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Open Innovation 2.0 Yearbook 2015

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Foreword

Dear reader, friend of Open Innovation,

Welcome to the 2015 edition of the Open Innovation 2.0 Yearbook.

This publication builds on the white paper by Martin Curley and Bror Salmelin on the new Open Innovation paradigm 2.0, already referred to in the 2014 edition.

The key is to see innovation as ecosystem-driven, including all stakeholders as active players in jointly creating and experimenting in the new ways of doing things and creating new services and products. Innovation is very much daring to see the unexpected and capture the moment. Experimenting and prototyping in real-world settings, with real people is a strong driver to stretch the boundaries for new marketplaces, new products and new services, to understand the changes and take advantage of weak signals that eventually become mainstream.

Open Innovation is not a silver bullet; learning and taking that on board is a major change process where the traditional control changes via leadership to enabling orchestration, letting all the stakeholders do their best, and play together. Exactly like a good conductor makes the sound of an orchestra.

In European innovation policy we begin to learn to walk; growing up from the observant toddler to more determined change interlocutors and orchestrators. The new policy for the Digital Single Market in Europe is creating a safety net for the change. We have the opportunity to experiment, scale up successes and kill early stage ideas which do not make sense; to be able to focus our limited resources correctly to create a genuine win-win game for all stakeholders. Having the users as active agents as well reverses the innovation pyramid, as already suggested in the Open Innovation Strategy and Policy Group publications some years ago. I am glad that we have evidence of this successful change published in this edition of the yearbook as well.

Open Innovation is very timely also from the current technological revolution perspective: Clouds, the Internet of Things (IoT), Open/Big Data and fast mobile communications are all creating opportunities for major changes in business models, in societal behaviour and in value-creation models in general. How to fully take advantage of the simultaneous technological and societal development can be answered by making Open Innovation 2.0 increasingly mainstream. It is all about creating entirely new markets, services and products benefiting all stakeholders. Do we have the courage to seek for disruptions?

Horizon 2020, the Digital Single Market, Member State activities, regional innovation systems... All these public initiatives create a good environment to match the innovation needs in society, and by and for the industry. Participative European Innovation Ecosystems lead to discoveries at the edges of disciplines, building simultaneously on the technical and societal experience and the courage to combine things in new ways. Setting the ambition level high there is plenty room for demanding research to be integrated into the solutions sought after. European Innovation Systems' governance issues will be very critical for impacting innovation investments.

Innovation is daring to seek the unexpected — and scale up the successes faster than ever. We can do it; Open Innovation 2.0 with its engagement platforms is creating a good framework for that.

Everyone, without exception, is welcome to share, build and experiment. Enthusiasm matters. Courage matters. Share them: motivate and inspire. We are all part of the same world.

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Executive Summary

Welcome to the Open Innovation 2.0 Yearbook 2015 edition. The yearbook supports the key issues on the table for 2015, also related to the Open Innovation 2.0 conference.

Themes range from European Innovation Ecosystems and their governance to several practical examples on how open innovation brings well-being forwards, both in terms of jobs and growth, but also in terms of quality of life.

New innovation space — interlinking crowds, rapid prototyping and scaling — is described in the article by **Salmelin**. The article further elaborates the elements of Open Innovation 2.0 and proposes an approach to harvesting a broad spectrum of ideas for solutions, and scales up the more promising ones. New challenging innovation spaces are described, and interlinked to the core processes of OI2.

In the article by **Markkula** and **Kune** the focus is on orchestration, and in igniting ideas and eventually turning them to real innovations. This requires behavioural changes induced by the integrated processes of preparing the commitment, engaging all stakeholders and entering into a relatively short rapid prototyping and experimentation phase. All these elements are an integral part of the Open Innovation 2.0 paradigm. The authors describe how this can be done in practice and share their experience from practical camps and experiments that they have done in Finland. All this also links to the experiment which is to be launched at the Open Innovation 2.0 conference in 2015 in Espoo, with a foreseen 6-9 months prototyping period on a regional level. This practical case will drive EU regional policy actions, and will be closely followed by a guide on the development of best innovation practices in a regional context in Europe.

The following article by **Karkkainen**, **Jussila** and **Erkinheimo** looks at industrial crowdsourcing from a very practical, evidence-based angle. The article goes beyond the current crowdfunding platforms and extends that to crowdsourcing, and even crowdworking. Engagement platforms and processes seem to be very important when doing the actual selection and scale-up of the ideas to innovation level. Work builds on the very deep experience of the authors on crowdsourcing in various environments.

In the contribution by **Schaffers** and **Turkama**, the process and drivers for shaping a functioning open innovation ecosystem is elaborated. The approach focuses very much on a systemic approach, aligning the various elements for increased impact. The article also builds on the experience from European Public-Private Partnership (PPP) instruments and the Future Internet PPP (FI PPP) in particular. The FI PPP opening up to various application areas is a very interesting example on how new engagement platforms could be designed in the technology transition we are in, towards the cloud, IoT and big/open data.

