The results are very promising. It is possible to simultaneously advance educational goals, support entrepreneurial innovations, and create positive social impact. Attaining all of these goals demands changes in thinking, however. Instead of fixed expert roles, system participants must move towards acknowledging all expertise in its various forms. Conventional barriers in communication must be torn down. Education must move out of the campuses and into the real world and educators must become coaches and mediators rather than traditional lecturers.

KEYWORDS: Innovation pedagogy, Practice-based learning, Partnerships, Innovation co-creation

1. Introduction

The demands for new types of cooperation between educational institutes, businesses, and the public sector have been voiced already for some time. The economic and competitive pressures of our time specifically require new approaches in integrating education, research, and innovation. One needs to go outside of the box in order to find new solutions to youth unemployment, adaptation to structural changes in the economy, forecasting future skill requirements, and promoting innovations.

As a result, there is a demand for partnerships between education and the world of work. The Council of the European Union (2009) has made this explicit in a call for enhancing partnerships between vocational and higher education, employers and other parties. The aim of the cooperation is to guarantee that student competencies are aligned with the needs of future employers. Without the input of the employers, it is difficult to identify the **right** competences. This is particularly important in terms of European competitiveness in the current economic climate.

The call for cooperation relates also to the current discussion on fostering innovation. New kinds of joint efforts are needed to improve knowledge sharing and knowledge dissemination. Educational institutions possess vast bodies of knowledge, which should be put into use in fostering innovation and ensuring its transfer into practice (The Council of the European Union, 2009).

Cooperation between education and the world of work is particularly important in terms of promoting entrepreneurial capabilities. Entrepreneurial education has a positive connection to the inclination of becoming an entrepreneur. However, all pedagogies are not equal. Entrepreneurship is difficult to teach only based on theory—a link to actual practice is necessary. One way of ensuring authentic learning is through cooperation with real-life entrepreneurs. Still, the hurdles of cooperation may compound in the entrepreneurial context, where time is scarce and scarce resources considered critical (Kolvereid & Moen, 1997; Fiet, 2000; Mariotti & Glackin, 2014).

It appears that the conventional ways of thinking about education, research and innovation cannot respond to the requirement of closer cooperation between the parties of the Triple Helix. To enable new, out-of-the-box types of innovations and emerging entrepreneurial capabilities, there is a need for a new kind of modus operandi: one that breaks the silos separating the knowledge communities.

In this article, we present examples of innovative pedagogical approaches that also serve the purposes of the innovation ecosystem and regional development in general. The examples highlight the competences of three educational institutions. Helsinki Metropolia University of Applied Sciences, Finland's largest university of applied sciences, educates the professionals of tomorrow in the fields of culture, business, health care and social services, and technology. Metropolia has a variety of Degree Programmes for both daytime and evening studies. It provides 21 applied Master's degree programs in Finland. It has 16,800 students, 1,100 staff and 65

degree programmes—14 of them in English. In the Metropolia community, people and Helsinki Region companies and organizations meet to create insight, expertise and well-being for both work and life in general. Metropolia is a reliable partner and an innovator in higher education and with the surrounding region. Through co-operation, the ecosystem discovers new ideas and solutions to create better employment opportunities in the Helsinki region.

Omnia, the Joint Authority of Education in the Espoo Region is owned by the municipalities of Espoo, Kirkkonummi and Kauniainen. Today Omnia is a regional lifelong learning development center with over 40,000 students and over 850 staff. Omnia trains youth and adults, offering over 40 basic, further and specialist vocational qualifications and several informal courses. The Finnish National Board of Education has chosen Omnia as a center of excellence for upskilling both K-12 and vocational teachers and trainers at a national level. Omnia was awarded the Ministry of Education and Culture National Quality Award in 2013. As a development center, Omnia has close ties to social partners in the region. On campus, the growing network of entrepreneurs acts as an everyday inspiring role model that actively engages Omnia students, customers and staff in learning projects. Mobile technology has been harnessed to bridge the world of work and education, making it easier than ever to make all learning outcomes, formal, informal and non-formal, visible.

Laurea University of Applied Sciences focuses on producing new competences in service innovations and carries out professionally orientated education, regional development and R&D activities. Laurea operates in the Greater Helsinki Region, employs approximately 500 professionals and has 8,000 students, of which 1,200 in adult education programs. Laurea's curricula are built on its proprietary pedagogical model **Learning by Developing,** or LbD. LbD is a practice-oriented approach that relies on authentic working-life cooperation, learning projects, and student activity. The model offers the dual benefit of providing service to the region while also improving student employability. Largely due to students' improved meta-skills, post-degree employment is over 98%.

2. Integrating Education, Research and Innovation with Regional Development

Education institutions have a key position in leveraging the innovation agenda of the European Union. To ensure competitive advantage for the EU, research, development and innovation activities need to have a strong regional dimension. This regional development mission needs to be based on an understanding of innovation ecosystems (Committee of the Regions of the European Union, 2012; Markkula, 2013).

The EU is seeking global leadership in various societal issues, as outlined in the Horizon 2020 programme. Solving increasingly complex societal problems in difficult economic conditions requires novel and innovative approaches. The Committee of the Regions (2012, p. 3) calls for new partnerships to improve open innovation and

multidiscipline knowledge sharing: "The laboratories for 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 of transformative and scalable nature."

The role of education institutions is crucial in the innovation agenda of the EU. What is needed from the educational sector, though, is a capability to transform into a new type of knowledge laboratory. Also, regional partner organizations need to find the commitment to the deeper and more integrated partnerships (Markkula, 2013).

These challenges highlight the larger societal change that demands new approaches to the Triple Helix. It seems that the role of education institutions is changing and this is seen in the institutions' important role in the innovation system in terms of regional impact (Arbo & Benneworth, 2007).

An active Triple Helix ecosystem is a fundamental part of a larger regional innovation system. In the networked, global and digital knowledge economy, the Triple Helix is morphing into something different (Cooke & Leydesdorff, 2006). As Arbo and Benneworth note, "...it is expected that the knowledge institutions not only conduct education and research, but also play an active role in the development of their economic, social and cultural surroundings. In other words, they are entrusted with a regional mission" (2007, p. 9).

Part of the on-going transition relates to changing roles. Today's challenges increasingly necessitate flexible, iterative, networked problem solving. As Gibbons et al. (1994) discuss, education needs to shift from the homogenous, science-based knowledge creation (**mode 1**) to a heterogeneous, practical and social process (**mode 2**). Mode 2 innovations demand open environments where all parties, regardless of their formal roles, can provide input. New knowledge is increasingly created in practical applications.

Changing roles, border-breaking innovations, and co-creation of new knowledge also imply that future learning needs and regional demands are no longer separate. Educational institutions have a critical role as providers of knowledge and innovation in the region (Redecker et al., 2010; Halonen, 2014). The challenge is to constantly equip teachers with up-to-date pedagogical know-how as teachers act as gatekeepers and facilitators in the joint innovation processes. Developing innovation pedagogies is the key in guaranteeing systematic growth of innovation competence in the region (Hero, 2014c).

Arbo and Benneworth (2007) suggest that education institutions are at a crossroads in the innovation space. Education has become strategically important for innovations. However, they simultaneously provide the crossroads through which different ecosystem actors and participants pass.

3. Innovation and Employment Synergies

It is nearly impossible to create accurate forecasts of the future requirements of innovation ecosystems. One way of counteracting uncertainty is to be proactive, creating flexibility and adaptive capability (Eyoang & Holladay, 2013). Proactivity is also related to the skills of creating new innovative solutions, seeing opportunities, handling unexpected situations, and communicating in boundary-spanning encounters. As a result, the demands for an innovation-pedagogical approach are becoming paramount (Siltala, 2010, Ayvisati et al.; 2013; Hero, 2014a).

In Finland, vocational institutes and universities of applied sciences typically have close ties with local economies. As a result, they have the capability to actively impact local businesses, which in turn have a direct link to employing the youth in the area. One way of approaching this is to acknowledge that education institutions working with young adults have a responsibility to advance the professional growth of a new generation; one that can employ appropriate meta-skills, including communication, collaboration, creativity, and adaptability. It is only through systematic development of the right competences that an innovative inclination and innovation capabilities can be ensured.

A key task for education regionally is to advance employability. In difficult economic circumstances it is typically even more challenging for young professionals to enter the world of work. In Finland, the Government Programme includes implementation of a social guarantee for young people. The programme requires that everyone under 25 years and every recent graduate under 30 years be offered work, a traineeship, a study or, workshop place or labour market rehabilitation within three months of becoming unemployed. Education institutions can have a key position in leveraging the creative potential of these young adults towards the growth and innovation capital of local industries.

Education institutions have an opportunity to participate in employment advancement in multiple novel ways with municipalities. There are still some hurdles on the road, however. Siltala (2010) claims that one complication stems from the role of the teacher. We need to empower and facilitate the change of traditional, authority-based teachership towards a productive, innovative customer service profession. According to innovation pedagogy, students' new meta-skills and attitudes are vital in improving innovation capital. Regional competiveness improves through multidisciplinary, multi-actor environments that nurture developmental agendas.

Through acknowledging the shared regional agenda, we are also taking a step towards closer communities of knowledge creation. As a result, the type of cooperation in education, research and innovation activities changes. In Wenger's (2011) terminology, we are moving towards knowledge-sharing communities. In new types of cooperation between education and the world of work, practical learning opportunities, life-long learning, authentic learning occasions, and concrete outputs for work organizations can all be achieved.

These knowledge communities also have other benefits for the participants. The community supports the participant organizations in developing future capabilities. It can support professional skill growth, promote sharing of best practices, improve recruitment activities, and facilitate leveraging strategic plans (Wenger & Snyder, 2000). All of these have a crucial link to innovation capability.

The demand for knowledge communities crossing organizational boundaries is present in education institutions as well. In the Helsinki region, new types of knowledge communities have been piloted in response to the demands. In these different projects, learning pilots, training and operation models, and new experiences have been collected. The key findings relate to:

1) multidisciplinary and multi-actor cooperation, where students as well as researchers and teachers are all learners,
2) crossing the boundaries between education and the world of work through joint activities and common languages, and
3) crossing the boundaries between educational levels through joint spaces, transitions, teacher skill sharing, and gamification.

In the following section, we discuss the findings from four case examples.

4. Case Studies

4.1 Case 1: Nurturing innovation potential and youth employment

Takeaway: Improving innovativeness and employability can go hand in hand

The TeiniMinno (TeenMinno) project is an innovative idea addressing the difficult situation that many young people face. When jobs are cut, it is becoming very hard for the youth to enter the world of work. The Finnish Government's social guarantee programme ensures education and training opportunities for this target group. The central idea of the TeiniMinno project is to harness the innovation potential in these young people to advance the innovation and development activities of businesses.

One part of the programme seeks ways to leverage innovation pedagogy into improving the innovation competences of young people. Innovation potential can be a crucial skill set when students are in a transition between vocational secondary education and higher education (Hero, 2014b). Although the potential for employment and further education is present at this stage, the danger of unemployment is also very concrete.

The project brings together students in vocational secondary education and higher education and lets them solve innovation challenges induced by work organizations. While producing new, innovative ideas and solutions, simultaneously, new career paths are being created. The young participants receive diplomas for their

work and gain important work contacts. As a result, the project can serve as one way of implementing the compulsory social guarantee with an innovative output. Students' social skills, project skills, problem solving skills, teamwork skills and innovation potential improve during the innovation process.

TeiniMinno is an ESR-funded project coordinated by the Uusimaa Centre for Economic Development, Transport and the Environment. The participants include Omnia, Metropolia, Espoo Liberal Adult Education Centre, The City of Espoo and a number of business participants in the Espoo region.

4.2 Case 2: Vocational institute as an innovative entrepreneurship accelerator:

Takeaway: Bringing entrepreneurs, students and educators in shared spaces improves innovative results for all.

InnoOmnia is the development unit of Omnia, the Joint Authority of Education in the Espoo Region. InnoOmnia was founded to enable flexible experimentation with boundary crossing between educational fields and the world of work. Today, it is a knowledge community inside a VET organization where teachers, students and entrepreneurs learn and innovate together and even share the same coffee pot. All of the spaces on the premises can be learning spaces and every participant can serve as a learner and a teacher.

InnoOmnia's main purpose is to bring together entrepreneurship, vocational education and various development programmes. These development programmes pilot different aspects of 21st century vocational learning, such as real-world skill-based learning, mobile technology and cloud-based learning solutions, and learning through entrepreneurial projects.

In InnoOmnia, entrepreneurs co-reside with the Omnia staff and students. The community develops new forms of co-operation on a daily basis. Also, the new viewpoints and approaches that arise in the dialogue support new innovations and business ideas. Everyday life in InnoOmnia is about innovation. The typical entrepreneur is an innovator or a creative craftsperson, constantly seeking new insights and ideas.

For starting businesses, InnoOmnia offers services similar to what a business incubator provides. Interested entrepreneurs can apply for a position in the community. There are multiple options for participating, including a tailored package of office decisions and a professional development plan. An opportunity to participate in the Omnia Adult Education Further Qualification Programme for Entrepreneurship is optional for the entrepreneurs.

VET education on business and entrepreneurship has moved into shared spaces with entrepreneurs. Hence, students' studies are integrated with the entrepreneurs' authentic challenges and leveraged to creating innovations. The teacher is no longer the only source of information. Information flows in all directions. A teacher becomes a tutor and guide, when there are multiple experts working on a problem.

4.3 Case 3: Empowering entrepreneurship through gamification

Takeaway: Gamification can support innovativeness in a knowledge community

In the LOL project, a business perspective, an entrepreneurial perspective, a pedagogical perspective and a social media perspective were brought together in an innovative knowledge community (Ylikoski & Oksanen-Ylikoski, 2014). The main finding in the project was that gamification can be employed as a tool in breaking down conventional silos.

The project was a game played in an online community of entrepreneurs, students and teachers. It featured an online game board and online rooms for preparing for game tasks. Pedagogically, it was designed to support learning on three educational levels.

In terms of innovation, the purpose was to let students work on real business problems and create creative solutions to them. Entrepreneurs offered their skills and knowledge for the community's use.

The game tasks focused on entrepreneurial day-to-day issues. This offered a dual benefit: it supported students' business studies through an opportunity to solve real entrepreneurs' authentic problems. For the entrepreneurs, the results provided new insights and solutions into business problems. The game lives on, having evolved into a pedagogical solution that InnoOmnia actively promotes.

The project was funded by the Uusimaa Regional Council (Finland), as part of the European Regional Development Fund Program. Participants were InnoOmnia, the Kasavuori Secondary School of Kauniainen and Laurea University of Applied Sciences.

4.4 Case 4: Mobilizing a higher education institution

Takeaway: Taking education out into the world supports authentic learning and fosters innovation potential

Laurea University of Applied Sciences operates in the Uusimaa region, a geographically diverse and wide area. It is impossible to be present in all parts of a region spanning hundreds of kilometres only by conventional means. For this purpose, Laurea has innovated an operative process that can simultaneously address specific local needs, improve innovation capabilities, and offer authentic learning opportunities.

In Laurea, studying revolves around projects originating in the world of work. These projects are adopted as problem-solving and development tasks, for which students develop new practices. This helps build new knowledge in the subject matter (e.g. marketing) as well as important meta-skills (e.g. team work). Teachers and staff moderate the requests from the region and translate them into learning opportunities.

Because of the great distances in its operating region, Laurea cannot be present in campuses everywhere. However, the pedagogical approach makes it possible to

create pop-up spaces around the Uusimaa region. There are multiple examples of e.g. seminar tours for novice entrepreneurs, counselling desks inside shopping centres, and rehabilitation assistance stands inside health care centres. These share the common features of a road show, where all the associated materials and artefacts can easily be transported to another venue (Ylikoski & Kivelä, forthcoming).

These pop-up spaces can be mobilised with little effort and operated as student learning projects. The concrete benefits are apparent: students have more opportunities to engage in dialogue with the real world and simultaneously create new insight, ideas and innovations to serve the needs of the local communities and businesses. In a way, putting Laurea's capabilities on wheels makes it accessible to the entire region. By taking learning out of the classroom, Laurea is piloting a way of improving mobility and closeness at the same time.

5. Reflection: Towards Partnership Thinking

This article showcases examples of multilevel and multi-actor cooperation bringing together education, research and innovation activities. By challenging conventional actor roles, it is possible to attain multiple goals in parallel. In the cases presented above, educational goals, entrepreneurial innovations, and positive social goals have been reached through cooperation and collaboration. These examples show that it is possible for education organizations to transform and regional partners to become committed (cf. Markkula, 2013).

Based on the cases, it appears that shared knowledge communities that gather together different educational levels, businesses and public organizations can serve as a strong basis for regional innovation ecosystems. In fact, it is possible that the type of flexible silo-breaking cooperation, as described in this article, may function as a trailblazer for more entrepreneurial attitudes and the entire regional culture.

The first finding arising from the cases relates to sharing knowledge and competence among all of the experts in a given field, irrespective of where these experts are situated. This type of shared asset helps improve education, research and innovation activities; it helps improve the level and quality of regional impact, and speed up the dissemination of new insights.

Another observation relates to the breaking of boundaries. Taking students outside of the safe boundaries of the education institution and taking them inside the world of work helps develop the meta-skills crucial at work. It also produces new insights into and viewpoints to learning, and helps refocus the attention to real, authentic development opportunities. In the best examples, real open challenges from the world of work, multidisciplinary, practical project-based learning, gamification and networking simultaneously improve innovativeness and the joy of learning. An intentional innovation process provides an optimal learning platform.

Tearing down communication barriers is a key facilitator in co-creation and learning. There are positive examples of service integrators who help turn a practical, work-based problem into a learning project, then collect the appropriate skills and

talent needed for solving the task—all the while avoiding the complex language and communication typical of the educational realm.

To some, a recent piece of shocking news has been the revelation that students can learn without the presence of the teacher. This trend has been emphasized by systematic attention to acknowledging everyday learning and previous capabilities. Also, the digitalisation of knowledge and the availability of information accentuate this development. This has a tremendous impact on the role of the teacher. The teacher becomes a facilitator of business deals between different stakeholders, a negotiator of complex agreements, a translator of learning outside the curriculum, an event producer of multidisciplinary meetings and workshops (Hero, 2014c). This has also direct impacts on the management of educational premises. What are the physical spaces actually needed for supporting learning? Through new types of co-operation, educational spaces can become venues for much more. We are moving towards shared spaces supporting learning rather than spaces dedicated only to certain institutions.

Regional youth innovation activity can be organized so as to identify common goals, shared practices, and pedagogical best practices. This may be a fruitful path to lowering the threshold for multi-level collaboration between education institutions and developing the innovation activities into an employment path.

There are still hurdles, as well. Structural impediments, rigid operational models, and system inflexibility are typical obstacles to cross-level cooperation. On the other hand, they may also serve as easy guises to hide behind. Instead, learning goals and educational programmes seldom seem to pose problems.

Successful cooperation in a learning project requires a trailblazing attitude from the teachers and developers. Sometimes appropriate support can be acquired from educational management. As more experience accumulates, and as the new type of innovative cooperation becomes a prevailing strategy, this problem will likely alleviate. In the future, we believe a future-oriented, innovation-igniting, customer-centric, service-design way of cooperating across boundaries will become the norm for education institutions, rather than the exception.

References

Arbo, P., & Benneworth, P. (2007). Understanding the regional contribution of higher education institutions: A literature review (No. 9). OECD Publishing.

Ayvisati, F., Jacotin, G., Vincent-Lancrin, S. (2013). Educating Higher Education Students for Innovative Economies: What International Data Tell Us. Tuning Journal for Higher Education, 1 (Nov), 223–240.

Committee of the Regions of the European Union (2012). Opinion of the Committee of the Regions — Horizon 2020, Opinion CdR 402/2011 final, http://ec.europa.eu/research/horizon2020/pdf/contributions/during-negotiations/european_organisations/committee_of_the_regions.pdf

Cooke, P., & Leydesdorff, L. (2006). Regional development in the knowledge-based economy: the construction of advantage. The Journal of Technology Transfer, 31(1), 5–15.

Council of the European Union (2009). Enhancing partnerships between education and training institutions and social partners, in particular employers, in the context of lifelong learning. Council conclusions, May. http://ec.europa.eu/education/lifelong-learning-policy/doc/policy/council0509_en.pdf.

Eoyang, G., & Holladay, R. (2013). Adaptive Action: Leveraging Uncertainty in Your Organization. Stanford University Press.

Fiet, J.O. (2001). The theoretical side of teaching entrepreneurship. Journal of Business Venturing, 16(1), 1–24.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). The new production of knowledge: The dynamics of science and research in contemporary societies. Sage.

Halonen, K. (ed.) (2014). CoInno. Innovaatioiden pyörteessä. Metropolia ammattikorkeakoulun julkaisuja.

Hero, L.-M. (2014a). Työttömät nuoret yritysten innovaatiotalkoisiin. UAS Journal 2014(2).

Hero, L.-M. (2014b). Moniasteinen innovaatio. Uusia mahdollisuuksia nuorten työllisyyden kiihdyttämiseen. Teiniminno esiselvitys. Metropolia ammattikorkeakoulun julkaisuja.

Hero, L.-M. (2014c). Innovaatiodidaktiikan käsikirja. Opas moniasteisia innovaatioprosesseja fasilitoivalle. Monimediajulkaisu—Kumuloituva kirja. Metropolia ammattikorkeakoulun julkaisuja.

Kolvereid, L., & Moen, Ø. (1997). Entrepreneurship among business graduates: does a major in entrepreneurship make a difference? Journal of European industrial training, 21(4), 154–160.

Mariotti, S., & Glackin, C. (2014). Entrepreneurship: Starting and operating a small business. Third International Edition. Pearson Prentice Hall.

Markkula, M. (2013), The Knowledge Triangle Renewing the University Culture. In Lappalainen, P. & Markkula, M. (Eds.), The Knowledge Triangle Re-Inventing the Future. Multiprint, Finland.

Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., Stoyanov, S. & Hoogveld, B. (2010). The future of learning: New ways to learn new skills for future jobs. Results from an online expert consultation. Technical Note JRC60869. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Seville.

Siltala, R. (2010). Innovatiivisuus ja yhteistoiminnallinen oppiminen liike-elämässä ja opetuksessa. Academic dissertation. University of Turku.

Wenger, E. (2011). Communities of practice: A brief introduction. Working paper. scholarsbank.uoregon.edu.

Wenger, E.C., & Snyder, W.M. (2000). Communities of practice: The organizational frontier. Harvard business review, 78(1), 139–146.

Ylikoski, T. & Oksanen-Ylikoski, E. (2014). Gamification and working life cooperation in an e-learning environment. eLearning Papers 07.

Ylikoski, T. & Kivelä, S. (forthcoming). Spatiality in higher education. A case study in integrating pedagogy and regional development. Higher Education, Skills and Work-Based Learning.

About the authors

Teemu Ylikoski is Director of Regional Services at Laurea University of Applied Sciences. He has a Ph.D. in Marketing and has published on various customer-related topics such as loyalty, e-commerce, and online buying behaviour, as well as pedagogical issues in innovation and regional development, including gamification. He has work experience in multiple higher education institutions, the business sector, trusteeship, and has worked as an entrepreneur in the advertising business. In his current position, he is leading Laurea's change towards partnership-based operation.

Elina Oksanen-Ylikoski, Ph.D. (Econ.), works as Director of InnoOmnia, a communication and development unit of Omnia. InnoOmnia creates innovative formal and informal learning solutions and environments for lifelong learning students and start-ups. Oksanen-Ylikoski has work experience in development of corporate services and innovative learning environments at the Helsinki School of Economics/Aalto University and Haaga-Helia University of Applied Sciences. She has worked in several development projects in professional sales education as well as in the area of market research and marketing. She is one of the founding members of the Global Sales Science Institute and a representative of the OECD-EC Entrepreneurship360 network. She is also a true believer of inspiring mondays.

Laura-Maija Hero is senior lecturer and innovation and project manager in Metropolia University of Applied Sciences. She has five years of experience in teaching in Cultural Management and multidisciplinary innovation studies, 10 years in international marketing and marketing innovations in mobile technology business. Hero has expertise in innovation and futures' thinking and she is preparing her doctoral dissertation in innovation pedagogy.

Heikki Rannikko
Senior Advisor, PhD, M.Sos.Sc.
Aalto University Small Business Center, Finland
heikki.rannikko@aalto.fi

Leena Alakoski
Principal Lecturer, PhD, Econ.
Laurea University of Applied Sciences
leena.alakoski@laurea.fi

Johanna Lyytikäinen
Project Manager, M.Sc. (tech.)
Omnia, The Joint Authority of Education in Espoo Region, Finland
johanna.lyytikainen@omnia.fi

17. InnoEspoo: Integrating Entrepreneurship and Education

Abstract

Several developments in society hint that co-operation must be increased between educational institutions in training future entrepreneurs. InnoEspoo project was a pioneering project in this respect as it was set up to enhance co-operation between the city of Espoo, educational organizations of different levels (vocational, university of applied sciences, university) and student entrepreneurs.

The project aim was to identify ways, and take concrete actions, to create a community that combines entrepreneurs' and students' needs to those of local government. The project followed two main tracks: service development and entrepreneurship training. Within the service development track, a well-being marketplace, for example, was created to facilitate the transfer of well-being services from entrepreneurs to ageing citizens of the city of Espoo. Within the entrepreneurship track, joint entrepreneurship training and 'Espoo Challenge' entrepreneurship camp, for example, were delivered.

KEYWORDS: Entrepreneurship, Training, Services, Espoo, Educational institutions

1. Introduction

InnoEspoo was a joint project between three educational institutions and the city of Espoo during 2013 and 2014. In short, the InnoEspoo project provided support for creative student entrepreneurs and enhanced the development of innovative services for citizens of Espoo. Besides the city, three educational organizations from different levels (vocational, university of applied sciences, university) participated in the project.

InnoEspoo was mainly funded by the European Social Fund. Specifically the following underlying issues were addressed: in the short-term economic downturn and in the longer term structural problems such as imbalances between government earnings and spending and economic and social challenges (such as aging population, and youth unemployment).

The project target groups included student enterprises, student co-operatives, small-scale service businesses, part-time entrepreneurs and entrepreneurs in creative industries. The project helped the target groups to find new service solutions, business ideas and advice for their business plans. Moreover, the project has helped to create a community where entrepreneurs, students and educational staff work together in shared facilities, training sessions, and events. Simultaneously new services for the area have been created.

2. Background

The City of Espoo is in the heart of economic well-being and development in Finland. Being one of the three cities of the metropolitan area, it is part of a one-million-inhabitant region that hosts many important companies and educational institutes. Espoo, among other Finnish cities, has challenges in producing services for its citizens and in benefiting from student skills and knowledge in developing its various functions.

The most important educational institutions that operate in Espoo include Omnia, the Joint Authority of Education in the Espoo Region, Laurea University of Applied Sciences and Aalto University. Omnia provides informal and formal education for 40,000 students, has 850 staff, and is known for the innovative approach in its entrepreneurship education. Laurea University of Applied Sciences is running more than 16 Bachelor's and 16 Master's degree programmes and has 8,000 students in seven study locations around the metropolitan area. Laurea has a good reputation in its task of educating young people. For example in 2012, it received the most honorary awards in different operating areas among universities of applied sciences in Finland. Aalto University is one of the main Universities in Finland with 20,000 undergraduate and doctorate students in six schools covering the disciplines of science, engineering, business, as well as arts, design and architecture. Within Aalto University operates also the Small Business Center, an Academic Continuing

Education institute that each year provides 3,000 Clients with new knowledge and skills in entrepreneurship. The Small Business Center has a thirty-year long tradition in entrepreneurship training that goes way beyond the current rising interest in entrepreneurship. Throughout years, it has for example participated in providing minor studies in entrepreneurship for university students in the metropolitan area and has been operating a successful Finnish business incubator, the Start-Up Center. As such, the Small Business Center is part of the Aalto university -based entrepreneurship ecosystem that is highly regarded in international comparisons.[1] Among other constituents of this system are Startup Sauna, Aalto Ventures Program, and Aalto Design Factory.

In the end, all educational institutes face the same fundamental question: how to provide entrepreneurship training with high impact and as low costs as possible for students from various disciplines and for students from working life. Moreover, from systemic viewpoint, entrepreneurship training should fuel the national system of entrepreneurship by providing sufficiently entrepreneurially minded students and new ideas to the system. The system dynamic of entrepreneurship ecosystem is demonstrated in Figure 1 in the high-growth entrepreneurship context.[2] In order for the system to operate and have sufficient momentum, a new (high-growth) entrepreneur talent pool is needed and a venturing team talent pool from which actors

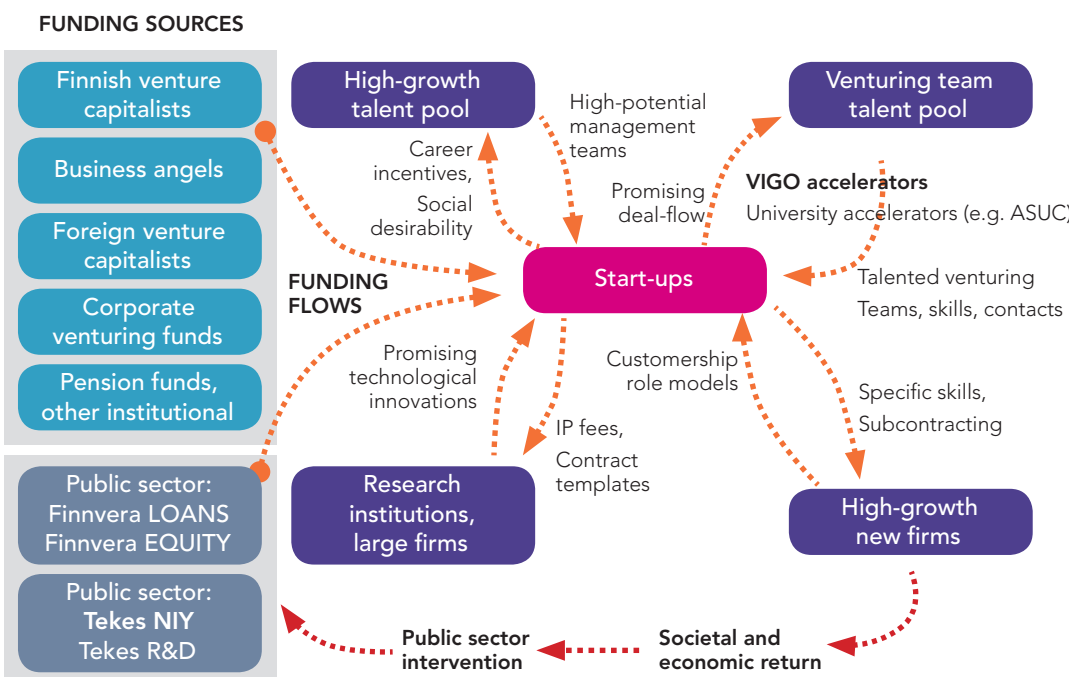


Figure 1. System dynamic of (high-growth) entrepreneurship ecosystem.

[1] Graham, R. 2014. Creating university-based entrepreneurial ecosystems—evidence from world leaders. MIT Skoltech Initiative.

[2] Autio, E., Rannikko, H., Handelberg, J., Kiuru, P. 2014. Analyses on the Finnish high-growth entrepreneurship ecosystem.

participate in the projects of new entrepreneurs. Also funding must be sufficient and technological and other innovations must flow into the system from research institutions, large firms and educational institutions. Looking at this system dynamic from educational institutions' perspective, it is especially the new entrepreneur talent pool and new innovation generation which educational institutions should contribute to. It is not only higher education institutions that play a role in fuelling the system dynamic. Under current circumstances, it may as well be lower education institutions from which entrepreneurial talent and innovations originate.

In sum, to improve the challenges mentioned above, the objectives of the InnoEspoo project were defined as the following:

i) to support creative entrepreneurs and student entrepreneurship
ii) to enhance innovative service development (for citizens of Espoo)
iii) to develop new ways of co-operation between learning institutions and the city of Espoo

3. Organization

The InnoEspoo project has been operated by the staff of Omnia, Laurea and Aalto Small Business Center. Eleven employees were hired for the project of which three represent Omnia, four come from Laurea and three represent Aalto Small Business Center. The project group represents an excellent mix of working-life experience, teaching experience and entrepreneurship training experience. Besides the project group, a significant number of students have contributed to the project both as a student project work and as hired project workers.

The operative work of the project has been supported by a steering group that was headed by the director for economic and business development of the city of Espoo, Tuula Antola. Other members of the steering group were Erkki Pärssinen (Manager, Enterprise Espoo), Elina Oksanen-Ylikoski (Director, Omnia), Sonja Lovelock and Heli Harsunen (Students, Laurea), Jari Handelberg and Marika Paakkala (Managers, Small Business Center), Sari Dhima (Aalto University), Kristiina Erkkilä (City of Espoo), Tuula Kilpinen (Manager, Laurea), Aape Pohjavirta (Start-up entrepreneur), Auli Vuorinen (Centre for Economic Development, Transport, and the Environment) and Antti Piironen (Metropolia).

4. InnoEspoo Project in Practice

In the first stage of the InnoEspoo project, the objective was to learn to know people and the service offering in each institution (Omnia, Laurea and Small Business Center of Aalto University). As institutions have very versatile operations, it takes time and effort to receive in-depth knowledge of other organizations' modes of operation and their services in entrepreneurship and city co-operation. In the second stage, the emphasis was on finding key areas and practical projects that would benefit

from the co-operation. In order for a project to become accepted as a sub-project, it needed to represent one or more benefits from the following list:

a) Project supports students to start new firms
b) Project creates new firms or businesses
c) Project creates new ways of working
d) Project enhances citizen well-being
e) Project supports co-operation between education, city, entrepreneurs and students
f) Project supports the creation of new service models

After various discussions and facilitated brainstorming sessions, for example the following sub-projects were defined and carried out:

- Creating a pop-up learning environment through organizing a celebration in an old manor house in Espoo
- Entrepreneurship training for students delivered in co-operation between different learning organizations
- Delivery of a series of workshops to find out the training needs of new entrepreneurs
- Espoo Challenge service camps for students
- Creation of a web-based well-being market place for elderly people
- Creation of Innovaara, a low entry barrier accelerator for students' business ideas
- Organizing a series of half-day seminars for new entrepreneurs in fall 2014

5. Outcomes

Perhaps the most valuable outcome of the project has been the creation of an actor-level network across different learning institutions. By mobilizing this network, it is possible to take benefit from up-coming opportunities in the area of student entrepreneurship support in the future and to respond to possible challenges in the city of Espoo. This, in turn, is likely to foster the development of the system of entrepreneurship in the capital town region as more ideas and more entrepreneurially minded students enter working life. In the following, examples of more tangible results of the project are highlighted:

I. Enhancing entrepreneurship skills and attitudes of student entrepreneurs / creative entrepreneurs through training and by facilitating social interaction

a) Various new student enterprises have been created with help of

entrepreneurship training, e.g:

- Co-operative in physiotherapy
- Start-up in green area planning
- Start-up for planning and constructing skateboard parks

b) Entrepreneur brunches were organized where ideas for training and coaching topics were developed. As a result, four half-day seminars for micro-enterprises were organized in fall 2014 in the areas of customer-centered thinking, business economics, well-being and sales.

c) A new start-up-center space (InnoVaara) for students was planned and implemented. The idea here is that students from different schools and educational levels work at the same events. Students can share their business ideas, find other business partners and further develop their ideas.

II. Providing ideas and solutions to various challenges of the city of Espoo

a) Idea/solution generation to meet the challenges of the city of Espoo in a service camp in collaboration with students and the city of Espoo. Some ideas are possibly implemented in practice.

b) A market place for well-being started its operation in September 2014. It will collect and present private service offering for senior citizens in Espoo. (www.seniori365.fi)

c) Filling in an empty space in Entresse -shopping center in Espoo for three months in fall 2014 with the help of entrepreneurs, student entrepreneurs and staff of Omnia, Laurea, and Aalto Small Business Center.

6.Conclusions

It can be concluded that the InnoEspoo project has successfully developed entrepreneurship in the metropolitan area and especially in the Espoo region. On the practical level, the joint activities were spread around entrepreneurship support and service development. The experiences gained for example from joint training courses, Espoo Challenge innovation camp or senior 365 sub-projects are promising and suggest that co-operation must be continued in the future. While entrepreneurial attitudes and capabilities differ between individual students or other possible new entrepreneurs, it is important to support each individual path to facilitate the flow of entrepreneurial talent and ideas to the system of entrepreneurship.

An emerging topic in higher-education institutions is learning by doing and developing. Also in the InnoEspoo project, this new way of learning has been further experimented with. For example, students from Laurea University of Applied Sciences had the possibility to acquire study points by developing one's own company. This

kind of a practical approach is a relevant way of learning especially in entrepreneurship studies.

The InnoEspoo project is one of the first steps to co-operate across educational institutions in the area of entrepreneurship development. As such, the project has been fully integrated to the regional innovation system, or better, the system of entrepreneurship. Enhancing idea generation and developing entrepreneurship potential at a very early stage of the entrepreneurship process (Figure 2) has been the key focus area. By so doing, the project has fostered the development of talent for the entrepreneurship ecosystem in the metropolitan area in Finland. It is assumed that most students pursue an employee career to begin with while some students choose small-scale entrepreneurship and only very few pursue high-growth entrepreneurship. All these groups, however, benefit from learning about entrepreneurship as a part of their studies.

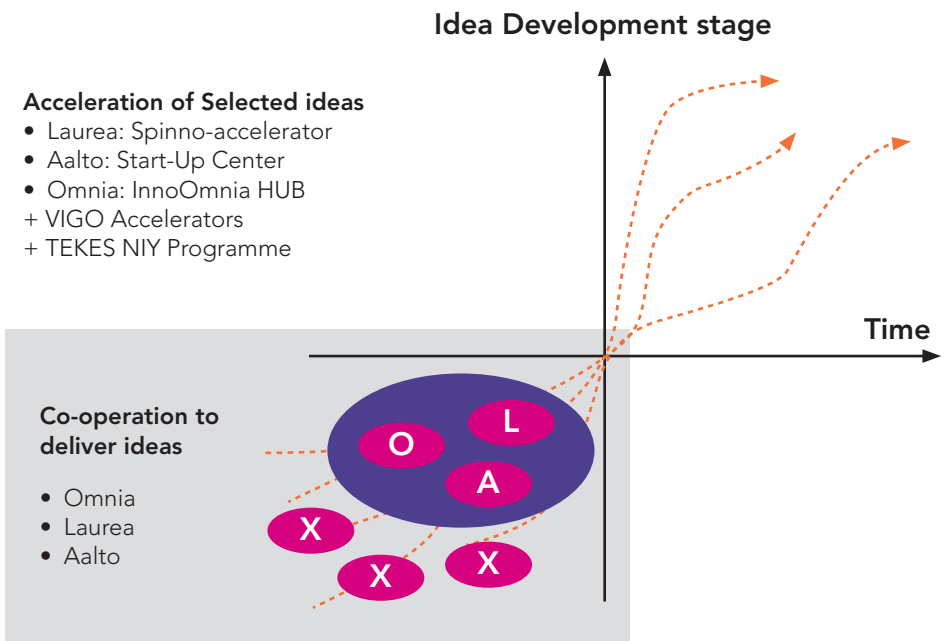


Figure 2. Learning institutions in role in developing entrepreneurship.

While the InnoEspoo project has been a decent start for joint development of student entrepreneurship and co-operation between the city of Espoo and education institutions, various challenges have been met. Challenges in the execution of the project include unfamiliarity of the individuals with each other at the beginning of the project. Other challenges include tight time schedules and different interpretations of project objectives in each organization.

Once people have learned to know each other and their organizations, co-operation has proven substantially easier. One key outcome of the project is an actor-

level network (practioners' community). This network can be rapidly mobilized in the future for entrepreneurship development activities and for service development in a border-crossing fashion. In the future, this resource needs to be utilised in order to promote new entrepreneurs from educational institutions and the various networks attached to them. This could take place as a continuation of the current project.

About the authors

Heikki Rannikko works as a Senior Advisor at Aalto Small Business Center. His duties include entrepreneurship and innovation policy evaluations, entrepreneurship training and development projects. Heikki holds a doctoral degree in entrepreneurship and management from the Hanken School of Economics in Helsinki (2012) and master's degree in economics from the University of Helsinki (1998). He is interested in entrepreneurship policy, entrepreneurial growth statistics and antecedents of entrepreneurial firm growth (see: http://pienyrityskeskus.aalto.fi/en/growth/). Prior to Aalto University, Heikki was employed for ten years by the Finnish Employer's Management Development Institute (currently Management Institute of Finland), where his duties included e.g. training (business economics), development project management, research and administration.