In **Schofield**'s article, open innovation and implications for universities are discussed. The drivers for practising open innovation need to change universities' behaviour and repositioning of their work in open innovation ecosystems. The new role of universities also leads to new approaches in Intellectual Property (IP) management, interlinking universities to joint actions with other stakeholders and developing new operating modes for academic institutions in the open innovation processes, beyond being only the scientific knowledge provider.

Huuskonen elaborates the Intellectual Property Rights (IPR) and intellectual capital in open ecosystems from a sharing and collaborative ecosystem perspective. In the article, evidence from Finnish, US and Swedish perspectives is integrated in very practical manner, giving suggestions for further analysis of the future European approach, catalysing innovation in the new networked ecosystems. There is a clear need to move from closed IPR to a shared system, enabling new value creation processes involving wider stakeholder communities.

Kleibrink and **Schmidt** are addressing open innovation ecosystems from communities of practice and an innovation lab perspective. Work is focusing on the new roles of the public sector with the example of the Danish Mind Lab concept. Also the German approach of having innovation labs outside the government structures are discussed in detail with practical examples. Innovation labs are then being extended to industry and academia-driven labs based on a similar conceptual approach. Some good examples are indicated.

In the description of Basaksehir Living Lab in Turkey, **Cakir** describes the rich functionalities that the newly established fully fledged innovation hub possesses. Strong community commitment is evident in the design of the Living Lab and the current operations as the glue between all the

stakeholders. Being a node in the quadruple helix approach for a large active population, thousands of SMEs and the public sector the Basaksehir Living lab is a very good example of what strong commitment can jointly create.

We have heard about the excellent developments of Smart Lighting in open innovation environments in previous editions of the Yearbook. This year in the article by de **Ouden**, **Valkenburg**, **Sheurs** and **Aarts** we go further; the article brings forward the practical experience and challenges that the innovation partners face in innovation ecosystems. The shift from products to services, from technology for people to societal needs and from products to platforms are all leading to refocusing the needs of the stakeholders in innovation environments. The shift to a continuous innovation environment and processes increase the interlinkages between all the stakeholders in the quadruple helix innovation process, and the creation of an agreed, common long-term vision.

In the paper by **Lin**, a new approach for the transition of cities to creative, smart cities is proposed. The transition model from Leadership, Execution, Resources, Partners (LERP) is proposed to change to Partners, Execution, Activation, Resources and Leadership (PEARL). The context for this work is Unesco's creative cities' network and the analytical approach behind it, elaborated through practical cases.

Sargsyan tackles the issue of Open Innovation 2.0 in cities, and how to make cities true innovation hubs. Future City is an urban innovation ecosystem where each of the stakeholders has a specific role. The approach is based on the quadruple helix innovation model where the citizens have a strong active role in the whole process, seamlessly. Citizen engagement, experimentation, the creation of new markets together with the enabling technology trends suggest that the OI2 paradigm can be the differentiation factor between the top performers and the average ones.

In the article by **Roos** and **Sargsyan** the innovation dilemmas of the future are tackled: How to focus correctly, and what is the role of the various players in innovation ecosystems? Should we focus on start-ups or established larger enterprises? Should we look at shared or trusted economy drivers? Should we focus on disruptions? What is beyond the obvious technology trends; connectivity and computation? How should all that influence our choices when we seek the impact? The article describes the dilemmas and comes with a balanced suggestion on the role of all-inclusive ecosystem thinking.

This reading is very stimulating and thought provoking. What is important is to make innovation happen; to harvest the new innovation space, and based on our experience catalyse (and select) the best way to grow further. What is also important, shown in the articles, is to take a break and have the courage to look at new disruptive approaches, experiment and even play with them. Play is important element in innovation, like curiosity and courage.

We have the opportunities Open Innovation 2.0 is paving the way for, in an inclusive, safe but disruptive way. Let's make innovation happen.

CHAPTER I

Regional Innovation, Innovation Platforms and University Research

Orchestrating an Entrepreneurial Discovery Process

The flow of targeted activities as parallel processes

In this article we review the entrepreneurial discovery process as an active driver of open innovation ecosystems, and specifically consider what is required for orchestrating the ecosystem as a set of emerging parallel processes. Our arguments are based on the newly published book, Orchestrating Regional Innovation Ecosystems: Espoo Innovation Garden, as well as the ongoing work of Finland's Energising Urban Ecosystems (EUE) research programme. Our focus is to explore how orchestration works in practice. Open Innovation 2.0, entrepreneurial discovery and societal innovation are key processes in this work and need to be orchestrated and supported in diverse ways.

Traditional management is often organised around meetings, planning sessions and workshops. However, when meetings, workshops and other events are organised without a support structure for follow-through, the capacity for the effective realisation of plans and decisions is limited. Orchestraion is needed to take ideas, proposals and decisions much further.

We take the following statement from the EU Committee of the Region's (CoR) Smart Specialisation Strategies conference on 18 June 2014 as a starting point for our article:

'New ways of thinking are needed for dealing with these challenges: more ecosystem thinking, more creative thinking, more synthesis, more thinking about outcomes and impacts, more attention to pattern recognition and awareness of weak signals. More thinking about solutions and less focus on problems. We have to practice thinking together, synthesising and comprehending: collective and distributed thinking about societal change, real challenges, contributing relevant support, building renewal capital.' [1]

This is in fact calling for a 'thinking renaissance' in Europe. Some important mindset changes are needed, and new skill-sets must be acquired and mastered for this to become common practice. It is important to do this, but not easy; capacity building is required. In the spirit of Open Innovation 2.0 and entrepreneurial discovery, learning-by-doing will certainly be the key. Skills and mentality can be learned in real-time, through coached practices while working in renewal projects, workshops, innovation camps and conferences.

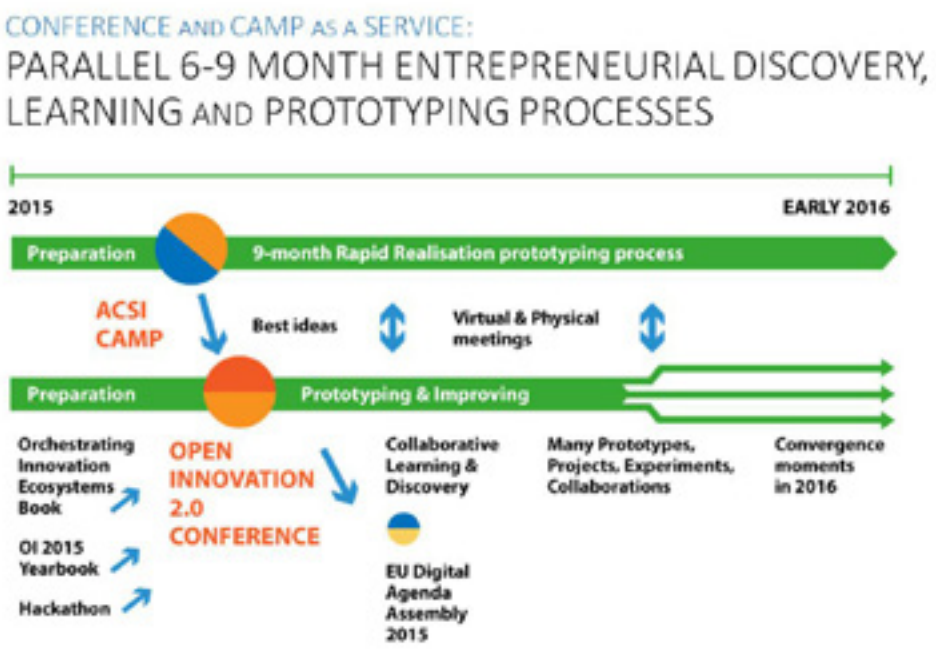
Ecosystem thinking impacts how we think about and organise our renewal activities. Our premise is that interactive activities like workshops, innovation camps and conferences are discovery learning processes — not simply events — and should be orchestrated as many parallel interactive processes extending well beyond the duration of the events themselves. In June 2015, two major activities will be organised in Espoo, Finland, together with the Energising Urban Ecosystems (EUE) research programme, local government authorities and the European Commission: the 8th ACSI societal learning camp and the 3rd EU Open Innovation 2.0 Conference. Both are concrete examples of 'events' framed as entrepreneurial discovery processes, created in parallel and supported by an orchestrated follow-through. Both Camp and Conference are also part of a larger innovation process begun in 2013 and conceptualised as continuing through 2016 and 2017.

This article describes the larger context of these events-as-process, and the role that entrepreneurial discovery, open innovation ecosystems, orchestration, prototyping and experimenting play in co-creative collaborative innovation. It emphasises the close integration of Camp and Conference, the interdependence and synergetic working of the diverse concepts, and how open innovation and ecosystem thinking require going beyond 'events'

to support the realisation of good ideas in practice. These are crucial concepts for achieving the mental changes that Europe needs.

In this way, the two 2015 discovery processes will be capable of scaling well beyond the borders of Espoo, to provide inspiration and learning to other regions throughout the world involved in similar processes.