Leena Alakoski, PhD, works as a Principal Lecturer in the research and development team of service business at Laurea University of Applied Sciences in Espoo, Finland. Mrs Alakoski worked as project manager in two externally funded Tekes projects: 1) Multisensory tourism marketing communication (MMM), and 2) Measuring multiple senses in service experiences (MMP). She has worked as a research expert in in other Tekes-funded service research projects; most recently in Service Innovation through Strategic Stakeholder Integration (SISSI) 2010–2014, Transferring Service Knowledge to SMEs (ServBis) 2010–2012, Grundvig Lifelong learning program Training high tech seniors for Discovery 2013–2015, and in InnoEspoo project, which is a pioneering project to enhance co-operation between the city of Espoo, educational organizations of different levels (vocational, university of applied sciences, university) and student entrepreneurs. She lecturers on new service development and corporate social responsibility courses and supervises student thesis on Master degree Programs. She is a member of the International Service Design Network (SDN), Finnish Service Alliance (FSA) and of Finnish Society of Tourism Research.

Johanna Lyytikäinen works for Omnia, a joint authority of education and a regional development hub in Espoo. Ms. Lyytikäinen is currently working as the project manager for the project InnoEspoo. She holds a Master's degree in Science (Technology) from Aalto University. Prior to working at Omnia, Ms. Lyytikäinen worked several years in various collaboration and innovation projects for the city of Espoo and Aalto University. Due to her background in urban development, she has a strong interest for regional issues and perception of developing diverse multi-organizational platforms.

Anikó Kálmán
Associate Professor, PhD.Habil.
Department of Technical Pedagogy, Deputy Head of Department
Budapest University of Technology and Economics, Hungary
kalman.a@eik.bme.hu

László Farkas
Associate Professor, PhD, MSc.E.E.
Student Innovation Centre
Budapest University of Technology and Economics, Hungary
farkas.laszlo@hik.bme.hu

Donát Dékány
Director, MSc.E.E.
Student Innovation Centre
Budapest University of Technology and Economics, Hungary
dekany.donat@hik.bme.hu

18. Budapest BME: Developing a Student Innovation Ecosystem

Abstract

Building on the Knowledge Triangle model of innovation, higher education is required to respond more directly to social and economic needs. New boundary-crossing organizations and structures are being developed to help negotiate the pathways, the new cultural and innovation tradition necessitating a different approach.

During the research university project presented here, the vision and frames of a new university structure and eco-system were developed at Budapest University of Technology and Economics.

The main aim of developing the student innovation eco-system is to form and propagate an innovation culture among university commoners. The set-up of the student innovation eco-system followed a more network-like, bottom-up approach, where attitude and mindset constitute the most important building blocks. The eco-system consists of new elective subjects, training of trainers, networking, new idea generation activities and competitions, university-student-industry partnership, and forming of an innovation society. This step-by-step, bottom-up approach, where small activities are launched and connected to each other, can serve as a good example for regions with a less accentuated innovation culture and tradition.



KEYWORDS: Innovation at university, the Knowledge Triangle, Forming attitude

1. Introduction

In the case of traditional universities, the mission and role of higher education and academic research is distinct from commercial activity. Presently the idea of university is changing due to several factors. Higher education institutions traditionally reflected a simplistic understanding of knowledge creation, different social classes and labour market requirements. Today traditional universities are unable to meet all the demands and requirements of the global knowledge society. Therefore there is a real need for a new model of higher education, which requires that traditional universities be reshaped (Kálmán, 2013).

Building on the Knowledge Triangle model of innovation, higher education is required to respond more directly to social and economic needs. Different programmatic models and initiatives are emerging that bring together actors from civil society, the state and state agencies, and higher education to mobilize and harness knowledge, talent and investment in order to address a diverse range of problems and need through coordinated action. New boundary-crossing organizations and structures are being developed to help negotiate the pathways and different cultures.

Budapest University of Technology and Economics (BME) is a research university in Hungary. BME is a partner of Aalto University that started to build a research-development-innovation (RDI) eco-system in the past years. However, the different culture and innovation tradition requires a culture different from Aalto's approach—a more network-like, bottom-up approach, where attitude and mindset constitute the most important building blocks.

2. Implementing the Knowledge Triangle in Hungary

The National Research and Development and Innovation Strategy (National Innovation Office, 2013) defines the following specific objectives for 2013–2020:

A. Developing knowledge bases

A1. Education and talent management
A2. Strengthening of research organizations (especially at the HAS and in higher education)
A3. Internationally competitive R&D infrastructure
A4. Modern research management

B. Knowledge flow

B1. Efficient central public innovation services
B2. Introduction of decentralized innovation services
B3. Strong traditional innovation co-operations
B4. Support for open, pre-competitive and social innovation co-operations

B5. Efficient participation in the EU and international calls for proposals and initiatives

C. Knowledge utilization

C1. The creation of a start-up ecosystem
C2. Awareness raising, law enforcement and relaxation of intellectual property protection
C3. Demand creation for R&D of medium-sized enterprises
C4. Efficient support for foreign market entry
C5. Deliberate public demand for innovation
C6. Large-company workplaces of high knowledge content with intensive local knowledge connections
C7. Increasingly innovative and diversifying SMEs
C8. The enhancement of the spread of adaptive innovation solutions primarily based on informationand communication technologies
C9. The most competitive R&D tax incentive system in Europe

Higher education has an important role in the objectives, especially in A1–A4.

The education strategy of Hungary, called Shift gear in education (Palkovics, 2014, underway) identifies the following main strategic aims of higher education institutes in Hungary:

- educational system based on performance
- world-class research
- leadership in regional and urban growth
- (smart) specialisation
- new institutional system
- educational innovation
- effective leadership and new market models
- The most important instruments (actions) to reach the aims include:
- setting up of centres for close cooperation between university and industry (especially SMEs)
- new financing instruments, long-term strategy for RDI resources (human and infrastructure)
- strengthening international cooperation
- developing incubator and technology transfer services
- taking part in implementing the smart city concept
- increasing activity in societal innovation
- strengthening services towards students and society
- including new and innovative ways and topics into curricula (project work, entrepreneurship)
- training of trainers
- increasing attitude-shaping activities

The innovation and start-up strategy of the Budapest region is described in Budapest Runway 2.0.2.0 (Korányi, 2014). This roadmap has a very ambitious vision: by 2020 Budapest will be the start-up capital of the region. The strategy states that "It is undeniable that good (higher) education, particularly in the STEM areas (Science, Technology, Engineering, and Mathematics)—where Hungarian excellence is traditionally strong—together with competition are necessary prerequisites for innovative enterprises. [… but] these necessary prerequisites alone are not sufficient. In fact, it is increasingly clear from the leading start-up and innovation centres around the world, that with only these two prerequisites in place, ideas and innovations will not result in new products and will not provide the basis for successful start-ups, as the innovations will die in the early stages of development. This is a waste of talent, energy, and ambition. What is needed is a certain environment, an ecosystem, which enables ideas and innovations to reach the market as products and services, and where consumers engage with the ideas as part of the innovation process, transforming the economy and seeding new industries."

The main components of the start-up ecosystem are:

- education and training,
- access to funds,
- taxation and regulation, and
- enabling environment.

In education and training, a new driver and support for university spin-off enterprises and start-up business academies are needed. To create an enabling environment, we must ensure personal knowledge transfer, social networking and awareness raising, as well as strengthen bottom-up (grassroots) actions.

The aims, activities and instruments at national and regional level are in good relation to European strategies like Triple Helix and Smart Specialisation (Markkula, 2013a) and the Knowledge Triangle (Markkula, 2013b).

As a summary, we can conclude that the main roles of universities in implementing the Knowledge Triangle in Hungary are:

- strengthening the R&D resources (infrastructure, human resources etc.)
- identifying strategic priority areas and research focuses
- strengthening the interdisciplinary approach and networking
- supporting the institutional technology transfer infrastructure, management and processes
- setting up a synergy between enterprises and researchers
- strengthening open innovation services and taking part in start-up ecosystems
- developing innovative trainings and educational materials
- identifying and developing talent
- strengthening creativity and entrepreneurial attitude in the entire education sector

3. Developing the Frames of University RDI Eco-System

Budapest University of Technology and Economics has a more than 200-year history and is traditionally good at education and research—it received the Hungarian government award research university in 2010. Until then, innovation was performed in parallel at innovation parks, like Innotech founded by BME (Pálmai, 2004).

During the research university project, the frames of a new university structure were developed as summarized in the report Research university milestones (Péceli et al., 2012), in parallel to the traditional educational structure. The Federated Innovation and Knowledge Centre was formed to join research and innovation activities. The most important results of the project include (Figure 1):

- Priority research areas were identified (sustainable energy, vehicle technology and transport, biotechnology, nanotechnology, intelligent environment)
- R&D infrastructure (equipment, places, resources) was invested and aligned across the university
- horizontal working groups were established
- institutional relations widened
- undergraduates, postgraduates and doctoral candidates were involved in the research work
- talent management was set up
- foreign language training was enhanced and training of trainers courses were started

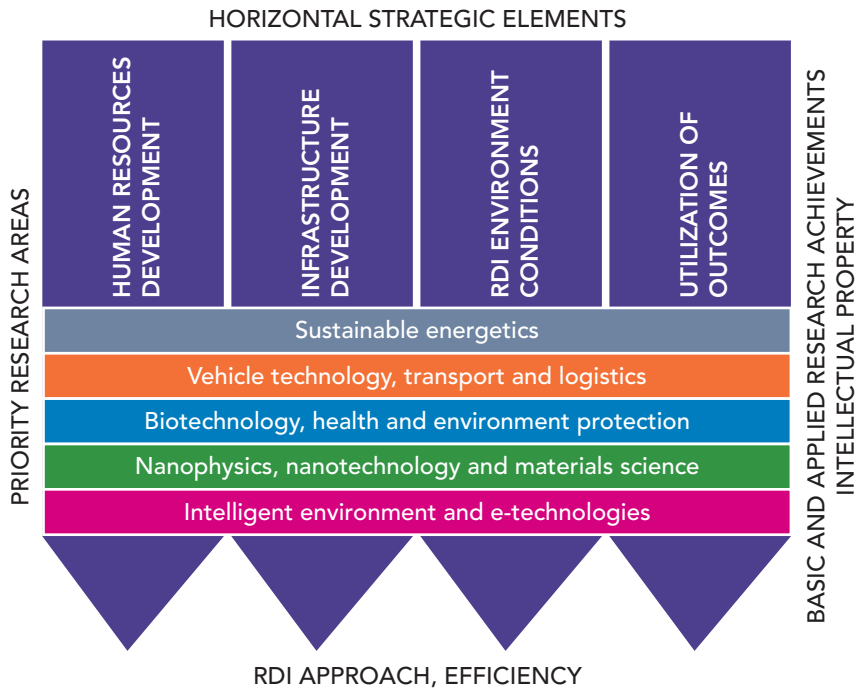


Figure 1. Results of the "Research University" project.

The vision of the research university is to create an RDI eco-system based on three main "legs".

The first leg, the concept of SME programme is based on the fact that R&D activities are relatively low in Hungarian SMEs. BME, as a university, has the sufficient knowledge to conduct R&D activities for SMEs with the help of state funding.

The second leg is Industrial campus, a place where large international research institutes and companies can use university resources. The funding is based on equal shares of the company, university and state.

The third leg is Student, university and industry programme, often called the student innovation eco-system, which is described in the following chapters.

The vision and activities of the research university project fulfils the requirements and recommendations of the Technical University of Tomorrow outlined by Ulab (Ulab, 2013).

4. Developing the Frames for the Student Innovation Eco-System

The Research university milestones (Péceli et al., 2012, 46–47.) report states that "Participation in the various technology transfer events requires a change of attitude from the stakeholders. [… Our aim is] to involve as many university students in the process as possible and to provide assistance for the utilization of the intellectual products created by students."

The main aim of developing the student innovation eco-system is to form and propagate an innovation culture and attitude at BME. Our vision is that an innovative society must be rooted at universities where the three legs of knowledge triangle can exist: education, research—and innovation.

In the last years, the organizational and administrative frames were developed at the university along with the establishment of the Technology and Knowledge Transfer Office (as part of the Federated Innovation and Knowledge Centre) and internal knowledge-handling regulations. But shaping a culture and an attitude requires long and hard work involving all university commoners—lecturers, researchers and, most importantly, students.

To shape the attitude, several formal and non-formal units and networks were established, in parallel to the traditional university organization, were commoners can work actively. The Student Innovation Centre (as part of the Federated Innovation and Knowledge Centre) helps students create and develop new ideas and products. The Technology and Knowledge Transfer Network gathers together researchers and lecturers interested in applying research results to develop new products and solutions.

The best way to shape the attitude is to show people new possibilities and futures, and involve them in these activities. Based on this idea, a local innovation eco-system was developed with the following collaborative elements: education (new subject sand training), networking, idea generation, partnerships and dissemination.

5. Elements of the Eco-System

5.1 Education

New elective subjects

An innovation attitude can be inspired with new, elective subjects. The Starting and Managing Innovative Businesses elective subject started four years ago, allowing students to become acquainted with the basics of an entrepreneurial mindset via case studies and invited talks, so practice is in focus (with very little theory). As homework, students have to start an (imaginative or real) new business.

The curriculum of the subject includes generating a business idea, developing a business concept, forming the core group, developing a business model, managing product development with the lean start-up, planning financing, stepping into the related market, and writing one-page pitch. The invited talks are held by start-up leaders, financial investors, company managers and lawyers.

The course runs with 200–300 students/semester.

5.2 Training of teachers

The training sessions organized within the frames of the project Training of Trainers at the University of Technology and Economics (Kálmán, 2012) provide significant contributions to the reduction of missing trainer competences that are necessary for the implementation of the requirements of the Knowledge Triangle. These sessions were based on the institutional demands and requirements of BME that were measured in the previous years within the themes addressed in a survey. The training is suitable for flexibly following the internal training demands and also for training participants to fulfil the competency requirements of the teaching profession, to be prepared for the challenges raised by the teaching-learning process, to learn how to learn.

The free training of a limited number of participants, organized within the framework of the project, provides the participants with knowledge and competences needed in competence-based curriculum development, in applying adequate teaching methods and in employing systems that provide individual, open learning ways. The professional content of the project is connected to the following programs: Methodological training, Training for tutorial tasks, Digital competences in the teaching activities, E-curriculum development, English professional language, and Health and security.

The training started in 2010. Until now, altogether 358 lecturers, researchers and PhD students attended the training.

5.3 Networking

Technology and Knowledge Transfer Network

Networking can enhance boundary-crossing cooperation and knowledge sharing between lecturers and researchers from different fields. The Technology and Knowledge Transfer Network (often called the Club) was formed at BME in 2011. Three to four lecturers and researchers from one faculty were involved, who could also interact with the faculty staff. The network is self-organized and its meetings held every month to set up and discuss new ideas, project possibilities, and calls for proposals. Our experience is that the network can help initialize cross-faculty cooperation and project work, as well as disseminate innovation-related information among the lecturers and researchers.

Starting and Managing Innovative Businesses 2.0

The most talented students from Starting and Managing Innovative Businesses elective subject are invited to take part in a facultative course (with no credit points at the moment) called Starting and Managing Innovative Businesses 2.0, where they can work on their businesses. Meetings are held weekly during the semester. At the beginning, students start working together, and later they work in groups with corporate mentors. At the end of the course they have a more detailed business plan.

SMIB 2.0 runs with 18–20 student projects/year.

5.4 New idea generation

Our experience shows that students at BME have many ideas but little knowledge of how to innovate and start a business. This mindset cannot be taught in a traditional, lecture-like way—they have to experience it.

Idea Competition

The Idea Competition is planned to be held annually (it started a year ago). During the competition, students can present their new solutions and to-be products. The competition has three rounds. At first, the interested students fill in an application with some basic information: a short description, demands and benefits, status of the development, and future plans. In the second round, additional questions have to be answered during an interview about: the novelty of the solution, competitors, market, time needed for the first prototype, and the team members. The aim of such a personal interview is to force the competitors to think about these questions. The applicants also receive training in presentation techniques, what investors look for, and case studies of start-ups.

Based on the second round, 15–20 applications are selected for the third round. They present their solutions for a committee in 10 minutes with 5-minute interaction. The committee consists of representatives of financial investors, innovation associations, and university experts. The prize of the competition is the award of Leading Innovative Project of the Year with a symbolic grant of 1000 Euros.



Figure 2. Creative groupwork in the Idea Hall.

The main aim of the competition is not to hand out the prize. During the competition, talented and determined students can interact with mentors and start their business. Both investors and university experts offer their help to the selected projects, and students interested in groupwork are also welcome. Every competitor receives positive feedback. This feedback is essential to form the targeted attitude.

In 2013, 31 applications were submitted. This year (2014), the number of applications increased to 63. In 2013, 19 applications were selected for the third round (competition in 2014 is still under way). Out of these 19 projects, three are mentored by investors, another three are running with the help of university experts and getting ready for the first prototypes, and one is under patent application.

Student Innovation Centre

The Student Innovation Centre (SIC) helps students create and develop new ideas and products. Experts in SIC support determined student teams from SMIB 2.0 and Idea Competition, as well as teams developing new ideas on their own. SIC helps students find resources, experts, consultants, laboratory and workshop capacity, new student members—anything that a student team needs.

Idea Hall—working and thinking together

An old machinery hall (laboratory) was renovated and transformed into a public hall, where student teams and start-ups can work on their own business. Our experience shows that these teams are willing to support each other because they can think together, gather other opinions, borrow and lend team members—work as an innovation society (Figure 2). To support the interaction, several social events and meetings are organized, for example Monday Breakfasts held every two weeks.

At the moment, two years after opening the hall, 11 teams are working in the Idea Hall (often referred to as Demola Hall).

5.5 University-student-industry partnership

Demola Budapest co-creation

Demola (www.demola.net) is an open innovation platform, working in eight European cities so far, where companies, universities and students co-create a solution concept for problems important for the companies. It is based on a fusion of ideas, skills, and perspectives of students from various backgrounds. They work together as a team, with the help of company and university experts. Getting started with Demola is free of charge for the companies. After the work is complete, the project team will present the results. If, and only if, the company finds the results useful and valuable, they have the option to either license or purchase the rights from the team.

Participating in a student team means approximately four months of self-organized teamwork and co-creation with the project partner. Each team has a Demola facilitator appointed to them to support their process and give them team management tools, contacts and links to professionals. Most of the students can match the Demola project with a subject or a subject project and receive credits for the work.

Demola Budapest (www.demola.hu) started with three pilot projects in 2013. In 2014, during the two semesters, we started 11 projects with 38 student participants, out of which 11 are outside BME and three are foreign students. The closing and final presentations of the projects are still under way. At the moment three project results are accepted by the company and none rejected.

5.6 Hosting events

The Idea Hall is also a place for innovation events. Several national and international start-up challenges, meetings and workshops are organized in the Hall, such as:

- Hackathon-in-a-Box—a two-day start-up competition for university students in Hungary
- Entrepreneurs in Focus—a training held by the American Chamber of Commerce in Hungary
- First Monday—Monthly gathering of the Budapest start-up community
- How to start a start-up—a free online course held by Stanford University is discussed together
- Startup Sauna—a closed coaching event for the most promising start-ups
- Appcampus—funding and coaching for mobile developers
- Mentoring innovative start-up companies—organized by Hungarian National Innovation Office

These events are good opportunities for BME student teams to present their start-up ideas, acquire feedback and mentoring from experts and build social capital. On

the other side, the innovation activities of BME become more and more known by the stakeholders.

5.7. Dissemination

Innovation activities and the eco-system must be advertised and disseminated among students and lecturers to involve more and more university commoners. Besides traditional communication ways, like news and articles in university media, new ways are also adopted to reach our target group, like Facebook notifications and Youtube virus videos. Every semester, SIC and Demola staff gives short introductions at university courses and organizes kick-off and social events which those interested can attend and interact in freely.

We believe that the best dissemination channel is the positive feedback from students who have already participated in the activities.

Interaction of the Elements

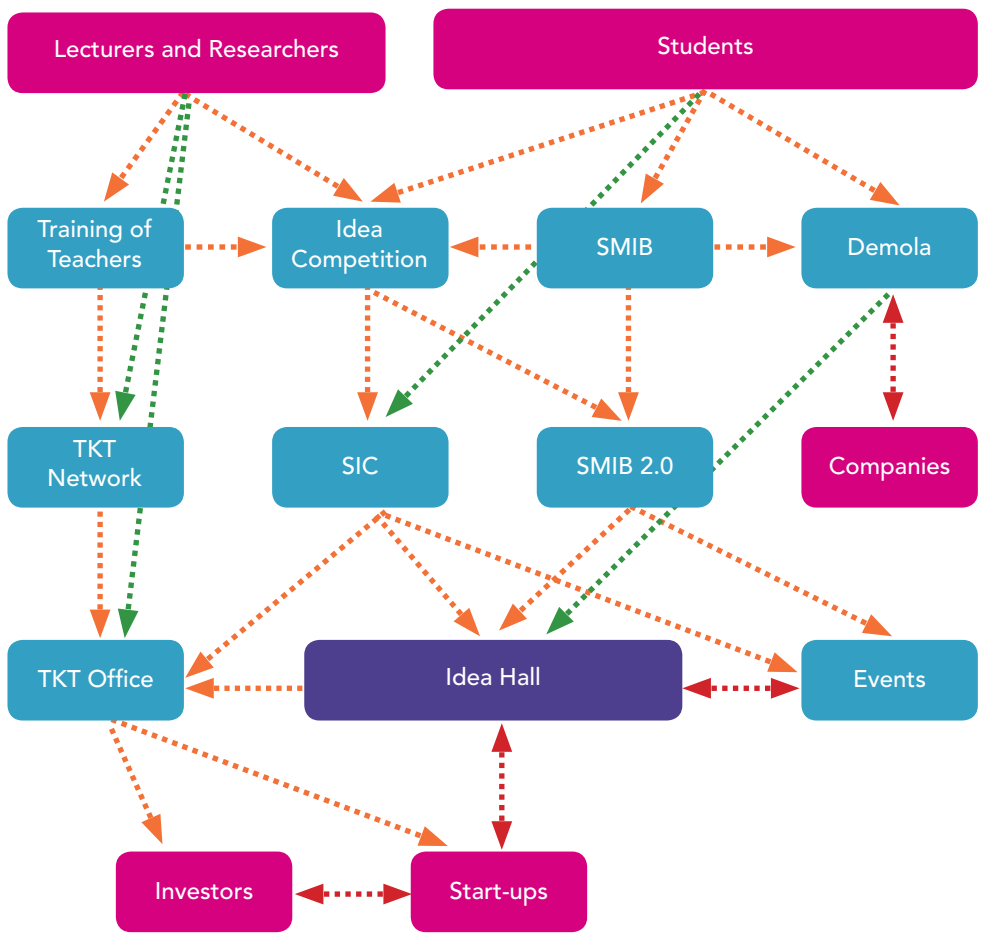


Figure 3. Interaction of the eco-system elements.

The interaction and connection of the elements in the mini eco-system is shown in Figure 3. Lecturers and researchers can attend the Training of Trainers and get in touch with the innovation culture. If they are interested, they can take part in the Technology and Knowledge Transfer Network. If a research and development project becomes a business idea, they can continue with the Technology and Knowledge Transfer Office. The role of the TKT Office is to find resources (investors) and to establish start-up companies—mostly shared by the researchers with a small share of the university.

The interested students can attend the Starting and Managing Innovative Businesses subject and shape the basic innovative mindset. Students with solution ideas can attend the Idea Competition, while those interested in corporate work can attend the Demola projects. In the next step, talented and committed students can start innovative work at the Student Innovation Centre and plan their business in Starting and Managing Innovative Businesses 2.0.

The central place of innovative work is the Idea Hall, where all innovative projects can find a place and support for their work.

Cooperation of students and lecturers is very important when forming a culture and an attitude. This collaboration is encouraging both for students and lecturers (and researchers). Our aim is to strengthen this cooperation. For example, lecturers supporting a winning team at the Idea Competition can also receive a prize. Student teams often need expert assistance to step forward. In this case, the Technology and Knowledge Transfer Network can e.g. help them find experts inside and outside the university, organize work with university laboratories and workshops.

The organization of the mini eco-system is parallel to university organization, only two of them being university divisions.

5.8 Extending the eco-system

The BME student innovation eco-system has many similar activities to other university innovation eco-systems, like, for example, Aalto University in the Helsinki Smart Region (Miikki, 2014). However, BME has to walk a more groundbreaking path to set up and operate the innovation eco-system—and change the mindsets of university commoners.

To widen our activities and reach our long-term aims, the following activities are planned in the near future:

- open the student innovation eco-system towards urban and regional innovation activities and networks (e.g. competitions, incubator and accelerator centres)
- create close cooperation with community innovation centres (workshops and living labs)
- include other Hungarian universities in the system (e.g. widen the Demola Network)

- strengthen international network activities (e.g. launch cross-border projects at international level)
- promote and disseminate the results and possibilities towards students and industry
- include incubator, pre-seed and seed funds, based on the results achieved

The method that we can employ to reach our aims is based on the ACSI (Aalto Camp For Societal Innovation) method, modified to meet local specialities and best practices. ACSI is an instrument created at Aalto University for answering real-life challenges with the help of quick prototypes, pilots and demonstrations. ACSI reinforces the role of the university as an important developer of innovation systems by connecting global expertise, high-quality research and university-level continuing education in collaboration with the public and private sectors (Triple Helix). It can also be adopted in developing applications for bridging the gaps between the university and other educational levels, as well as in supporting the different paths of lifelong learning.

6. Summary

The student innovation eco-system started its operations two years ago. This time is not enough to yield long-standing impacts, but the feedback and the increasing number of participants shows that the direction is good, and, step by step, a new culture and attitude can form among university commoners—lecturers, researchers and students. This step-by-step, bottom-up approach, where small activities are launched and connected to each other, can be a good example for regions with a less accentuated innovation culture and tradition.

References

Kálmán, A. (2012). Training of Trainers—Paradigm Shift in Qualitative Higher Education. In: IACEE 2012 World Conference on Continuing Engineering Education, 17–19 May 2012, Valencia, Spain. ISBN: 978-84-8363-858-3 (CD).

Kálmán A. (2013). Developments in Hungarian Lifelong Learning Policies as Means of Implementing the Knowledge Triangle. In: The Knowledge Triangle—Reinventing the Future, 85–100. Lappalainen, P. & Markkula, M. (Eds.). ISBN 978-2-87352-006-9, SEFI—Aalto University—Universitat Politècnica de València and VLC/Campus.

Korányi, L. (Ed.) (2014). Budapest Runway 2.0.2.0. Accessed from http://www.nih.gov.hu/strategy/publications/budapest-2-0-2-0-runway.

Markkula, M. (2013). Special Report of the Triple Helix 11 Conference on 8–10 July 2013, http://www.triplehelixassociation.org/helice/volume-2-2013/helice-issue-8.

Markkula, M. (2013). The Knowledge Triangle Renewing the University Culture. In: The Knowledge Triangle—Reinventing the Future, pp. 85–100. Eds: Pia Lappalainen, Markku Markkula, ISBN 978-2-87352-006-9, SEFI—Aalto University—Universitat Politècnica de València and VLC/Campus.

Miikki, L., Markkula, M., Schaffers, H. (Eds.) (2014). Helsinki Smart Region: Pioneering for Europe 2020. Accessed from http://www.uudenmaanliitto.fi/en/helsinki-uusimaa_region/helsinki-uusimaa_region_facts.

National Innovation Office (2013). Investment in the future. National Research and Development and Innovation Strategy (2013–2020), from http://www.nih.gov.hu/strategy/national-rdi-strategy/hungarian-rdi-strategy.

Palkovics, L. (Ed.) (2014). Shift gear in education. Accessed from http://www.kormany.hu/download/5/65/20000/Fels%C5%91oktat%C3%A1si%20strat%C3%A9gia_2014_10_21.pdf (in Hungarian).

Pálmai, Z. (2004). An innovation park in Hungary: INNOTECH of the Budapest University of Technology and Economics. In Technovation, 24 (5), 421–432.

Péceli, G., Kovács, K., Tömösközi, S. (Eds.) (2012). Research university milestones 2012. Accessed from https://kutatas.bme.hu/portal/system/files/M%C3%A9rf%C3%B6ldk%C3%B6_2012_EN_20121123.pdf.

Ulab (2013). White Paper: How to build the Technical University of Tomorrow. ISBN 978-84-695-7624-3.

About the authors

Dr. **Anikó Kálmán** received her PhD in the field of higher education-lifelong learning in 1999. She is Habilitated Doctor in Management and Organizational Sciences and Deputy Head of Department of Technical Pedagogy. She is president of Hungarian University Lifelong Learning Network, was leader of international working groups in five European Adult Education and Lifelong Learning projects, and organized numerous national and international conferences and workshops. She is the elected member of the SEFI Administrative Council; from September 2012 the appointed ambassador for the Budapest University of Technology and Economics by the Rector, responsible for the EU projects (fostering the promotion of the Horizon 2020 program and the implementation of the Knowledge Triangle); tasks: ensuring that these projects and relations work for the benefit and the development of BME.

Dr. **László Farkas,** Director of Science at Student Innovation Centre, received his PhD in 2003. He participated in several Hungarian and international development projects, was responsible for two EC projects, and organized several scientific workshops, exhibitions and summer schools. He developed and teaches BSc and MSc courses titled Engineering problem solving and Development of new products, and he is consultant of 5–8 student project works/year.

Mr. **Donát Dékány** graduated as an electrical engineer at the MSc level at the BME Faculty of Electrical Engineering and Informatics. He was the head of the student organization of the Faculty and member of the board at the university level. He founded the Alumni organization of the Faculty and has a specific relation to the graduated students of BME. Currently he is the director of Student Innovation Centre and member of the project management team responsible for the development of supporting framework conditions and tools for technology transfer at the university.



© Cederqvist & Jäntti Architects

ACTIVATING BUILDINGS

ALL BUILDINGS AT street level must open towards public spaces. Architectural solutions permit people to interact through the walls between the street and the indoor-spaces. The street level is the key to all action.







STARTUP VILLAGES

THERE ARE many spots for horizontal business parks. The platform is 10 meters high and could cover 1–3 stories of village-like buildings. 120 000 sqm of floor-space is easily available. Frank Gehry designed the Facebook office based on a similar concept.





IV
OTANIEMI IN TRANSITION

Relationships between urban space, societal movement, and natural systems are changing, creating both opportunities and threats for an Otaniemi in transition. New, spatial concepts and services to support, attract and engage people must be invented. Systems thinking, stakeholder interests, and ecological sustainability all play important roles in modern urban design. This chapter examines rapid urban development projects taking place in Otaniemi, focusing in several articles on Aalto University's ongoing campus development process. It presents lessons in how users collaborate to co-create and impact their environments.

In his article, **ANTTI AHLAVA** reviews the societal dimensions of the future-oriented Aalto University campus, analysing the assumed interests of the key stakeholders in the University's current development process. **SIRKKU WALLIN** and **AIJA STAFFANS** look at different kinds of urban development projects taking place in Otaniemi in terms of co-creation, connectedness, and complexity management. **EELIS RYTKÖNEN, SUVI NENONEN** and **ROBERT ERIKSSON** explore the potential for scaling the lessons learnt from managing the campus as a small city to managing the larger-scale urban area of T3, using the five Cs framework of urban process capabilities. **KATRI-LIISA PULKKINEN** introduces the Swedish concept of social-ecological urbanism for a future university campus, which requires the campus to be designed as a learning system, and she uses this as a benchmark to consider future sustainable development at both the Aalto Otaniemi campus and in Tapiola garden city. **HEIKKI HARTELA, TERO VANHANEN,** and **PETER VESTERBACKA** provide a visual and visionary introduction to the potential global start-up village that can be the future of Espoo Innovation Garden.

Antti Ahlava
Vice-President, Professor
Aalto University, Department of Architecture
antti.ahlava@aalto.fi

19. Participant Interests in Developing Aalto's Otaniemi Campus

Abstract

This article reviews the societal dimensions of the future-oriented university campus. It analyzes the assumed interests of the key stakeholders in the current development of the Aalto University campus area in Otaniemi, Espoo. This analysis is based on the key reports related to the development of the area. We will also make further studies in order to create a feasible background for an urban design management process.

The special trait of Aalto University campus design is its user orientation, inviting active community participation in the development process through competitions and open dialogue. The aim is to create a campus characterized by effective teaching and research facilities, vibrant recreational and freetime activities, and intensive collaboration between the different Schools and the University and its neighboring business region in Keilaniemi.



KEYWORDS: Otaniemi, Campus, Urban design management, Stakeholder interests

1. Introduction

Urban Design Management is a collaborative method of urban development benefiting from public imagination as a resource. It starts by mapping participant interests in an urban development project and finishes with a co-created, shared vision for the future of an area (Ahlava & Edelman, 2008). Investigating the interests of project participants—or stakeholders—is useful in any land-use and urban develop-

ment project, because it makes explicit the values and strategies of each participant related to the project. It is also easier to develop synergies and negotiate discrepancies when the agendas of each of the participants are clear.

This article analyzes the assumed interests of the key stakeholders in the current development of the campus area of Aalto University located in Otaniemi, Espoo. This analysis is an educated guess, because it is based on the key reports from the past projects related to the development of the area and not that much on current discussions.

The aim in the actual development process of the area is to use this material as a starting point for collecting the current interests of the project participants, when continuing the strategic and urban design development of the area.

Here the key stakeholders are those institutions and companies which have a responsibility to represent larger groups of users and have a direct stake in the development of the area: the land owners and real estate owners, the largest education and research institutions operating in the area and the major companies. Because the Otaniemi land area has strategic value for the whole country, the Ministry of Employment and the Economy should also be included amongst the core players of the area planning its future. The extended participants include local and state administrators, construction companies, real estate investors, more corporate and institutional partners from the area and student associations; such Aalto University student associations as **Aalto University Student Union (AYY),** Aalto Entrepreneurship Society (Aaltoes), the student union of the students of economy (KY) and the Swedish student union TF. This list of examples is constantly extended with new student-initiated endeavours.

2. Aalto University Perspective

Aalto University is one of the two largest property owners in Otaniemi with the state-owned Senate properties.

2.1 The board setting the frame

The Board of Aalto University decided in 2011 that the main campus of Aalto University will be located in Otaniemi, Espoo. The main campus was actually already then in Otaniemi with far more students, faculty and staff than in the other two campuses. However, the rationale behind the Board's decision was to direct the removal of units from other two campuses to Otaniemi. In the decision, the aim with one main campus was to "support the aim of Aalto University as a multidisciplinary and creative university".

As the prerequisites for the new Aalto University were very ambitious and eventually influential politically and economically, the developed Otaniemi campus would have remarkable consequences in the integration of the neighboring areas and the entire metropolitan region. The campus had to, for example, support the land-use

of the new metro station, and not only manage sufficient and well-equipped research and teaching facilities.

The values and mission of Aalto University have steered the planning and construction of the new main campus. Through a series of campus workshops, it has become clear that the university community would like to have a vibrant and interactive research and study environment, where work, education, recreational activities and everyday life will be closely connected to each other. Attaining the ideas of sustainable development will require new energy and transport solutions, if realised. Aalto University aims to diversify the university services, recreational opportunities and cultural services.

The principle of centralizing operations is supposed to "create the prerequisites for a high-quality, inspiring and versatile learning environment", where students have the opportunity to "make choices". The centralized campus supports "boundary-breaking" research and artistic activities by enabling "versatile and active forms of interaction".

According to the decision of the Board, the Aalto University campus will be built step-by-step in an "economically and ecologically sustainable" manner. The development of one main campus will begin by gradually concentrating all bachelor-level education to Otaniemi from 2013 onwards.

The focus of constructing new buildings will be in Otaniemi, where the joint use of teaching and research facilities can be developed in a creative and cost-effective way. However, the University will not give up any of its own facilities that serve its interests well. The School of Economics will continue its operations in the current facilities in Töölö, Helsinki. The present rationale is that the bachelor-level education will be transferred to Otaniemi. Due to their central location in the city centre, these facilities can also be developed for the needs of the other Schools of the university. Aalto University will continue its operations also in other locations in Finland and abroad in the scale necessary for strategic partnerships and cooperation. (Aalto University, 2011a)

The Campus Vision presented by the President of the University in June 2011 was based on multiple collaborative workshops within the university. It criticizes the present state of the campus, marked with isolation, poor services, and areas heavily zoned for specific use and the infrastructure dominated by cars. The Vision defines the task of the campus development to meet the prestigious history of the place with modern design. The Vision emphasizes a physical framework, which can support a community of interdisciplinary collaboration. This principle is supported by an "interactive learning environment", a "setting for transcending traditional boundaries in research and art", supporting open innovation and social interaction in a sustainable manner.

The learning environment should also be "non-hierarchical", centered around cafes and other social spaces and including so-called "learning hubs", flexible spaces dedicated for students. Spaces and other infrastructure should be shared and smart facility management, reservation services and spatial guidance developed. University facilities will be opened for the student community. The processes of cre-

ation should be made visible. The Campus Vision includes an imperative for a later "strategic brief", which should include plans for the renovation and transformations of buildings and areas and the designs for new buildings through an architectural competition. (Aalto University, 2011b)

The above-mentioned "strategic brief competition" was never organized. However, in 2012 the University organized a competition for the new building of the School of Arts, Design and Architecture (ARTS) and the adjacent university-owned shopping centre by the metro station. The competition was called "Campus 2015", even if this was only a small, yet important fragment of the entire campus. The competition was won by Verstas Architects Ltd with their entry "Väre".

2.2 Active participation of the personnel

The key document for mapping the interests of the personnel of the University is the so-called "Harrison's Report"—an internal study of the spatial requirements of the schools and departments of the University, which has not been published openly. This work was conducted by Andrew Harrison from the British architectural agency Spaces That Work Ltd in 2011–12. Every School worked together with STW to explain how they currently use the spaces and what their future needs are within spatial and financial constraints. The aim was to look for opportunities when intensifying the use of the spaces by sharing the facilities between the Schools. This chapter summarizes the recommendations of the report with a focus of the urban and public scale, not that much the building level with private use.

Moving to the main campus in Otaniemi from Arabia and Töölö allows the Schools to work more closely with each other. However, according to Harrison's report, the key question for the Otaniemi campus is the feasibility of the current learning and teaching spaces. Furthermore, the challenge with the growing Otaniemi is maintaining the identities of the two Schools, that of Economics and School of Arts, Design and Architecture. Also Biotechnology and Chemical Technology in Otaniemi share the perception that these departments need a stronger image and better branding according to the report.

Harrison's consultation with the different departments showed which types of generic spaces should be provided. This reflects the growing desire for more open, shared and urban working spaces that are available to a larger number of occupants, for greater periods of time and that support a wider range of activities than was previously possible. Informal meeting spaces, as well as open individual and collaborative working areas have been requested.

Harrison suggests that open and shared areas such as student premises, lounges and rest rooms could be located near main routes to allow easy access. He finds that teaching and learning spaces could be located at junctions with the main routes in order to ease the large number of students accessing spaces. Smarter use of lobby and circulation spaces was suggested, for example, through 'pop-up' settings.

Also new buildings and facilities were suggested. For example, the department of Applied Mechanics would like to create a collaborative, project work based 'Sim

Lab' laboratory, similar to the Design Factory. In addition, new dining and cafeteria spaces were requested, with extended opening hours. Free-time services was actually one of the major concerns in Harrison's report. In Otaniemi, students do not stay for any activities outside the classes because there are no amenities or other incentives available. Also the student catering provision is considered insufficient and poor.

Especially the campus size hinders the travel between buildings and therefore also interaction. For example, the School of Engineering is spread across fourteen different buildings in the Otaniemi Campus. The Civil and Environmental Department is the most dispersed with the largest parts of the Department being located in four separate buildings. Related to locations, Harrison proposes in his report that the future amenity spaces for students should create a central student social facility that encourages interaction between students across the schools and with faculty. This social space should also welcome people from all the Schools and contain a range of spaces to support different sizes and types of social activities.

The need for a faculty club in Otaniemi was also expressed to support formal and informal learning and social interaction for faculty and administrative staff on School or university level. All the faculty and administrative staff in Töölö will retain their base as the main working space. However, some departments would like to move towards more open, collaborative work environments to create a more communicative and vibrant atmosphere.

According to Harrison's report, the key elements of the future shared spaces are social spaces, such as cafes and lounges that should be provided to support collaboration, knowledge-sharing and social interaction. It is also important that there are event and exhibition spaces for all departments, Schools and the community at large. The main reception should be friendly, informative and look after the variety of occupiers and visitors through to their destination.