Figure 1: Parallel 6-9 Month Entrepreneurial Discovery, Learning and Prototyping Processes



A systemic renewal process needs integrated instruments

Many societal challenges are clearly connected to financial recovery and good possibilities for employment, just as societal welfare depends to a large extent on economic development, jobs for people and new opportunities for industry. The issues are often complex and must be understood in a systemic way, and addressed in challenge innovation ecosystems. Unfortunately they are all too often still seen through the lens of limited responsibility as separate issues, problems, silos and entities. Policy also tends to remain too long at the level of talk and good intentions. Europe and its actors need a systemic renewal process. There is a lot to do, and although a lot is already going on, excellent activities often miss the connection to the complementary activities they could leverage for synergy and greater societal benefit. Renewal capital can only be built by having a better understanding of the overall challenge, the processes involved, the diverse projects in progress and the proposed, targeting joint actions based on that.

Part of the renewal process is the mentality needed to fuel the spirit of enterprise and the mindset of entrepreneurial discovery that needs to be embraced by large portions of society; citizens and third-sector engagement are essential for making new things happen. Nothing will happen without sufficient curiosity, creativity and courage. A start-up mentality, both in the economic sphere and for society as a whole, along with voluntary activities are important ways to contribute to society, and together they are becoming crucial success factors.

Of course, all these joint actions and new enterprises need to be financed. There are diverse European instruments for this, but they too are often independent of each other, and not well connected for supporting the challenge innovation ecosystem. Some excellent sources of financial support stand out: industrial and other private investments are one source of financing; national, regional and local public actions are another; and a third one is EU level policy with its financing instruments. The focus of EU policy needs to encourage more bottom-up movements and concrete actions at the regional and local level, and in the last few years the Commission has launched new mega-level initiatives. These include:

- Better and more targeted use of cohesion funding (around EUR 350 billion in the seven-year programme period 2014-20) with the help of regional innovation strategies based on Smart Specialisation.

- Renewing European-level research and innovation policy framework through Horizon 2020 funding (around EUR 80 billion in 2014-20).
- More recently, the new Juncker-Katainen investment package (EUR 315 billion within the next few years).

These EU-level financial instruments need to be used in an integrated way to better promote the mindset changes needed for increasing entrepreneurial discovery, the spirit of innovativeness and Open Innovation 2.0 activity throughout society. There is a clear need to stimulate and support regions to practice the effective cross-fertilisation of ideas. An integrated funding resource of this kind, supporting excellence in implementing regional smart specialisation strategies (RIS3), cutting-edge research, innovative practical projects and other activities targeted to tackle societal challenges, would go a long way in helping to achieve shared European objectives and create renewal Europe needs.

Challenges of the knowledge economy

It is abundantly clear that working in this way in the coming years calls us to action. Despite the abundance of good intentions, excellent ideas and (often) visionary proposals for renewing the innovative capacity of Europe, there have been too many discussions without conclusions, conferences without follow-through, plans without realisation and realisation without achieving the intended impact. We have to move faster than ever before towards smarter regions, smarter solutions and open processes, which enable citizens to take a more active role in addressing the social and societal challenges they face. There are only a few easy answers, off-the-rack interventions or ready-made solutions, and that is why exploring, experimenting, prototyping, discovery and learning have become essential societal processes. Europe and the entire world are facing great challenges, and recent advances in digitalisation and globalisation have added both additional stress to our systems and powerful resources for dealing with it.

We need to marshal our resources: Europe has enormous expertise in its regions, intelligence and talent in its citizens and diverse new and existing technologies, methodologies and instruments — promising potential *and* proven practice — for realising innovation in practice. There are many ways to engage stakeholders at all levels to participate in and actively contribute to these processes. We need new ways to orchestrate ecosystems so that they are invited to do so. We have to move faster and more effectively from thinking and talking to discovering, doing and learning.

This is the practice we call entrepreneurial discovery. It is the key mindset defining the new knowledge economy.

There are many ways to create value and many ways for stakeholders and citizens to contribute, but there are also diverse challenges along the way. Horizon 2020 invites us to Integrate Excellent Science, Industrial Leadership and Societal Challenges, but not how to do this in practice. RIS3 asks us to identify what we do well and find appropriate partners to help us excel, but not how to deal with the dynamics of power, status and entrenched interests on the one hand, and blind spots, short-termism and multiple distractions of thinking-in-the-present on the other.

Demographics, digital literacy and generational values influence jobs and work, and software substitution may soon make more than 50 % of current jobs obsolete. Knowledge workers especially will be under pressure, and perhaps even more jobs in knowledge sectors may disappear. Many of the major institutions that we use to organise society are out-dated and obsolete. And current practice does little to alleviate the situation: we work with quick fixes that ignore real systemic shortcomings. New societal contracts are needed, new ways to thinking about societal inclusion and participation, new ways for framing employability, connectivity, intellectual property, openness and co-creation. We must accept and embrace disruptiveness in all its forms, including both disruptive technology and disruptive thinking.

In the face of such challenges, Open Innovation 2.0 and its basic tenets — the '20 snapshots' [2] — provide a framework for thinking and acting. The entrepreneurial discovery process is relevant here.

Entrepreneurial discovery as a process

Entrepreneurial discovery is one of the key concepts underpinning Europe's Smart Specialisation policy. Described in different ways by different authors, entrepreneurial discovery is essentially a process by which entrepreneurs, entrepreneurial regions and entrepreneurial citizens become aware of new opportunities for business and social innovation and leverage resources to take advantage of them. It is both a mindset and a skill set; it entails a way of interacting with the world with certain skills for making sense of the world around you, seeing things which are there (and not there), interpreting the bigger context and understanding the consequences of action or inaction. It calls for the spirit of entrepreneurship: curiosity, creativity and courage (for calculated risk-taking). It requires the capacity to act. It comes naturally to some people, others come to it in the course of their lives. Moreover, it can be coached, practised and learned.

Israel Kirzner coined the expression 'entrepreneurial discovery' in 1997 to describe 'the process of systematically scanning for technological, political, and regulatory, social, and demographic changes to discover opportunities to produce new goods and services'. Kirzner focused on entrepreneurship as a process of discovery, in which the entrepreneur looks for previously unnoticed profit opportunities, after which he/she initiates a process in which these newly discovered opportunities are acted on in the marketplace.

Of course, opportunity discovery for enhancing societal value is an entrepreneurial process as well. The Financial Times Lexicon tells us that, 'Entrepreneurship involves creating or discovering new ideas or opportunities for the purpose of creating value, whether economic, social, or even political — and forming a new organisation to do so'. [3]

Dominique Foray, one of the conceptual founding fathers of smart specialisation, describes entrepreneurial discovery as the 'discovery and exploration of a new space of opportunities, which is likely to generate many innovations and the development of a new activity'. [4]

It is a process at the core of renewing Europe's capacity for renewal. As the Committee of the Regions wrote in its 2013 Opinion on Closing the Innovation Divide:

'As many phenomena of the digital society have already demonstrated, significant transformation takes place from the bottom up, and a pervasive mindset of "entrepreneurial discovery" is critical. The term "entrepreneur" is inadequate here because it is often interpreted rather narrowly. Discovery also means more than innovation. It is rather a new activity — exploring, experimenting and learning what should be done in the relevant industry or sub-system in terms of research, development and innovation to improve its situation. Entrepreneurial discovery means experimentation, risk-taking, and also failing. It means individuals often working together with others in networks, assessing alternatives, setting goals and creating innovations in an open-minded way. This development also requires that citizens, communities and businesses be given the opportunity to have their say, as traditionally they have often felt that they do not have a voice.' [5]

We recognise the importance of these definitions, distinctions and statements; at the same time we understand the dilemmas of putting them into practice. The processes are difficult, the obstacles diverse, and while the calls to action inspire enthusiasm in some people, they activate fear of change and anxiety about the unknown in others. Too many initiatives, left to themselves, get bogged down and often do not get beyond their good intentions. Good processes are required, with adequate support where needed. The people and organisations are part of ecosystems, and open innovation ecosystems work at their best when their core processes are understood, respected and orchestrated.

Actualising the Dublin Declaration

The Dublin Declaration was an output of the first Open Innovation 2.0 Conference, held in May 2013 in Dublin. During this international conference, which brought together more than 350 decision-makers, leading innovation experts and entrepreneurial practitioners from around the world, participants co-created a document about using Open Innovation 2.0 to help achieve a sustainable economy and society, and pave the way for future innovation policies. Conference participants ratified this declaration at the end of the second day.

Mission: Develop widespread innovation literacy in Europe.
Vision: Open Innovation 2.0 — The next new Official Language of the European Union.

The intention is to implement this by the following actions:

Action No 1: Develop a New Business Model for the European Union;
Action No 2: Design for a New End State;
Action No 3: Create an EU Innovation Strategy;
Action No 4: Move from a European Research Area to a European Innovation Ecosystem;
Action No 5: Create a European Innovation System and Capability;
Action No 6: Quadruple Helix Innovation;
Action No 7: Focus on Innovation — Adoption Matters;
Action No 8: Create incentives to encourage Openness to Innovation and Experimentation;
Action No 9: Stimulate High Expectation Entrepreneurship;
Action No 10: Drive Intersectional Innovation;
Action No 11: Promote Successful Innovators and Entrepreneurs as Heroes. [6]

The 2014 OI2 conference enriched the discussion of these actions points with powerful examples of OI2 solutions in practice, and new approaches to innovation adoption based on open business models.