3. Campus 2015 Architectural Competition

The aim of the Campus 2015 competition, organized in two phases in 2012–2013, was to design the new ARTS building with its nearby core campus for Aalto University in Otaniemi.

The new metro station with its new shopping centre gives a starting point for the development of the Otaniemi campus. It concentrates traffic flows and increases the accessibility of the area especially from the areas along the metro line in Helsinki and Espoo. Finding an appropriate way of renewing a central part of Alvar Aalto's well-known campus university area is a daunting task for any architect or urban planner.

The competition attracted many entries, 189 in all. Proposals featured various versions of learning environments ranging from low, dense urban village solutions to sculptural and monumental large-scale urban city blocks or individual buildings.

The targets of the competition were defined in the competition programme. These include, among others, the following guidelines which characterize the start-

ing points of the campus development in 2012 as a whole (Competition Jury Report, 2012):

- The architecture of the central campus needs to reflect Aalto University's values: passion for exploration; freedom to be creative and critical; courage to influence and excel; responsibility to accept, care and inspire; integrity, openness and equality.
- The facilities should, therefore, promote and support active collaboration and interaction. The objective is to find new concepts and create a lively and interactive environment for research and learning activities wherein work, studies, leisure and living are interwoven in a natural way and create the foundation for a university city of the future.
- What is sought is a new functional model: the university's and the whole Otaniemi science and research community's 'mental core', a dynamic centre which allows people to move freely in and out, stops and attracts them, awakens curiosity and – most importantly—inspires them to study.

The Otaniemi campus is one of Alvar Aalto's major urban designs, and the competition and the jury were challenged by the existing environment and the philosophy behind it. According to the jury's decision, the winning entry respects the existing architecture of the area and is flexible in terms of adapting to future needs.

The winning entry, Väre, has a layout based on its own structural matrix as the organizing principle for the new buildings; it forms this pattern based on two of the principal coordinates taken from the nearby old main building of the former Helsinki University of Technology and the main library, which were designed by Alvar Aalto.

The jury finds that the spatial concept of Väre is completely in tune with the expressed aims of the university. The users move from the general public areas upwards towards more private and intimate places or from interdisciplinary to more specialised activities, a mode of operation. (Competition Jury Report, 2013).

4. Student Perspective

In the recent years, the teaching and research resources allocated to the analysis, development, design and planning activities related to campus development has been extensively increased. Various courses and student assignments have investigated the campus itself and its vicinity in a versatile manner. Similarly, many Bachelor's and Master's theses have been contributing to the topic, as well as research projects yielding e.g. doctoral dissertations.

The Aalto University Student Union AYY participated in numerous development workshops organized by the University before the campus decision was made. AYY emphasizes the importance of seamless cooperation between the University community and its stakeholders to promote the role of students as the largest actor

group on campus but also as a resource producing and refining new ideas. AYY has defined the following as its core operating principle: "Campus development must be user-driven so as to allow the users of its premises and functions to influence their development."

Currently close to 4.000 inhabitants live in Otaniemi, mainly students residing in the apartments owned by AYY and the Foundation for Student Housing in the Helsinki Region (HOAS). One of the targets of the Espoo City Planning Board is a city plan that allows at the minimum 7,500 new citizens into the area. At least one third of this number, that is roughly 2,500, is constituted by students.

The vision document of the Student Union, produced at the end of 2014, is a detailed analytical proposal on the future student housing. The vision is to increase communal housing close to the premises of the university while simultaneously taking into account the values of the natural environment. The present car parking areas have been suggested to be one new key location to be changed to new housing. According to an AYY proposal, there could be 900 new inhabitants in the Servinniemi area and 1,000 new inhabitants alongside the Otakaari road. In addition, the Student Union gives its strong support to the plans to have new apartment buildings for students and professionals working in Otaniemi in the neighborhood of the new metro station. (Aalto University Student Union, 2014)

5. The Perspective of the Espoo City Planning Board

The City Planning Board of the City of Espoo has an important role in the urban planning and design of the city where Otaniemi is located. The board informs about its views through handouts called "Decisions of the City Planning Board". These are published on City's web pages. According to these Board decisions, the City is to integrate technical and urban planning principles to the political goals based on lively discussions between the Board members. (The City of Espoo, 2014)

These guidelines include enabling, with the help of urban planning, the Otaniemi—Keilaniemi—Tapiola area to become a global reference area as a testbed in co-creating innovative solutions for sustainable wellbeing. This means, among others, integrating living, working and learning 24/7 in different seasons. New apartments are targeted mainly to students, researchers and staff, as well as industrial professionals working in the area.

The Board recommends the Otaniemi coastal areas to be developed according to these guidelines, while increasing housing and services in the area in a way that supports the multidisciplinary concept of Aalto University. Remarkable construction should be allowed in the coastal areas, with amenities related to the sea and maintaining the characteristics of nature. There should be a continuous light traffic route following the waterfront also in the future. The Board also made recommendations restricting construction in certain areas due to the values of the natural environment (May 5th, 2012).

The Board has expressed its special emphasis on traffic solutions. The aim in traffic planning should be to considerably lower car traffic in the area, to speed up the adoption of intelligent mobile communications systems for traffic, to make a general plan of mobility directed towards the period when the metro starts operating in the area and to prepare a description of the attractiveness of pedestrian and bicycle mobility (January 22, 2014). The long-term aim for the new shopping centre should be underground parking and there should be no park-and-ride parking in Otaniemi (December 20, 2014).



Figure 1. The draft of the Otaniemi Campus area around the metro station brings to the discussion some potential locations for new residence buildings.

6. Conclusion

This article is only a preliminary attempt to summarise the present interests of different actor groups in the Otaniemi development. The objectives are compatible. Further studies are to follow in creating a feasible urban design management process integrated into implementing the investment and other action plans to achieve the ambitious targets of Aalto University and the Espoo City.

The next steps in decision making will be taken in the approval of the city plan around the metro station in a way that enables the implementation of the con-

struction plans derived from the architecture competition. On the side, preparatory decisions will be made to increase housing, start-up entrepreneurship and multidisciplinary activities, as well as more intensive connecting of the Otaniemi and Keilaniemi areas. In all this, tight collaboration between the diverse interest groups plays a crucial role.

References

Ahlava, A. and Edelman, H. (Eds.) (2008). Urban Design Management: A Guide to Good Practice. Abingdon and New York, Taylor & Francis.

Aalto University (2011a). Aalto University main campus to be located in Otaniemi. Retrieved January 15, 2014, from https://into.aalto.fi/display/enaalto/Aalto+University+main+campus+to+be+located+in+Otaniemi.

Aalto University (2011b). A Campus Vision for a Thriving Learning Community. Retrieved January 15, 2014, from https://inside.aalto.fi/download/attachments/11731182/campusvision_for_a_thriving_learning_community.pdf?version=2&modificationDate=1306922431000&api=v2.

Aalto University Student Union (2014). Eds. Pyry Haahtela, Laura Keski-Hakuni and Patrick Jensen: Aalto University Student Union Campus Development Work Group. Retrieved January 15, 2014, from http://ayy.fi/wp-content/uploads/OtaniemiOK-Aalto-yliopiston-ylioppilaskunta.pdf.

Competition Programme (2012). Open international architectural design competition for Otaniemi central campus of Aalto University. www.Campus2015.aalto.fi.

Competition Jury Report (2013). Open international architectural design competition for Otaniemi central campus of Aalto University. www.Campus2015.aalto.fi.

The City of Espoo (2014) Meeting Proceedings. Retrieved January 15, 2014, from http://espoo04.hosting.documenta.fi/cgi/DREQUEST.PHP?page=meeting_frames.

About the Author

Antti Ahlava, architect SAFA (M.Arch SAFA TKK) DA (TAIK) is Full Professor of Emergent Design Methodologies at the Department of Architecture in Aalto University. He was Head of the Department of Architecture 2011–14 and is now also Vice President of the University. In this task, he is responsible for campus development. Ahlava made his doctoral research-based design thesis on the topic of architecture in consumer society. He is also an architect and partner at Helsinki Zürich Office Ltd (helsinkizurich), located in Helsinki, Finland and Zürich, Switzerland. He has been a lecturer in urban design at Helsinki University of Technology, a visiting professor in Architectural Design at Århus School of Architecture, Royal Danish Academy of Arts and TU Vienna and collaborated also with the architecture schools of MIT, Columbia, Yale, Keio and Tokio. Ahlava is a certified designer both in urban and building architecture.

Ahlava has won many prizes in architectural competitions, for example the first prize in Espoo City Hospital competition with K2S Architects in 2009, in Andermatt city centre competition in Switzerland in 2011 and a second prize in Katara Hills housing competition in Qatar in 2013.

Ahlava has participated in research projects on sustainable urban development, infill building and the management of urban development. He has lectured in Estonia, Sweden, Spain, Denmark, India, China and USA. Ahlava's publications include articles and books published by Taylor & Francis, The Finnish Architectural Review, Intern, Ehituskunst, Maja and the Finnish Building Information Society. His work has been featured in several architectural exhibitions.

Ahlava has been a jury member in several international architectural competitions in Estonia and Finland and a member of architectural specialist boards in Estonia and Sweden.

Sirkku Wallin
YTK/Department of Real Estate, Planning and Geoinformatics, School of Engineering
Aalto University, Finland
sirkku.wallin@aalto.fi

Aija Staffans
YTK/Department of Real Estate, Planning and Geoinformatics, School of Engineering
Aalto University, Finland
aija.staffans@aalto.fi

20. From Statutory Urban Planning to Living Labs

Abstract

Otaniemi, the heart of the Finnish technology education is under a rapid urban transformation. In addition to top-down large-scale infrastructure development, Otaniemi has witnessed new kinds of bottom-up development initiatives issuing participatory service production and re-development of existing brownfield real estates into shared public spaces and scientific research facilities. Together they conceptualize the variety of urban development ranging from statutory urban planning processes to the actual co-creation of urban space, in which local stakeholders seek to take action to produce their everyday environment. The urban drivers presented here have been studied in several urban planning research projects at Aalto University. The aim of this chapter is to analyze the urban transformation from the perspective of expanded urban planning, which anticipates plausible continuities and urban complexities better than straightforward management of megaprojects.

KEYWORDS: Urban development, Expanded urban planning, Megaproject, Participatory design and co-production, Living lab

1. Introduction

Urban space emerges through the interplay of urban structure and social movements. It is not a void filled by institutionally governed actions but gradual transformation of everyday life (Jacobs, 1961; Manzo & Perkins, 2006). Urban planning is responsible for forecasting and steering this interplay. It provides methods and processes for visions, strategies and plans, resource management and political and juridical decision-making. Urban planning defines the rules, but it cannot play the game. This becomes tangible in large-scale urban development projects fueled by high expectations of cumulative economic gain. In their book Megaprojects and Risks (2003), Flyberg et al. argue that the sheer complexity and potential impacts of a megaproject dictate deep public-sector involvement for many issues, for instance safety and environment. However public sector has limited jurisdiction, when interventions take place through local networks, and the finance is provided by outside investors. Their interventions scale up accordingly, but following the logic and resources of each stakeholder. Thus, the implementation of megaprojects remains in constant flux, when interventions become interconnected and impact each other from scale to another. (Haughton & Allmendinger, 2009; Salet & al., 2013).

Otaniemi, the heart of the Finnish technology and engineering education is under rapid urban transformation. It is a part of a grand urban development process, a megaproject even in the national context. In this article, we analyze three kinds of urban interventions which impact the Otaniemi future. First of all, there are the major transportation investments such as the new subway line West Metro and the T3 innovation strategy of the City of Espoo that generate urban transformation in the entire Helsinki Metropolitan Region. Second, we describe the change process of the Aalto University itself in developing the Otaniemi campus towards an internationally recognized forum of research and innovations. In addition to these more or less top-down large-scale infrastructure development and statutory urban planning processes, Otaniemi has witnessed new kinds of bottom-up development initiatives. These initiatives have issued participatory service production and re-development of existing brownfield real estates into shared public spaces and scientific research facilities. They have actually succeeded not only to plan, but also to co-produce new kinds of urban spaces.

This article provides an overview to the on-going urban development in Otaniemi. The urban drivers presented here have been studied in several urban planning research projects at Aalto University.[1] Together they **conceptualize the variety of urban development ranging from statutory urban planning processes to the actual co-creation of urban space,** in which local stakeholders, i.e. students, inhabitants and enterprises participate in the design and production of urban space. The

[1] See: EUE (Energizing Urban Ecosystems) is a research program where e.g. large urban ecosystems and regional information modeling has been studied as part of urban development (www.rym.fi). APRILab Project (Action oriented planning, regulation and investment dilemmas for innovative urban development in living lab experiences) at http://aissr.uva.nl/research/externally-funded-projects/sites/content13/aprilab/about.html

cases presented here aim to **analyze the urban transformation of Otaniemi,** and to **introduce the value and connectedness of those initiatives which seem to be less coherent but yet entwined.** This article seeks to answer what kind of urban development is currently taking place in Otaniemi and to review literature on urban planning and development.

2. Structures, Drivers and Stakeholders—Transcalar Urban Development in Otaniemi

2.1. Metro line as an urban booster

Otaniemi is a textbook example of the interaction between land use and transportation. There is seldom an opportunity to discover such a rapid urban change as there is at the moment in the urban structure of the City of Espoo because of the new metro line.

In 2011, the City of Espoo launched a new urban development strategy, known as T3. It comprises urban development in three neighboring areas in Espoo, Otaniemi being one of them. The objective of the City of Espoo (2012) is to incite and maintain Otaniemi as the largest high technology hub in Northern Europe. Large transportation projects, such as the West Metro, Jokeri Light Rail and the tunneling of the Ring I[2] will connect Otaniemi to corporate headquarters of Keilaniemi and to the garden city of Tapiola. Together, the strategy of T3 aims to foster cultural, scientific and economic activities estimated worth of 5 billion euros, and targeted on large investments on land-use, real estate development and infrastructure (City of Espoo, 2012).

This kind of a large-scale initiative is enormous by any measure. The City of Espoo, the second largest city in Finland, is an example of fast growing urban fringe attracting affluent tax-payers. Since the collapse of the mobile phone empire Nokia[3], it has struggled to maintain the economic drivers and to introduce more urban life style and real urban environment for the growing population. The most remarkable of these efforts has been the T3 strategy and the new metro line. The metro line is financed jointly by the City of Espoo, the City of Helsinki and the state, Espoo's share being 800 billion euros. This is a substantial investment of the City; it makes the T3 strategy tangible and actualizes new opportunities for the local stakeholders, land owners, investors and developers.

The West Metro can be considered a megaproject as such. Together with the T3 strategy it has proved to catalyze several urban development initiatives which Espoo seeks to govern through land use planning and land use contracts. These initiatives often include complex technical, financial and administrative interdependencies which might shatter the progress of the projects; e.g. the financing of the tunnel for

[2] Similar project in Boston: The Central Artery/Tunnel Project called The Big Dig took place in Boston in 1992–2006 (MassDot, 2014).

[3] Nokia's headquarters were located in Keilaniemi, Espoo.

the Ring Road I in Keilaniemi is dependent on the building right for the new high rise towers but, the towers can technically be built only after the heavy tunneling investment.

The contingency of the projects has forced the City of Espoo to consider more closely its policy. There has been the promotion of the large-scale infrastructure initiatives as described above. However, the city seems to implement an additional strategy to involve stakeholders and nourish the anticipated initiatives. It has launched and supported local learning-based ecosystems, i.e. it has enabled and encouraged the stakeholder networks by introducing to them several opportunities in local development. This kind of participatory and co-evolving development approach has been regarded as a test-bed for societal innovation or even as an urban living lab (ACSI Camp, 2012; Juujärvi & Pesso, 2013).

There are 20 research and development centers in the T3 area, among which is the National Research Institute of Technology (VTT), the largest applied research organization in Northern Europe (City of Espoo, 2012). However, the most influential key player in the T3 strategy is Aalto University. As an organization, Aalto University is an independent, foundation-based, land-owning institution in the area and an important image builder for the city, as well. The relationship between the city and the university is strong and special because of the long roots of technology and engineering in Otaniemi. In the next chapters, we examine the university and its interplay with the city more closely, and how these two nourish each other in developing urban space.

2.2. University campus as an innovation driver

The Otaniemi campus area is an exceptional urban environment; contrary to the typically complex stakeholder networks of urban processes, Otaniemi is a simplified case with its clustered land ownership and clearly recognizable parties, all more or less connected to the university.

The traditional campus of Helsinki University of Technology, built in 1960's, was chosen to be the main campus area of Aalto University and all of the bachelor's-level students of Aalto will be studying in Otaniemi from autumn 2015. This means that the traditional campus of technology students will host arts and business students that have described Otaniemi to be far away. The distance has been more mental than practical; the traffic connections to Otaniemi have always been fairly good and with the new metro line, the travel time from Helsinki will be reduced considerably.

The key players in the campus development include Aalto University Foundation and Aalto University Properties Ltd, Aalto University Student Union, Senate Properties and the City of Espoo. Senate Properties is a state-owned enterprise under the Ministry of Finance and provides property services mainly to customers in the government. In Otaniemi, the biggest customer of Senate Properties is VTT. The Aalto University Student Union owns most of the apartments for student housing in Otaniemi. The City of Espoo is responsible for urban planning and providing the public infrastructure to the campus area.

The biggest volume of the built environment in Otaniemi belongs to the Aalto University Properties Ltd. It was established in conjunction with the Finnish university reform in 2009 and it is part of Aalto University Group. Aalto University Foundation holds two thirds of the shares in the company, with the remaining third held by the State of Finland. Approximately 95% of the total 272,700 square meters owned by the company is leased to and some 4% is leased to private companies. (www.aaltonet.fi/en/).



Figure 1. The new Campus Center of Otaniemi. A proposal by Verstas Architects Ltd for the AAD Building. Copyrights, Aalto University Properties Ltd.

Aalto University's investment program of 350 million euros in 2012–2025 will deeply change the built environment in Otaniemi. The largest project, approximately a half of the investment program, is the new campus center closely linked to the new metro station. An open international architectural design competition for the area was held 2012–2013. The university was looking for "brave, visionary and groundbreaking ideas for the campus—innovations that respect both the principles and the objectives of the university, as well as the surrounding, architecturally outstanding environment and the unique natural setting". The results of the competition were expected to be "pioneering in spirit" and express "profound understanding and vision of the functionality and the context of the new premises". (Campus2015 competition program, http://campus2015.aalto.fi/en/about/) Verstas Architects Ltd, the winner of the competition, is currently designing a new building for the School of Architecture, Art and Design (Figure 1).

The academic community has high expectations for the new campus center. At the same time, it should be capable of producing a land use policy that supports sustaining but flexible innovative environments in forthcoming decades also. From urban planning point of view, many questions still remain to be answered. Otaniemi needs improvements in service supply, but a campus alone has internationally proved to be too week to carry a strong service network (Otaniemen palvelurakenneanalyysi 2014). Consequently, Otaniemi needs more inhabitants besides the new

metro line to reach the desired service supply. The immediacy of housing in the center of Otaniemi is necessary but challenging to fit into the university's core area. One extra challenge is the remarkable architectural heritage of Alvar Aalto that also locates in this hot spot of the future Otaniemi metro station. It is an internationally attractive and valuable piece of art and an important element of the image of Aalto University. But, at the same time the protection of Aalto architecture strongly limits the development of the central campus area.

Innovations are in the urban context and policy making often linked to dense city structures and various proximity factors. In the case of Otaniemi, the central question from the innovation point of view is how the transformation of the traditional forest campus to urban buzz succeeds. Or, is this vision even relevant for Otaniemi? Could Aalto University find a more innovative interpretation of an innovative environment for its own future success?

2.3. Shared platforms as innovation incubators

While the urban planning and design processes are seeking for answers to the questions above, smaller and concrete spatial development has already got off to a good start at the Aalto University Campus. We have chosen three initiatives which have all managed to make urban transformation more tangible and introduced new user-driven approach to plan and produce innovative environments for learning and education.

The first is the renovation that transforms the Aalto main library into a Learning Center. The main library is an acknowledged part of the built heritage in the Aalto campus. The building is protected, and therefore a challenging target of renovation,



Figure 2. Engaging stakeholders to co-design the Learning Center.
Photos by Aalto Learning Center (2013).

in which the place of books become space for intensive working, rest and recreation. Instead of architecture of past decades, it should act as a showcase for the new innovation university. The need for renovation was defined first in the campus center development strategy launched by the Board of Aalto University. But soon after resourcing a development project of its own, new kind of service design process were implemented that engaged not only the library staff, but a large amount of Aalto students and staff. Professional designers mediated the development process. New services were generated and refined in a variety of workshops and the best ideas were prototyped and tested with the users (Figure 2). Alongside the service design project, partners were interviewed in the University's other service units to examine their wishes regarding activities at the Learning Center. "We didn't ask users to come up with ideas for new library services, but instead we charted working and studying routines and daily life on campus. This way we got our hands on concrete user needs" says Jari Danielsson of Kuudes Kerros Ltd., which was in charge of the service design project (Aalto University, 2013).



Figure 3. Urban Mill, the contemporary use of an existing brown field facility at Aalto campus. Photos by Sirkku Wallin (2015) & Lars Miikki (2014).

The second example of facility development is even more driven by bottom-up operations. A few entrepreneurial minded researchers conceptualized a new kind of a public-private co-working and co-creation platform for urban innovations. This thematic platform called Urban Mill, was launched as a startup in 2013 in an old manufacturing building which was renovated and developed into a co-working space and event venue (Urban Mill, 2014) (Figure 3). The platform is open for all interested actors (city, industry, university researchers and students, citizens). Like the Learn-



Figure 4. Designing and producing new kinds of research facilities.
Photos by Aija Staffans & Antti Kauppi (2014).

ing Center, Urban Mill is a show case and a platform also for Aalto University, but it is based on fast and experimental use of a marginalized space with very limited resources. Within two years, Urban Mill initiative has managed to establish itself as a part of Aalto University ecosystem and yet as an open space for all walks of life at the Aalto campus area.

Inside Urban Mill lies the third initiative of innovative space for learning and education. The Aalto Built Environment Lab (ABE) is a new collaborative research and learning initiative of Aalto University, School of Engineering. It offers a space and technology for interactive human-centred co-creation of the built environment. The aim of ABE is to investigate new digitally supported and interactive planning and design methodology. Immersive modeling and simulation technologies, process modeling and data visualizations are developed to serve decision making and present ideas, visions and plans. ABE caters to the needs of multidisciplinary teams and people with different backgrounds working towards a shared goal (Figure 4). The on-going change process of the campus area offers alluring opportunities to action

[4] More: http://abe.aalto.fi

research on urban transformation and has inspired several academic interventions to the campus development.[4]

All these examples are products of co-evolution enabled by participatory design. Partnerships and local networks have found their position in the facility development process through testing and iteration. The project management would have been less competent, and the policies and programs would have had less steering power without the input of local participants. Together with the affiliations of the University and local entrepreneurs and students have managed to take part, design and produce a space suitable for their purposes. According to the on-going APRILab Research Project, with traditional urban planning based on statutory planning, this type of use of buildings and urban space would have been difficult to produce. In fact, the implementation of the high-status policy projects turns out to be slower and easier to fail than these "quick and dirty" experimentations of existing urban space.

This kind of bottom-up approach in urban development provides the necessary affordances (platforms, tools and channels), which assist the visionary and operational objectives and provide conditions, structure and content of desirable urban space. Consequently, the connections between the operational, strategic and policy decision-making levels become looser and thinner. Open innovations would require rapid feedback loops. It would proliferate a shorter path between policy making and day-to-day activities (Gregory, 2003; Sotarauta & Srinivas, 2006). Thus, the double devolution could take place as power is shared from the town hall to neighborhoods, and from the heads of organizations to the actual innovators and practitioners.

3. Conclusions—Urban Dynamics and Expanded Urban Planning

This article has described and analyzed current urban development in Otaniemi. It is difficult to simultaneously comprehend all the strategy-making, statutory land-use planning processes and on-going infrastructure and real estate development initiatives that are taking place there. These initiatives share location and some of the stakeholders, but their scale, resources and the actual implementation escape an analytical framework. However, it has been possible to see their interconnectedness. Together they prove that urban development is a complex phenomenon which cannot be explained or forecasted thoroughly.

When analyzing the current urban development in Otaniemi, the concept of megaproject is in line with the investments and the strategic position of the area. Also, the idea of a megaproject is necessary for sense-making and contingency. Consequently, it would be difficult to create understanding between different stakeholders, to tell a story of the forthcoming place they share (Sassen, 2009). Unfortunately, the traditional statutory urban planning process gives very little space for this kind of co-evolving urban development. Also, Otaniemi should not be understood as a territorial container of one or two megaprojects but rather as relational spaces and participatory places that are intertwined with regional, national, international,

as well as with formal, semi-formal and informal networks, links, hubs and discursive spheres. These trans-scalar and dynamic processes of urban transformation require attempts to deal with the complex territorial and functional relationships of different stakeholders operating at varying scales (Horelli et al., 2013).

In the case of Otaniemi, some of its several strategies combine the approaches and measures of community development, user-sensitive service design and participatory urban planning. The boost and support by the new metro line and the grand-scale urban initiatives with high-end architecture live side by side with everyday life of the local stakeholders and their endeavours. The implementation of planning takes place, besides building, also through the communication and coordination of activities. For example, in the case of the Learning Center, the role of the user-sensitive service design within urban planning was a bridge builder that embeds the planning in the local context. In addition, it is a vehicle which transfers the planning content to the phases of implementation and use. This will promote "architecture of opportunities" in which people do not participate inside a certain planning procedure but in actual co-production of their community and everyday environment (Hamdi, 2010, 13).

This approach can be called expanded urban planning (Staffans & Horelli, 2014; Wallin & Horelli, 2010). It brings forth, with extended measures, the knowledge of stakeholders and their objectives. Therefore it might enable the anticipation of the future, the understanding of plausible continuities or even tie up loose trends which urban complexity summons (Wallin, 2013). The contributions of incremental and rationalistic planning approaches should be understood with their limitations in the context of the changing, multi-actor and even disruptive urban reality in which planning takes place. Seeing urban planning in terms of complexity management, it liberates planning from the straitjacket of having to plan at all the levels, comprehensively and in detail. The strategy for a cultural, technological and economic cluster will earn its success by winning each battle, in each initiative.

References

ACSI Camp (2012). T3 as the Societal Innovation Test Bed. Aalto Camp For Societal Innovation ACSI. Accessed 28.1.2015 from: http://acsi.aalto.fi/en/acsi_camp/acsi_camp_2012/case_descriptions/building_a_regional_innovation_ecosystem/.

City of Espoo (2012). A Nordic Story of Youth, Growth and Excellence—Facts about Espoo. Publication of Espoo City. Accessed 28.1.2015 from: http://www.espoo.fi/download/noname/%7B07B004C2-A125-4A32-88EB-9DDAFDDBEA3F%7D/27544.

Eräranta, S. (2013). Situation Awareness in Urban Planning. Case: Mobility Planning Decision-making in Otaniemi Campus and T3 Area. Master's Thesis. Department of Architecture. School of Arts, Design and Architecture, Aalto University.

Flyvbjerg, B. Buzelius, N. Rothengatter, W. (2003). Megaprojects and Risk: An Anatomy of Ambition. Cambridge, Cambridge University Press.

Gregory. J. (2003). Skandinavian Approaches to Participatory Design. International Journal of Engineering. Vol 00, 2003, Tempus Publications. 1–13.

Hamdi, N. (2010). The Placemakers Guide to Building Community. London, Earthscan Ltd.

Haughton, G. & Allmendinger, P. (2009). The new spatial planning: territorial management with soft spaces and fuzzy boundaries. New York, Taylor & Francis.

Jacobs, J. (1961). Death and Life of Great American Cities. New York, Random House.

Juujärvi, S. & Pesso, K. (2013). Actor Roles in an Urban Living Lab: What Can We Learn from Suurpelto, Finland? Technology Innovation Management Review, 22–27. Retrieved 28.1.2015 from: http://timreview.ca/sites/default/files/article_PDF/Juuj%C3%A4rviPesso_TIMReview_November2013.pdf

Manzo, L.C. & Perkins, D.D. (2006). Finding Common Ground: The Importance of Place Attachment to Community Participation and Planning. Journal of Planning Literature, 20(33), 336–350.

MassDot (2014). The Central Artery/Tunnel Project—The Big Dig. Massachusetts Department of Transportation. Accessed 28.1.2015 from: http://www.massdot.state.ma.us/highway/thebigdig.aspx.

Otaniemen palvelurakenneanalyysi. 2014. Real Project, Ovenia Group. Draft 31.10.2014.

Sassen, S. (2009). Reading the city in a global digital age. In S. McQuire, M. Martin and S. Niederer (Eds.), Urban Screens Reader, 29–44. Amsterdam, the Netherlands, Institute of Network Cultures.

Sotarauta. M. & S. Srinivas. (2006). Co-evolutionary Policy Processes: Understanding Innovative Economies and Future Resilience, Futures 38(3). April. Accessed from http://ssrn.com/abstract=1099518.

Salet, W., Bertolini, L., Giezen, M. (2013). Complexity and uncertainty: problem or asset in decision making of mega infrastructure projects? International Journal of Urban and Regional Research, 37 (6), 1984–2000. doi: 10.1111/j.1468-2427.2012.01133.

Staffans, A. & Horelli, L. (2014). Expanded Urban Planning as a Vehicle for Understanding and Shaping Smart, Liveable Cities. Journal of Community Informatics, 10(3). Accessed from http://ci-journal.net/index.php/ciej/article/view/1171

Wallin, S. (2013). Urban Complexity Challenging Urban Planning, in L. Horelli (Ed.) New Approaches to Urban Planning, Insights from Participatory Communities, 23–41. Helsinki, Aalto University.

Wallin S. & Horelli L. (2010). The methodology of user-sensitive service design within urban planning. Environment and Planning B: Planning and Design, 37(5), 775–791.

About the authors

Sirkku Wallin, (M. Sc.) is a researcher at YTK/ Department of Real Estate, Planning and Geoinformatics at Aalto University. She has 15 years of experience in applied research on participatory urban planning, community development and ICTs in urban space. Her field of interest is in action research and the development of urban planning practices. Currently, she coordinates the APRILab research project in Otaniemi. Her doctoral thesis focuses on participatory planning, urban development and management of urban complexity. In addition to the research work, she has several expert positions in governmental agencies, NGOs and scientific journals.

Aija Staffans, architect M.Sc. and D.Sc. (Tech) is Senior Research Fellow at YTK/ Department of Real Estate, Planning and Geoinformatics, Aalto University. She teaches urban planning and leads a research group which makes action research in urban planning & design processes, architectural competitions and neighborhood development. Her research interest is in the interpretations and implementations of sustainability in planning practice, and in the digitization of planning in the context of smart cities. She is a pioneer in developing participative methods, digitally supported platforms and interactive environments for urban development and collaborative processes. Recently, she has been the initiator of the Aalto Built Environment Lab ABE, a new interactive modelling and visualization space at Aalto University, School of Engineering. She holds several positions of trust and expertise in academic, professional and NGO organizations.

Eelis Rytkönen
Campus dude, PhD candidate (Tech), M. Sc. (IDBM)
Aalto University, Finland
eelis.rytkonen@aalto.fi

Suvi Nenonen
Research manager, Dr., Docent
Aalto University, Finland
suvi.nenonen@aalto.fi

Robert Eriksson
Senior Advisor, Architect
BES
robert.eriksson@bes.fi

21. Scaling Business Opportunities to Facilitate Mobile Knowledge Work

Abstract

Societies are shifting towards more complex structures and agile, denser networks through spatial transformation that affects the ways in which citizens interact with and within the physical and virtual surroundings. The interactions define purposes for the modern hybrid spaces, depending on individual demands in relation to space and time. As facilities per se are becoming less relevant, spatial concepts and services that support, attract and engage modern individuals must be invented.

This paper explores the potential in scaling the lessons learnt from managing a campus as a small dense city to managing a larger-scale urban area. The basis for the scalability is investigated by comparing the Aalto University main campus with the T3 area inside the city of Espoo through five urban capabilities.

The results indicate that the lessons can be scaled from campus- to an urban-area scale. Space users have a need and will to collaborate, co-create and impact their environments. This expands the roles of decision makers and planners from controlling the uses of spaces to supporting grass-root initiatives. Consequently, active citizens engage and contribute, which can be a driving force for co-creation, shared ownership and attractiveness of small- and large-scale areas.

KEYWORDS: Urban development and management, Campus management, Mobile work, Hybrid spaces, Scaling businesses

1. Case Introduction: History, Visions, Decision Making, Physical Dimensions

The T3 **area is** located in Espoo, consisting of three districts: the Aalto University main campus as a district for science, research, education and arts, the business district of Keilaniemi, and the cultural, living, leisure and retail district of Tapiola. Each district has a strong history: the task of the city is to integrate the original Tapiola garden city vision from the 1960's, Keilaniemi business tower vision from the 1990's and Otaniemi campus vision that was updated from the original 1960's vision of Alvar Aalto to first the 2006 vision for Otaniemi as a hub for science and business, and most recently, the interdisciplinary Aalto University campus vision of 2011, bringing together arts, technology and business. Together these districts form one of the most attractive areas globally. In order to make it even more attractive, professional operators are needed to facilitate and integrate the collaboration that creates synergies. The region and its districts are illustrated in Figure 1.

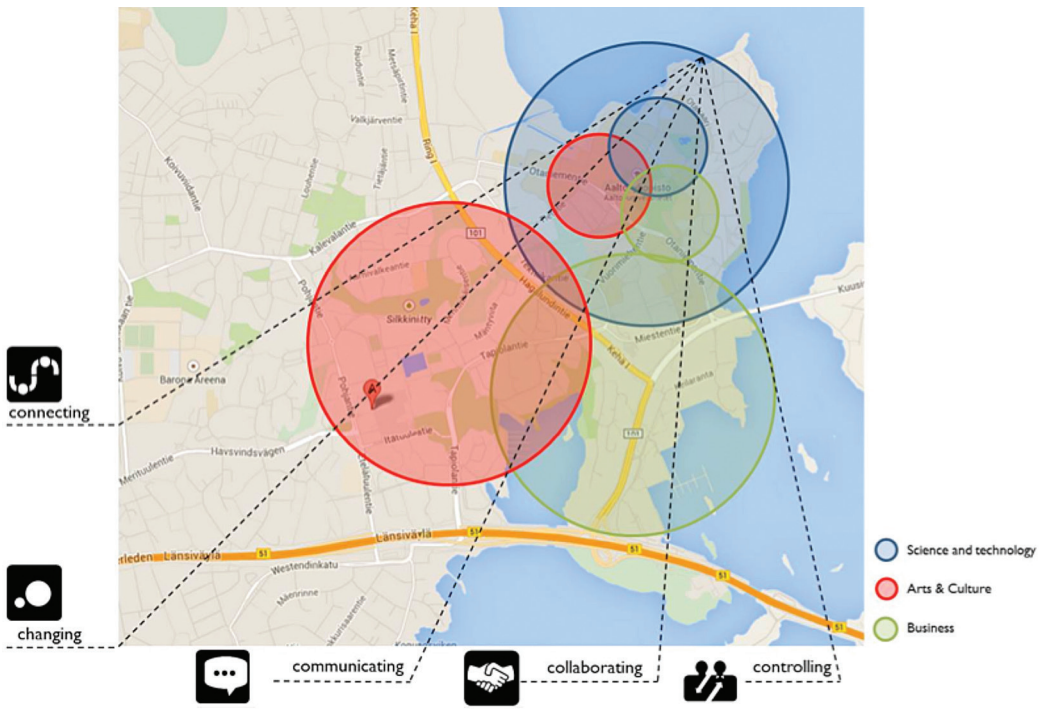


Figure 1. T3 region and 5C model (Applied from Worthington & Bouwman (2012), Niemi et al. (2013).

The Aalto University main campus, representing one of the three districts of the T3 area, is the playground for the university that merged in 2010 from three original universities: Helsinki University of Technology (TKK), University of Arts and Design Helsinki (TaiK) and Helsinki School of Economics (HSE). The vision of Aalto University, and consequently, the vision for its campus, is strongly rooted in the interdisciplin-

ary synergies between technology, arts and business and it has been collaboratively created by 2500 Aalto community members. It aims to be a world-class university by 2020. In order to facilitate the synergies, the majority of the actions are centralized to the main campus of the former Helsinki University of Technology (TKK). The former TaiK campus on the other side of the Metropolitan area of Helsinki is abandoned, as a new construction is being built on the Aalto main campus and all the bachelor-level education is centralized to the bachelor cradle, formerly the main building of TKK. In addition to these and other strategic decisions, various grass-root level bottom-up projects are on-going: Design Factory, StartUp Sauna, AaltoHUBs, ADDlab and Urban Mill, to name a few. Their quick and dirty, iterative process approaches to creating attractive collaboration seem unique in the university context, and have potential in scaling up to urban development level.

2. Interaction within Surroundings Is Evolving

The digital paradigm and technological innovations are changing the way we interact with and understand the surrounding spaces. Castells (2004) argues that we are shifting from a space of static places to a space of flows where information and knowledge is exchanged globally in ever denser networks. Building on similar thoughts, Mehaffy (2014) sees cities through lenses of six fundamental elements: cities as spatial networks, as social networks, as partially decentralized and as partially generated by self-organizing agents, as partially **scale-free,** as partially **scale-dependent,** and as cognitive and symbolic systems. Nonaka (1998, 2000) introduces the concept of Ba in organizational settings as a shared physical, social and virtual space that can facilitate knowledge creation between individuals. Multiple scholars argue that as the cycles of change are becoming ever denser in increasingly competitive markets, the adaptability of the built environment to constant change is becoming a more and more crucial capability for organizations (Finch 2012).

However, the essence of moving from the stable built environment settings towards dynamic multi-locational concepts is a major factor in scalable urban development. Nevertheless, the mere concepts do not suffice: the change in user behavior and community culture is an essential driver of the emerging change.

New forms of behavior have been induced by increasing alignment and integration of virtual and physical environments. A large part of our daily activities taking place in virtual environments affect the physical layers of our environment. For example, Demos Helsinki (2014) announced a Smartup Manifesto listing organizations that represent a new wave of startups that focus on taking physical resources to more efficient use by virtual services, such as AirBnB, Uber, Sharetribe and Venuu. As another simple example, one can observe the disappearance of telephone booths from the cities and buildings as static small cubicles—now the telephone is a mobile, intangible bubble around us whereever we are. Diverse solutions, propositions and recommendations are available for mobile phones. Moreover, the city of London, for example, has updated numerous old booths by providing free wi-fi in them.

Physical, social and virtual layers of our environments are inevitably more and more integrated.

Mobility has increased individual freedom and choice. Sustainability drivers have made individuals more aware of e.g. patterns to move. The new ways of using and sharing resources are increasing (Termaat et al 2014, Brinko et al 2014, Lindsay 2014) due to the rise of the sharing economy. Additionally, the emphasis on social sustainability includes issues like happiness, well-being and satisfaction with life. The flexibility and attractiveness of the social, virtual and organizational infrastructures that city creates provides a competitive edge for them. The more variety cities are able to offer in terms of local dense thematic communities, the larger their potential is to attract talented people and organizations.

3. From Desk Ownership towards Collaborating in Nodes

The consequences of more mobile life and work styles can be seen both in the academia and the private sector: both are struggling with low utilization rates resulting in high bills. Multiple studies in European and US-based universities indicate utilization rates of under 40% during the office hours (Neary et al. 2010, Den Heijer 2011, University Herald 2013, Harrison and Les Hutton 2014, Den Heijer and Zovlas 2014). According to Den Heijer and Zovlas (2014), campuses constitute about 5–15% of European University budgets.

For example, a recent study in Aalto University showed that the utilization rates tend to vary between 20–40% during the office hours (Hietanen 2014). The Aalto University main campus consists of 30 buildings covering an area of about 240,000 square meters. The campus costs including rents and maintenance equal to more than 70 million euros in 2015. Facilities form the second largest cost after human resources.

At the same time, despite slightly higher utilization rates, a million square meters of office premises lack tenants in the metropolitan area of Helsinki. This equals to about 12% of the total office building mass unoccupied in Helsinki and 20% in Espoo. The empty or half-empty offices are part of the image of the campus and cities. The supply of the built environment does not match with the demands of mobile life and work.

It seems that the places where knowledge work is accomplished are scattered to multiple spaces from traditional offices and business park complexes, to hubs, co-working spaces and home offices (Waber et al. 2014). What we used to know as the 'third place' that supports the infrastructure created by offices and homes is remodeled to diverse service offers in a more conscious way (i.e. Termaat et al. 2014, Brinko et al. 2014). The organization no more defines the location of the work, the work is disseminated all over the city structure: homes, public spaces, premises of clients or partnering organizations and private cafes and restaurants and diverse co-working places. The whole city can be seen as an office and in minor scale, and similar dissemination can be seen in the campus area: the location of an individual's

own department or faculty is not the main determinant any more. The administrative section can have an address, but networks rarely have a stable address—learning and working on the campus occurs in diverse locations if the mobile possibilities are offered by the university.

The total amount of square meters per knowledge worker is not thus diminishing, but probably even increasing. Even though workplace changes from traditional office concepts towards activity- based offices can reduce the amount of square meters in relation to one work station, the amount is increasing per employee, because mobile work can be completed in diverse work zones. Work is scattered to multiple places and dictated by the collaborative processes—considering the utilization rate of diverse places is much more relevant than the rate of one single work station. A similar trend can be identified in the context of learning environments. The use of classrooms is no more the main success factor but more and more emphasis should be put on the amount, quality, diversity and use of diverse learning and working zones—to scatter the learning and working activities around the campus instead of siloes of faculties, or building wings for staff or students only.

Institutional ownership of buildings and individual ownership of desks will most probably lose some of their dominating role in the course of time. The booming trends indicate that work is increasingly accomplished in shared premises of multiple organizations that have a common agenda. Gathering the stakeholders and facilitating their collaboration requires operators who would take the premises into efficient use. This will most probably offer new business opportunities while, on the other hand, changing the dynamics of traditional ways of leasing spaces on the basis of fixed contracts for multiple years. Dynamic spatial abilities such as flexibility and adaptability of the building services and processes that building facilitators and operators are offering will probably play a growingly important role in the market.

Actually, new operators are constantly entering the market and diverse concepts can subsequently be identified both in the city and on the campus. Examples of multi-locational work concepts in the metropolitan area of Helsinki include service concepts for co-working like Kontoret, Hub13, Urban Office, Urban Mill, and StartUp Sauna, to name a few. For example, Kontoret as a concept aims to build a network of on-demand spaces for the modern knowledge workers. The operators of Urban Mill strive to replicate the lean methodology they applied in Urban Mill and take over underutilized assets in the outbound of the campus in an attempt to attract organizations and create more thematic communities that would benefit from a common platform. In their operations and risky business strategy, facilities management is in the secondary role and more emphasis is put on the community management supported by physical and virtual infrastructures.

The focal question for both effective and efficient workplace orchestration lies in scalability: from use of workstation to use of building to use of city. On the space user level, the core is thus in scalability of new ways of working and learning in individual, team and organizational level. On the other hand, there is a variety of reasons why organizations do not support the dissemination of work. Lindsay (2013) proposes that co-working generally falls into one of three categories: Co-working in

a **separate location, Co-habiting** a common space with a partnering organization, or **Opening up** an organization's workspace for a wide community, resulting in **working commons.**

Co-working in a **separate location** involves shared environments in which individuals and small groups gather together to work in a community, usually paid for on a membership basis and invoiced either monthly or daily. These spaces provide a community workspace with shared services that let individuals and small groups share ideas and mutually support each other's work. Lindsay has found that corporate organizations are encouraging their own employees to work in co-working spaces as an alternative to their regular workspace, not primarily to save on costs, but to facilitate their interaction and knowledge sharing with others and to inspire creativity.

In addition to co-working spaces, organizations are **opening up** their own workspace to a wider community in an attempt to invite others in to share it (Lindsay 2013). **Working commons** emerges as one kind of a semi-public shared space similar to learning commons in the university context. University campuses have moved away from libraries exclusively designated as places for reflective study, to spaces in which informal and ad-hoc collaboration happens in a **learning commons.** This is also the direction towards which the Aalto library is developing its premises through bottom-up processes such as AaltoHUBs, which recycle underutilized spaces through collaborative, community-engaging design processes. Typically, these spaces include places to meet, study, make connections and exchange ideas. Food and drink are welcomed, furniture and equipment are mobile or re-configurable, and access is allowed at all hours. Settings change by hour, day and week. City governments could have an emerging role in hosting these kinds of shared spaces.

Co-habiting means several partnering organizations that share a common work environment. They are types of workspace in which, rather than an individual organization opening up to others or to the wider community, several organizations together share a work environment with the purpose of gaining from each other's knowledge and experience. Furthermore, Lindsay (2014) has identified six new types of workspaces that he sees as killers for the corporate campuses: Real-time offices, permeable offices, office networks, office neighborhoods, office-as-a-service and the new guilds.

4. Complex Decision Making to Engage Noding Communities

The complex environment challenges decision makers and politicians to prioritize and make decisions between a vast amount of initiatives, projects and events around the cities. Organic bottom-up projects have become more and more attractive alongside hierarchically structured top-down projects. In a recent study (Rytkönen 2015), the same phenomenon has been detected in micro-scale in university campuses, where spatial transformation is affecting the rules of the game. From the university campus management organization, the spatial transformation seems to

require ability to balance between individual and communal demands, local and global foci, project-based pioneer projects and standardized hierarchical projects. In order to support the core tasks of universities, campus managers and university administration should support multiple business models and processes enabling interdisciplinary, cross-organizational actions to take place in their campuses. Rather than facilitating or managing the facilities per se, the essence of their work seems to shift towards orchestrating the communities that take action inside the facilities.

Horelli and Wallin (2013) have identified on the urban planning scale that similarly, rather than only having roles as administrators and hierarchical watch dogs, the tasks of city managers and planners are expanding towards following, engaging, empowering and supporting the grass-root pioneer initiatives that attract interest and buzz in the cities. Balancing between them and the more stable, standardized, static processes is a focal task in competing in the global market. On the one hand, it is important to identify the typographies of different scales in order to respond to the needs of mobile living, working and learning, but on the other hand, it is important to identify the common factors in diverse processes of developing such a physical and virtual infrastructure.

5. Five Cs for Analyzing Evolving Environments

In this chapter, we open the discussion of such development processes by exploring the T3 area in the city of Espoo and the Campus of Aalto University in Otaniemi, Espoo. The aim is to start building a bridge between smaller-scale campus management and larger-scale urban management practices. In analysis and comparisons we pick up five crucial processes in the development of urban areas. These processes have been initially introduced by an urbanist John Worthington based on his expertise and his colleague Henrik Bouwman's (2012) work: Connecting, Changing, Collaborating Communicating, and Controlling. The 5Cs have been further explored and developed by Niemi et al. (2013) and Mangs et al. (2013). Niemi et al. (2013) concluded that the 5Cs as a framework is applicable to analysing open-ended projects with clear goals, budgets and deadlines spread over time. The approach was furthermore seen as scalable in city and in district scales and particularly for observing certain everyday practices. However, the scholars pointed out its restrictions as an evaluation tool but emphasized its ability to recognize different phenomena in city development.

5.1 Connecting

Connectivity refers to the connection between different communities as well as to the capability to connect to the physical environment, with help of virtual infrastructure, e.g social media and social networks.

Aalto University has three separate campus areas that will be diminished to two: one in the Helsinki city center and one in the traditional campus location in Espoo,

in the former campus of the University of Technology. The vision of Aalto University is to connect professionals of arts, technology and business. Both campuses have their buildings but concepts such as Aalto Design Factory and Learning hubs are the elements truly connecting Aalto University: they are physical surroundings, virtual platforms but more than that, they are ways of accomplishing tasks, processes to develop, use and maintain places which serve as platforms for collaboration in between different disciplines and actors. In addition, connectivity between the city of Espoo and Aalto University has been thriving thanks to the Urban Mill initiative operated by a private firm run by two actives who know the university context, which aims to connect the municipalities with latest research and practitioners in urban innovation. So far this idea serves as a single concept and hot spot in the main campus—not spread yet in the network of concepts like Aalto Learning Hubs and Aalto Design Factory. The latter serves also as a connector in the global environment. The Design Factory concept has been reproduced e.g. in China, Chile, and Australia, and the network between the factories is vital.

The T3 area still has three urban areas with different profiles to connect: The Aalto University campus as an area for research and education, the business district of Keilaniemi, and the cultural, living, leisure and retail district of Tapiola. The three districts are physically separated by large highways. The main driver of connection is often viewed to be transportation. Connectivity is seen as a flow of networks or transportation networks (e.g. roads, streets pipes, aqueducts, power lines) or nearly any structure which permits either vehicular movement or flow of some commodity or people. It combines different modes of transport—in T3 development, the new metroline is the main connector. It is seen as a major link between the three areas as well as linking the region to the city center of Helsinki. Additionally, the connecting characteristics of nature are identified in terms of cycling, walking and using natural pathways and green corridors as shortcuts across the areas. Water as an element has more surrounding than connecting characteristics.

Connectivity can be encouraged by creating hotspots which are connected to each other as a network of places but more than that, as processes to co-create, operate and co-develop them. Grass-root initiatives are able to create cross-organizational communities. But communities require active facilitation. Even though packing interdisciplinary, cross-organizational students, researchers, professors, practitioners and the public sphere into a dense area might support connectivity due to the proximity, it is not enough if there is no process to connect the diverse actors. Similarly, a connector in infrastructure guarantees no connectivity in the social context if it does not serve mobility between the areas which also connect people by through processes of creating the area.

5.2 Changing

Change is a natural phenomenon of a development, but the essence in organizational settings is in reacting to a change. Change occurs both physically and perceptually and it is more about changing a mindset than physical alterations per se. The

built environment should be changed in an attempt to empower the organizational structure.

The current changes on Aalto University campus are based on the organizational change of the University, which affects the built environment by large. Innovative grass-root initiatives are blossoming next to massive traditional renovations, new investments and exits. Larger change nurtures smaller and vice versa. However, the cultural change of breaking out from the traditional silos takes time, and engaging the middle management is in the core of continuous change. Often a change is not a peculiar project but rather a process which consist of different phases and sequences.

The organizational change of Aalto University has potential in affecting the city of Espoo as an attractor of new types of businesses to the Keilaniemi area. The campus area functions as a pioneer area nurturing the change in the districts of Keilaniemi and Tapiola. The challenge in Aalto University is to integrate three old institutional systems while respecting the original identities and creating motivators for the units to follow and implement the ambitious new visions. The same challenge applies to the T3 area. From these ingredients, a believable synthesis and incentive system, that the actors from all areas can relate to and are motivated to implement, should be created.

Both Aalto University and the T3 area could become more resilient and adaptable to change from spatial, organizational and operational perspectives. Involving people in the early phase of development process decreases the unwillingness for change. Flexibility and resilience are the focal capabilities in recovering from the changes. The resilience strategy for the T3 area could be part of the visionary work conducted in long-term urban development.

5.3 Communicating

Communication concerns promotional activities and interaction with others. By means of communications, a brand and a collective image can be built but identity is built by individuals. A brand can be seen as a collective agreement of the image, whereas identity concerns an individual, her self-perception and self-presentation expressing one's personality.

The Aalto University brand is strong and externally well-known. The Aalto main campus offers world-class examples of co-creational actions and initiatives that have been well-communicated and function as communication platforms for their user communities. Yet, these communities only represent a small portion of early adopters among the university actors. The internal institutional units of Aalto University are still heavily struggling with building the Aalto identity, which is why the internal communications require more investments and time. AaltoHUB is one of the projects that aims to affect the overall identity of Aalto people.

The challenge in the T3 area is communication between the three districts—today, its role is undervalued. In the future, it will be focal to the success of the whole area. The city of Espoo should engage its citizens and empower entrepreneurs and

industries to follow the external communications examples of Aalto University. There is no single sign to brand or identify the T3 area—it is rather an internally strong mental model. To make it visible, sensible and encouraging requires action in the physical and virtual, internal and external communication channels.

The capability to create experiences—sense of place and diversity—is increasing in Aalto University. This is an important competence, because often decisions are based on feelings and, therefore, it is important that those involved in planning processes are aware of this phenomenon and create (communicate) solutions which in the best possible ways support the end user choice. The essence of the successful grass-root activities is in the interaction and communications between the top management and grass-root actors. Two-way communication (top-down and bottom-up) is a process in which participants create and share information to research mutual understanding. The middle management can have a huge role in facilitating the communications. Communications can raise awareness and change perceptions to support cultural, behavioral and physical change.

5.4 Collaborating

Collaboration means capability to collaborate informally and formally. Two key phenomena related to collaboration are complexity and diversity. Collaboration should not be seen as restrictive practices, but rather as a set of processes of creatively balancing between conflicting and mutual interests. It is about working across different scales, interests, functions and cultures with the aim of building up a community spirit. Collaboration includes both informal and formal processes.

The complexity of the Aalto main campus is multiplied by the merger of three universities into one organization. On the one hand, complexity forms a barrier for the new organization to collaborate internally. On the other hand, the increasing diversity offers great opportunities which should not be underestimated. Due to the diverse characteristics of regional development projects in the T3 area, one can encounter questions which are "wicked", "messy" and "fuzzy", and one profession or industry simply cannot solve them alone, which is why collaboration is needed to overcome the issues of complexity and diversity.

Aalto University plays an important role in creating partnerships, linking and forming platforms for public and private sectors. It can be seen as an operator that can, for instance, help in sharing valuable resources. One of the most promising concrete grass-root initiatives is Urban Mill, which focuses on facilitating new public-private-people partnerships in an attempt to find common and shared value within the public and private sectors. On Aalto main campus, interdisciplinary and cross-organizational collaboration has been fostered through these kinds of boundary objects—buildings and spaces that function as thematic platforms for collaboration around the campus. Creating a collaborative culture across organizations and disciplines requires time. However, a collaborative culture can be empowered by hybrid operators that facilitate the activity process. Aalto University has been successful in external collaboration but the internal collaboration would require even more incen-

tives to be reinforced—this is not the tradition of rewards systems in universities in general as they rather focus on individual merits and achievements.

In order to create a collaborative culture among the T3 spectrum of areas -culture, arts, living, leisure, business and science—initiatives exist, including Espoo Innovation Garden, Espoo day, and Base camp, among others. The collaboration should be active among operators that identify and facilitate collaboration of organizations and institutions with the same agenda or theme. This active facilitation could mentally draw areas closer to each other in an attempt to blur also the physical boundaries. A continuous series of small events is essential to gradually raise awareness and change perceptions. When building a community, engaging individuals who are willing to be pro-active and responsible –and who then spread a climate of confidence and opportunity for change -helps in achieving a paradigm shift.

5.5 Controlling

Controlling in this context should not be perceived as traditional top-down restrictive action. Rather, it is defined here as a continuous management process, which has a forward-looking attitude. Control can be achieved through a common direction, principles and rules. Organizations should, therefore, be motivated to relate to and engage in the same principles. Successful control requires a balance between creating and reinforcing vision and mission, and then managing the process of change through a combination of regulatory controls and behavior.

Aalto University has a strong mission and vision but the incentives for implementing them are contradictory. A path should be selected for whether to aim for high international university rankings with the criteria of interdisciplinarity and focus on societal impact or to position oneself in more traditional rankings emphasizing the academic research merits. The lesson of successful bottom-up cases in Aalto is that shared control and active communications between top, middle and bottom levels of organizations is important.

The vision of the T3 area for connecting the physically separated cultural, business and science districts together challenges organizations to perform a profound cultural change and institutional collaboration. To perform such a change, boundary objects and thematic entities are needed—platforms that foster sharing across organizations and nodes. The implementation can then be built on the on-going collaboration. The developments of area management and areal operators evolve besides the developments of the physical environment and the temporal development and control.

Control can be managed through functioning partnerships between the key stakeholders with the agreed goals. The essence is in finding an operator with the ability to keep the different parties aligned and engaged. The operator has to orchestrate the process of change and sustain other stakeholders who are committed and keep the project alive. Engaging the actors to contribute to the common mission through incentives is focal.

6. Discussion

According to the initial comparison, the challenges in the campus area and the T3 area are similar when explored through the lenses of the five processes of connecting, changing, communicating, collaborating and controlling. The campus area has facilitated testing of successful bottom-up projects. If change and collaborative action are aimed for on an areal scale, an increasing amount of boundary objects are needed. And this has to be actively pursued by operators who facilitate the collaboration and strive to gather the people with common interests together because every organization tends to want to collaborate for better results—they just do not know how.

There are spatial solutions which drive the change in an agile way. Successful pilots have been developed on Aalto campus for creating interdisciplinary and cross-organizational hubs (i.e. StartUp Sauna, Design Factory and other Factories, Aalto-HUBs, ADDlab) but most of them have been mainly based on strategic university or department funding with just a tiny amount of complementary external funding. From a conservative point of view, this can be positive as some consider the academia more unbiased and objective when operating primarily on internal funding. On the other hand, if universities wish to maintain their facilities and staff, something needs to be done about the funding structures. Now all the stakeholders benefit from the advancements but the university is the one to pay the bills of the increasing collaboration. As an exception, Urban Mill strives to re-invent the business logics of university facilities so that the partnering private organizations would pay a larger share of the facilities costs and have access to the latest research results in the field of Urban Innovation, and thus university would bring its value to the facilities service through knowledge and know-how with the content and research it provides.

For the collaborative culture to emerge in a larger scale in the area, more of these sorts of pilots for different thematic communities are needed. It seems that the changes in the university organization and its campus are capable of affecting the larger surrounding area. But for the different areal nodes to collaborate, more facilitation across the nodes is needed. For example, what will happen for the retail facilities in 20 years? Could some of the abandoned spaces be adopted for thematic gatherings or showrooms for research and arts? Would that bring the university closer to the public?

Reflecting on the learnings from the campus organization, it seems that pioneer facilities and community operators should start actively seeking for underutilized facilities and start gathering stakeholders that benefit from one another under the same roof. On Aalto campus, the first steps have usually been thematic events and workshops. Moreover, these operators tend to offer pop-in and collaborative spatial entities in which the organizations should not stay statically but dynamically spend some of their time collaborating with each other and then again head towards their clients or home organizations to share the lessons. It is yet remarkable that most of the campus real estate mass is still operated rather conservatively. To implement the

novel dynamic kind of culture on a larger scale takes time but the next generations are already knocking on the doors of the job market. The spatial transformation paradigm seems to be bubbling on the surface of the city as a blurry playfield for a mixture of working, learning, retail, leisure and daily routines.

6.1 Recommendations

The following recommendations can be summed up based on the analyses:

- Dynamic connectivity can be created through alternative spatial platforms and processes including co-creation, maintaining and co-development.
- Change has a pearl in it—incentives towards the targeted change and respect of minor-scale changes can provide elements for large-scale changes, too. Resilience can be a strategy to overcome ongoing turbulence of change.
- Communication materializes in visible artefacts and in social discourse: a brand can be strong but identity weak—balancing between internal and external communication is as important as balancing between vertical and horizontal communication.
- Collaboration is rarely linear—it happens even though it would seem chaotic, unclear, fuzzy or wicked.
- Control is about communication and incentives—motivation cannot be commanded but ownership and empowerment can be enforced.

7. Conclusions

The shift in the concept of space from being a space of static places towards a more dynamic space of flows is evidently ongoing, as Castells and Nonaka, among others, describe. As the activities increasingly mix regardless of the space, the current practices in the built environment do incompletely support this mixture but tend to silo each activity in their own block. The 5C analysis indicates that the campus areas can function as great living labs for experimenting and prototyping bottom-up concepts for facilitating collaboration among public and private stakeholders as they are densely packed to a manageable entity and as universities create new models and practices, through their core business, research. They are also rather objective and capable of providing a common ground for institutes, municipalities, decision makers, politicians, business and industry representatives alike.

The tested solutions can thereafter be applied on a larger city scale to answer demands outside the university barriers. Based on the results of the analysis, it seems clear that the spatial solutions are only knots in the network. Collaboration needs to reach beyond the single hot spots in order to create a real interactive network where great minds interact in spaces of flows. To truly reach the business potential

of mobile knowledge work facilitation and revitalize larger city areas, we need new types of hybrid operators—or new processes, practices and businesses for the existing operators—that are capable of strengthening what is in between the knots. The buildings themselves are not in the core but the essence is in managing what happens inside and in between them, in the network facilitation.

The challenge in land use and planning is that it is dictated by law, and there is no control or ownership of the management of processes—a situation similar to the campus area only a decade ago. Then again, the case examples on the campus outlined here are led by strong individuals who seem to have strong ownership of the projects. If they leave the organization, they are difficult to replace and the successful initiatives might discontinue. On the other hand, little by little, these novel practices, niche innovations, build on each other, creating change in the standards of processes. In order for the bottom-up processes to take place by large in the built environment, the approach of managing and commanding through hierarchies, standards and mechanisms of passive control must be flipped to the approach of actively orchestrating the actions by support, incentives and other enablers. And the results must be measured in terms of holistic quality of the action and the effectiveness that the built environment enables—not solely in terms of the efficiency of the built environment itself.

References

Brinko, R., Van Meel, J. & Balslev Nielsen, S. (2014).The shared building portfolio: an exploration and typology. In proceedings for CIB Facilities Management Conference in DTU Copenhagen, May 2014.

Castells, M. (2004). Space of flows, space of places: Materials for a theory of Urbanism in the information age. The Cybercities Reader, Routledge, London, 82–93.

Demos Helsinki (2014). Smartup manifesto—A new wave of high impact startups is emerging from consumer cleantech. Available at: http://www.demoshelsinki.fi/wp-content/uploads/2014/11/Smartup-Manifesto-Demos-Helsinki.pdf.

Finch, E. (ed.) (2012). Facilities Change Management. 218, November 2011, Wiley-Blackwell.

Hietanen, P. (2014). Co-designing campus. A presentation in NUAS seminar on August 26th 2014, available at: http://blogs.helsinki.fi/nuas-facilities-and-environment-2014/files/2014/08/Co-designing-campus_Paivi-Hietanen.pdf (accessed 14 October 2014).

Horelli, L. and Wallin, S. (2013). Towards an Architecture of Opportunities. 153–161, in Horelli, L. (Eds.) New Approaches to Urban Planning- Insights from Participatory Communities.

Lindsay, G. (2013). Coworking Spaces From Grind to GRid70 Help Employees Work Beyond the Cube. Fastcompany, Published 11th February 2013, available at: http://www.fastcompany.com/3004915/coworking-nextspace (accessed 15th October 2014).

Lindsay, G. (2014). 6 new workspaces that are killing the corporate campus. In Harvard Business Review Blog Network, published in 18th September 2014, available online: http://blogs.hbr.org/2014/09/6-new-workspaces-that-are-killing-the-corporate-campus/ (accessed 15th October 2014).

Mehaffy, M. (2014). What can a 'science of cities' offer planners? Planetizen, published 25th June 2014, available online: http://www.planetizen.com/node/69957 (accessed 15th October 2014).

Niemi R., Nenonen S., Junnonen J-M. (2013). Investigating the competencies for Serviceability of urban areas. CIB 2013 World Congress, Brisbane, Australia.

Nonaka, I., Konno, N. (1998). The concept of "Ba": Building a foundation for knowledge creation. California Management Review, 40(3), 40–54.

Nonaka, I., and Toyama, R., and Konno, N. (2000). SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. Long Range Planning, 2000, 33, 5–34.

Mangs A., Väistö T., Karhu J., Rajala A., Niemi R. (2013). Facilitating the emergence and development of Engagement networks in urban surroundings. IMP2013, Atlanta.

Rytkönen (2015). University Campuses in Spatial Transformation—a business model typology of case Aalto University. Facilities, forthcoming, 33(9/10).

Termaat et al. (2014). Workspace 2020—Club, Hub and Co-work space: business models for optimal FM support for office workers in the future. Proceedings for EuroFM Conference 2014.

Waber, B., Magnolfi, J., and Lindsay, G. (2014). Workspaces That Move People. Harvard Business Review, Oct 2014, available at: http://hbr.org/2014/10/workspaces-that-move-people/ar/1 (accessed: 16 Oct 2014).

Worthington, J. & Bouwman, H. (2012). Places of connection—themes, concepts and principles. Utrecht 2012, The academy of urbanism, Learning cities platform.

About the authors

Eelis Rytkönen is interested in socio-technical phenomena, managerial practices and spatial design in organizational settings. Currently, he works as a researcher for BES research group in Aalto University, finishing his doctorate research on dynamics of campus management in spatial transformation. He holds a B. Sc. in Real Estate Economics and an interdisciplinary M. Sc. degree in International Design Business Management (IDBM). Eelis gets excited about friends, extreme sports, music, and people who do stuff.

Suvi Nenonen has worked as a Research manager in Aalto University after finishing her doctorate in 2005 on work environments that support new knowledge creation. She has published over a hundred scientific publications and acts actively in multiple international facilities management networks such as EuroFM and NewWOW. Nenonen also acts as docent in Tampere University of Technology.

Robert Eriksson has graduated as an architect from Chalmers University of Technology in 2005. Currently, he works as a senior advisor in a consultancy solving problems related to the built environment. He has extensive experience in city planning, renewable energy and open data. Eriksson has also been active in research, having published scientific publications related to e.g. user empowerment and future campus development.

Katri-Liisa Pulkkinen
YTK/Department of Real Estate, Planning and Geoinformatics, School of Engineering
Aalto University, Finland
katri.pulkkinen@aalto.fi

22. Sustainable Campus Founded on Social-Ecological Synergies

Abstract

The relationship between urban and natural systems is a fundamental question as climate change and other human-induced global threats become more severe. These threats are actual on local levels, too, calling for leadership and pioneering examples. The aim of Aalto University, developing the Otaniemi campus area into the "leading sustainable campus in Finland by 2020", could rise to this occasion.

This article introduces a Swedish concept of social-ecological urbanism for a future university campus. The Patch Work Group's concept for the future Albano campus area of Stockholm University was planned to showcase social, urban, and natural systems and processes intertwining so that they support each other, creating sustainable and resilient urban environments. To fulfill these aims, the campus needs to be designed as a learning system. One of the aspects discussed here involves branding the urban campus area as a leading example. Sustainability and resilient ecosystem services offer an asset that will have an important role in creating urban environments in the coming decades. Not forgetting about the economic aspects of sustainability, social-ecological urbanism focuses on the main supporting systems on the planet.

KEYWORDS: Ecological sustainability, Ecosystem services, Resilience, Social-ecological urbanism, Systems thinking, University campus



Figure 1. Outdoor areas of the Albano campus area are suggested to be a patchwork of diverse attractive functions. A wide array of activities could be connected to research institutes or association based activities such as allotment gardening and experimental fields. Recreational use is also important, including visitor tours and commercial actors such as bicycle and canoe renting. All urban-social activities support also the ecosystem services of the area (see Figure 4).

1. Introduction

What if the outdoor areas constituted an integral part of the university's education and research at the campus? Would it be possible to have a variety of interesting outside areas that produced a diversity of urban and ecosystem services? And could the campus become a hub, connecting nearby urban areas with a network of green routes and parks, attracting also other users than the university people?

As the traditional Otaniemi campus is being recreated to be the main campus of Aalto University, it could become a leading example of how sustainable development and ecosystem services should be taken into account in urban environments. Indeed, the aim to be the "leading sustainable campus in Finland by 2020" (http://www.aalto.fi/en/about/strategy/sustainability/?$) is included in Aalto University's strategy. The Otaniemi campus area is also currently in a need for a new urban vision—the traditional best qualities of a "forest campus" (http://www.aalto.fi/fi/about/campuses/) should not be lost while new, more urban solutions are needed as the area develops.

To discuss these aims and ways to reach them, this article introduces a case study from Sweden. Albano resilient campus is a concept designed for the extension of the campus area of Stockholm University (SU). It was first conceived during the preparation phases that preceded the official detailed planning by the city planning office. A group of researchers and architects, the Patch Work Group from Stockholm Resilience Center (SRC), Royal Institute of Technology (KTH) and an architectural company KIT Architects, made their own proposal as a voluntary pioneer work, outlining how the new campus should be built.

The group presented their initial ideas of a socially and ecologically resilient campus in a conference organized in 2009 by university property company Akademiska Hus (AH) and SRC. Their approach and ideas caught on, an AH commissioned the group to produce quality guidelines for sustainability and social-ecological urbanism for the future campus area. They aimed to create principles on a conceptual level, together with design components that could be employed in actual planning of the area. In their conceptual proposal, presented in a Q-book, later published as **Principles of social-ecological urbanism** (Barthel et al., 2013), the future Albano is planned to showcase how social, urban, and natural systems and processes should intertwine to support each other, creating sustainable and resilient environment.

The ecological aspects of the concept of the Patch Work Group were chosen by the AH as the starting point for the official planning of the new campus by the city planning authorities of the City of Stockholm. As Albano is located in the National urban park in Stockholm, it is evident that there is also additional pressure for ecological solutions. The natural values of the park areas should not be compromised when building a new area—rather, they should be improved. Representatives of the pioneer group worked as advisors during the detailed planning process. According to the Patch Work pioneers, however, many of their original systemic ideas, combining urban form and ecological processes, were cut off or partially changed in the planning process, which resulted in a different emphasis in the detailed plan.

This article presents some of the main characteristics of the Patch Work Group's original concept. The concept as such can be said to hold seeds for a world-class example of a new kind of an innovative and co-evolving urban environment. One of the aspects discussed in this article is the role of university campus area as a leading example which can be used in area branding. The concept of a future campus area of Albano could show a way to position a campus in an international class of pioneers and torchbearers on how to work with ecosystem services within an urban context. The approach of Albano concept is applied here as a benchmark case for the development of a leading sustainable campus in Otaniemi by 2020, and it could even guide the redefinition of the Tapiola garden city.

2. Albano Example: Emphasis on Social-Ecological Synergies

The ambitious starting points of the Patch Work Group's concept design for the new Albano campus include the aim to address especially two of the human-caused, global-level harmful processes (Rockström et al., 2009): biodiversity loss and climate change. Also, the role of urban form in urban experience was an important starting point. The starting points are based on the research on social-ecological resilience at the SRC and research on urban morphology at the KTH.

Biodiversity loss, a major planetary system-level change caused by human actions, is an ongoing process that has received less publicity than climate change. With the current rate of biodiversity loss the rate of extinction of species is estimated to be

100 to 1,000 times more than what could be considered natural. We are actually in the middle of the sixth extinction of species in the entire history of the planet (WWF, 2014, Rockström et al., 2009). In the last 40 years, the amount of vertebrate species in nature has declined by 52% (WWF, 2014). During the same time, the amount of humans has approximately doubled. Biodiversity loss is caused by many types of human actions and accelerated by e.g. land use that diminishes the size and quality of habitats of ecosystems (Rockström et al, 2009). UNEP's Millennium Ecosystem Assessment, an extensive global overview from 2001–2005, revealed that out of the 24 ecosystem services examined globally, 60% were degraded, which should be seen as extremely alarming. "The impacts of current trends of biodiversity loss on human well-being are multifaceted. While people benefit directly from components of biodiversity in the form of provisioning services […], the more fundamental role of biodiversity is in the functioning of ecosystems and thereby in the capacity of ecosystems to provide the full range of ecosystem services." (MEA, 2005, p. 834)

Climate change can be addressed with the aim to reduce the overall carbon footprint and emissions of greenhouse gases of the future campus area. Also, there should be good, healthy soil that absorbs CO2 and vegetation, especially trees, that sequester CO2 from the air. It has to be noted that biodiversity loss and climate change are interconnected processes. Climate change in its part enhances biodiversity loss, and a diminished biodiversity then, in its turn, weakens the possibilities of ecosystems to adapt to changes in climate. This set of feedbacks is also connected systemically into many other global-level problems, such as anthropogenic distortions in the phosphorus and nitrogen cycles, ocean acidification and, for example, the diminishing quality of land for growing crops due to too much fertilization and monoculture practices (Rocksröm et al., 2009). All these problems are wide, wicked, dynamic and systemic and they will indisputably rise sooner or later into a new importance in urban planning.

In the Albano Patchwork concept, taking these global level problems as starting points when working with the urban form is a unique, trailblazing approach, especially in what comes to biodiversity loss and working with ecosystem services. Not many university campuses address these issues. Energy use and climate change are often on the agenda of sustainable campuses, but enhancing the natural systems and working with and learning on-site about ecosystem services is quite unique. One other rare example of regeneration of ecologcal systems is the John T. Lyle Center for regenerative studies in California State Polytechnic University, Pomona.

3. Social-Ecological Approach and Ecosystem Services

The social-ecological urbanism approach emphasizes that social systems and ecological systems are inseparably connected. The Patchwork concept strives for a dynamic equilibrium in which the whole campus system is co-produced by social and urban systems together with ecosystems. The group's work is also announced to anchor strongly in the resilience theory (Hollin, 1973, Folke, 2006). Ecosystems and

social systems should be resilient, which means that they should be able to deal with change and continue to develop under changing circumstances.

The aim in the Albano concept is to create a deeper understanding of how social and natural systems could work together, enabling better ecosystem services by creating more resilient urban and natural systems. The urban form should support this understanding. The ecosystem service approach should be seen as a mutual relationship: in order to be able to provide us with the so-called ecosystem services, natural systems in urban environments also need support from urban design and planning. In practice this means that habitats for ecosystems should be in the focus of the design and use of urban environments.

Ecosystem services—our lives depend on them. "Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services." (MEA, 2005, p. Vii)

Ecosystem services as a concept calls attention to the many resources and beneficial processes that are delivered by the ecosystems to humans. Social-ecological systems are formed by complex, dynamic relationships between human action and the natural environment. Human actions should, first and foremost, ensure that ecosystems are not endangered as only then is it possible to provide the ecosystem services that we depend on. Especially in populated urban areas with heavy traffic and land use, we should make sure that the social system, including the technological and economic system, supports and enables the functioning of ecosystems.

Ecosystem services can also be seen as a link to the way nature is present to us locally in an urban context. Every place on earth, from natural world heritage sites to the most urbanized environments is always dependent on functioning ecosystems. Examples of ecosystem services include raw materials provided by the environment, but these services extend also to more systemic processes such as pollination of plants, cleaning of water, and regulation of climate. Even the experienced quality of environment can be seen as a service provided by the ecosystems.

Our dependency on nature, in reality, also means interaction—we are parts in the same system with nature and we exist in the same sphere of life. In systemic interaction, everything we do influences our environment and our environment influences us: "The primary approach has been to deal with sustainability in depth and to argue for urban design that transcends the old dichotomy between ecological and social systems. This is not just about including the ecological systems alongside the more traditional urban systems but to understand their linkages and interplay, making all systems a natural and integrated part of future urban design." (Barthel et al., 2013, p. 29)

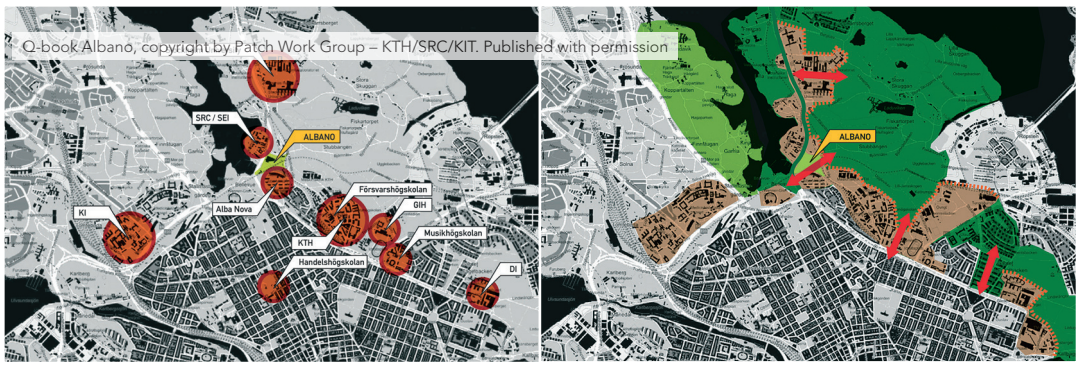
All this leads to social-ecological urbanism, which essentially means searching for synergies and positive interaction possibilities between ecological and social systems. The concept aims to create a set of principles and components that could

be adopted to create a social-ecological, resilient campus in Albano and also more widely in urban contexts.

4. Albano—an Attractive Hub

While the social-ecological urban approach is linked strongly with research and theory, the concept for the Albano campus area was developed together with the stakeholders. The Patch Work Group held a series of workshops for gathering knowledge and ideating the future for the campus, concerning both the ecological and the social spheres.

A background analysis of the ecological systems of the surrounding parks and of the social and urban context set the targets for developing the Albano area. Even though located within the National urban park, the Albano area has been an urban brownfield for decades, and it is not currently featuring any important ecological systems. Thus, one of the main objectives was to create high-quality habitats and dispersal routes for organisms generally found in managed semi-urban garden landscapes. This kind of an area character is emphasized by the many nearby allotment garden areas, which support especially the pollinators and natural pest control in the local ecosystems.



Q-book Albano, copyright by Patch Work Group – KTH/SRC/KIT. Published with permission

Figures 2 and 3. Albano is situated in the Northern part of the city of Stockholm and centrally in relation to several important education centres.The Patchwork group suggested that the area should become one of several connecting gateways between the city and the National Urban Park.

Because of its location, Albano has potential to become an important urban hub that adds connectivity between several higher education and research institutes nearby, especially Stockholm University, KTH and Karolinska Institutet. Simultaneously, an overarching social and urban theme for the site is publicity—the area should attract not only university people, but, by and large, all urban citizens. One of the main attractors would be the recreational values of the area, such as quality of urban and natural environments.

The objectives for the ecological and the social-urban systems were then translated into a series of services, as the more fine-grained aims for the area. The ecosystem services on the site include pollination, water treatment, dispersal routes, indoor and

outdoor air quality management and natural pest control. From the point of view of urban services, university campus areas generally lack diversity, especially outside the office hours. Campus areas can even be perceived as unsafe outside the active daytime hours. The aims for urban system services thus include publicity, accessibility and safety. Some services turned out to hold extensive synergetic possibilities: urban and biological diversity, recreation, attractiveness and international competitiveness as services can be tuned to benefit both urban and ecosystem spheres.

The main spatial design components from the Albano concept, designed to enhance the synergies between the ecological and social systems, are universal and could be employed in many different contexts. Green arteries, active ground and performative buildings all link urban, social and ecological systems in many ways. For example, the green arteries are not only routes that act as dispersal corridors for the ecological systems; they are also connecting, attractive routes in the urban context, including light traffic and railroad connections. The system would also include some blue corridors: water routes for dispersal which are connected to the rainwater treatment in wetland areas.

Active ground is a design component that features different uses for the ground. These different uses create a varying pattern of mixed activities, adding to the diversity of both ecological and urban functions. And the third main design component, performative buildings, would then add to this diversity by offering even more possibilities for different social and ecological functions. Performative buildings could feature, for example, green roofs, green walls and rainwater collecting systems.

These spatial design elements need to be supported by a certain approach to managing the whole system. To these questions, the Patchwork concept suggests a series of institutional design components, including guidelines for arranging property rights and rules so that management of different systems is distributed to the users of the area. This would add diversity and enhance the way the campus area performs as a large-scale living laboratory.

5. Campus as a Learning System

The Albano Patchwork concept is essentially a systemic design for a learning system. The process of producing these principles was a learning process in itself, more recursive and iterative than simple and linear, and included input from many local stakeholders in different phases of the process.

Adaptability and place-based learning are interwoven to the concept in many ways. First, the ecosystem services and the urban system services are composed together as an evolving system that supports both subsystems, the social-urban and the natural. The aim is to create a resilient system in which the natural and urban systems grow together as one. They support each other mutually, instead of either one being a threat to the other. The underlying principle is that the socio-ecological system, which is essentially built on the interaction between human and natural systems, is in balance.

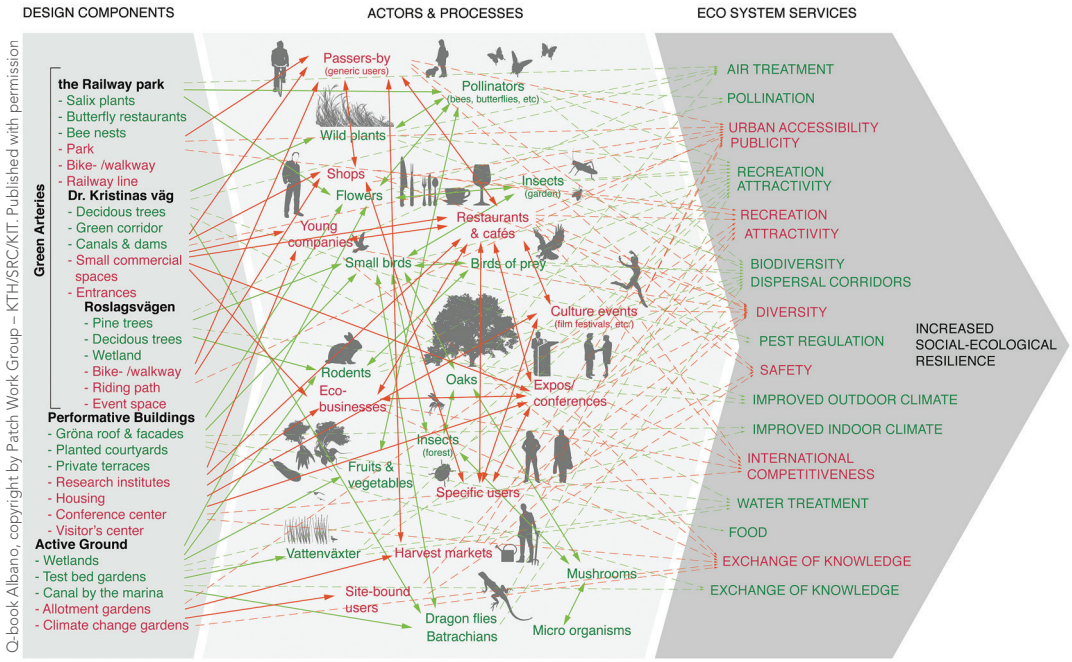


Figure 4. This graph by the Patch Work Group illustrates how spatial morphology can be designed to create high quality urban areas and services while supporting local ecosystem services in the Albano area. Green arteries, for example, will promote services such as urban accessibility, attractiveness, recreation and publicity as well as supporting ecosystem services such as biological pest control, seed dispersal and treatment of air and water.