The realisation of action points like these on a European-wide scale is no easy matter. Obstacles arise at every step, and each action point has its own unique set of issues that must be dealt with. Despite some good examples, a concerted effort and orchestrated approach are needed. Isolated

examples and good intentions are not enough. As the Foreword to the European Commission High Level Group's 2013 report on Innovation Policy Management states.

'Innovation is a paradoxical process, which requires a leap into the unknown and at the same time complex management processes and efforts for rigorous planning. How can we support innovative companies, both large and small, across all business sectors in Europe? How can we innovate our own governance structures? How can we create a culture of innovation and a permanent ecology of innovation? These are the challenges and questions that Europe urgently needs to address.' [7]

This requires an attitude where action, experimentation, discovery learning, accepting the uncertain and willingness to embrace change are essential. The High Level Group's final report, Inspiring and Completing European Innovation Ecosystems (2014), strongly emphasises this. The report outlines ideas and recommendations for moving towards the actualisation of an inspiring innovation ecosystem. Diverse actions are required:

'In addition to removing all European and national, even regional, legalistic obstacles to innovation and modernising governance methods and tools for an open innovation approach, the completion of the European innovation ecosystems demands evidence-based policy-making and transparency in order to encourage public acceptance and support. This approach finds support in the Dublin Declaration on Innovation (2013). It highlighted how modern innovation and technology can help turn research into profits and tackle unemployment in Europe. The Declaration calls for stimulating collaboration between citizens, businesses, universities and governments and for moving from the ERA towards European innovation eco-systems.' [8]

The Dublin Declaration is clearly of value, but evidence and examples are essential to move the process forward. That is why the 2015 OI2 Conference will be orchestrated with the explicit intention of taking the Declaration action points further. Specific steps that are needed to implement the Declaration across Europe will be discussed in the light of the recommendations of the High Level Group's final report, Inspiring and Completing European Innovation Ecosystems. Conference participants will have an opportunity to propose concrete activities to translate each of the action points into practice in their own real-world environments, and develop plans to work together on realising these proposals. And an orchestrated process will be put in place to support their activities in the six months after the Conference.

We need a clear action plan — and an action process — to carry this out. The Dublin Declaration and the High Level Group reports provide the contours of what to do. Based on insights in orchestrating innovation ecosystems in Espoo and the Helsinki Region, the Conference will provide the Action Process to move the many parallel project proposals forward.

The importance of orchestration

As the authors wrote in their 2013 Yearbook article, 'Orchestration is not the same as management. In an innovation ecosystem it is not possible to *manage* many aspects of the innovation process. Orchestration is needed; this relates to both:

- The capacity to create conditions where the diverse parties can work together with the right balance of inner and outer focus, and thus reinforcing both their own work and benefiting the ecosystem as a whole; and
- The provision of supporting service infrastructure to help sustain effective operation within the system.

One needs to know how to organise the right methods, tools and facilitation processes for helping projects and partners achieve their objectives. The methods may range from tools and technologies for creative-problem-solving, user-centred co-creation, building synergies and breaking silos, to finding ways to deal with resistance to change and create breakthroughs in stuck situations. In addition, a systemic learning infrastructure is needed to ensure effective learning, and to facilitate entrepreneurial learning — the rapid application of lessons learned within the ecosystem so that projects and players can systematically benefit from each other's experience and expertise. Processes for benchmarking (accessing and applying relevant and inspiring lessons and good practice from diverse sources around the world) and bench-learning (a collaborative, symmetric learning process based on peer-to-peer exchange) are also essential. ... In practice, this refers to diverse skill-sets, mentality issues, methodologies and tools, which need to be actively applied to orchestrate joint processes in the ecosystem. The processes, and especially those needed for building mutual understanding and trust, must be facilitated.' [9]

We must bear in mind that the ecosystem is a commons, shared by diverse parties, and in the commons certain rules prevail. These are often unseen processes, unspoken conventions and customs. A healthy ecosystem needs diversity, and for diversity to thrive it must be recognised as a resource, and treated with respect. This in turn

furthers respect for the commons, and helps the ecosystem thrive.

A key danger of the new commons is that people do not know that they are actually part of an ecosystem. They do not understand that their actions and interventions affect all others in the system, just as the actions of others affect them. This lack of awareness is a blind spot that is every bit as dangerous to the healthy functioning of ecosystems as complacency, egocentricity, or unbridled desire to maximise profit.

For orchestrating open networks, learning is a key competence, and co-learning in networks and ecosystems is essential for maintaining healthy systems. But we should not take this too lightly: the capacity to learn as an individual, project team or a single organisation is difficult enough; learning in a network or ecosystem is the real challenge, and diverse orchestration methods to create the right mindset, conditions and capabilities — from 'reflective practitioner' to U-process to creative dialogue — can be used to support learning between organisations. Learning in networks and 'networked learning' are relevant concepts here.