Further, the learning system itself grows and develops over time. Through learning and co-evolving between the site and the actors, it is possible to follow up the interaction and adjust to the changing conditions. The learning system also seeks to influence and include circles even larger than the campus area or the university, attracting a growing number of people and other actors to the area.

Planning for ecosystem functioning, like in our Albano example, requires both background research and follow-ups and constant monitoring. Local ecosystem resilience calls for an adaptive approach and flexibility in planning. There should be a possibility to adapt to changing situations and follow the change on-site. Planning for ecosystems also means there needs to be a possibility to develop solutions over time. Adaptability is emphasized by the notion that the concept is not a finalized plan that should be realized at once. There should be a possibility to renew plans as the system learns.

6. What's in It for Otaniemi 2020

The aims at leadership in sustainability and the concept of social-ecological urbanism from Albano could also be something to consider for the future development of the Otaniemi campus area. In fact, in all its processes of change and development,

there might be high potential in the Aalto main campus to become a living laboratory for finding solutions to global sustainability challenges. The social-ecological concept focuses both on the long-term life-supporting aspects of sustainability, while adding to the attractiveness and competitiveness of urban areas. The question of supporting diversity and renewing ecosystem capacity in the presence of human and urban systems will be crucial in the coming decades or even sooner. This field also has a strong need for academic research and is linked to the fields of green economy and bio-economy.

The aim to be "the leading sustainable campus in Finland by 2020" is a reasonable one; but what it means in practice and how it could be reached are still open questions. The approach also requires new areas of research. At the moment, the respective discussion has concerned mainly technical solutions and improvements, such as energy efficiency as well as traffic solutions for the campus area. While such questions are important, it can be asked whether working with only these would place Otaniemi anywhere near the leading positions in Finland, not to mention internationally. Many other campuses in Finland and around the world also work ambitiously with the same aims—even in Albano there are aims to produce most of the energy for the campus locally. Being a living laboratory for sustainable development includes not only technical solutions but also social and ecological development. This is the area where the social-ecological approach can give a game-changing contribution.

Sustainability leadership and models for new urban patterns are likely to have a strong influence on area images and branding. Otaniemi, the whole Espoo Innovation garden (EIG), and even the metropolitan area are currently in the process of seeking for its future direction. Developing resilient social-ecological systems is crucial on many levels. High-quality social-ecological systems increase diversity, usability and attractiveness in urban areas. Natural areas, such as active parks, green corridors and stormwater treatment wetlands add to the character and recreational value of urban areas. Also, these features are important in climate change adaptation and mitigation.

From the starting point of Otaniemi, with a background as a forest campus, the approach of working with ecosystem services and aiming at local resilience would be a well-justified direction on many levels and Otaniemi could be a world-class leading example in this respect.

Locally, the connection to the garden city Tapiola is also an interesting one. Could the social-ecological approach bring a valuable addition to the discussion of how Tapiola should be developed? Currently, the fragmentation and degeneration of local green areas is a threat to the image both in Otaniemi and in Tapiola, in which the possibilities are still open for the social-ecological approach. Especially Otaniemi is aiming at sustainability leadership—so how could this social-ecological approach work in the Aalto campus? To start with, the local ecosystem functions in the Otaniemi area should be analyzed from the vantage point of ecosystem services. What is the history of the area, and what are the current weak and the strong ecological systems in Otaniemi and adjacent green areas? What are the existing and pos-



Figure 5. The Patch Work Group suggested that an elevated railway passage in the Albano Area, the Railway park, could be redesigned into a connecting route to be used also by cyclists and pedestrians. The mesh cover should be planted so that it attracts also beneficial insects and birds and supports thus pollination services in the area.

sible ecosystem services? And how could we innovate technologies and businesses that support the local natural ecosystems instead of disturbing them? Again, even though these questions may at first sight seem to address only local questions, globally they are even more important in larger cities. And cities everywhere are looking for examples that lead the way in this development.

From the ecosystem services point of view, the social-ecological approach requires an analysis of not only the visual impression of green and park-type areas, but a more systemic understanding of how the ecological systems function. Typically, in all growing cities around the world, green areas are becoming more and more scattered over time. In Otaniemi, as the new subway connection is likely to diminish the green areas, we should discover ways to improve the ecosystems in novel ways. This could be accomplished with the intelligent application of synergetic social-ecological design components, such as the green arteries and performative buildings. Also the way that the land surface is used is crucial. Empty grass fields do not support diversity; there should be a variety of different functions and different types of vegetation. Both managed, urban gardening –type and unmanaged, wilder areas are needed. For this, outside areas in Otaniemi have vast possibilities. There are large grass fields that could be treated as an active ground for diverse functions and services. This would enhance the process that was already started in Otaniemi by urban gardeners and other actors.

Also, the urban features and services that are desired for the new campus area should be mapped together with the ecosystem services, as the Albano case shows. The new urban form in Otaniemi should be created from the point of view of the urban and ecosystem services. How does the area in general support learning by doing in social-ecological systems, and does it attract other than university users? And on the level of individual buildings, while the architeture of some of the buildings in the Otaniemi campus are protected, some are more free to be changed and retrofitted. We could see not only solar panel rooftops but also green roofs and walls, terraces and other features that enrich the urban environment by bringing in

possibilities for ecosystems to flourish. Performative buildings should be developed in the context of research and innovation, further attracting diversity and businesses to the area. This aspect, retrofitting current structures for more resilient urban environments, is also interesting for many heavily urbanized areas.

The above-mentioned design components—green arteries, performative buildings and active ground—should be developed together with the institutional components, further following the example of the Albano model. It is important to find possibilities to engage the community at all levels, from inhabitants to institutional actors and from student groups to large businesses. The Otaniemi campus area already hosts many actors and more are getting involved as the new students from Töölö and Arabia campuses join the main campus. Establishing open communication between all of the local stakeholder groups would give a possibility to create a unique model of producing local activities and services.

7. Leadership and Co-operation

The dual benefits of the social-ecological urban approach can be found in the combination of improved local conditions and in the possibility to be a leader in sustainability in ways that touch all growing cities around the world. The real key for leadership in sustainability would be the ability to design and develop, in a systemic way, the entire Otaniemi campus area so that it shows how humans can actually make the natural environment stronger, not weaker.

Regarding the sustainability aims in our Albano example, we should remember that Stockholm has long been a leader in sustainable urbanity. The Albano area in Stockholm is seen as a possibility to renew the leading position in sustainability and redefine what sustainability and resilience mean in urban contexts. Having such an example in a neighboring country should encourage us at Aalto University to work with our local solutions to the same pressing questions. This connectivity and even the possible co-operation between the campuses could enhance the positive area branding effect even further.

Aalto's take on sustainable urbanism on Otaniemi campus could be a vivid social-ecological learning system—helped, where needed, by innovative technology. If the fact that the social-ecological system is the most fundamental one is taken as the guiding principle, then the task of technology and innovation is to find ways to support this complex system and steer away from those technological solutions that disregard the existence of and harm the ecological systems. International leadership in this field is certainly needed and sought after.

Images

All images from Q-book Albano (2010), http://www.stockholmresilience.org/download/18.3ebb718712ed6075a67800089/1381790126503/albano-english.pdf. Copyright © by Patch Work Group – KTH/SRC/KIT. Published with permission. The concents of the Q book are later published as: Barthel, S., J. Colding, H. Erixon, S. Grahn, C. Kärsten, L. Marcus, J. Torsvall. 2013. Principles of Social-Ecological Urbanism - Case Study: Albano Campus, Stockholm. Trita-ARK Forskningspublikationer 2013:3

References

Aalto University, strategy. http://www.aalto.fi/en/about/strategy/sustainability/?$.

Albano green urbanism conference. http://www.stockholmresilience.org/21/news--events/seminar-and-events/seminars-and-events/10-30-2009-albano-green-urbanism-conference.html.

Albano planning process, City of Stockholm, http://insynsbk.stockholm.se/Byggochplantjansten/Pagaende-planarbete/PagaendePlanarbete/Planarende/?JournalNumber=2008-21530.

Barthel, S., Colding, J., Erixon, H., Grahn, S., Kärsten, C., Marcus, L., Torsvall, J. (2013). Principles of Social-Ecological Urbanism—Case Study: Albano Campus, Stockholm. Trita-ARK Forskningspublikationer 2013:3.

Ecosystems and human well-being : current state and trends : findings of the Condition and Trends Working Group / edited by Rashid Hassan, Robert Scholes, Neville Ash. Millennium Ecosystem Assessment. (2005).

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analysis. Global Environmental Change 16(3), 253–267.

Holling, C. S. (1973). Resilience and stability of ecological systems. Annual review of ecology and Systematics, 4, 1–23.

John T. Lyle Center for regenerative studies in California State Polytechnic University, Pomona. http://www.csupomona.edu/~crs/regeneration.html.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C.A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V.J., Hansen, J., Walker, B. H., Liverman, D., Richardson, K., Crutzen, C., Foley. J. (2009). A safe operating space for humanity. Nature 461: 472–475 DOI 10.1038/461472a.

Living Planet Report (2014). Species and spaces, people and places. WWF. http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/.

About the author

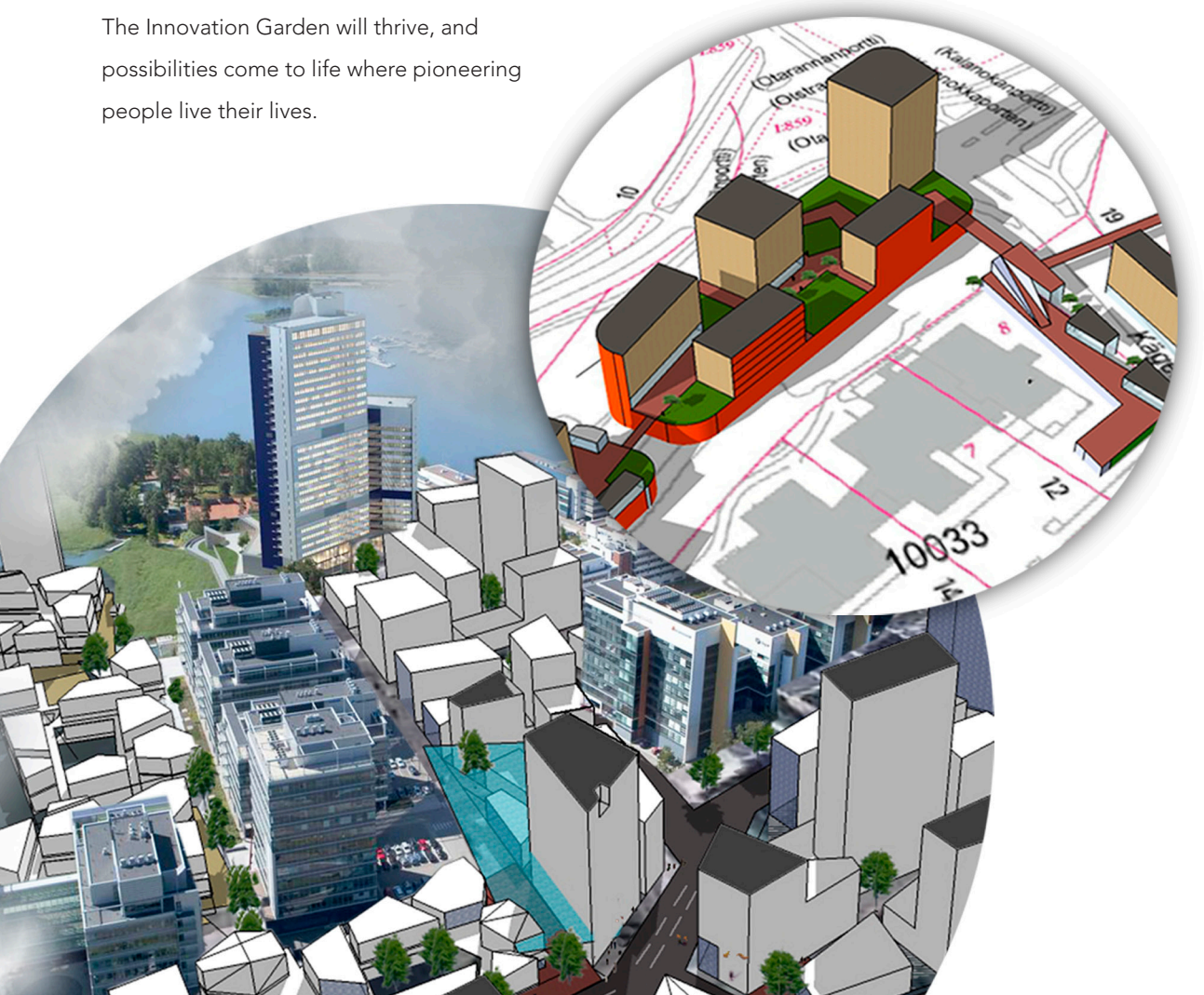
Katri-Liisa Pulkkinen is an architect M.Sc. and doctoral candidate, currently working as a researcher in Aalto University in the Future Learning Environments Research Group at YTK—Land Use Planning and Urban Studies Group in the School of Engineering. She also teaches systems thinking at Aalto University, in the multi-disciplinary master program Creative Sustainability. In systems approach, her interests are in complex adaptive systems, especially systemic emergence and dynamics of change from the point of view of transition into more sustainable lifestyles. Her forthcoming dissertation studies urban pioneers and pioneering sustainability initiatives, with the dual aim of finding patterns that would help in designing future learning environments and more generally bridge transition to sustainability.



WHY, WHAT AND HOW

TODAY'S ROADS are wide and dominated by cars. The land is owned by the city. This provides a great opportunity to create unique mixed-use buildings and areas with a pedestrian-oriented townscape. The win-win situation: The City of Espoo will gain millions of euros from selling the building rights, the creative class will have places to work, live and buzz and car-drivers will get a new road system.

The Innovation Garden will thrive, and possibilities come to life where pioneering people live their lives.





ABOUT THE AUTHORS

HEIKKI HARTELA

Owner, Hartela Group

Hartela is a 70-year old family-owned construction and development company. Heikki is one of the owners and the most visionary Executive in the industry.

heikki.hartela@hartela.fi



TERO VANHANEN

Chief Creative Officer Hartela Group

Architect Tero Vanhanen works as the Development Director at Hartela. Tero is an experienced and visionary town planner, innovator and real estate developer.

tero.vanhanen@hartela.fi



PETER VESTERBACKA

Mighty Eagle, Rovio Entertainment Ltd

Rovio Entertainment, founded in 2003, is an industry-changing entertainment media company and creator of the globally successful Angry Birds franchise. Peter is the visionary leader and the face of the company.

peter@rovio.com

V
DIGITALISING CITY DEVELOPMENT PROCESSES

Smart cities of the future will demand new kinds of planning and participation processes, and digitalising the urban development in Espoo and elsewhere has already led to many breakthroughs in interactive design, allowing cities to engage larger numbers of stakeholders and citizens in co-creative processes. The drivers of innovation are diverse, requiring cities to act as orchestrators to connect service providers and user in innovation platforms that create and maintain sustainable ecosystems. This will eventually result in socially innovative, resilient and pro-active cities.

TAINA TUKIAINEN and **PÄIVI SUTINEN** discuss ways in which a city can become an orchestrator and supporter for digitalisation, open innovation and business ecosystems, encouraging public and private sector innovation. **PEKKA SIVONEN** and **ANTTI KORHONEN** explore how Aalto's AppCampus results in faster business acceleration through its vertical focus. **SANNA AHONEN, AINO VERKASALO, KAISA SCHMIDT-THOMÉ, SIMO SYRMAN** and **RAINE MÄNTYSALO** describe the roles that the City of Espoo has adopted in the electric vehicle proliferation, balancing between proactive measures and observing emerging developments. **HANNU HYYPPÄ, JUHO-PEKKA VIRTANEN, MARIKA AHLAVUO, TOMMI HOLLSTRÖM, JUHA HYYPPÄ** and **LINGLI ZHU** show how the development of Interactive 3D tools has facilitated various processes in cities since 2007, presenting cases from Espoo that prototype virtual environments, regional information models, and new tools to support decision making in virtual environments. **HANS SCHAFFERS** discusses recent trends in the role of Future Internet technologies and infrastructures as enablers of Smart Cities, emphasizing the cooperation of citizens and stakeholders in co-creating social innovation and urban renewal.

Taina Tukiainen
Senior Scientists, PhD (technology)
Aalto University, Finland
taina.tukiainen@aalto.fi

Päivi Sutinen
Services Development Director, PhD (education)
City of Espoo, Finland
paivi.sutinen@espoo.fi

23. Cities as Open Innovation Platforms for Business Ecosystems

Abstract

This article discusses ways in which a city becomes an orchestrator and supporter for digitalisation, open innovation and business ecosystems. The aim of the article is both theoretical and practice-based. We elaborate concepts such as digitization, innovation platforms and business ecosystems and analyze their successful implementations. Furthermore, we examine and discuss Espoo Innovation Garden and Matinkylä Service Centre as leading examples of open innovation platforms and multichannel services development.

The cities will be the heart of innovation in the future. Because the drivers of innovation are diverse, cities should act as orchestrators to connect the various parties in innovation platforms for creating and maintaining sustainable ecosystems. This paper also argues that the cities should establish active dialogue with the markets and private sector for service innovations, testing and offering. This will encourage public-sector innovations.



KEYWORDS: Digitalisation, Open innovation, Platform, Business ecosystem.

1. Introduction

Cities are a valued and important living environment; by 2050, 70% of the world's population will be living in cities. According to Richard Florida, cities that are able to attract and retain creative citizens and new firms are better positioned for sustained growth. Smart cities are looking towards open innovation and new technologies to more efficiently manage services and infrastructure while improving quality of life and business viability. As an example, cities enable accessibility to real-time data on everything from energy efficiency to crime and pollution. (Cohen et al., 2014)

The essential question is what the main challenges are and how we enable urban innovations in Finland and especially in Espoo Innovation Garden. This invites us to review innovations and business ecosystems and the roles and possibilities of cities in this developing process.

We have studied earlier why innovations and business ecosystems are important. The results provide the building blocks to better understanding how ecosystems work and influence on business success of public sector and firms. The study suggests that understanding the ecosystems and portfolio management can yield significant benefit to Finland and municipalities. (Tukiainen et al, 2014)

An ecosystem should be understood **as a context where there is an ongoing interplay between actors taking on different roles as keystones, dominators, or niche players** (Iansiti and Levien, 2004, p. 76). We propose that the key actors in business ecosystems are the public sector, universities and the firms—small and large ones. Large firms are or aim to be platform leaders and small firms mainly are partners or complementors. Though small firms may grow to be the platform leaders. The actors and roles are illustrated in Figure 1 (Tukiainen et al., 2014).

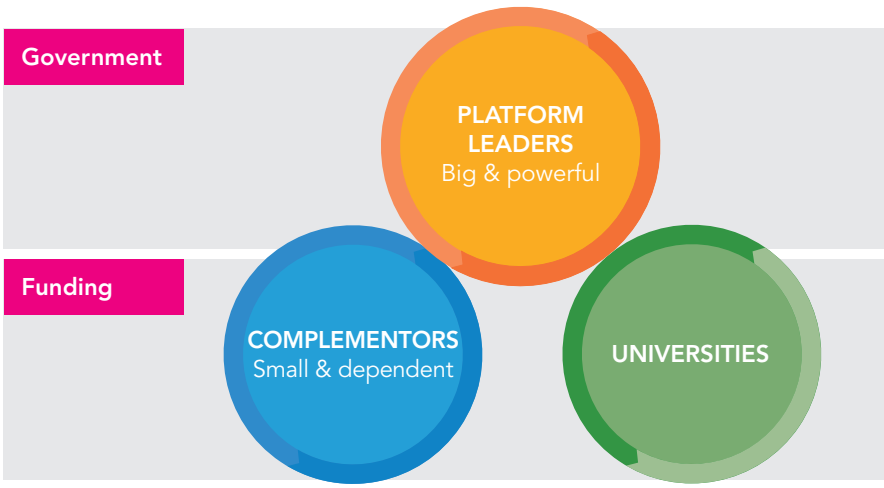


Figure 1. The key stakeholders in business ecosystems include firms (large and small ones) and universities as enablers.

A business ecosystem is as a combination or a set of companies (large and small) from different industries that aim to work with each other because they have complementary economic, knowledge and/or capability interests, usually based on technological or business interdependencies. The firms are loosely or tightly coupled in order to co-create value, but largely independent of geographical location. The firms sometimes compete and sometimes collaborate. (Tukiainen et al, 2014)

We proposed that such growth is based on three pillars: strategy, platforms and networks. The role of startups in business ecosystems is somewhat complex. Due to these dynamics, the roles of business ecosystem actors cannot be taken for granted. At large, we therefore suggested that startups develop and apply a defined ecosystem strategy. In this study we further proposed that there are three ecosystem strategies to choose from: the single ecosystem strategy, up to multiple -boundary crossing or a boundary spanning strategy. In single and boundary crossing strategies, firms tend to follow the rules of the game as set by ecosystem leaders in order to gain fast customer access. Applying the single strategy method means that there is a single ecosystem leader while with boundary-crossing strategies, there are multiple ecosystem leaders to follow. In the boundary-spanning strategy, the rules of the game are challenged, which opens an avenue to the new global ecosystem leaders. The ecosystem strategies are illustrated in Figure 2. (Tukiainen et al., 2014)

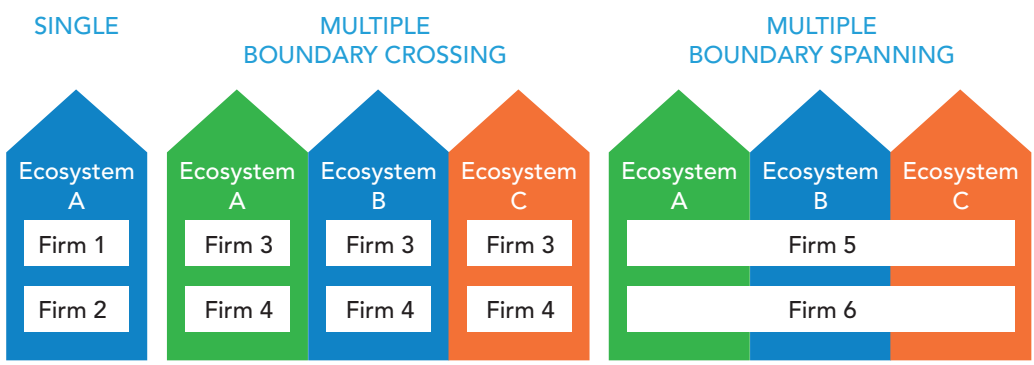


Figure 2. Business ecosystem strategies: single and two multiples.

Uncertainty means opportunities and innovations. However, capturing the opportunities depends on the behavior of the firm. It might be tempting to treat all startups as the same; however, such action is disastrous. Actually, business ecosystem strategies are context dependent. For example, game developers are born-global firms. They succeed or fail fast. They need to analyze how ecosystem leaders can be a part of a sequential value chain and probably applying a single ecosystem strategy or if multiple then the boundary crossing. Such strategy allows for fast market penetration. On the other hand, such a strategy does not suffice for a global platform wannabe. Platform wannabes are actors who identify rough novel technological breakthroughs and challenge traditional business ecosystem boundaries. Platform wannabes create a boundary-spanning strategy, where new rules of the game are being challenged and invented. (Tukiainen et al, 2014)

All previous business ecosystem studies emphasize the importance of establishing and managing platforms in order to perform successful global business. Our study showed that Finnish startups are slowly adopting and creating platform strategies. However, on a national level, this adoption needs to be established in a more consistent and goal-oriented manner. Such adoption starts in universities and other institutions that train future entrepreneurs. The adoption continues with real-life entrepreneurs testing and developing sustainable platforms in practice in testbeds. Their knowledge and experience in managing platforms should be preserved for future generations of new entrepreneurs. Such preservation can be achieved through novel public-private collaboration forums where managers can meet, discuss and compare platform management experiences. This development is most relevant when keeping up with global ICT competition where the cloud plays a vital role (Tukiainen. et al, 2014)

2. The City's Opportunities and Role in Accelerating Open Innovation Platforms for Business Ecosystems

The national ecosystems and public sector's current challenges from the city perspective can be summarized into three main themes. First, the public-sector sustainability gap has increased and the cities' competitiveness declined. Second, the operating principles of the cities are based on the bureaucratic administration and organizational silos. Last, but not least, the finance of the cities and costs are not in balance. The demand for public services is greater than the reality allows. (Vakkuri, 2009; Vakkuri et al., 2010)

The governance of cities and their individual operational models are based on bureaucratic administration and decision-making. The administrative structures are not customer-, action- or process-based. Hence, they are not interoperable with other cities or with companies. This is obvious from the point of view of all stakeholders; citizens, firms, and employers.

In practice, the processes are not planned and optimized in an end-to-end fashion, rather per each governance silo or profession, which results in complex error-prone and inefficient city governance. Thus, cities are unable to effectively utilize residents' contribution or new emerging innovations like digitalisation of services and robotics in their governance. Cities are not able to reuse the other cities' innovation capability for efficiency. This is a major challenge since cities have a huge role in urban planning and built environment development, technology and services. Succeeding in this mission requires interoperability and city-level governance.

All cities have a constitutional self-government operating mode based on the right and the obligation to decide on the use of its own territory and carry out their statutory duties and obligations. However, the state decides on the legislation tasks and obligations of the cities. Cities are financed by taxation and government grants. The state subsidizes cities and the rest is covered by taxation. City governance has

special characters compared to private-sector operating models. The unique feature is that the finances and production of services are disconnected.

According to the Nordic welfare system, public services are free of charge or there is a minimal fee, for example for hospital services. This leads to the increase in demand and customers. The expenditures are growing, but that does not bring in more revenues for cities. (Meklin, 2008; Meklin et al., 2009; Vakkuri, 2008, 2009)

Figure 3 shows the opportunities and roles of cities in accelerating open innovation platforms. The target is to open the data, share the knowledge, citizen participation and open innovation between all city stakeholders (Sutinen P, 2012).

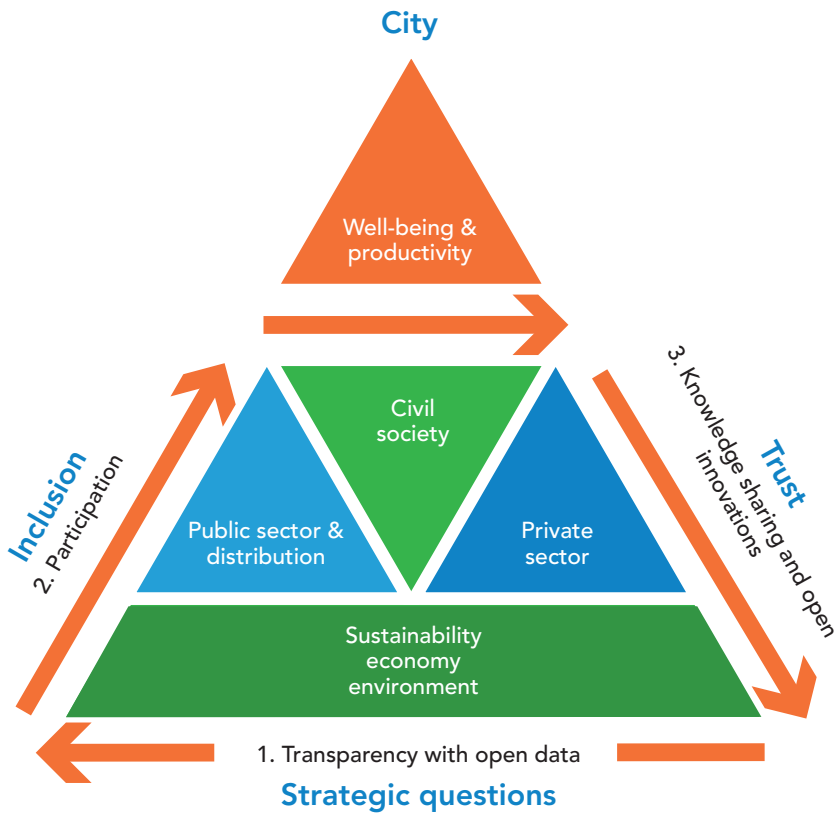


Figure 3. The model for the cities to accelerate open innovation.

The cost-effectiveness of cities can be improved by opening up the city to market innovations, customers and citizens. There is a need for new businesses and operating models oriented towards customers. We call this model an open, action-oriented customer-based business model. It enables open, customer-based, agile, collaborative and cost-effective development of service operations. In addition to city-level operational efficiency, this will also improve national competitiveness and welfare when applied nationally throughout cities. The new model responds to the challenge and is opposite to the bureaucratic and silo/profession-based operational model. It can be described as an action-oriented customer-based business model applied in cities.

When developing the new governance structure with a new operational and business model, the essence is the holistic process development. As a starting point, Espoo is developing a national reference architecture for cities. This is crucial for modular operations and open data. Developing a reference architecture is a tool to improve city-level operations.

The holistic process development is vital for economies of scale of services. Customer data and needs form the basis for service development or productization. If the services are developed in a modular way, the economies of scale become feasible. The key is to enable multi-channel scalable service solutions.

The six largest cities in Finland—Helsinki, Espoo, Vantaa, Turku, Tampere, Oulu—developed together The SixCity Strategy for 2014–2020 and are developing a new innovation platform. The target for this new innovation platform is to:

- create a national framework which allows cities to holistically lead action and customer-based business and operations
- open up the city market and promote local businesses
- encourage interoperability of cities and firms
- improve information, development and knowledge management of cities.

This will promote new types of innovations such as digital, service, robotics and technological to be implemented in cities. Innovation platforms enable the new creative national economy and renewed management and operations for cities. This is based on opening up of the market and supporting the new kind of entrepreneurship.

3. Espoo Innovation Garden as an open innovation platform

3.1 Open innovation platform development

Digital value creation will grow to be as large as the material value in the future. Digital technology and the opening up of public databases create new global business opportunities. Digital governance is also an opportunity for Finland.

The Energizing Urban Ecosystems program the Regional Innovation Ecosystem (EUE-RIE) is a pioneering project to demonstrate, prototype, implement and experiment the innovative digital solutions and service concepts and create an open innovation digital platform and multichannel services in Finland in Espoo Innovation Garden.

As digitalisation plays an important role in EUE activities, we will create a digitized testbed and platform for Espoo Innovation Garden which enables companies to develop, prototype and test products, services and solutions and support their transfer to global markets. The way of working includes interactive, user-centric and open innovation enabled by simulation and visualization in action research settings. The

core activities will include demonstration, prototyping and implementation of new urban designs and business-driven innovative solutions, as well as service concepts for the future, benefiting from cutting-edge knowledge and technologies such as digitization, information modelling, cloud computing, visualization and virtual reality.

The regional modelling research and the development of virtual tools for effective communication and information sharing will be integrated into the processes of creating an Open Innovation 2.0 demonstration platform. This platform materializes the conceptual models and improves the multi-dimensional urban development approach, which combines the physical and digital infrastructures at the city scale. One multichannel customer service example accomplished by Elisa for Espoo Innovation Garden is depicted in Figure 4.

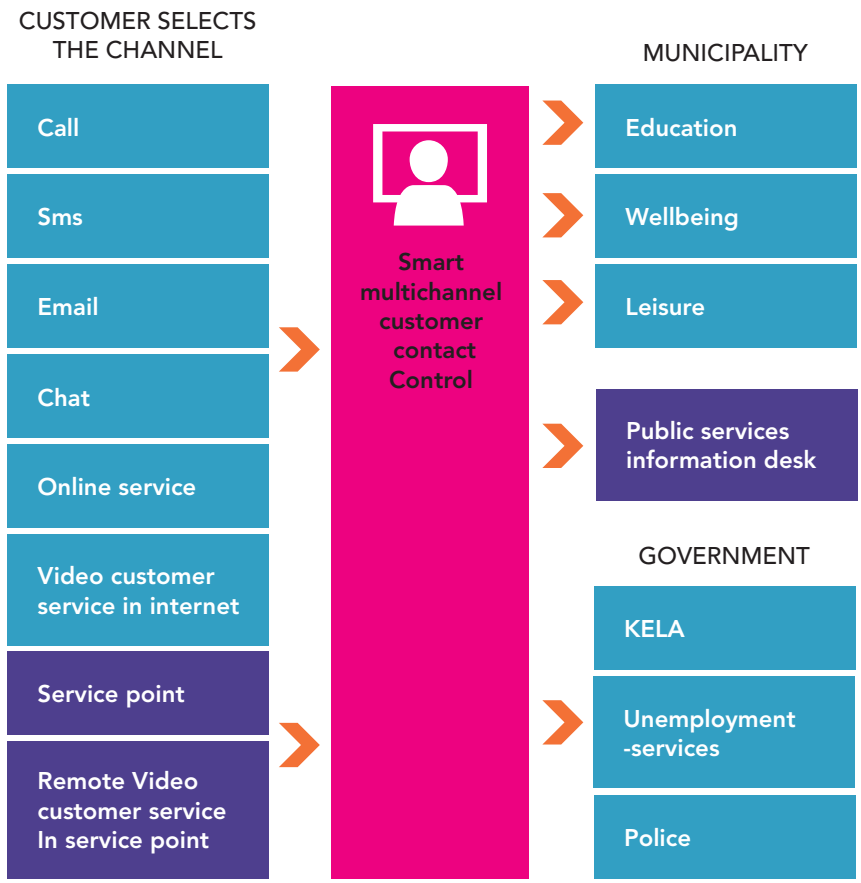


Figure 4. Multichannel customer services.

In order to achieve this, new processes for city planning and management need to be developed, communicated and visualized in a proper, adequate and transparent way. There is also a need for new operational models and service provision concepts for different user groups. The implementation of the new digitalisation activities and integration of smart digitalisation and urban design is conducted in order for Espoo Innovation Garden to be the forerunner in European Union.

Design thinking is an integral part of this work. The methods adopted in service design, such as scenarios, storytelling and prototyping, help decision-makers to see the changes in the operational environments of the future. It is a question of collecting the existing data and analyzing it in a new way to develop innovative and flexible city planning and service architectures. The focus is on customer-centric value models.

In an open urban information platform model, the visualized data will be published via the latest version of a 4D urban information model. The first pilot is the Espoo Innovation Garden including Tapiola, Otaniemi and Keilaniemi. The model will include the current as-is model, as well as future plans for the year 2020. The work will be completed together with Sito, Nokia Here and Adminotech in close collaboration with Finnish Geodetic Institute and Aalto University.

3.2 Matinkylä Citizen Service Centre as a leading example

Many cities are currently considering and experimenting with multi-use service centers but the work is hindered by a lack of experience. Espoo has excelled with the model of seven public citizen services hubs, Tapiola, Iso-Omena, Espoonlahti, Kivenlahti, Leppävaara, Kalajärvi and Vindängen for years. Now, the new arena in this further development is the Matinkylä public services market place.

Espoo's Matinkylä district will place several city services under the same roof. Hosted within the local shopping center premises, the new spaces call for common guidelines and a joint understanding of service promises. Espoo's first pilot is the Matinkylä citizen service center where the shopping center is stretched into including services such as a library, child health center, health clinic, city service unit and youth services. The new service center is meant to produce understanding of what requirements citizens have regarding public services. The core idea is to merge the spatial planning and digital service models together. It is also relevant to find a common service promise and vision for the different providers.

Plenty of groundwork has been accomplished for the Matinkylä citizen service center. The core is a service centre process, which deals with waiting and queuing for services, service functionality, service accessibility and security issues, customer relationship building and maintenance. The work outlined the importance of user experience and speciation of different user groups like seniors, youth, immigrants and families with children. (Toimiva kaupunki)

Espoo Innovation Garden is a strongly developing area for living and working, and provides the main environment for experimenting with the elements needed for creating this platform. The platform is currently under development and a relation with Horizon 2020 funding opportunities is being sought. Espoo Innovation Garden will be the pioneering region in regional area modelling and multichannel services in the European Union.

4. Conclusions

Smart cities are looking towards open innovation and new technologies to more efficiently manage services and infrastructure while improving quality of life and local innovation. The essential question setting is what the main challenges in the cities are and how we enable urban innovations. In Finland we are seeking for solutions to the above challenges—with major input of open innovation platform 2.0 and multichannel services in Espoo Innovation Garden.

In order to provide predefined and emerging services with limited financial resources, cities have to renew their operating and governance models to be more agile and efficient. In addition, the business opportunities for startup companies to succeed in the global market increase only if the public-sector conditions are optimal for creating networks between cities and startup companies. Consequently, this should facilitate further opportunities for wider expansion and utilization of local experiences and learnings. An open innovation platform is the functional entity where new innovations and services can be facilitated by the city community. In this city community, its infrastructure, physical and virtual environments, processes and operating models, including people meet to create value. A city has to establish active dialogue with the market and private sector to promote service innovations and offering. This will also mean that a city will open service development and testing to partners and citizens. This will further encourage potential business and public-sector innovations locally and their scaling internationally in the future.

The prerequisite is to renew the operational and governance model of the cities to be action-driven, customer-based and process-oriented.

Cities should act as orchestrators to connect the various parties in innovation platforms to create and maintain sustainable ecosystems. In the future, cities will constitute hearts of innovation with lungs pumping in open air (data) and empowerment (as contributions by citizens and firms). In the future knowledge-intensive economy, new elements are required in sustainable ecosystems, including open innovation platforms, open data, citizen inclusion/ empowerment and crowdsourcing, thus utilizing a model of **mixed crowdsourcing.** The Espoo Innovation Garden will be one of the leading examples.

References

Cohen, B., Almirall, E., Chesbrough, H. (2014). The City as a Lab: Open Innovation meets the Collaborative Economy. Call for papers.

Helsinki smart region: Pioneering for 2020. (2014). Second edition, EKA B project.

Iansiti, M. & Levien, R. (2004). The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability. Harvard Business School Press.

Iansiti, M. & Levien, R. (2004). Strategy as ecology. Harvard Business Review (March), 68–78.

Meklin, P. (2008). Tuottavuuden mittaaminen verorahoitteisessa toiminnassa. Kunnallistieteellinen aikakauskirja, 36(4), 386–395.

Meklin, P., Rajala, T., Sinervo, L-M., Vakkuri, J. (2009). Kunta hyvinvointipalvelujen järjestäjänä—Rajallisten voimavarojen tehokkaan hallinnan ongelma. Teoksessa Karppi, I & Sinervo, L-M (Ed.), Governance—uuden hallintatavan jäsentyminen. Tampereen yliopisto, Hallintotieteiden keskus.

Salmelin, B. (2014). Europe needs to focus on new models of innovation. Newsroom Editor on 17/07/2014. http://ec.europa.eu/digital-agenda/en/news/bror-salmelin-europe-needs-focus-new-models-innovation.

The SixCity Strategy 2014–2020.

Sutinen, P. (2012). Johtajana kehittymisen olemus kunta-alan johtajan kokemana. Acta Electronica Universitatis Tamperensis 1173. Suomen Kuntaliitto Acta 233. Tampereen yliopisto ja Suomen Kuntaliitto. Helsinki, Kuntatalon paino.

Toimiva kaupunki; http://www.toimivakaupunki.fi/en/projects/matinkylä/.

Tukiainen, T., Lindell M., Burström T. (2014). Finnish Start-ups in Global Evolving Ecosystems.

Value for Finland. Tekes. Helsinki: Hanken.

Vakkuri, J. (2008). Kuntien tuottavuus—lääke ongelmaan vai itse ongelma. Kunnallistieteellinen aikakauskirja 36(4), 386–395.