A second danger is demanding that the ecosystem be purely self-organising. While it is true that a healthy ecosystem 'in flow' will self-organise around collective awareness, collective ambition and shared resources, there are enough examples of systems failures to argue for the importance of an orchestrated process, and orchestrators who are alert to the larger context, able to recognise patterns and make interventions when required, and support key processes with contributions that matter.

Open Innovation Ecosystems: the example of EUE in Finland

Finland's Energising Urban Ecosystems programme is researching and pioneering ways of working in open innovation ecosystems. This 4-year programme — EUR 20 million in research — is closely tied to the national innovation policy of Finland, as a significant part of implementing the Europe 2020 Strategy. Its general goal is to create a multi-disciplinary centre of top expertise for city planning and design. The conspicuousness of the Otaniemi-Keilaniemi-Tapiola area — known as the Espoo Innovation Garden — as the largest concentration of science and innovation resources and businesses in northern Europe provides a solid foundation for such a centre. The five square-kilometre area 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. 110 nationalities mix in the area. Internationally speaking, the region represents a true metropolitan area in Finland. The orchestrated activities of the programme focus on finding answers to questions about how to create new concepts and methods to achieve the objectives of the Europe 2020 strategy by effective regional implementation, and how to turn the Espoo Innovation Garden into one of the leading and one of the most attractive innovation hubs and urban environments in the world by 2020 by enhancing the collaboration between the city, universities, research institutions and enterprises. Operating since 2012, the EUE programme has brought together a broad group of researchers, innovators, business interests and civil sector participants to pursue its ambitious objectives. Early results of this programme have been described in 2012 and 2013 Yearbook articles.

Espoo Innovation Garden is the metaphor adopted for the area to symbolise the innovation ecosystem with its major players and activities. In transforming the Espoo Innovation Garden area, diverse challenges and opportunities are being addressed. Mega-endeavours like the West Metro, a major transportation infrastructure project with a capital investment of close to EUR 1 billion, is one such example of effective collaboration within the innovation ecosystem. Additional investments in housing and businesses in the West Metro corridor are tens of billions of euros in the next decades. These create growth and new jobs, and renew the city structures. The 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.

For this reason, the city of Espoo — as part of the 2015 EUE activities, and in conjunction with the Helsinki-Uusimaa Region — is organising the 8th international ACSI camp in Espoo, and has invited the European Commission to hold its 2015 Open Innovation 2.0 Conference in the Espoo Innovation Garden in June 2015. These two activities in June will draw about 300 innovators — researchers,

Figure 2: The West Metro Growth Corridor

decision-makers and practitioners — to experience how the open innovation ecosystem works, learn from the ideas and examples of global thought-leaders, address real world challenges, and take part in an entrepreneurial discovery process for prototyping, experimenting and ultimately the rapid realisation of open innovation projects throughout the region and the world.

The OI 2.0 Conference as a service: defining a six-month prototyping process

We know how to create exciting and inspiring conferences as events. We also know that after the event is over, it is not often that ideas get taken further. This is the syndrome of most workshops, training courses and other off-site events: once back in the actual working life, there are too many too many fires to fight, and too many obstacles to overcome such as colleagues, accumulating priorities and colleagues who haven't shared the experience.

This conference builds ecosystem support services into its design: support and facilitation for taking ideas further after the event is over. It is framed as a six-month discovery learning, entrepreneurial prototyping process, in which good ideas and project proposals arising at the conference — and the groups that convene around these ideas and proposals — will be able to prototype them after the event itself ends.

The conference as a service is based on the idea that:

- innovation is a process, not an event;
- entrepreneurial discovery can be supported;
- orchestration of a discovery processes is important;
- some support is important, even for entrepreneurs;
- individual and group learning is enhanced by learning together.

Running the OI2 Conference jointly with ACSI as parallel and interrelated prototyping processes for discovery learning is itself an experiment, and promises to be an enriching a learning experience.

ACSI as a rapid realisation process

ACSI — the Aalto Camp for Societal Innovation — is an international instrument for addressing societal challenges in a powerful and effective way. It combines an entrepreneurial way of thinking and working with a concrete process for developing breakthrough ideas and insights, aiming at producing real-world impact. Participants from diverse countries and disciplines work together to discover and leverage in-and-out-of-the-box opportunities for creating breakthroughs in a process of collaborative solution seeking. ACSI increases our possibilities, opens new thinking, goes beyond the ordinary and expands our insights into how to tackle societal innovation issues.