Vakkuri, J., Kallio, O., Tammi, J., Meklin, P., Helin H. (2010). Matkalla kohti suuruuden ekonomiaa? Kunta- ja paikallistalouden lähtökohdat Paras-hankkeessa. Paras-ARTTU-ohjelman tutkimuksia nro 3. Tampereen yliopisto. Suomen Kuntaliitto, Acta nro 218. Helsinki, Kuntatalon paino.

Vakkuri, J. (Ed.) (2009). Paras mahdollinen julkishallinto? Tehokkuuden tulkinnat. Helsinki, Gaudeamus.

About the authors

Taina Tukiainen, Ph.D (technology), is now a senior researcher at Aalto University. She has worked over 20 years within the industry and universities, over 10 years at Nokia Corporation as a senior manager. She was until 2014, Director of Digibusiness Finland. Her research interest is strategic research including innovation, technology management and entrepreneurship. Her dissertation was "The Unexpected benefits of Internal Corporate Ventures: An Empirical Examination of the Consequences of Investment in Corporate Ventures" in 2004 and the topic of the latest book was "The Finnish Startups in Globally Evolving Ecosystems. Value for Finland" in 2014. She has published recently papers in Organizational Science and MIT Sloan Management Review. She has done various projects in international university and industry collaboration.

Päivi Sutinen, PhD (Education), is now Services Development Director at the City of Espoo. She has worked over 25 years as a director or developer at the Cities of Espoo and Helsinki. She has worked at Espoo also as a Corporate Services Director, Director for Occupational Health Services and at Helsinki as a Development manager and Section Director. Her dissertation was "The Essence of Developing as a Director: Experiences of Directors in the Municipal Sector". Recently she has been leading the development of the business models for the New Smart Cities.

Pekka Sivonen
General Director, Vertical
Executive in Residence at Aalto University
pekka@vertical.vc

Antti Korhonen
MQ, Co-founder, xEdu
Student and Researcher at Aalto University
antti@korhonen.com

24. AppCampus: Faster Business Acceleration through Vertical Focus

Abstract

The AppCampus program started as an experiment within Aalto University in May 2012 and has already shown what can be achieved with University and industry collaboration. The model developed for the program has generated dozens of new companies and created hundreds of new jobs not just in Finland but internationally, as well. Aalto has gained positive PR globally, and together with Startup Sauna and the Aalto Ventures Program it has boosted Aalto´s recognition as one of the global hotbeds in start-up creation and education.

Ecosystem build-up is a demanding task and sometimes requires new creative ways to bring all participants to the same table. Universities or large multinational corporations alone could not have achieved the same effectiveness and efficiency as AppCampus did. The key participants were the phone application developers that needed a home for their ideas. AppCampus was a platform into which the developers could enter, without the prejudice they have towards Multinational Corporations.

The AppCampus model can be used as a template for other similar projects to drive the change and create a flourishing ecosystem. The model can be utilized in different verticals with a need for a similar ecosystem setup where big companies can benefit from the innovativeness and clock-speed of young start-ups.

Implemented in a similar fashion, the model can help Aalto University implement its strategy and further amalgamate its three disciplines of technology, design and business in this rapidly converging digital world in verticals, like xEdu (education business accelerator) and Vertical.vc (healthcare accel-

erator). And as Aalto, xEdu and Vertical all have their homebase in Espoo, they will be important actors in creating the Espoo Innovation Garden success story.



KEYWORDS: Appcampus, Vertical, Developers, Business Accelerator, Start-ups

1. Introduction

AppCampus was established to build a mobile software application Windows Phone ecosystem in Finland around Aalto through a 3-year project that aimed to attract application developers to the Windows Phone software platform. AppCampus became a joint collaboration project between Aalto University, Nokia and Microsoft.

The Windows Phone platform had fallen heavily behind Apple's and Google's application ecosystems at that time. Developers did not want to focus on developing applications on it, due to the lack of Windows Phones on the market, which prohibited monetizing on the applications compared to Apple's and Google's applications. The phone manufacturers who focused on iOS and Android were grabbing the smartphone market share from Nokia. As the Windows Phone platform was announced to be Nokia's main platform in smartphones, it harmed Nokia's smartphone sales. Nokia's future did not look very bright.

Since Nokia was and still is a huge employer in Finland, the downward spiral of the company also impacted the Finnish economy. As one of Aalto's strategic foci is to positively influence Finnish society, it had a strategic incentive to be part of AppCampus. Each founding partner had an incentive to make AppCampus happen. By creating more attraction to Windows Phones, each party wins. Microsoft and Nokia gain market share and revenues as well as a key part of their competitive requirements (an active application store). Aalto would be positively influencing Finnish society, while gaining other benefits (e.g. extended networks, new know-how, increased brand awareness).

Aalto provided the premises and the staff to manage AppCampus' daily operations. Nokia and Microsoft each provided 9MEUR funding, in addition to access to their go-to market partnership network in 200 countries and visibility for applications funded by AppCampus after their release.

2. Structure of AppCampus

2.1 Founding partners

The AppCampus project was initiated by Will Cardwell, the Head of Aalto Center for Entrepreneurship (ACE) at the time, who started the discussions with Microsoft Finland. Around the same time, Microsoft Finland had also been thinking of ways to

attract developers to the Microsoft Phone ecosystem. Tapio Siik was hired to Aalto Center for Entrepreneurship to manage the tripartite negotiation between Aalto, Microsoft and Nokia. During the following months, the concept was clarified and Nokia agreed to match Microsoft's investment in AppCampus. After initial development of the idea, Pekka Sivonen—an Entrepreneur in Residence at Aalto University, was selected as the lead for the AppCampus project. He represented Aalto in the project and finalized the development of the concept as well as negotiated the rules for the AppCampus' tripartite agreement implementation. The agreement focused on finding a collaboration model that benefitted all the three parties without harmful side effects. These effects posed a major obstacle and necessitated many negotiations.

The collaboration model between non-profit (Aalto) and for-profit (Nokia and Microsoft) organizations created a unique combination for the AppCampus project, which could not have been possible if the members had attempted to create this on their own. Aalto focuses on education and research and has a globally recognized status for it. One of Aalto's main concerns was that it would lose its independence with AppCampus, with 18MEUR funding from two commercial operators under Aalto. In addition, it was unclear to Aalto if its investment in AppCampus would provide sufficient return, since there was no direct financial benefit.

Aalto's concerns were tackled by giving it the brand ownership of AppCampus and reassuring it of the non-monetary benefits it would receive from AppCampus. These non-monetary benefits included, for example, knowledge about entrepreneurship, ecosystems and acceleration. The ecosystem knowhow was and is important to Aalto since it struggles with bureaucracy and funding limitations when creating startups and therefore also the startup ecosystem creation had substantial obstacles. By nature, the startup ecosystem requires flexible rules in order for the people with startup mentality to be interested about it. This is where the University and a startup ecosystem do not function alike. They can support each other, but they cannot follow the same rules due to their nature. Nevertheless, Aalto has gained a good reputation through Startup Sauna in the startup scene internationally.

Also, Nokia and Microsoft have limitations similar to Aalto about the rules and bureaucracy. What these commercial giants can provide is funding and commercial assistance (e.g. go-to-market) for the ecosystem participants. While parties, university and commercial giants can bring valuable assets to the table, they lack the independence and freedom to operate in a manner that is required for the startup ecosystem to bloom. A catalyst was needed to channel the assets provided for the ecosystem without a possibility of contaminating the ecosystem. Application developers want to avoid getting into a corporate surroundings, which is exactly what Microsoft and Nokia feels like for them. Therefore it was important to create a new, neutral stakeholder that could bring all these parties together.

AppCampus as an independent operator bridged the gap between the startups, the university and the multinational companies. By clearly establishing AppCampus' independence from all parties, there was no bias in the eyes of the ecosystem—meaning the developers, coaches, mentors, networks, and other global hot beds.

This was vital in order to change the perception of the developers and ecosystem participants, who are the ones who made the ecosystem flourish. With AppCampus the founders, Aalto, Microsoft and Nokia, were seen as powers supporting the entire startup ecosystem, and especially the mobile software application Windows Phone ecosystem. The global brand, publicity and knowledge the founding partners have are hard to measure in monetary value. The combination of young, innovative teams and multinational megabrands working together is a rare one, and that is exactly what AppCampus managed to facilitate.

2.2 Extended partners

After getting the program started and ramped-up into an operational mode, AppCampus started identifying 3rd parties in the mobile value chain that could bring additional value and start-up deal flow by working as an extension to the core program and its co-founders. Extended partners would need to bring at least one of the following value-adds into the collaboration in order to qualify: extended reach geographically or competence-wise, go-to-market channels, or awareness-raising networks.

Within the first 12 months of operations, AppCampus negotiated and published the following partnerships to extend the global reach and meaningfulness of the programs: Telefonica´s accelerator Wayra (active in 12 markets), World Bank, China Mobile, Founders Institute and Harvard Business Angels (Bangalore).

2.3 Appcampus team—structure and responsibilities

Creating a Windows Phone ecosystem around Aalto built a functional combination of partners, who all bring uniqueness to the table. Aalto brought world-class research with innovative young minds for the executers to the startups. In addition, it brought a physical place in providing premises and long-term startup knowhow by putting people to place to manage the AppCampus.

The idea of AppCampus was initiated by Will Cardwell on Aalto's side by brainstorming on how to create a functional Windows Phone ecosystem and sharing his thoughts with Mika Okkola on Microsoft Finland and Roope Takala on Nokia's side. As all the parties were interested in the idea, Will started to make AppCampus a reality. This required more people to become involved, which is when the team building got started to make qualified people take it forward. Will hired Tapio Siik and Pekka Sivonen to start negotiating the AppCampus deal, they together formed a team that drove the AppCampus idea forward. Pekka was selected as the Head of AppCampus. These three recruited an operational team where the main functions of the operations were screening, quality control of the apps, deal flow, marketing & communication and bootcamp operations.

In the beginning, also a Steering Group was established to include one member from each organization, that is Aalto, Nokia and Microsoft. The Steering Board reviewed the program results in its monthly meetings and made decisions on bigger issues, such as exceptions to grants and new rules to grant funding.

3. Building awareness, PR & Marketing

Even though AppCampus had three strong brands as founders, the main purpose was to distance AppCampus from them when creating publicity. Aalto, Nokia and Microsoft all bring assets to the table, but none of them has an excellent reputation among startups or application developers. Some even have an adverse connotation and one general example is that Microsoft and Nokia are considered too corporate by application developers.

The common problem application developers seem to have is that they do not fit the MNC mold of an employee. This is a key consideration when AppCampus' visibility was created—how to bring in the application developers who were neglected and overlooked by competitive ecosystems. Pekka and the team believed that there was a huge group of application developers available, but somehow excluded from existing ecosystems. This undiscovered talent was what AppCampus went for.

AppCampus created a buzz by its activities. It held many coaching sessions annually, which helped the developers to acquire new skills and develop further. In addition, AppCampus hosted month-long training camps for developer teams per quarter. The first one took place in November 2012 with 13 teams. By doing this centrally, AppCampus was able to manage quality and focus more on the training while bringing teams to Finland from all over the globe. Some of the team members might even stay in Finland and therefore bring new talent and entrepreneurial spirit in. The ones who returned worked as excellent spokespersons for AppCampus, since they were the trusted locals who were now telling the AppCampus story. With their personal stories, the message became much more interesting and trustworthy.

The drive behind AppCampus has been high from the start. Already by the end of 2012, members of the AppCampus team had participated in around 100 events organized by the ecosystem. Pekka and Paulo Borella (director at AppCampus) started informing people about AppCampus thorough all possible channels; web, Twitter, email, phone with an excellent response. Simultaneously with the launch of AppCampus, there was an AppCampus Soundtrack and Tagline competition. Both were launched in over 80 countries in seven languages. Creating awareness definitely worked, since during the first year of operation AppCampus received over 2,600 applications from 96 countries, of which 166 were funded. This is about 10 times more deal flow than a Venture Capital fund typically receives annually.

Aalto has a good and widely spread reputation, but it had not been previously internationally well known for entrepreneurship. AppCampus has definitely helped this task in multiple ways (e.g. luring in international students, marketing Aalto to potential students and faculty). Because of AppCampus and Startup Sauna, Aalto is now internationally recognized, boosting early stage companies and start-ups.

4. AppCampus Methodology

AppCampus has developed a unique approach to early stage startup-acceleration. The combination of grant funding with an accelerator program and a global go-to-market practice could not be found under one roof anywhere else in the world.



Figure 1. AppCampus as an early stage startup-acceleration: basic facts.

When diving into more detail with this 3-step value-add, all of them have been implemented in a unique way. First of all, AppCampus funding by nature was grant funding, where no equity, no revenue share nor IPR was taken from the company.

4.1 Process-model for funneling deal-flow

Since AppCampus was a new brand and concept, it was lacking visibility and public awareness of its existence. In addition, the Windows Store had no strong brand name or user base if compared to competitors. In the mobile phone application industry, there are two main brands, which have a major share of users and market share of applications for smartphones. These are Apple with App Store and Google with Play. In order for AppCampus to get developers to focus on Windows Phone applications, it needed to gain global visibility among developers. This was and is a huge challenge.

AppCampus increased its visibility e.g. by participating or hosting multiple different events internationally, creating MAAC (Mobile App Accelaration Camp), managing communications together with Wayra. These created deal flow as well as referrals. After the deal flow was established to the desired level, AppCampus started to limit the application submissions. After July 2013, the online application form was gradually closed down and the deal flow was based on MAAC.

The deal flow was managed with a carefully designed process. First, the online applications go to AppCampus evaluation to check if they meet the criteria. If passed, the first milestone, called a Vetting milestone, focuses more or less on checking practicalities such as signed contracts with AppCampus. Second, in the Design milestone, the team has to provide a project plan, info specific to mobile phone applica-

tions, and most importantly, information about the visual design of the application. This explains how the application should work, how to navigate through it and what it should do. After completing the design project as planned, the developers get 30 percent of their grant. Third, the developed application is submitted to the Windows Store for certification and it is hidden from public at this point. If the application is certified, it is published and the developers receive the last 70 percent of the grant as they have gone through the implementation phase successfully. Finally, the application is released to the Windows Store and the go-to-market activities can start. Now as part of the AppCampus Alumni network, the developers get help from AppCampus, Nokia and Microsoft for commercialization, and the application is to be held exclusive only for Windows Phones for 90 days.

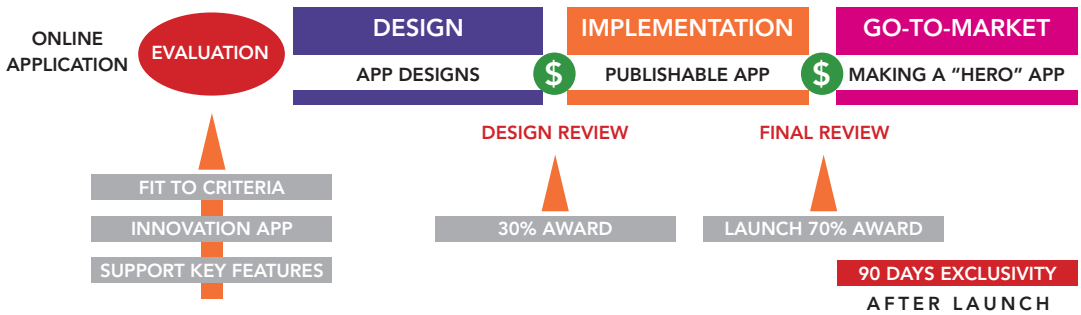


Figure 2. The AppCampus process includes initial evaluation and after that the three phases with one evaluation in each: Design, Implementation and Go-to-Market.

4.2 Screening and vetting

AppCampus adopts an iterative process to help the developers in application development. The evaluation is completed in multiple stages in order to evaluate the situation and the development, even though there will be an initial evaluation of the funding application. In the Figure above, you can see that there is one evaluation per phase.

Initial evaluation is completed when the funding application is submitted. In this stage, the quality level varies. This shows the situation when no training is given, at least not in AppCampus. The application needs to have the required characteristics in order for it to pass the Evaluation phase.

After the initial evaluation, there will be a new evaluation per module. There are three modules: Design, Implementation and Go-To-Market. These focus on different dimensions, helping the developers systematically develop all aspects right on the application.

4.3 Funding

AppCampus gave funding in the form of grants to Windows Phone application developers whose application and other info complied with the AppCampus rules.

The grant size varies from 20,000 euros to 70,000 euros and it is dependent on the complexity of the application. In spring 2014, a new 10,000 euros grant was put to place. With this new grant, the developers already working on their Windows Phone application could also produce a Windows 8 version of the same application.

4.4 Quality assurance

Quality assurance was vital for AppCampus results. Developing only quality mobile applications is a base for all benefits for Aalto, Microsoft and Nokia. The applications that have demand and receive high download and/or usage rate will incentivize also others to develop mobile applications for Windows Phone. It can be seen that there actually is an ecosystem around WP that monetarily supports the developers. By going through AppCampus' rigorous and iterative evaluation process, the developers learned also important skills for future software development projects.

Quality assurance started with a detailed description of the AppCampus website of what is expected from the team in terms of receiving funding from AppCampus. This information was emphasized with the AppCampus personnel attending and hosting a start-up and/or mobile development events, which also increase AppCampus' visibility. After the funding application was submitted, it was examined by an AppCampus member to assess whether the developers have understood the questions and answered them accordingly.

During the development process, the teams were offered coaching and training with the business. This included working on e.g. problem recognition, business model, value proposition. By helping developers to acquire skills and knowledge to manage their new application software business, they have much better chances of succeeding.

When the development has progressed to the phase where the application is ready for distribution via the Windows phone ecosystem, the company and is coached about the app market entry. Microsoft's and Nokia's go-to-market functions assisted in choosing the right launch locations, required localizations and partners.

4.5 Coaching

AppCampus offered training and coaching to the developers in the areas of mobile technology, design and usability, and marketing support. After they were accepted, the developers were able to participate in trainings and receive coaching in the development issues. As there is a process for development, there are multiple different phases on what to get the coaching. Coaching can be focused on the development phase development or on the industry and/or skillset of the coach needed. AppCampus has over 100 coaches on their pool of coaches. This large number of coaches gathers a wide variety of skills and experiences (e.g. PR, branding, finance, digital go-to-market, customer development, law).

AppCampus is using experienced coaches mainly on a pro bono -basis, but few of them are paid in order to direct their unique expertise to the use of AppCampus.

The coaches' participation is dependent on many factors as their timetables are very busy. AppCampus has managed this by managing the coaching face-to-face, remotely and via online. This provides coaching with flexibility without losing its effectiveness and efficiency. In addition to AppCampus' general coaching, there are also AppCademy, AppCademy Online and MAAC.

AppCademy is an intensive 4-week accelerator camp run by AppCampus in AppCampus premises in Otaniemi into which AppCampus invites the most talented and promising teams that had been accepted to the AppCampus program. During the intensive camp, the teams are offered extensive coaching and training e.g. in branding & positioning, design and UX excellence, pitching, development, monetization, marketing, and communications. AppCademy is focused on face-to-face coaching.

AppCademy Online is the online version of the AppCademy. It offers a selection of relevant modules from the AppCademy program online. This way the AppCampers can flexibly access the coaching and training and develop their skills. The modules are delivered through a series of video lectures, slides, articles and exercises.

The MAAC event is a 2-day camp, which focuses on pitching and mentoring sessions, AppCampus application submissions and 1:1 discussions. The MAAC was created to provide expert insights and coaching to talented teams for launching a successful mobile app or game through the AppCampus program. AppCampus provides technical, business and financial support to help getting the app to Windows Phone Store.

4.6 Co-working space

Aalto provided a working space for AppCampus operations based in Otaniemi. These premises are functional for the start-up ecosystem, since the space is used wisely on the basis of the demand. There are meeting rooms, quiet office spaces, and available seats for people to come together and share ideas while working.

The real estate investment Aalto allocated to AppCampus can be seen as taking a leap of faith, since something like this has not been done before. After the first 2 years, it can be seen that AppCampus has been widely successful for Aalto. The amount of funding applications around the world is stunning, even on a global scale. The amount of international visibility AppCampus has brough to Aalto is hard to calculate, but there has been at least 15 organizations/delegations per month visiting AppCampus. As these parties are given a sightseeing tour around the co-working space, it has become more evident how functional the spaces are. It is a non-disturbing cohesion of people working passionately on what they are interested in. Teams are able to work in this flexible culture and space even with large groups of visitors walking through the same space.

5. Events at home & abroad

An important part of AppCampus have been the different kind of events, with different participants, but all are boosting the awareness of AppCampus. AppCampus has gained much visibility by participating in events in Finland and abroad.

Domestic events started with AppCampus' own kick-off event to promote AppCampus. On top of these, AppCampus has made a tour twice with Microsoft in the form of an Mobile App Acceleration Camp (MAAC) event around Finland. Once the concept was tested and found working well in Finland, it was taken to 25 different markets in the same 2-day format. The event is very well documented as a practice, and it increased the quality of the AppCampus deal flow dramatically.

When taking MAACs abroad, AppCampus leveraged the field force of 1,100 Microsoft DPE- epresentatives, as well as 400 Nokia DX employees worldwide. The use of these software market specialists in their respective countries worked as a very powerful pre-selection and awareness-raising vehicle for AppCampus globally.

Microsoft also arranged a WOWZAP event, which was a huge success with 600 teams participating. Also the main sponsorship for Slush and helping with the screening put AppCampus in a visible position, since Slush is a widely known event and has perceived much international publicity in the start-up scene. The international visibility of AppCampus has been boosted also through various events globally. AppCampus visited the Mobile World Congress in Barcelona, Techrunch Disrupt SFO and Global Mobile Internet Conference in Peking annually. The latter one is China's largest mobile event while the previous is the world's largest exhibition and networking event for businesses in mobile space.

In Tech Crunch Discrupt's San Francisco event, AppCampus was one of the stakeholders who donated a 50,000 euros prize to the winning team of TechCrunch Disrupt SFO hackathon. Since the event itself is an important forum to be for many participants of the start-up ecosystem, it was an excellent venue for AppCampus to transmit knowledge about the program.

Microsoft assisted in ecosystem creation with their ImagineCup that focuses on entrepreneurship. AppCampus also attended another entrepreneurial event that is also Europe's largest tech event called LeWeb. These served well in promoting AppCampus and educating people regarding AppCampus.

6. Go-To-Market—channels and partnerships

AppCampus provides go-to-market assistance to Windows mobile applications. The means and extensity of the go-to-market assistance is decided case by case, since the need for assistance differs between applications. This go-to-market assistance is largely based on Nokia's channels as it has the infrastructure and global presence established. On top of this, AppCampus and Microsoft have their own go-to-market actions.

For all applications, the go-to-market assistance starts when the application is ready for the Windows Store. AppCampus plans the marketing activities together with the developers, depending on their application's particular needs. Applications get published on the AppCampus website with occasional Facebook and Twitter promotions. AppCampus also uses third parties for promoting and increasing visibility of the applications. Third parties used by AppCampus include AdDuplex, myAppFree and conversation blogs. AdDuplex and myAppFree are promotional networks specifically targeted at Windows Phone.

Nokia had multiple channels for promoting applications, such as:

- Nokia APPetite—a website for promoting phones and applications.
- Nokia Collections—a listing of applications selected by Nokia in the Windows Store.
- App Social—Nokia's own application that allows the user to list the applications (s)he uses. Other users can then follow what applications the particular user is using.

These channels provided comprehensive promotional toolset for a computer and mobile use. Also they brought a different aspect of the promotion (Nokia and the users) and created a sense of participation where one can follow other users application usage and get followers for themselves.

Windows Store is the place to download the applications and gaining visibility there is crucial. The teams making applications in AppCampus usually have no track record in the mobile application industry. Therefore, for them it would be nearly impossible to get their applications on the Windows Store's front page. With AppCampus this can happen and it has an enormous influence on the application download amounts. In the Window Store there are so many applications that it is easy for an application to be unfound by users. On a weekly basis, AppCampus suggests some of their applications to be highlighted in the Windows Store. This possibility of getting your application highlighted in the Windows Store is a unique feature of AppCampus, since this kind of visibility and promoting cannot even be bought for an application.

Another unique feature of AppCampus is that the applications coming from it could get visibility on Nokia's webpage. This was on the special AppCampus section or on other webpages and/or sections (e.g. on a specific phone model webpage). The AppCampus section includes handpicked applications, which meet the tight criteria of the selection process. The visibility that the application received on Nokia's webpage seldom had such a big influence on the application download amounts, but it creates value for the company that developed the application. This value comes in the form of appreciation, credibility and/or recognition. This intangible value can boost developer morale, which supports the AppCampus goal involve more developers in the ecosystem. Also the recognition of getting your application to Nokia's webpage can have a big impact in business negotiations for a start-up (e.g. Venture Capitalist might see this as a differentiator and agree to meet the developer).

7. Appcampus Outcomes

As year 2014 progressed, Microsoft bought Nokia's mobile phone business. It also meant that the collaboration between those two companies on AppCampus needed to be re-evaluated (as basically that part of Nokia that was supporting AppCampus was bought by Microsoft). The main business decision maker was Microsoft. For them it was important to take the developer approach even closer to their core, so instead of running AppCampus as a separate entity after its original 3-year charter, Microsoft is taking the good practices of AppCampus within Microsoft Developer Community collaboration where the practices live on because of the good business results for the developers.

The key business results of AppCampus can be seen when comparing AppCampus graduates to other developer companies that were on par level before the program; Appcampus graduates have 7.5 times the downloads of their peers, higher app scores and most strikingly, twice the revenue compared to developer companies that have not gone through AppCampus.

The networks, partnerships and global publicity AppCampus created around Windows Phone application development helped with the key issue of changing developer mindsets about Windows Phone applications. Gaining traction for Windows Phone applications in the global start-up scene snowballs the benefits to the main partners. Microsoft made their application ecosystem known among application developers by partnering with AppCampus to promote it and manage the application evaluation, coaching and funding process. This led to a more active Microsoft Phone ecosystem and therefore new revenues through applications sales commissions, license fees from the actual Microsoft Phone OS and, these days, actual phone sales.

Aalto benefited from AppCampus in multiple ways. First, AppCampus improved Aalto's image internationally and one example of this is the vast amount of international delegations that want to visit and learn about AppCampus. Second, the partnerships that AppCampus has created with a wide variety of world-class entities (e.g. World Bank, Wayra, Founders Institute, Harvard Business Angels). Third, AppCampus has given the best empirical knowledge and proof about ecosystem creation, start-up acceleration and entrepreneurship mentality. These are unique on the global scale and surely benefit Aalto research and education more than the monetary investment put into AppCampus. Finally, AppCampus has been a global visibility success story for Aalto. The brand can be applied in many ways in Aalto from the door opener to exclusive networks all the way to being labeled as an international pioneer in catalyzing ecosystem creation.

8. Repeatability of AppCampus-model

AppCampus has shown what can be achieved by university-industry collaboration with a special independent vehicle created as the driving force behind the move-

ment. The AppCampus model can be used as a template for other similar projects to drive the change and to create a flourishing ecosystem.

As shown in the case AppCampus, an ecosystem creation is demanding task and it sometimes requires new innovative ways to bring all participants to the same table. Universities or large MNCs could not have achieved the influence with the same effectiveness and efficiency as AppCampus did. The key participants in this case were the phone application developers that needed a home for their ideas. AppCampus was the home and vehicle to help them to become interested and part of the ecosystem. The appearance and unique characteristics of AppCampus was a soil where the developers could enter, without the prejudice they would have had towards a MNC like Nokia and Microsoft.

The AppCampus model can therefore be utilized in different verticals with a need for similar ecosystems where big, well-established companies join the innovativeness and high clock-speed of young start-ups. Iterations on various vertical xCampus programs have been made and these have demonstrated an evidentneed for similar accelerators e.g. in the areas of health, media and education.

8.1 Startup accelerator xEdu

Building on learnings and good practices of Appcampus, the start-up accelerator xEdu was founded in February 2015, around the same time as the healthcare-focused business accelerator Vertical became operational.

xEdu focuses on helping start-ups that are bringing new learning solutions to the market. Despite the success of the Finnish education system e.g. in Pisa tests, the amount of successful educationly focused start-ups is very limited. There is a number of reasons for that; e.g. the large role of public purchasing in education, closedness of the Finnish school system for start-ups, cultural ties of education into a specific country culture, consume perception of free education that makes it more difficult to acquire paying customers from consumer markets.

However, these hindrances can in many parts be overcome with a systemic approach where all the actors of the education ecosystem come together. And this is now happening in Espoo together with the City of Espoo, Aalto and University of Helsinki, and the xEdu business accelerator and its partners.

The City of Espoo has decided to open its school network to be a living lab where the new learning solutions can be tested and developed rapidly. The standard processes for collaboration together with the culture for collaboration provide a good home ground for new learning solutions and applications. These are in part brought into market by start-up companies that participate to xEdu accelerator program. For the start-ups a standard collaboration practice with the City is a great benefit.

The start-up accelerator program is run at xEdu by entrepreneurs and experienced professionals (like Kirsti Lonka and Pasi Sahlberg as mentors). Each time the program is run, a number of early stage companies are chosen for the program. The start-up accelerator offers companies an environment where to develop and grow their business: together with selected partners, the program offers members work

spaces, a training program that meets international standards, help in financing, and connections within marketing and international product distribution, like AppCampus did.

9. Conclusions

The AppCampus program was started as an experiment within Aalto University and one of the goals was to investigate how University could work as a start-up type of partner for big multinational corporates in a co-funded 3-year project. Building a separate, lean and focused unit makes that possible. The model developed for the AppCampus has generated and made possible hundreds of new companies and created hundreds of new jobs not just in Finland but internationally. Microsoft and Nokia were able to build a developer community around the Windows Phone ecosystem faster. Developers participating in AppCampus got measurable business results. Aalto gained much positive PR globally because of AppCampus and together with Startup Sauna and AVP has boosted Aalto´s international recognition as one of the hotbeds in star-tup creation and education. AppCampus' integrated, focused accelerator approach is now bringing a new set of start-ups to markets in selected focused verticals, like healthcare and education.

About the authors

Pekka Sivonen, Co-founder of xEdu and Vertical, is founder of Digia, a Nasdaq–listed software company for which he raised 38 million in private equity (Finnish record) and grew the company from zero to 1,600 people. In 2012 Pekka became the head of the AppCampus program that he led until 2014 when he co-founded HealthSpa Ecosystem Booster in the field of healthcare technology. In early 2015, Vertical.vc, a healthcare-focused business accelerator became operational. Pekka is co-founder and General Director of Vertical.

Antti Korhonen, Co-founder of xEdu, has a long working history from Nokia, where he co-authored the business bestseller Work Goes Mobile. As a CEO of Leia Media start-up, he was one of the first ones to go through the Appcampus accelerator program in early 2013. Now he is helping other entrepreneurs become more successful in xEdu; a vertical business accelerator in the field of learning.

Sanna Ahonen
Researcher
University of Helsinki, Department of Social Policy
sanna.kaisa.ahonen@gmail.com

Aino Verkasalo
Researcher
Aalto University, Department of Real Estate, Planning and Geoinformatics
aino.verkasalo@gmail.com

Kaisa Schmidt-Thomé
Researcher
Aalto University, Department of Real Estate, Planning and Geoinformatics
kaisa.schmidt-thome@aalto.fi

Simo Syrman
Researcher
Aalto University, Department of Real Estate, Planning and Geoinformatics
simo.syrman@aalto.fi

Raine Mäntysalo
Dr.Tech, Professor
Aalto University, Department of Real Estate, Planning and Geoinformatics
raine.mantysalo@aalto.fi

25. Multiple Facilitation Roles by the City: Emerging Electric Vehicle Platform

Abstract

The paper describes the roles the City of Espoo has adopted in the electric vehicle (EV) proliferation. Espoo has been a project partner in several EV-related experiments and has encouraged the private sector to be active in building a charging infrastructure. As a policy maker, Espoo has communicated consistent views on electric vehicle promotion, although the status of electric vehicle promotion still seems relatively marginal. For a true innovation ecosystem to emerge, Espoo would need a multi-actor platform, for instance in the Espoo T3 area, the potential of which is thus far incompletely utilized by the City. A profound rethinking of the interplay of transport modes is also not yet in sight. In sum, in proliferation of electric vehicles, the City of Espoo is balancing between proactive measures and the role of a looker-on.

KEYWORDS: Electric vehicles, Proliferation, City administration, Facilitator

1. Introduction

Becoming a part of an existing transportation system is a highly complex socio-technical process for a new transportation mode. The private combustion engine car has gained and maintained hegemony as a mode of transportation. Environmental problems and climate change challenges have forced governments to look for cleaner solutions for mobility, with electric vehicles (EV) possibly providing one solution. In order to integrate EVs with other modes of transport and urban structure, cities have to be active in creating prerequisites for the infrastructure as well as new business models, partnerships and marketing approaches. A technology that has had a marginal position requires the creation of a new business ecosystem consisting of vehicle manufacturers, service providers, land owners, power grid owners, infrastructure planners, financiers and users.

This article describes how the EV cooperation platform has emerged in Espoo and the role the City of Espoo has adopted in the process. The discussion touches upon different actors within the public sector as well as between the public and the private sector. The empirical material of the study includes documents related to EV proliferation and the associated networking process, and 40 interviews that were conducted with different actors included in the EV promotion. The main informants represented officials from the City of Espoo. The interviews were carried out in 2011–2012 during the Eco Urban Living II project, but the material was updated during the early phases of the SASUI project (see http://maa.aalto.fi/fi/research/ytk/research/sasui/).

This article is structured along the roles that Espoo has—and could have—adopted in forming the EV platform. It focuses, in particular, on the process history, conditions for the proliferation of EVs, and actors as well as networks strengthening mutual understanding. Finally, it discusses the role of public policy in EV proliferation.

2. Roles of the Cities in Technology-Specific Innovation Systems

The current rise of the EVs, which begun in 2005 (Orsato et al., 2010), has come coupled with considerable public support. Together with the technological advance, it has become possible to provide at least a modest infrastructure for testing EVs, and then, gradually, for creating sufficient operating conditions for a new transport mode. The increasing networking of actors has also enhanced the development of services and infrastructure that can cater for fluent and user-friendly adaptation of EVs. That development is made easier by the spread of ubiquitous ICT appliances and platforms which can be connected into a strategic vision of smart mobility (Nylund & Belloni 2014).

As Hodson and Marvin (2012) write, maintaining or changing the present mobility regime is a complex process. It is not only the technologists and engineers, but also policymakers, business interests, NGOs, consumers and researchers that influence the situation. The elements within each socio-technical configuration include regulations, policy priorities, consumption patterns, investment decisions, business alliances, public-private partnerships, promotion projects, and service innovations. Reconfiguring these interconnected actors and elements is truly challenging.

The public policy promotion of EVs has taken the following forms: 1) financial (tax reliefs, purchasing subsidies), 2) technical (research and development funding), 3) infrastructural (planning and implementing a charging infrastructure), and 4) governance-based (projects networking stakeholders and boosting cooperation). The first is often seen as a national-level issue, but the other forms apply also to cities, depending on political will and available resources.

Since technical challenges have dominated the discussion for long, the governance of EV platforms has gained attention only recently. The essential role of the public policy, central or local, has not been thoroughly analyzed before. Such governmental subsidies for purchasing vehicles as tax reliefs are essential in promoting EV markets and proliferation of EVs.[1] The cities are also important actors, but not necessarily the driving forces, in creating the charging infrastructure for the vehicles. They are, moreover, a key player in developing networks and partnerships within the branch.

As Malinen and Haahtela (2014) point out, the cities of Helsinki, Espoo and Vantaa have the potential to make a difference in EV proliferation. Already quite modest contributions of the current staff can bring about significant steps forward. As a sector, land-use planning has a particular role through designation of land for transport routes and charging stations. Malinen and Haahtela (2014, 62–66) also list a series of other measures that can be undertaken by cities. They include concrete tasks such as purchasing the City's own EVs (including electric buses), providing public charging infrastructure and free and designated parking for EVs, permitting EVs on bus lanes, as well as broader efforts (attention to electric trip chains, improving park&ride arrangements), also in strategic planning (EV strategy, EV considerations in other planning, publicity for electric transport).

3. Espoo's Multiple Roles

The City of Espoo has promoted the use of EVs in many ways. The history of EV proliferation is also described in this chapter, but not in a chronological order. The

[1] A recent evaluation (Malinen & Haahtela 2014) of the state-of-the-art in Finland came to the conclusion that Finland is currently far from the forefront of EV proliferation. TEKES, the Finnish Funding Agency for Innovation sets high hopes to 'EVE', the Electric Vehicle Systems programme the long-term goal of which is to increase the EV business from the 2010 figure of EUR 200 million to approximately EUR 2 billion by 2020. The evaluation itself formed a part of EVE, and it also marked the launch of a development programme (Sähköisen liikenteen kehittämisohjelma 2014), initiated and prepared by The Federation of Finnish Technology Industries and Aalto University.

passage follows the different roles of Espoo as a facilitator of EV development. It also discusses the roles that Espoo has so far not assumed although they would have been available at least hypothetically, in the light of international comparisons and research literature.

3.1. Project partner in experiments

Espoo has created preconditions for the fluent use of EVs through several projects in the area. The TEKES-funded project Eco Urban Living promoted electric vehicles e.g. by acquiring EVs with subsidies by the central government. There have also been projects testing on-demand transportation as well as smart infrastructures for electric mobility, including another project funded by a TEKES/EVE Programme called Electric traffic and the eBus. In Aalto University Otaniemi campus there is also an on-going transportation reform governed by the City of Espoo.

Other examples of research and development projects include the following:

The Adjutantti housing construction project

The construction project Adjutantti Housing Corporation, in Mäkkylä, Leppävaara in Espoo, aims to create a new concept for a group of eco-efficient urban apartment buildings, which can produce energy for their own consumption. Adjutantti produces energy with solar panels on the roof of the buildings. Solar energy is employed e.g. for charging the shared-use electric vehicles, as well as for lighting staircases and other common areas. The construction corporation Skanska and Fortum offer an electric vehicle for the residents' disposal for a year after the building project has been completed. The car is a Citroen C-Zero electric car and the reservation service is operated by the City Car Club. The charging posts are reserved for the electric cars in the parking garage. The energy engineer points out that the City of Espoo is interested in how the system works and how people experience it and the vehicles.

The Suurpelto urban area project

The Fortum and Espoo cooperation agreement was established during negotiations with the Suurpelto Project director. The Suurpelto urban area was considered to be a suitable area where electric vehicles could be promoted.

The Suurpelto detailed plan proposal is being prepared by the City of Espoo. The intention is to enable charging electric vehicles in some parts of the area. The specifications for the sub-areas Suurpelto IV–V in the detailed plan proposal include charging points. The sub-area specifications will be attached to the land use agreements between the City of Espoo and the land-owner-developers, obligating the future constructors as well. An environmental strategy has been prepared for the Suurpelto area. In addition, the Suurpelto IV-V sub-areas have their own environmental strategy, which will also be included in the land use agreements. Moreover, the implementation of an electric bus service Haukilahti–Suurpelto has been planned.

Energy producing with solar panels for charging electric vehicles on the roof of the Espoo City Depot

The Espoo City Depot has set up 400 square meters of solar panels in cooperation with Fortum on the roof of the depot in Mankkaa. This solar power plant, third largest in Finland, will generate electricity to charge City-owned electric vehicles in the future. The system will generate electricity for about 45 000 kWh per year. The Espoo City Depot was granted by HSY (Helsinki Region Environmental Services Authority) a Climate Award in 2011.

The Chinese electric bus started test drives in autumn 2012

Veolia Finland started electric bus test runs in the autumn of 2012 as part of the VTT-led (Technical Research Centre of Finland) TransEco research project. The Helsinki Metropolitan Region Transport is also included in the project. Their goal is to cut public transport emissions by 80 percent by 2018. The first test bus will start on the route Tapiola–Matinkylä–Friisilä. Veolia aims to test 4–6 electric buses and explore issues such as their suitability for regional transport.

The first electric bus was introduced in autumn 2012. Veolia carries the main financial responsibility for the project, but both the City of Espoo and HSL (Helsinki Region Transport) will invest 120 000 euros in the project during a three-year period. There will be a total of six busses operating in internal lines in the City of Espoo. The planning and implementing of the charging system has been more demanding than expected. One charging point costs 50 000–60 000 euros.

The City officials consider this kind of cooperation projects important for gaining experience in the use of EVs. The technological development is less of a priority, as from the official's perspective, suitable technology is already in use. The City is not keen on taking financial risks and is therefore far from being the only or principal funder of these projects. Although some outcomes might not have met the original expectations of the project initiators, the interviewed official did not appear disappointed. Rather, they saw that underachievements may occur when people who drew the project plans are not the same officials who were made responsible for their implementation.

3.2. Developer of charging infrastructure

Even though the high price and short range of EVs are becoming ever smaller problems, the widely acknowledged dilemma with the infrastructure generation remains. The scarcity of electric cars does not encourage building up the charging infrastructure, but in turn, the insufficient infrastructure prevents the vehicle proliferation (Orsato, et al 2010; Electric Vehicles … 2012). This dilemma can be addressed both by private players and public bodies. Three different patterns in the management of developing a charging infrastructure can be distinguished: business driven, city driven and central government driven. In the cities where EVs are tested on a large scale, for example in Oslo, Norway, the infrastructure has been created in many cases by public–private cooperation (Electric Vehicles … 2012). In the City of Shenzhen

in China the EV business is heavily involved in making the city a vanguard in EVs. Both the City of Shenzhen and China government have supported and subsidized the EV sector. In Estonia, the government has been active in building a nationwide charging infrastructure and providing subsidies for EV purchasing. The government has funded this by selling CO_2 emission quota to Mitsubishi Corporation.

The strategy chosen by the City of Espoo has been to encourage the private sector to be active in building charging points. In the autumn 2012, Fortum, Nissan and the service station ABC (belonging to Helsinki Cooperative Society Elanto, HOK-Elanto) started cooperation in order to build charging networks for EVs in the Nordic countries. The first Finnish fast-charger point was built in Espoo Nihtisilta ABC service station (ABC Nihtisiltaan 2012). The Espoo City officials were pleased that Fortum, Nissan and ABC started to build the charging point. They also welcomed other service providers to the field, but had not been contacted by other companies.

The City of Espoo has its own EVs and has also built some charging points. Those situated in public places will also be opened to the public, but those in the buildings owned by the City will only be available for the City use. The public ones will be fast-chargers. There is usually no need for charging the City's own EVs during the day, since the batteries last one day and are charged during the night. Thus, making the charging points public does not reduce the possibilities of the City officials to use EVs.

So far the City of Espoo has not felt the need to take a proactive role in regulating the development of the charging infrastructure or the charging network for many reasons. First of all, the City officials see that it is not the City's responsibility to create the charging infrastructure, since it does not belong to the City's core functions. It also involves financial risk, which they want to avoid. The City of Espoo does not have a holding in the local energy company governing the electricity grids in Espoo. Since the entire energy business is outsourced, they see no point in starting up new business activity in charging services, especially when they do not have experience from it. According to a City official, the situation would be the same even if the City had holdings since it is not the duty of the City to provide such service. According to the law, the local energy company is obligated to cooperate in building the charging infrastructure if it is ordered and financed by some organization. The City officials emphasize that the City provides opportunities for private companies to create the charging infrastructure—no permission would be needed if no building was included.

Secondly, it was seen that it is not the City's role to guide the placement of the charging points. Nor is it the City's role to prepare a map suggesting suitable positions for the charging points. This topic was brought in to the discussion because the City Planning Office of the City of Helsinki drew a plan to increase the amount of charging points up to 113 and prepared a map showing their location. This map, a preliminary suggestion by its nature, was published in the newspaper Helsingin Sanomat and gained thus plenty of publicity (Lempinen 2012). The City of Espoo officials interviewed thought that it is the charging service providers' role to estimate where the business is economically viable. They did not believe that service provid-

ers would be guided by a map drawn by an official from the City Planning Office and considered it an unwise way to use scarce resources. However, some saw that such a map could be effective in arousing public interest in the issue. It might also help people keen on finding the charging point closest to their home.

Once the charging points were placed, for example, at the service stations, there was no need for the City to be involved in planning the individual placements. In many cases, the need for permissions is so context-specific that general guidelines cannot be determined. The need for permissions is dependent on the assessed impacts of the actions, and the issue was described in the interviews as a 'grey area' open to different interpretations. However, it was held evident that in the future there will be an increasing need for public-private partnerships.

Following citizen feedback, the City of Espoo provided instructions for taking into account the electric vehicle charging service in new construction projects as well as in changes made to old real estates. The City of Espoo ordered from Fortum a recommendation Rechargeable Cars in the Internal Electricity Networks of Real Estates. The Recommendation provides a brief overview of the necessary requirements for creating a charging infrastructure. The required investment is also estimated in the guidelines.

3.3. Consistent policy maker

In order to be a successful facilitator of multi-actor EV proliferation, the City of Espoo should be able to enhance EVs in a consistent manner across the sectors, from the environmental policy to the economic affairs policy of the City. Currently, three employees work most closely with the promotion of the electric vehicle process. One of them is an energy engineer working in Tilakeskus-liikelaitos (The Premises Department). She is responsible for the coordination of energy issues concerning the entire City of Espoo. The second is the project manager in the City Planning Department. His work is to coordinate land use, urban development and energy and climate issues. Both of these vacancies were established in 2009 along signing the Energy Efficiency Agreement. The third is the CEO of the Depot of The City of Espoo, which is the service provider. In addition, the Espoo Environment Centre coordinates the Mayor's report on climate change, in which electric transportation is one part.

The responsible officials themselves had no unconditional confidence in EVs and regarded "EVs as a good (but tiny) tool in the large toolbox of energy-efficient policy means". The officials mostly follow the project-oriented mode of action, which has also led to the provision of some permanent facilities (such as the charging infrastructure in Suurpelto) and conceptual development (e.g. in car sharing).

Some also saw that the wider potential of EVs for land use should be studied. The implications of reduced traffic noise levels for land use were found especially interesting.

Other EV-related actors within the City include the development manager of the Environmental Agency, who is also the climate change coordinator, as well as the director of economic development and another economic policy official. The for-

mer has had her doubts about whether the technology is sufficiently advanced to encourage investment. She thus connects to the EV discussion rather via the international cooperation that Espoo contributes to in the field of low-carbon city development. The economic policy officials, in turn, have had a role in planning some projects (such as the Eco Urban Living project which aimed to build and strengthen the EV business ecosystem in Finland), but have not always been part of their implementation. However, they have showed interest in EV demonstration in promoting the potential of Espoo, in general, and the T3 area, in particular.

Figure 1 shows how the different actors within the City are not operating in the same field, but rather have separate discussions in their networks.

A **Economic affairs policy**
The economic affairs officials have participated in EV-related projects in partnership with private companies. For instance, the City cooperated with car manufacturer Valmet Automotive Inc. in the Eco Urban Living project.

B **International low-carbon city cooperation**
The environmental agency is engaged in international cooperation in the field of low-carbon city development.

C **Private companies building a charging infrastructure**
The privately owned but open-to-all commercial charging infrastructure has been planned by the companies Fortum, Nissan and ABC (HOK-Elanto). The City of Espoo will grant the permissions. In fall 2014 there were seven charging points in Espoo, two of which located in the T3 area.

D **The City of Espoo EV platform**

EcA	Economic affairs
EnA	Environmental agency
D	Depot
CP	City planning
EO	Energy official

The interviewees (politicians and officials) from Espoo see that the citizens would not be hostile towards increasing the use of EVs. They rather consider the citizens a suitable group for the electric vehicle experimentation because they are perceived as affluent, highly educated and interested in technology and new innovations. It was also seen that in Espoo, the private car will always be an important mode of transportation.

The cross-administrative development programmes of the City might induce changes to the current EV promotion efforts. In particular, one could expect that the Sustainable Development Programme would strive to address the issues of sustainable mobility in a manner that would integrate different actors. The programme (Espoon kaupunki, 2013) also claims that for electric traffic to develop, the City should set a good example for others to follow.

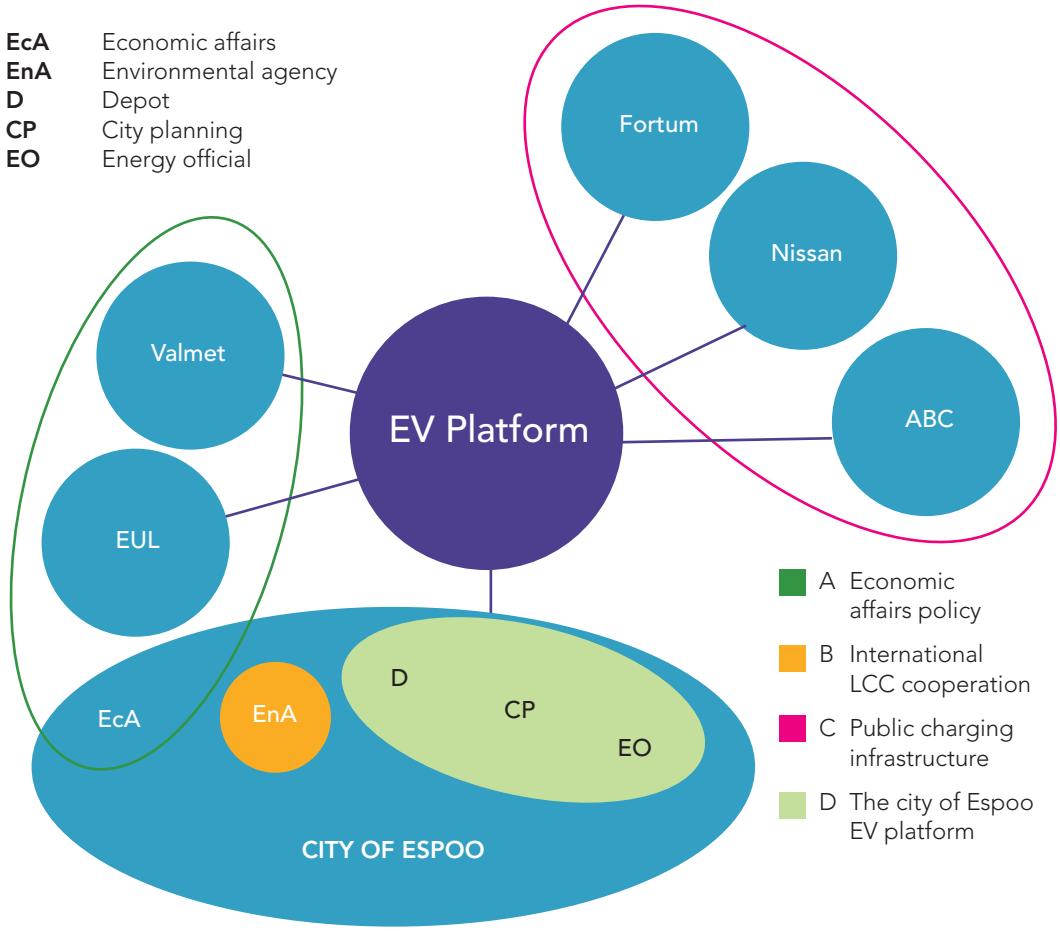


Figure 1. City of Espoo in relation to the platform of electronic vehicle proliferation.

3.4. Promoter of an innovation ecosystem

For a true innovation ecosystem to emerge, Espoo would need a multi-actor platform, for instance in the Espoo T3 area. This area, also labelled as the Innovation Garden, is an important part of the City's strategy promoting innovative, attractive and sustainable urban development. It brings together three neighbouring areas: Tapiola, Otaniemi and Keilaniemi, making the largest hi-tech hub in northern Europe. The second biggest university in Finland, Aalto University, is also located in the area, as is also the Technical Research Centre of Finland (VTT).[2] Besides providing a nucleus of research and development organizations, there is a high amount of potential EV users working within the T3.

[2] Recent related projects in Aalto and/or VTT include SIMBe, eSINi and ECV. As a result of the first mentioned, a charging operator Virta Ltd has been launched. This joint effort makes it possible for electric car drivers to charge their cars at all charging Virta stations in Finland. Virta is owned by Finnish energy companies, including those owned by Espoo's two neighbouring municipalities, Helsinki and Vantaa.

The advent of the metro in Espoo would also be an opportunity to reconsider the current mobility regime, which is based on private and public ICEs. Besides the EVs, cycling could also be promoted. The metro will change the transportation system by providing easy and fast connection to the area, but it will also cause changes in the local land use and overall transportation infrastructure. In this rupture, the area could be updated to meet the challenges of more sustainable mobility. In practice, this could mean better parking facilities, lines and services for cycling, as well as smart mobility solutions and services for shared and electric vehicles. It is good news that the City intends to address the mobility issues through its cross-administrative development programme Sustainable Development in the near future.

In the interviews, it was emphasized that as a public-sector actor the City of Espoo had to put EV proliferation into a larger context and consider what would benefit the City and how the interests of the City would be prioritized. Although the City of Espoo has had many transportation reforms and experiments underway at the same time, including the huge investment in the West Metro project, the interviewed officials said that these actions have not influenced the way the EV proliferation process is resourced. The moderate level of resourcing was rather explained by the opportunity costs and the uncertainty about the true benefits of the investments made in EV proliferation. The officials thought that since there are always risks when a new technology is introduced, it is not so clear whether the issue should be funded more generously.

4. Conclusions

Within the innovation ecosystem that can emerge through the proliferation of electric transport and related efforts in urban development, the City of Espoo is balancing between proactive measures and the role of a looker-on. The City promotes electric vehicles predominantly in a project-based way by launching and facilitating experiments. The basic network infrastructure for cooperation between various departments does exist, but it is not very active. Cross-sectoral working documents are produced when considered necessary, but so far Espoo has adopted a role of keeping track of both opportunities and challenges. The City is open to public–private partnerships, however, avoiding a proactive role in providing services (energy, EV infra). When needed, the City provides help to the private companies in building up e.g. a charging infrastructure, but it does not intervene in planning the network itself. A profound rethinking of the interplay of transport modes is not in sight, despite the opportunities opened up by the metro line.

At an early phase of EV proliferation, even a minor but consistent role of the City may make a difference, as the example of Espoo indicates. Many companies are now taking the same step of introducing the first electric vehicles which Espoo took already in 2009. At the end of 2011, there were 56 EVs in Finland, out of which eight were owned by the City of Espoo. Since that time, the number of EVs in Finland has increased more than tenfold (Sähköautokanta…, 2014). When thinking about

the next steps, the question of charging infrastructure may climb up on the list of Espoo's priorities. If Espoo wishes to belong to the vanguards of EV proliferation, it may choose to strengthen its role in infrastructure planning. Further, the potential of the T3 area as an innovation platform is not yet fully benefited from or promoted by the City.

Although there seem to be no contradictory opinions on electric vehicle promotion, the status of electric vehicle promotion seems relatively marginal when considering policy making in general in the City of Espoo. On the other hand, the interviewed officials from the City of Espoo were pleased with the achievements of the City so far, and they admitted having had prior doubts that the expected proliferation rate was overestimated.

References

ABC Nihtisiltaan ensimmäinen sähköauton pikalatauspiste (2012). HOK-Elanto press release 26.9.2012. http://www.hok-elanto.fi/index.php?id=10441 (Accessed 13.3.2013).

Electric Vehicles in Urban Europe (2012) Final report. http://urbact.eu/fileadmin/Projects/EVUE/outputs_media/EVUE_report_280912_FINAL.pdf (Accessed 1.2.2013).

Espoon kaupunki (2013). Ohjelmasuunnitelma: Kestävä kehitys –kehitysohjelma, 16.12.2013.

Hodson, M. and Marvin, S. (2010). Can cities shape socio-technical transitions and how would we know if they were? Research Policy, 39(4), 477–485.

Lempinen, T. (2012). Lisää virtaa sähköautoille. Helsingin Sanomat 15.8.2012.

Malinen, P. and Haahtela T. (2014). Sähköisen liikenteen toimenpideohjelma – Kohti päästötöntä liikennettä. Teknologiateollisuus ry, Helsinki.

Nylund, N.-O. and Belloni, K. (Eds.) (2014). Smart sustainable mobility. VTT Visions 5. VTT, Espoo.

Orsato, R. J., Dijk, M., Kemp. R., Yarime, M. (2010). The Electrification of Automobility. The bumpy ride of electric vehicles towards regime transition, in Geels, F.W.; Kemp, R.; Dudley and Lyons, G. (Eds.) Automobility in Transition? A sociotechnical analysis of sustainable transport. Routledge, New York, 205–228.

Sähköautokanta kipuaa ylöspäin (2014). Sähköinenliikenne.fi 10.10.2014. http://www.sahkoinenliikenne.fi/uutiset/sahkoautokanta-kipuaa-ylospain (Accessed 4.11.2014).

About the authors

Sanna Ahonen, M.Sc., is PhD student at Department of Social Policy, University of Helsinki. Ahonen's research has focused on environmental and social policy, especially on strategies for coping with the environmental challenges and prerequisites for successful implementation of new sustainable practices.

Aino Verkasalo, M.Soc.Sc, is a researcher at the Department of Real Estate, Planning and Geoinformatics, Aalto University. Verkasalo has studied various topics related to housing and urban planning, such as neighborhood relations and social mixing, amateur art as an instrument for suburban development, environmental mediation and Finnish third sector as a housing provider. Lately she has been working with the theme of Swedish housing policy.

Kaisa Schmidt-Thomé, LicSc, is a Research Fellow at the Department of Real Estate, Planning and Geoinformatics, Aalto University. Schmidt-Thomé's research has focused on urban regeneration and the associated processes of stakeholder collaboration. Her other research interests include "geographies of the life-course" as well as bottom-up urbanism.

Simo Syrman, MSocSc, is a Doctoral Candidate at the Department of Real Estate, Planning and Geoinformatics, Aalto University. His research focuses on mobility-related lifestyle choices.

Raine Mäntysalo, DSc, is Professor of Strategic Urban Planning at the Department of Real Estate, Planning and Geoinformatics, Aalto University. Related to his professorship, his theoretical interests concentrate on pragmatist and dialectical planning theory and developmental planning research. He has recently published on the relationship between planning theory and democracy theory, agonism and power analytics in planning processes.

Hannu Hyyppä
Professor
hannu.hyyppa@aalto.fi
Aalto University
Helsinki Metropolia University of Applied Sciences, Construction and Real Estate

Juho-Pekka Virtanen
M.A., Researcher
juho-pekka.virtanen@aalto.fi
Aalto University
Helsinki Metropolia University of Applied Sciences, Construction and Real Estate

Marika Ahlavuo
Coordinator
marika.ahlavuo@aalto.fi
Aalto University
Helsinki Metropolia University of Applied Sciences, Construction and Real Estate

Tommi Hollström
CEO
tommi@adminotech.com
Adminotech Oy

Juha Hyyppä
Professor
juha.hyyppa@nls.fi
Finnish Geospatial Research Institute FGI, NLS (Formerly: Finnish Geodetic Institute)

Lingli Zhu
Research Group Leader
lingli.zhu@nls.fi
Finnish Geospatial Research Institute FGI, NLS (Formerly: Finnish Geodetic Institute)

26. Regional Information Modeling and Virtual Reality Tools

Abstract

Cities and companies are interested in employing new digital and virtual solutions, tools and practices in the monitoring, maintenance and development of the built environment, and in urban planning. A key question is how 3D Internet, information models and virtualization will support participation and communication between different actors in these processes. In the smart cities of the future, there is demand for new kind of planning and participation. By benefiting from the opportunities offered by virtual worlds, it is possible to produce functional and community-oriented tools that enhance the formation of digital cities.

In this article, we demonstrate the development of interactive 3D tools to facilitate various processes in cities from 2007–2014. The presented cases are from Espoo City and they prototype virtual environments and regional information models. Emerging measuring methods have been combined with available data and building models to produce models of urban areas. The process of developing tools to support decision making activities in virtual environments is also presented.



KEYWORDS: Regional Information Model, Virtual World, Meshmoon, 3D, Laser Scanning

1. Introduction

The ongoing digitalisation of cities and individual spaces results in the information related to them being increasingly available from digital sources. Dynamic entities, like vehicles, pedestrians with smart devices, and even commercial pop-up structures will begin to know where they are, what is around them, and what they will **do** in the immediate future. The world's entities will also be aware of their connections: physical architecture, processes, and social architecture. Temporal, spatial, and structural data, with inferred metadata of the real world—becomes connected, dynamic, and available. As the physical and virtual worlds are merged, knowledge management becomes increasingly connected to the behavior of people. Applications based on these massively networked data are becoming a part of our everyday life. The services based on them are becoming more and more ubiquitous. As the digitalisation progresses, the concepts and technical implementations of communication methods for professionals become increasingly important. New, networked ways of working require novel communication methods in disciplines such as design and product development (Manner & Virtanen, 2011). The new applications and processes enhance digitalisation of "Future Espoo 2020", and support the pioneering activities of the Digital Agenda for Europe in this particular region.

To fully support digitalisation, the existing physical infrastructure of urban environments has to be digitized, i.e. reconstructed into a 3D model and then textured to resemble physical environments. 3D reconstruction is the process of determining the shape and appearance of objects for creating virtual replicas, for example, of natural environments, old towns, and archaeological elements. Virtual reality refers to environments simulated on computer that either replicate the real world, or are imaginary. These models usually include rendered, textured planes and surfaces. The 3D environment reconstruction not only needs the advanced technology but also requires data sources to be available. The major sources of data to be used in the reconstruction include photogrammetric images, laser scanning and existing map data. Photogrammetry is the technology of deriving 3D data from 2D images by mono-plotting (single-ray back projection), by stereo-imagery interpretation or by multi-imagery block adjustment. Laser scanning is based on laser (lidar) range measurements from a carrying platform and the precise positioning and orientation

of the platform. If both techniques are applied, the laser scanning is typically used for creating the 3D model, and digital images to create the textures.

In these intelligent virtual cities of the future, city processed become digital. New kinds of working environments and processes are needed for planning and participation. Game engines offer one possible prototyping and development platform for these virtual models. As an example from Espoo Innovation Garden area, the 3D Tapiola (see from Google Play) was created in 2011 from mobile laser scanning data by the mobile mapping team of the FGI. It was an exact, virtual copy of the real Tapiola center in Espoo, with some location-based services and augmented reality included.

With virtual world platforms, it is possible to produce functional and community-oriented tools that enhance the formation of smart and intelligent cities, and support citizen involvement. The main benefit of these technologies is that they can be applied easily for prototyping these systems on a small scale, permitting iterative, user-inspired development. Some of the user interface conventions seen in current virtual worlds can be transferred to these virtual cities. In a 3D virtual smart city, citizens can move around and communicate using avatars, i.e. characters they have created for themselves. Interactive Smart Cities, based on virtual world technology, function as an entirely new type of 3D Internet, linking separate thematic virtual worlds that are compatible with each other. This has been successfully prototyped with the Meshmoon platform, developed by Adminotech Oy. (Meshmoon, 2014). The platform, based on open source RealXtend technology, can be used to link virtual worlds and develop specific applications utilizing virtual environments in real cases (Virtanen et al, 2013 and Hyyppä et al, 2013a,b).

The objective of this paper is to describe the accurate techniques for 3D smart city modeling and to summarize our previous activities. The process covers the acquisition of the accurate measurements, virtual city modeling, and development of location-based services, using the virtual worlds as a platform of participation in the Espoo Innovation Garden. In this article, we present the overall concept, methodologies and descriptions of how virtual reality tools can be applied in regional area modeling. As cases, we present examples of urban measuring and modeling. In addition, we review our experiences from utilizing virtual 3D environments in workshops and decision making. Our research aims to link the digitalisation of existing infrastructure and buildings in Espoo Innovation Garden area with the operational activity planning.

2. Techniques for 3D Smart City Modeling

The National Land Survey of Finland (NLS) coordinates the collection of countrywide elevation data with Aerial Laser Scanning (ALS). For example, the forestry centers in Finland have employed this ALS data as input data, together with aerial images, for forest inventory since 2010. FGI and Aalto University have contributed to technology transfer in these projects. With these activities, Finland has become a forerunner in applying Airborne Laser Scanning (ALS) in operational surveying and forestry.

The objective of NLS and Forestry Centers is to cover the entire country (338 000 km^2) with point clouds of a density of 0.5 pts/m2. By spring 2013, the scanned area covered some 235 000 km^2 (National Land Survey of Finland, 2014). Swedish Lantmäteriet followed NLS in the countrywide laser scanning and produced similar point clouds from the whole of Sweden during 2009–2014.



Figure 1. Different platforms for mobile mapping systems (MMS) © FGI and Aalto University.

Mobile mapping systems (MMS) offer a new method for collecting data from urban and natural environments. A mobile mapping system is a multi-sensor system that integrates various navigation and data acquisition sensors on a rigid, moving platform (for example a car, boat, person, or an Unmanned Aerial Vehicle—UAV) for remotely determining the positions and shape of objects (Figure 1). The navigation sensors typically include GPS receivers and an Inertial Measurement Unit (IMU) (Kukko et al, 2012 & Kaartinen et al, 2012). With the technological development of MMS and data processing, covering entire city environments has recently become possible with Mobile Laser Scanning (MLS). Models based on MLS can be adopted for design, maintenance, rehabilitation and environmental purposes. Similar techniques are used by Nokia Here and Google (Google Street View Car). Automatic techniques for processing the data into 3D models are being developed by several parties. Both ALS and MLS methods provide significant potential for accurately measuring and modeling existing urban areas. Their data can be used as a starting point when creating regional models for virtual world applications.

2.1 Regional Information Modeling

In recent years, the use of virtual worlds in the construction sector has been pushed by the popularity of building information models (BIM). A BIM model combines the different plans required to construct a building, and allows the users to examine the bulk of information at different stages of the construction process. The existence of detailed BIM models in a commonly used format has also generated interest in their application in virtual world systems. The advances in BIM and virtual world technology create the starting point for the development of regional information modeling.

The first phase in regional information modeling is the integration of existing geographic and regional information, building models, and infra models with mod-

ern measuring technology and virtual elements (Figure 2). Defining the content and structure of the model is essential, as it creates the foundation for future applications that may focus on topics such as information retrieval, the use of services, mobility or urban planning. As the regional information model is a combination of the digital and the physical world, it can be utilized for various areas of expertise in the urban environment. The use of 3D virtual world environments as the platform makes it possible to rapidly develop innovations and new ways of accomplishing different tasks. Application prototypes can be built directly on top of the virtual world hosting system, such as Meshmoon. The existing information can be both stored and applied for new types of activities while considering the needs of different user groups. The opportunities offered by virtual worlds in terms of supporting learning, working as a community and presenting technology will also come about with the adoption of these environments for different types of cooperation (Figure 3).

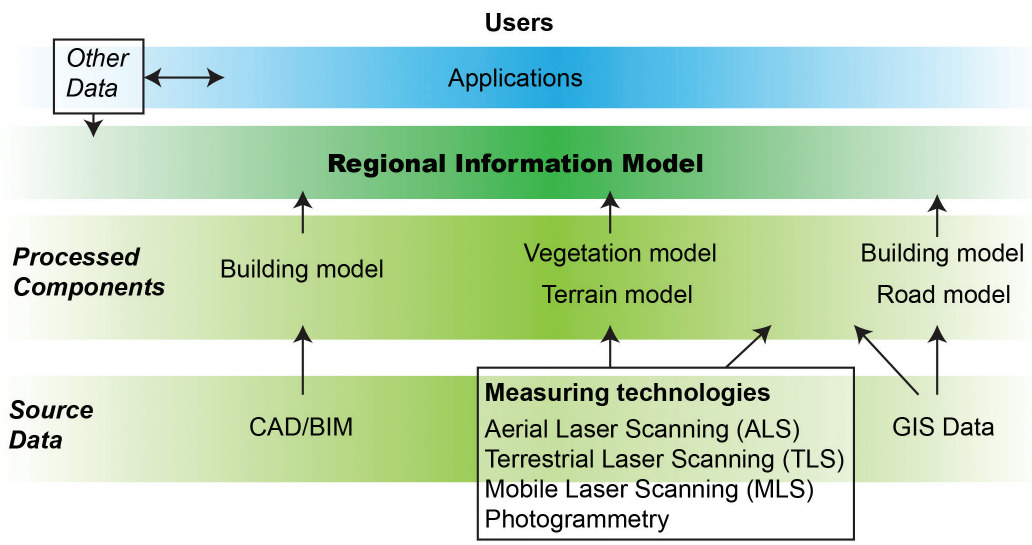


Figure 2. Overview of the possible components of a regional area model.

3D virtual worlds enable the effective visualization of information and presentation of 3D maps and models. For example, they make it possible to display statistics within the context of a specific time and location. Virtual worlds can be employed to represent entire buildings or neighborhoods as functional virtual spaces. In urban planning, the objective is to visualize the planned built environment, and update the scene in almost real-time as plans evolve.

Three-dimensionality and geographic information introduce new perspectives to virtual worlds: information can be bound to a specific location in 3D space with high accuracy. This allows for the recognition of regional connections, proximity and structural equivalence. Naturally, the information can have several parallel locations. Moreover, it can be targeted to a physical area with precisely defined limits or to a larger entity. Users in the world are able to identify other users that are working in the same area or topic. This increases the efficiency of communication when working

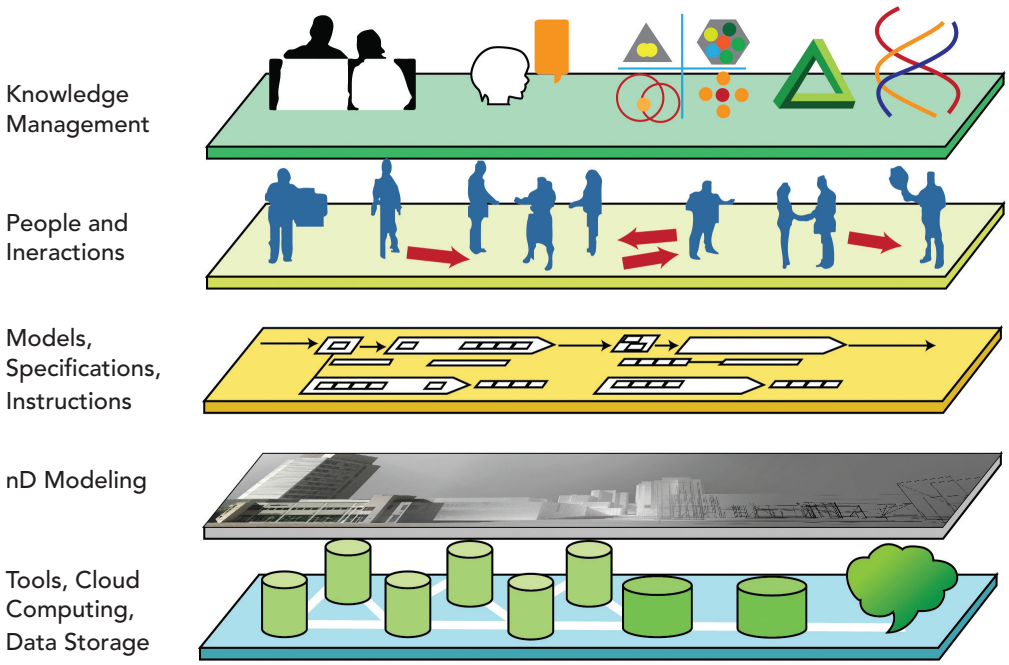


Figure 3. Levels of Regional Information Modeling. © Hyyppä, Ahlavuo, Virtanen.

with complex entities. In addition to visualizing information from the real world in the virtual environment, the physical and virtual worlds can have an interactive relationship. A proper link between these worlds enables synchronous interaction between devices and information across both worlds. For example, real world equipment can be operated from the virtual environment. Augmented reality applications based on the real world are also possible.

Identifying and taking into account the wishes of cities and their residents, combining different sources of information, optimizing functions, producing services and maintaining the openness of data guarantee that multidisciplinary expertise will be utilized applied through virtual worlds for several decades to come (Figure 4). This raises several important questions. How do we effectively benefit from location-specific information in our possession and the sense of presence generated by immersive virtual environments to support digital trends and markets? How do we make sure that the information transferred to the virtual world is reliable? Is it possible to generate new forms of joint activities based on visual information updated in real time? Usability is another central concern. In order to operate in virtual worlds, we have to develop intuitive ways for moving around in 3D virtual environments, interacting with virtual objects, communicating with other users and producing content. These tools must be developed in cooperation with users.

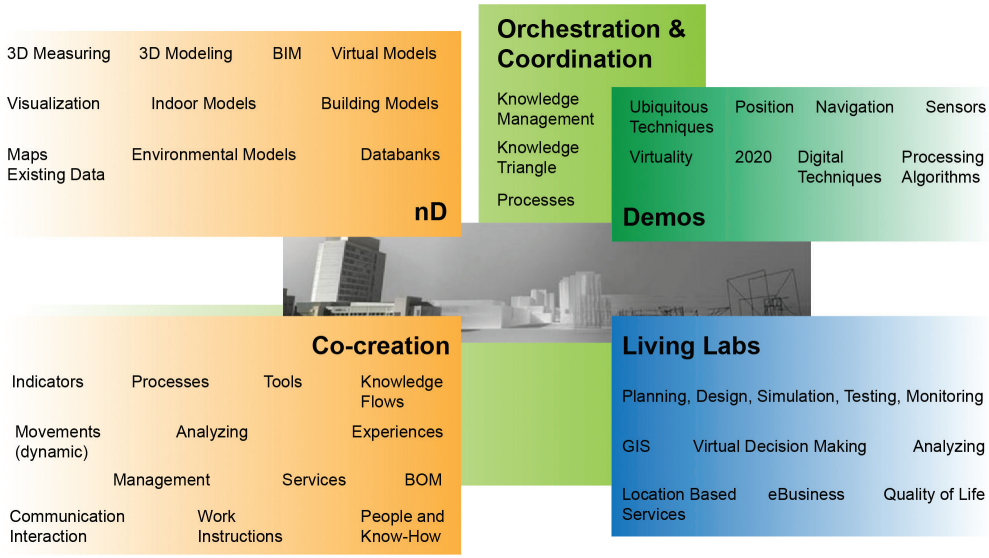


Figure 4. Different techniques and elements of Regional Information Modeling.

2.2 Tapiola 3D—2011.

In 2011, The Tapiola model was created from mobile laser scanning data by the mobile mapping team of the FGI. The aim of the measuring and modeling work was to demonstrate first the potential of applications of location-based data in combining the physical and virtual worlds, and second, the capability of MLS measuring and automated modeling algorithms.

The Roamer measuring system, developed at FGI, was used to obtain a dense MLS point cloud covering the area. Based on this data set, the model was generated in two steps: geometry reconstruction and texture mapping. During the geometry reconstruction, the main focus was on automated processing algorithms for noise point filtering, ground and building point classification, detection of planar surfaces, and on the derivation of the key points (e.g., corners) of a building. Buildings were extracted by transforming the 3D point cloud to binary images and employing image processing technology for non-building data removal, and then transforming the cleaned binary image back to a 3D point cloud. This method utilized powerful image processing technology for point cloud classification (Zhu et al, 2011).

The resulting 3D model of Tapiola is shown in Figure 5. The model accuracy was evaluated by field testing. The accuracy of the model is sufficient real time positioning by smart phones and pedestrian navigation in the Tapiola center. Clearly, 3D photorealistic models from high-resolution MLS data can be successfully reconstructed according to the requirements of navigation based on a smart phone: small computational model size, good visual appearance, and desired model accuracy. The final, textured model was published as a smartphone application using the Unity 3D development environment. The user can freely explore the model with his or

her smartphone or tablet. To test potential emerging presentation methods for 3D virtual models, a 3D printed physical model was also made (Figure 5).

► You can explore the Tapiola center in Espoo in YouTube or GooglePlay.
Youtube video of the model:
http://www.youtube.com/watch?v=5Q6t1Xqnbgk.
The model is available for Android devices from Google play:
https://play.google.com/store/apps/details?id=com.FGI.Tapiola3D&hl=fi

2.3 Prototype of a Regional Model—Case Keilaniemi

In 2012, a model of the Keilaniemi area in Espoo Innovation Garden was built as a demonstrator of area modeling with automated processing methods, using an online virtual environment as a platform.

The model components were created with different, largely automated workflows. The terrain model was obtained by point classification, triangulation and mesh decimation. The vegetation model and building models were based on ALS data with automatic classification, building and tree detection and modeling algorithms. In total, the model covers an area of 1.7 by 1.7 km, thus totalling an area of roughly 3 square kilometers. In processing, the original geodetic coordinate system was maintained, making it possible to accurately combine other data to the model. The completed model components were uploaded to the online virtual environment hosting system, Meshmoon. The CAD model of the Keilaniemi Towers project was added to the model and its accurate location was determined from the area plan (Figure 6). In addition, a simple model depicting the zoning plan of Keilaniemi area was created and added to the model as an optional layer.

As game engine technology is used in visualizing the model, immersive visualization techniques like full CAVE environments (Figure 6), multi screen stereoscopic desktops, or wearable display devices such as the Oculus Rift can be used to study the model. With modern web technologies, the models can be viewed directly in browser, without any installed viewer software. Two examples of area models of different detail level can be seen in Figure 7, both of the models can be accessed with a web browser.

The benefits of utilizing an online virtual environment as the model platform are apparent: the model can be accessed via the Internet, without professional software licences. The environment is inherently visual, and compared to current CAD systems, avatar-based navigation of the model is intuitive. The construction project can be studied on apartment level in its realistic surroundings. In addition, the multi-user environment offers tools for interaction between different users. As the model is hosted in cloud, the updateability and synchronization of data are simple, and this also applies to adding datasets to the model.

► A demo of the Keilaniemi area can be found from:
http://www.meshmoon.com/webrocket/KeilaniemiDemo

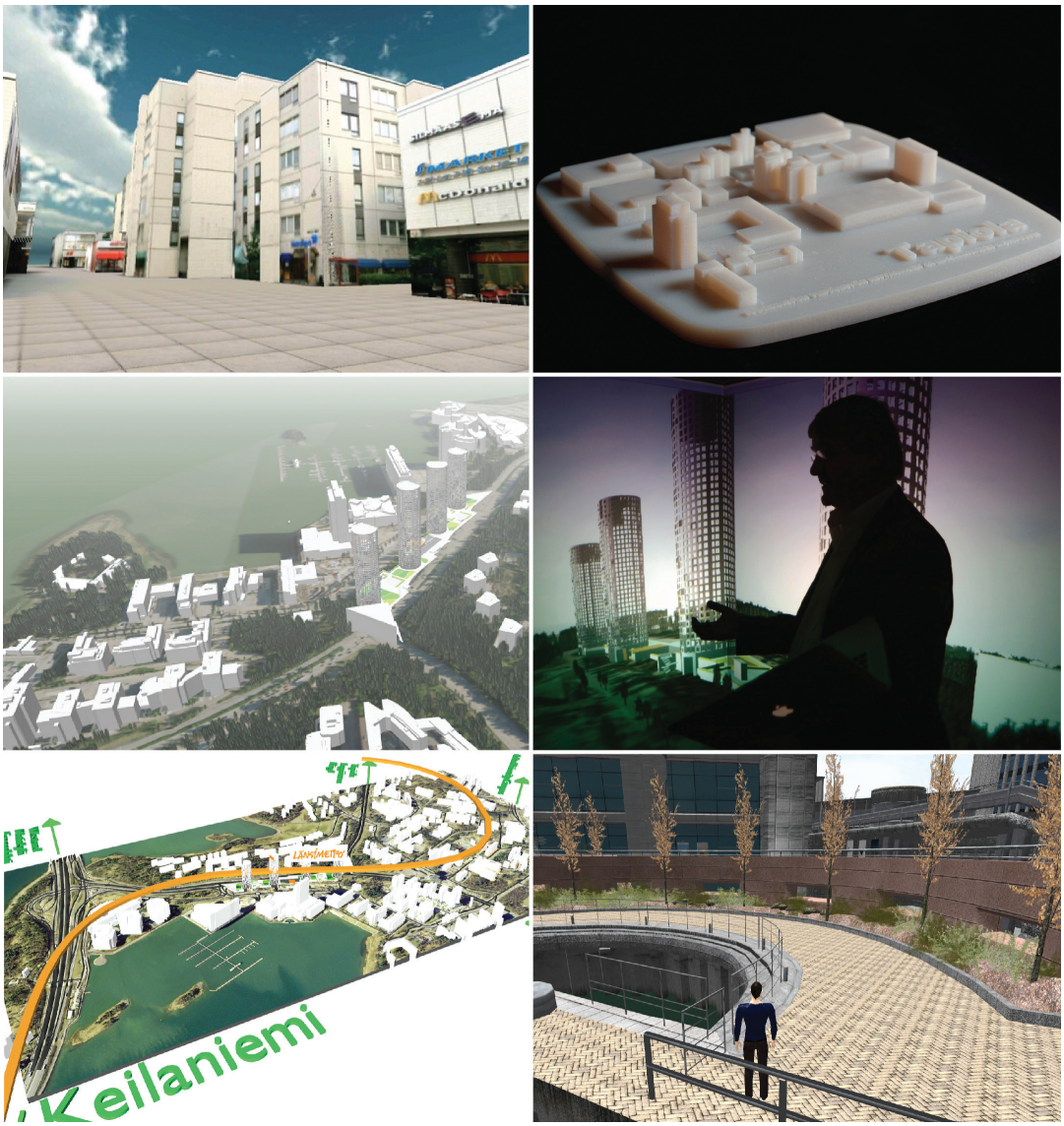


Figure 5 (top). A 3D model of the Tapiola area and the rapid prototype made from the model (Zhu et al. 2011, Virtanen et al. 2014).

Figure 6 (middle). Overview of the model (Hollström & Virtanen, 2013a), and a CAVE implementation.

Figure 7 (bottom). Two models of the Keilaniemi area with different accuracy and user interface.

3. Facilitating Interaction with Virtual Environments—Meshmoon

In the previous chapters we have introduced the concept of regional information modeling and presented two demonstrations of creating regional models from measured data sets. In addition to the technical development of modeling methods, the integration of models and users is essential. In this chapter we present our activities in utilizing virtual environment, Meshmoon, in workshop situations.

The Meshmoon networked 3D platform was published on 10th Oct 2012 during the EUE project, as a result of cooperation between researchers of Aalto University and Adminotech Ltd. Meshmoon is based on open source RealXtend technology and it utilizes on-demand cloud hosting to provide reliability and scalability. By 28th of November 2013 the Meshmoon user base had grown +1000% and it was already used by educational institutes, companies and individuals globally. As the applications can be developed and published on the Meshmoon system, it can be employed in a variety of use cases. The Meshmoon Rocket viewer can be downloaded for free, and the limited hosting service is also available free of charge. In addition to the Rocket viewer, the browser-based WebRocket viewer can be used.

Meshmoon can be found from: http://www.meshmoon.com/

3.1 Meshmoon Virtual Environment in Open Days 2012 Seminar

The first public appearance of the Meshmoon system was in the CoR EPP seminar "Innovation Regions and Cities for Territorial Development", arranged in Brussels in late 2012. The themes of the seminar were Open Innovation and Digital Entrepreneurship, and it brought together some 150 participants.

A virtual working environment was designed for the seminar, consisting of areas dedicated for background material, seminar inputs, and thematic material. The working environment was designed to be navigated by walking around the 3D virtual "islands" with an avatar. A model of the Espoo Innovation Garden area was used as a backdrop, tying the workshop environment to a physical context. During the workshop, material was presented from of the virtual environment. Participant inputs were uploaded to the same environment and further developed by facilitators (Figure 8).

The workshop consisted of the following steps (Virtanen et al, 2012):

- Keynote and panel presentations
- Presenting the background material and slides from the virtual environment
- Notes and observations
- Adding the contributions from the audience, images and other material to the virtual environment in real time
- Finalizing the topics for voting
- Voting on topics

3.2 Meshmoon Virtual Environment in Innovation Union 2013 Conference

Based on the experiences gained from the earlier workshop case and other projects, a new type of working environment was developed on the Meshmoon platform. It was first tested in the Innovation Union 2013 Conference organized by the Committee of the Regions. The development had two main goals: first, to create a working tool with high usability and a simple user interface, and second, to utilize the Mesh-



Figure 8 (top). Meshmoon used during the Open Days 2012 seminar (Virtanen et al, 2012).

Figure 9 (bottom). The workshop template from Innovation Union 2013 Conference (Hollström & Virtanen, 2013b)

moon Webrocket browser-based viewer. The aim was to minimize the learning effort and technical setup work required for adopting the tool.

To make the tool as easy to use as possible, a 2.5D solution was developed. This made moving the virtual space extremely simple and familiar to users that had previous experiences from any Internet-based map service. Elements permitting the multi-user interaction, like avatar, were retained in a redesigned form. This resulted in a virtual environment where users could see other users and explore 3D content but operate using an extremely simple interface. Content creation tools were also developed, making it possible for the users to add material to the working environment with the Webrocket viewer.

The virtual environment was used interactively during the workshop in the conference to collect and cluster ideas. Participants, divided into four groups, shared the same virtual canvas that had designated areas for each group's material. Each group had a member responsible for adding material to the virtual working environment. Comments, key points, images and presentations were added to the environment during the group work (Figure 9). With the shared virtual environment, it was possible for the groups to also follow the progress of the other groups in the conference. The input gathered was transferred to the closing session.

3.3 Meshmoon Virtual Environment in Smart Specialisation Strategies 2014 Conference for Pioneering Innovation Regions

A further developed version of the working environment was utilized in the Smart Specialisation Strategies: Implementing European Partnerships, Bench-Learning Conference for Pioneering Innovation Regions event on June 2014. This work was supported by the EKA—Forerunner Area Helsinki Region, work package B. The improved version included a new set of content production tools that made it possible to easily create documents and presentations in the working environment or add existing ones. All tools were usable directly from the browser, without anything installed on the user's computer. In addition, it was possible to work with the documents with other users in the virtual environment, permitting working in groups with the same document. The working environment was partially redesigned, benefiting from the possibilities of 3D content better.

With the improved tools and user interface, it was possible for conference participants to access the virtual working environment directly from their own laptops, and interactively participate in the working process. During the workshop, over 20 participants were simultaneously using the virtual working environment, taking notes of the discussions and commenting on the material.

3.4 Meshmoon Meeting Tool

In late 2014, a productized version of the content production and interaction tools was released by Adminotech Oy, as the Meshmoon Meeting tool. Users are able to easily create a virtual working environment, choosing from a number of templates available. Both map-like templates (such as a map of EU area) and thematic templates, e.g. a lean process canvas, are offered. The created virtual space can be accessed with a browser and shared as a link.

In the space, users can communicate with video conferencing and chat (both integrated to the tool), and move on the working template with a simple avatar. Content production tools are offered for creating working platforms to the template, adding and creating documents, and moving objects on the template. Activity between the users is synchronized, so that the users in the same virtual space can see each other and edit the documents together.

Meshmoon meeting tool can be accessed from:
http://meeting.meshmoon.com/

4. Conclusions

Based on the emerging measuring techniques, like MLS, highly detailed models of the urban environment can be created. By combining these models with GIS data, BIM models and other CAD models available of the built environment, a base for a regional information model can be created. This has already been demonstrated in an early prototype form in area modeling cases from Espoo Innovation Garden area.

Three-dimensional virtual environments, such as Meshmoon, can be used as a technical platform for operating these models. The benefits of virtual world technology in regional information modeling are apparent: accessibility, multi-user nature, and application development potential. With the latest technology, the models can easily be made accessible online, only requiring a web browser to function. This considerably lowers the technical requirements of utilizing the models, as no professional software tools are needed to access the model. With a natively multi-user platform, the models can easily be accessed by several users at the same time and also actively utilized for cooperation. This has been demonstrated in the EUE project, in successful facilitation of workshops utilizing a virtual world platform. Finally, the possibility of developing model and user-specific applications running on top of the regional information model creates significant application potential. The same model can be adopted in decision making, as a workshop platform, or as an information portal for citizens, by developing different applications for each user group. This creates synergy and also enables the integration of data from different stakeholders.

The tools for cooperation and participation in workshops have been developed iteratively. Throughout the process, the tools have improved in design, usability and technical aspects. In addition, the ways in which they can be successfully used in workshops with hundreds of participants have been invented. The development has progressed to a state where a set of tools has been released as a commercial product. The development of such tools is the starting point for wider utilization on virtual world technology and application of regional information models among stakeholders in the urban environment.

The foundation for success in the EUE project has been the active cooperation between universities and industry partners, benefiting the decision makers. As a concrete demonstrator of this cooperation, the Meshmoon virtual world service platform was launched during the project and has already gained a considerable user base.

References

Hollström, T., Virtanen, J-P., (2013). Integration of CAD/BIM-models and ALS-data in virtual world http://rym.fi/results/integration-of-cadbim-models-and-als-data-in-virtual-world/

Hollström, T., Virtanen, J-P., (2013). Meshmoon virtual environment in Innovation Union 2013 Conference http://rym.fi/results/meshmoon-virtual-environment-in-innovation-union-2013-conference/

Hyyppä, H., Ahlavuo, M., (2012). Smart City – Kilpailukykyinen ja energisoiva kaupunki. Maankäyttö 1/2012, 10–13.

Hyyppä, H., Ahlavuo, M., Markkula, M., Miikki, L., Hyyppä, J., Launonen. P., (2013). Monialaisesti ratkaisuja kaupungistumiseen. Maankäyttö 3, 2013, 20–22.

Hyyppä, H., Virtanen, J-P., Ahlavuo, M., Hollström, T., Hyyppä, J., Markkula, M., Zhu. L., (2013). Osallistuminen uusiksi 3D-virtuaalimaailmoilla. Maankäyttö 3, 2013, 26–27.

Kaartinen, H., Hyyppä, J., Kukko, A., Jaakkola A., Hyyppä, H., (2012). Benchmarking the performance of mobile laser scanning systems using a permanent test field. Sensors 12 (9), 12814–12835

Kukko, A., Kaartinen, H., Hyyppä, J., Chen, Y., (2011). Multiplatform mobile laser scanning: Usability and performance. Sensors 12 (9), 11712–11733

Manner, J., Virtanen, JP., (2011). Natural and intuitive video mediated collaboration. Intelligent Interactive Multimedia Systems and Services, 21–28.

Meshmoon, (2014) http://www.meshmoon.com

National Land Survey of Finland, Laser Scanning Data, (2014). http://www.maanmittauslaitos.fi/en/maps-5,.

Virtanen, J-P., Hollström, T., Miikki, L., Markkula, M., Hyyppä, J., Ahlavuo, M., Hyyppä, H., (2012). Overview of the workspace used in the Open Days 10A16 Workshop. http://web.cor.europa.eu/epp/Events/OpenDays/Documents/ProcessDescription.pdf

Virtanen, J-P., Hyyppä, H., Ahlavuo, M., Hollström, T., Hyyppä, J., Markkula, M., Kurkela, M., Viitanen, K., Zhu, L., Lehtinen, J., Honkanen. T., (2013). Rakennetun ympäristön suunnitteluun mittatarkkaa virtuaalisuutta. Maankäyttö 3, 2013, 28–30.

Virtanen, J-P., Hyyppä, H., Kurkela, M., Vaaja, M., Alho, P., Hyyppä. J., (2014). Rapid Prototyping—A Tool for Presenting 3-Dimensional Digital Models Produced by Terrestrial Laser Scanning. ISPRS International Journal of Geo-Information 3 (3), 871–890.

Zhu, L., Hyyppä, J., Kukko, A., Kaartinen, H., Chen. R., (2011). Photorealistic building reconstruction from mobile laser scanning data. Remote Sensing 3 (7), 1406–1426

About the authors

Professor **Hannu Hyyppä,** D.Sc., is the head of the Research Institute of Measuring and Modeling for the Built Environment since 2007. Professor Hyyppä orchestrates the Aalto University´s share of the Centre of Excellence in Laser Scanning Research. He has contributed to three widely recognized handbooks and contributed with over 300 publications in the fields of civil engineering, knowledge management and geoinformatics. He is also the inventor of 5 issued or pending patents. He is one of the leading experts worldwide in 3D laser scanning and remote sensing methods in civil engineering and engineering.

Marika Ahlavuo is the Coordinator of Research Institute of Measuring and Modeling for the Built Environment and the Centre of Excellence in Laser Scanning Research. She has contributed with over 60 publications in the fields of innovation, knowledge management and geoinformatics. Personal interests: tacit knowledge, organizational knowledge, popularization, and orchestration.

Lingli Zhu, born in 1971, received her M.Sc. (Tech.) degree in photogrammetry and remote sensing from the Helsinki University of Technology (Current Aalto University), in 2007. Currently she has finished her Doctoral thesis. She is a senior research scientist, group leader of 3D modelling and virtual worlds in department of remote sensing and photogrammetry, FGI. She has achieved more than 20 publications mostly in journal papers and one in book chapter and few from conference papers. Her research interests are 3D city modeling, algorithm development of laser scanning and photogrammetry.

Juho-Pekka Virtanen, M.A. received his Master of Arts degree from Aalto University School of Arts, Design and Architecture in 2012. He is working in the Institute of Measuring and Modeling for the Built Environment, on the research topic of regional information modeling. His interests include virtual worlds, game engine technology, and 3D printing. He has ranked well in a number of design competitions.

Professor **Juha Hyyppä,** is a professor of Remote Sensing and Photogrammetry at the FGI since 2000 and Director of the Centre of Excellence (CoE) in Laser Scanning Research. He has a distinguished professorship in CASM, China and is currently invited to distinguished professor in Japan. He has focus on laser scanning systems, their performance and new applications, especially related to mobile laser scanning and point cloud processing. He is the most cited researcher in the world in the field of laser scanning (surveying).Totally, he has more than 500 publications. (H index 24 in ISI, 41 in Google Scholar)

Tommi Hollström, CEO and CTO, Adminotech Oy, has a long history in entrepreneurship (since 1991) and 3D Internet application and business development. Adminotech is one of the main realXtend development companies, and currently operates the most advanced realXtend hosting system, the Meshmoon. Due to his background in participating in several 3D Internet-related projects, Tommi Hollström has connections to people and organizations around the world.

Hans Schaffers
Research Director, CKIR
Aalto University School of Business
hans.schaffers@aalto.fi

27. Experimenting with the Future Internet for Smarter Cities

Abstract

This paper reviews recent trends in the role of Future Internet technologies and infrastructures as an enabler of smart cities. The smart city perspective presented here emphasizes the cooperation of citizens and stakeholders towards social innovation and urban renewal. Eventually this should result in socially innovative, resilient and pro-active cities. Several European Future Internet initiatives are discussed in terms of their contribution to smarter cities through the development of ecosystem platforms for open innovation and providing easier access to Future Internet resources.



KEYWORDS: Smart Cities, Societal Innovation, Future Internet, Experimentation, Open Innovation

1. Introduction

During the last decade, digitilization has become more and more important as a driver of innovation in cities. Many cities have initiated smart city initiatives and implemented applications based on broadband infrastructures, sensors, large open datasets, and real-time information and response, in areas such as mobility, energy, environmental management, tourism and e-government services. As a result, the term smart city has now become widely adopted in the research, innovation and policy communities (Townsend, 2014). However, the term also raises some confusion, as it is not characterised by a well-defined meaning but rather by a variety of meanings and interpretations. In many publications, a smart city represents a technology-oriented vision of the city, and the term does not always distinguish between the actual state of things in a city and a promising scenario for the future. This makes

it a useful concept for the purpose of city marketing but it also confuses the essential social innovation challenges of the city. Other conceptualisations are based on identifying the key domains of smart cities, such as smart economy, smart mobility, smart environment, smart living, smart people, smart governance, and identified rankings based on measurable underlying indicators. While these definitions are relevant for benchmarking or for identifying specific development priorities, they are merely based on technology-led views. In contrast, there is a need for effective, bottom-up citizen-supported strategies of cities to become smarter, taking into account the particular socio-economic context and urban development objectives, and on approaches mobilizing the participation and intelligence of citizens, businesses and societal organizations (Schaffers et al., 2012).

This contribution focuses on the available capabilities and resources for developing smarter cities, emphasizing the collective intelligence and cooperation of citizens and stakeholders towards social innovation and urban renewal resulting in socially innovative, resilient and pro-active cities. Technologies, and in particular Internet- and sensor-based infrastructures, services and applications, as well as the toolboxes facilitating their use are among the enablers behind such collective intelligence. Other enablers include collaborative networks among city stakeholders organised through pro-active and experiment-driven innovation policies. Rather than the technologies in themselves, there is a need to establish platforms for innovation and collective intelligence, through which not just the technologies but their shaping and adoption by the users within co-evolving social settings will be experimented with and validated in terms of their contribution to resolving the societal challenges of the city and making the city more resilient and proactive.

2. Making Cities Smarter

The growing interest in smart cities and the widely published visions and success stories should not confuse the fact that today's cities face important challenges for years to come. These challenges, in a period of relative economic stagnation, ageing population and political uncertainties, include economic prosperity, housing, transport, environment and climate, education, public security and more. Besides the large-scale cities that gained most of the publicity, smaller and mid-sized cities in peripheral regions should also be considered as they face the implications of the forces of re-urbanisation and ageing, in terms of sustainability of essential infrastructures and facilities for education, health, government services, physical infrastructure and knowledge resources.

The current economic climate across Europe is making it even harder for cities and their citizens, neighbourhoods and businesses, and many European cities are trying to return from decline. Cities, particularly in rural areas, face the implications of ageing population in combination with the economic decline. At the same time, the modern city also represents a promise: a vision of freedom, creativity, opportunity and prosperity (Glaeser, 2011; Townsend, 2014). More than half of the global

population is now urban and projections estimate that this percentage will edge towards 70% around 2050 (United Nations, 2014). In this context, the concept of the smart city represents technology and innovation-driven visions and solutions. The challenge is to redefine the smart city as an environment of innovation, empowerment and participation of citizens, businesses and other stakeholders in shaping their future. The challenge stems from change and transformation towards a smarter city which is more participative, inclusive and empowering, instead of imagining an ideal, technology-led future vision.

Many European cities are currently undertaking strategies towards becoming "smarter cities". Such strategies are based on an assessment of the future needs of cities and innovative adoption of ICT embodied in the broadband Internet and Internet-based applications now and in the future. These strategies are also based on a new understanding of innovation, grounded in the concept of open innovation ecosystems, global innovation chains, and on citizens' empowerment for shaping innovation and urban development. Partly these strategies include the development of new types of innovation in urban areas. These new ways of innovation are characterized, firstly, by a high level of citizen involvement in co-creating services in all sectors of the economy and society through the use of the Internet and web-based technologies; secondly, by the emergence of new forms of collaboration among local governments, research institutes, universities, citizens and businesses (e.g. Public-Private-People Partnerships). Such strategies and the resulting urban innovation ecosystems are becoming increasingly relevant given the urgent need to tackle growing social, economic and societal issues that cities are currently facing in the context of economic woes while simultaneously many improvement opportunities are offered to cities by new technologies and approaches to innovation (Komninos et al., 2013).

It is also evident that a smart city strategy involves many actors, organizations, communities and clusters. The strategy should achieve a shared vision, flagship projects, and collaboration. For that, top-down planning and bottom-up initiatives should complement each other. Urban development and planning has been dominated by top down blueprint approaches since long. At the same time there have always been grassroots developments based on empowering neighbourhoods and communities of citizens. These grassroots developments have now become considerably stronger, and they are enabled by a wide spectrum of social media / web 2.0 technologies (Townsend, 2014). Where the smart city visionary but technocratic approach still provides inspiration as a target scenario, there is a need to consider real and daily-life problems and issues and to foster grassroots movements aiming to empower citizens, neighbourhoods and businesses, and to push for social innovation.

Social and technical infrastructures form one of the key determinants of the future welfare of cities. The other important determinants are a creative population, infrastructure and institutions for education and innovation, networks of collaboration between businesses and governments, the role of active and demanding citizens, businesses and authorities to push for innovation and quality of services. In analogy

to Michael Porter's well-known concept of national competitive advantage, the welfare potential of cities and urban areas depends on factor conditions such as human resources, capital, infrastructure and information, on demand conditions (the citizen), on urban networks of industries and entrepreneurs, and on the role of local government. This also has implications for the smart city concept itself. The smart city is not the future urban scenario but it is about how citizens are empowered, through the use of widespread technologies, to contribute to urban change and realizing their ambitions. In this sense, the city constitutes what is called with different terms an urban laboratory, urban innovation ecosystem, living lab, or agent of change.

In this context, the concept of living labs as open and user-driven innovation looks well positioned to serve as a mediating, exploratory and participative playground combining the Future Internet push and urban policy pull in demand-driven cycles of experimentation and innovation. Innovation ecosystems driven by living labs may evolve to constitute the core of "4P" (Public-Private-People-Partnership) ecosystems. Hence, it would provide opportunities to citizens and businesses to co-create, explore, experiment and evaluate innovative scenarios based on technology platforms such as Future Internet experimental facilities involving SMEs and large companies as well as stakeholders from different disciplines. However, in order to fulfil their promise as a key element of urban innovation ecosystems, such living labs possibly integrated with experimental facilities should become mature and professional in terms of their business model and business process management, service offering and capabilities to create networks and orchestrate collaboration among a wide diversity of actors such as SMEs, citizen user groups, larger companies, policy actors and research laboratories.

3. Future Internet as Enabler: Opportunities and Dilemmas

The dominant concept of smart cities emphasizes the technological infrastructure of cities and how this infrastructure enables a variety of services in relation to areas such as transport and mobility, health and care, tourism, energy, citizen participation and many others. These services are increasingly enabled by broadband infrastructures, wireless sensor networks, Internet-based networked applications, open platforms and open data, resulting in a growing network of sensors tied together in computer networks, giving shape to the Internet of Things. Such sensor-based networks—where sensors can be represented by citizens' devices and communications—capture crowd-sensing data that provide insights into the dynamic flow of life and work in a city and can be used for all kinds of services based on open, often user-generated, datasets. Such approaches provide a deep insight into the social interactions within the city, the flow of ideas and cooperative behaviours of people, and the structure of incentives and interventions aimed at influencing such behaviours (Pentland, 2014).

At the European level, the Horizon 2020 comprises key research and innovation activities aimed at the Future Internet, e.g. related to Big Data, Cloud Computing,

Cyber-Physical Systems, Networking technologies and other key areas. In addition, specific large-scale programmes and initiatives that are shaping the Future Internet are now running and are also relevant to create smarter cities and boost regional development. Two of these deserve a special mention:

- The Future Internet Research and Experimentation (FIRE) initiative has, over the last 7 years, established a range of testbed facilities across Europe, supporting technological research and experimentation and increasingly innovation. Traditional emphasis has been on investigating networking technologies; during the last few years, several testbeds and projects in the domain of Internet of Things and smart cities have been launched (SmartSantander, OrganiCity). We may assume that the future direction of FIRE will continue towards the support of research and innovation in a diverse range of user settings, including for SMEs, and increasingly making use of Experimentation-as-a-Service concepts.
- The Future Internet PPP (www.fi-ppp.eu) programme is a five-year, 600-MEUR industry-led partnership among 150 leading European Future Internet actors. The programme has developed a software platform called FI-WARE (www.fiware.org), which makes available a range of software components together with tools for application developers, including for smart cities. Of critical importance for the programme is the engagement of developer communities and SMEs. A key facility is called FI-Lab, which enables application developers, user communities such as cities, and other parties to jointly develop and experiment solutions.

Other relevant programmes and initiatives related to the Future Internet include the e-Infrastructures programme, the EIT ICT Labs and the new 5G Public Private Partnership. At least the first two are initiating promising activities aimed at supporting innovation clusters in regions. While these programmes focus on different time scales and objectives and fulfil different roles in the Future Internet landscape, and while the linkages and synergies between them will need to further increase over time, all contribute to the evolution of an open innovation ecosystem, which, besides addressing the programme objectives, will also boost urban and regional development.

In developing and adopting Future Internet technologies, concerns for privacy, security and data protection become apparent and within the FI-PPP programme they have been identified (Schaffers and Stollenmayer, 2014). Privacy and data protection in a wide sense has gained considerable interest judging by the current public debate on potential misuse of personal information; however, a higher level of awareness is definitely needed. Privacy mechanisms are important for service users, but also in the market as a whole, as it is important to establish trust in order to let users feel comfortable regarding privacy. From this perspective, it is essential that software platforms and infrastructures adhere at least to existing privacy laws and regulations—and it is important that these laws and regulations will further evolve

with new violations of personal data and with the increasing cybercrime. Protection of personal content is absolutely essential for the users and hence for creating a market successfully offering content-related services. Currently there are many sector-specific privacy and data protection rules and, for example, in the health industry these are comprehensive and complicated.

As an example, privacy and data protection within the FI-PPP programme poses a concern in the access to open data. The success of the FI-PPP exploitation and business creation is dependent on access to such data. These data are of different types. First, the data include public data (such as geographical, environmental, traffic and scientific. data) that should be accessible to enable FI-PPP applications to make use of them and / or build new applications on the basis of these data. Open data is widely considered to offer much potential in this respect. Conditions under which data are made available for use, however, are still significantly different across states or regions, thus hindering their exploitation. A second type of data is product and service information. Sometimes such information is blocked because of business strategies enforcing lock-in of customers and preventing interoperability. Probably we need to distinguish between open data for applications, and product-service data as regards interoperability information. Another type of data is personal data, which can be very important for business. However, exploiting personal data has a strong link to privacy and data protection; all existing rules must be obeyed. Well-established conditions for easy access to (open) data will be most relevant for the further exploitation of FI-PPP and for stimulating innovation and entrepreneurship.

Citizens and organisations become increasingly concerned about protecting their personal data and privacy, as well as about the increasing cybercrime related to personal data. These worries include attacks from both private business organisations and from intelligence agencies. It will be crucial for the success of Future Internet services that users re-gain their lost trust in their data and privacy being properly protected. The Future Internet initiatives have it in their own hands to provide this trust to potential customers. There are many technical solutions to support this, but the underlying policy and regulatory frameworks both at national and European, even global levels, need to reflect the state of the art. Within such large-scale Future Internet initiatives, policy makers and regulators should be supported to identify problems, barriers and possible solutions. Such programmes and the related test-bed facilities and trials could form an ideal playground for practically experimenting with these issues.

4. Open Innovation Ecosystems for Smarter Cities

Technology-oriented developments with high relevance for user- or community-driven and open innovation have been taken up by many cities to develop smart city visions and strategies. It is necessary to collect a corpus of observations about current and emerging strategies and policies towards smarter cities and how these aim to benefit from the opportunities of ICT-based technologies and applications,

and this has started in recent European projects (Komninos et al., 2013). Several cases illustrate how cities are working with experimentation infrastructures such as technology testbeds and living labs. They provide an overview of the current situation and future planning and a roadmap towards the development of smart or intelligent urban systems. The cases present lessons learned that are of interest for current and future stakeholders. These cases demonstrate, besides the similarities as regards their future vision, also differences in the concept of the smart city, the driving factors, strategies, driving factors, and challenges ahead. There are also similarities such as the formation of innovation districts, neighbourhoods and clusters as fundamental elements of the smart city strategy. This also offers the opportunity for exchanging good practices and solutions from one city to another. Overall it seems evident that the smart city is more a strategy than reality. Several of the investigated cities are advanced in terms of technology infrastructure. However, a smart city is more than technology and infrastructure, it is also a universe of smart applications and platforms which empower citizens in innovative ventures. This is why many cities have endorsed the concept of living labs, promoting a more proactive and co-creative role of users in emerging urban innovation ecosystems. Within the territorial context of cities, rural areas and regions, the main goal of living labs is to empower communities of users at an early stage of the innovation process. Interestingly there is a trend towards integration and shared use of living labs and experimental testbed resources related to the Future Internet, as exemplified in smart cities projects like SmartSantander.

A promising strategy to foster innovation ecosystems in urban areas is to ensure open access to innovation resources (Schaffers et al., 2011). Innovation resources include testbeds, living lab facilities and services, access to user communities, technologies and know-how, open data and more. Such resources can potentially be shared in open innovation environments. Evidence of collaboration models for sharing innovation resources such as the use of living lab facilities and methods in experimenting with Future Internet technologies and the use of living lab methodologies for implementing innovation policies of cities is growing. However, the potential types and structures of these collaboration frameworks and the concrete issues to be resolved in sharing research and innovation resources, such as governance, ownership, access, transferability and interoperability, need further examination, development and piloting. A promising area of work in this respect is **connected cities,** addressing issues such as how different cities in a region or in different regions can gain access to the services provided by assets or resources hosted elsewhere. And, what kind of new services can be foreseen to build on this concept of common, geographically distributed assets (e.g. testbed and living labs services for innovators in smart cities). There are examples of emerging bodies integrating a technology testbed and a living lab, such as ImaginLab in the region of Bretagne in France, which is an open platform dedicated to experimentation, from integration and interoperability testing to usability evaluation for new products and services on fixed and mobile networks (FTTH and 4G LTE). To some extent, projects dedicated to Future Internet experimentation and to living lab innovation may interact and even

work together in hybrid models. Such models could dynamically evolve over time, as **organisms** constituting the infrastructure of urban and regional innovation ecosystems. Hence, a vision for 2020 as regards smart cities and regions might be that Internet infrastructures, services and applications form the backbone of connected regional, urban and (trans)national innovation ecosystems, fostering co-creative innovation and new business creation.

The importance of creating effective innovation ecosystems or platforms that are capable of driving innovation (Evans et al., 2006) is recognized in European-level practice as well. Representative examples include EIT's Knowledge and Innovation Communities (such as EIT ICT Labs). Additionally, it can be observed that several EU-level large-scale research and innovation programmes are establishing thematic research and innovation ecosystems or platforms, during and after the external funding period (Schaffers & Turkama, 2015). It is increasingly recognized that due to the intense technology, market and actor dynamics, innovation ecosystems are in continuous change. Neither top-down nor bottom-up approaches alone suffice to resolve the identified gaps, such as lacking entrepreneurship and business creation, and lacking impact on societal innovation. This demonstrates the need for a focal actor with no vested interests to steer and stimulate the development and evolution of the ecosystems. The Future Internet PPP is an excellent example of initiating ecosystem development within a large-scale research and innovation programme, enabled by the FIWARE software platform. Still, there remain challenges in synchronizing technical platform development and the creation of innovation communities based on the platform. The platform owner decides the rate of evolution of the platform. The progress of the platform project FIWARE was pivotal to the progress of the other projects and in the initial phases, there were some bottlenecks to make available more technologies to start with the user pilot projects. Similar issues were encountered with the setup of the EIT ICT Labs. Institutionalising the organisation and governance structures took longer than expected, partly due to the variety of the different partners and offering. EIT ICT Labs has since focused on mobilising the community with frequent calls and tenders. For the FIRE initiative, which is grounded in a wide range of experimental facilities across Europe and also more and more addressing user environments such as smart cities and Internet of Things, there seem to be good opportunities to become part of a network of open, shared facilities and platforms, through cooperation with other initiatives. The longer-term goal of FIRE is to realize a sustainable, connected network of Internet experimentation facilities providing easy access for experimenters and innovators across Europe, and offering advanced experimentation and proof-of-concept testing services. This way FIRE could act as a technology and service-oriented accelerator of research and innovation for the Future Internet.

5. Concluding Remarks

For the near future, it will be necessary for the smart cities' and regions' narrative to explicitly address real-life challenges for business, SMEs and citizens. There is a need to demonstrate how the ongoing important work on smart cities addresses practical issues and how it achieves real-life results for the city and its citizens through new forms of cooperation and community building. It will also be needed to address the methodologies adopted in smart city projects. There is an increasing need not to merely add social sciences and humanities to the projects but to devise and employ integrated multi-disciplinary socio-technical approaches based on action research principles. This becomes apparent in a variety of smart city projects applying user data blurring the domains of public and private and aimed at implementing models of social big data. Finally, it can be foreseen that the emergence of connected platforms for innovation, where among a wide range of resources can be selected such as experimental technology testbeds, software platforms providing a cooperation space among developers, innovators and users, tools to support experimentation life cycles, and living labs and usability methods. Making these resources interconnected and service oriented will provide a next challenge to establish the infrastructure and tool environment for smarter cities and regions.

Acknowledgment

The work presented in this chapter has considerably benefited from intensive collaboration in several research projects and publications, in particular with Nicos Komninos, Marc Pallot, Carlo Ratti, Peter Stollenmayer and Petra Turkama.

References

Evans, D.S., Hagiu, A., Schmalensee, R. (2008). Invisible Engines. How Software Platforms Drive Innovation and Transform Industries. MIT Press.

Glaeser, W. (2011). Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier. Pinguin Press.

Komninos, N., Pallot, M., Schaffers, H. (2013). Open Innovation Towards Smarter Cities. Open Innovation 2.0 Yearbook 2013. European Commission.

Pentland, A. (2014). Social Physics: How Good Ideas Spread —The Lessons from a New Science. The Penguin Press, New York.

Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., Oliveira, A. (2011). Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation. In: J. Domingue et al. (Eds.). The Future Internet, Springer Lecture Notes in Computer Science 6656.

Schaffers, H., Ratti, C., Komninos, N. (2012). Guest Editors' Introduction to the Special Issue on Smart Applications for Smart Cities: New Approaches to Innovation. Journal of Theoretical and Applied Economic Commerce Research 7(3), December, 1–15.

Schaffers, H. & Stollenmayer, P. (2014). Policy, Regulatory and Governance Recommendations and Roadmaps. Deliverable D3.4 of the CONCORD Project (Future Internet PPP).

Schaffers, H., & P. Turkama (2015). Research and Innovation Programmes Shaping Ecosystems for Open Innovation—Some Lessons. To be published in: Open Innovation 2.0 Yearbook 2015. European Commission.

Townsend, A. (2014). Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia. W.W. Norton, New York.

United Nations (2014). World Urbanization Prospects. New York.

About the author

Dr. **Hans Schaffers** is currently the research director at the Centre for Knowledge and Innovation Research (CKIR) at Aalto University School of Business. His key expertise is in the domain of theory, methodology and practice of innovation. His recent work has been in the area of collaborative innovation networks, living lab methodologies, smart cities, and the Future Internet. He is the coordinator of the AmpliFIRE Coordination and Support Action within the 7th Framework Programme, which develops a vision, roadmap and strategy for the Future Internet Research and Experimentation (FIRE) initiative.



Moving Forward

This book is the story of a journey, and the steps taken to arrive at where we are today. As part of that journey, the authors of these articles have described some of the things we have done and the milestones that highlight what we have learned along the way, which enable us to see where we have come from, where we are now, and what lies ahead.

It is above all a learning journey: the ecosystem is a learning space, and—for its many authors—this book has been a learning process. We hope it will help others taking similar journeys to learn from the work-in-progress in Espoo Innovation Garden, and inspire yet others to embark on journeys their own.

The way forward from here will be as exciting and diverse as what has gone before. Looking ahead we see paths in all directions, some already open, others just being discovered, and many more we are curious to find out more about, and follow to see where they may go.

Regarding research and practice in the regional innovation ecosystem, we see a growing interest in ideas and practices like these:

- **Sustainability as our way of living.** We need systemic integration of the different dimensions of sustainability—economic, social and ecological—to be the synergic foundation of our citizens' mindset, in all their business and societal activities.
- **Active idea nurseries.** There are lots of good ideas around, but far too few ever get beyond the ideation phase. Recognizing this, many organisations in business already use incubators, accelerators, opportunity enrichers and other facilitated environments to develop and nurture new ideas. How would this work for an ecosystem? What kinds of places would the public sector need? Where can citizens go to work out and enrich their good ideas in collaborative co-creation with others? Idea nurseries fit well with the gardening metaphor—where can they be established here?

- **Nordic School of Urban Development.** It is clear that people and organisations in Nordic Europe work differently than those in other parts of Europe. One already talks about a Nordic school of design. So we can look at the innovation ecosystems here and across Northern Europe and ask: can we define the major guidelines of a Nordic school of urban development? How unique is the way things work here, and the lessons learned here, and the successes we achieve? What lessons can be drawn from them, and from other innovation and management activities in Northern Europe? How can these innovation good practices be transformed for wider use in other parts of Europe?
- **Pan-European flexi-work prototypes.** In the past we have focused on bringing people to jobs, encouraging a mobile workforce (at its best) or a brain drain (when people move to where they perceive the opportunities are). However, in the coming single digital market it makes sense to consider how to bring jobs to people. Much work can be done online, anywhere, without the need to commute to the office, move to another city or immigrate to another country. Tax laws, pension arrangements and other issues have to be rethought to accommodate this. Where are the prototypes to discover what works and what is needed? They could happen here.
- **Rethinking work, jobs, employment, societal participation and contribution.** We are heading into an age of disruption, where software will change the contours of 'jobs' and 'employment' as we know them. We need to rethink work, and what constitutes relevant participation in and contribution to societal well-being. How will that develop in the coming years?
- **Ecosystem results** can be assessed through the lenses of the Espoo Innovation Garden metaphors: pathfinding, icebreaking, prototyping and the lighthouse, in order to more accurately understand the nature of the lessons learned, and still to be learned, and the contexts in which they can be disseminated and applied.

These are some of the many things worth considering as we move into the last year of the Energizing Urban Ecosystems project, the next phase of regional innovation strategy realisation, and the next steps on the road ahead. One thing is certain about the future of innovation practice in Espoo Innovation Garden: it will be curiosity-driven, underpinned by powerful research, powered by creativity, driven by entrepreneurial spirit and the courage to act.

How can we create an inclusive and fully accessible society, in which all citizens are 'smart' and can contribute to co-creating quality of life? This is not the kind of inclusion that means someone tells us what to do and what is important for us, hoping citizens will simply comply. It is an inclusive society in which all citizens are seen as people with talents—"potential waiting to be unleashed"—who can creating value

for their own lives and for their communities. It is a society in which innovativeness is the common state of mind. It is a region of reciprocal relationships and relevant roles for government and civil society, empowering and engaging people to contribute in the most appropriate ways.

The City of Espoo has re-organized its governance structures and processes by initiating five policy programmes, each with a steering group of five top decision-makers and five top civil servants. The targets are defined to focus on creating new innovative solutions to grand societal challenges. The themes of these policy programmes are:

1) Innovation and Entrepreneurship,
2) Sustainable Development,
3) Youth Inclusiveness,
4) Active Healthy Ageing, and
5) Citizen Collaboration and Active Partnering.

The City Council has set ambitious targets for each programme. The planning phase is over, and the implementation has begun. These programmes are based on multi-sectoral, multi-disciplinary and multi-stakeholder collaboration both within the city organisation and with public-private partners.

In practice, the real challenge is in creating synergy by integrating and orchestrating the City's vast number of bottom-up activities, as well as many others. This means a new culture of mega-endeavours, project portfolios which will play an important role in modernizing the Triple Helix culture.

The Espoo experiences could be further developed through **Policy prototyping and policy innovation labs.** What would a policy prototyping lab look like, how would it work, and what value would it add? How can we take policy prototypes out of the lab for real-time testing, without disrupting society? We know a few things about policy prototyping, but there is much we haven't experimented with, and should.

In this future, we will explore how to create and enhance opportunities for digital inclusion, for the inclusion of talent, for start-up initiatives and new business, and for students, international knowledge workers and innovators. We will address pioneering innovative hotspots and city hubs as places in which diversity is valued and citizens of every kind—young and old, male and female, well-qualified and disadvantaged, immigrants and the children of immigrants, of every cultural background and belief system—can find opportunities to create excellent innovative ecosystems together.

Scaling good practice is one clear milestone for moving forward. Regions elsewhere in Europe can benefit from learning what works in specific contexts, and what does not. Disseminating by doing, coached practice, and co-creating active testbeds in 'innovation builder' countries and regions of opportunity are various ways to scale learning. Orchestration guidelines, toolkits, and communities of excellence can help move things forward for networks of practitioners. The challenges of our world do not end at the borders of Espoo Innovation Garden, southern Finland, or

Northern Europe. So we hope that the future will include enough entrepreneurial discovery and good partnering to explore and extend the diverse possibilities people see, and create good practice everywhere. The lighthouse illuminates possible paths of opportunity, and then pioneering, icebreaking, pathfinding, prototyping and other processes can kick in. In the meantime, we continue to tend the soil of our innovation gardens, so that many people, both in Finland and abroad, can enjoy the fruits of their mutual endeavours.

Saija Äikäs
Chair, Espoo Innovation and Entrepreneurship Policy Programme
Member of the Espoo City Council
Former Chair of the Espoo City Board

Sirpa Hertell
Chair, Espoo Sustainable Development Policy Programme
Member of the Espoo City Council
Former Vice-Chair of the Espoo City Board



REGIONAL INNOVATION ECOSYSTEMS—the theme of this book—is one of the key concepts of our time. Societies all around Europe need to get more innovation from research. This requires not just excellent science but also its effective integration with industrial leadership and societal challenges.

THIS BOOK IS A SNAPSHOT OF DEVELOPMENTS in Espoo Innovation Garden—state-of-the-art at the time of publication. It shows what's happening at this moment—through the work of the authors—but also points to the future, as their work continues within the Energizing Urban Ecosystems research program.

ORCHESTRATING REGIONAL INNOVATION ECOSYSTEMS is an emerging science—and an art. So it is important to research its secrets, learn how they work and why, and thus come to understand how to better maintain and improve them. That is what the many authors of this book—researchers, practitioners, businesspeople and politicians—have done. We must continue to learn how orchestrating these ecosystems creates opportunities for business, universities and local government, and enhances the quality of life of our citizens. The work accomplished here is exemplary and has much to offer to other regions in Europe.

CARLOS MOEDAS
EU Commissioner for Research, Science and Innovation



ISBN 978-952-60-3701-1