Figure 3: Rapid Realisation Prototyping Process

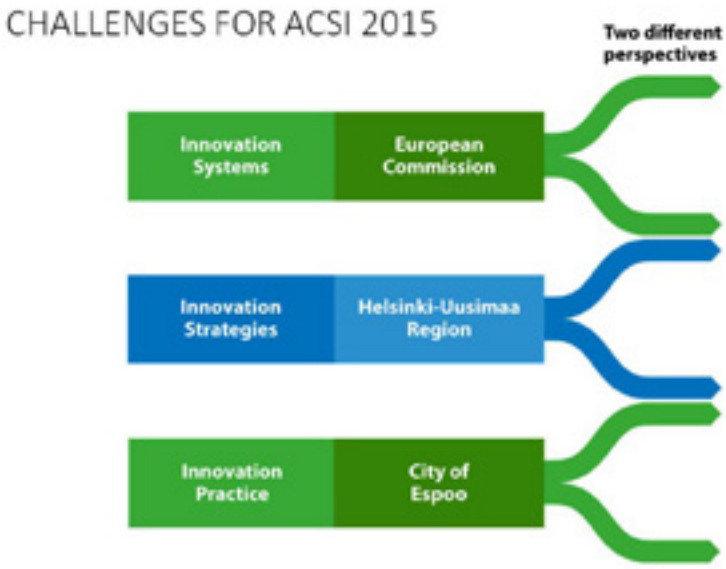
ACSI was co-developed by the New Club of Paris and Finland's Aalto University. Supported by scientific research, ACSI has proven to be an effective instrument to understand how societal innovation works and to create perspectives that stimulate societal renewal. Since 2010 it has been run seven times, in different forms, in different cities in Finland, Sweden and South Africa. ACSI challenges have addressed issues such as low carbon urban planning, realising regional test-beds and demonstrators, renewing citizen-government engagement, and enhancing the innovativeness and inclusiveness of society. The process has been used to create breakthroughs in understanding complex issues and stuck situations, stimulate cross-border collaboration, explore opportunities for open innovation and help eliminate the obstacles that block it. During the Camp, multi-disciplinary and international groups develop new ideas and perspectives on real-world challenges brought to the camp by cities, regions, business organisations, universities and NGOs. After the Camp, prototypes of promising ideas are tested and improved at locations where the issues occur. This opens the process to encompass and engage all the stakeholders of the challenge innovation ecosystem, and supports parallel open, co-creative innovation processes in the real world, creating an entrepreneurial discovery framework not only for Camp participants but also for the entire challenge ecosystem.

ACSI is a human-centred process, which begins when key people commit to take the results further. The prototyping period after the Camp is an integral part of the ACSI process. Follow-through takes place at diverse and relevant locations, with direct stakeholder engagement, and orchestrated support from facilitators, coaches and experts on different steps in the innovation process. Living labs and (urban) test-beds may be part of this co-creation process. This leads to more robust prototypes, to practical experiments, pilots and — with sufficient commitment — plans for fast-track realisation. For ACSI, the prototyping process after the camp is an essential part of a nine-month journey to rapid realisation.

This year, ACSI will address three challenges, each formulated at a different level:

- At the level of innovation practice: the city (Espoo);
- At the level of innovation strategy: the region (Helsinki region);
- At the level of innovation systems: transnational governance (European Commission).

Figure 4: Challenges for ACSI 2015



The interconnectedness of ACSI and OI 2.0

ACSI and the Open Innovation 2.0 Conference are clearly connected in diverse ways. Both strive to support and enable societal innovation by stimulating processes of rethinking the basic assumptions of co-creation, collaborative action, and engaging people in open innovation. Both use real issues and concrete initiatives to engage people in the practice of societal renewal. Both emphasise the practice of rapid prototyping to go quickly from idea to experiment to practice.

This year's ACSI — aimed at the challenges of implementing RIS3 strategies on a practical level, and enhancing the governance of open innovation ecosystems on a broader, European level — resonates fully with the underlying themes of this year's OI 2.0 Conference: stimulating experimenting and rapid prototyping, showcasing the Espoo Innovation Garden as a collaborative concept for energising urban ecosystems, and implementing the Dublin Declaration.

Both are seen as starting points for a prototyping process: the ACSI is framed as the initial step of a rapid realisation process for *taking ideas to implementation in nine-months*; the Conference is framed as the launching place for prototyping and improving participants' ideas during the following six months. The Conference is designed as a service for participants (and their networks): *the* place to be inspired by excellent practice and to create good ideas, to meet potential partners for taking the ideas forward, and to find support for actual prototyping in 2015. In this sense it is intended to be far more than the usual conference, where for many people learning stops when the conference does, and entrepreneurial practice is limited to the examples provided by works-in-progress and presented by speakers.

We see this Conference as continuing for six months after the participants leave Espoo, empowering people to translate their ideas into prototypes and test them in experiments, supported by peers, facilitators and virtual working environments custom-made for this purpose. In this way, the spirit of ACSI resonates in the design and follow-through of the conference-as-process and conference-as-service.

Fed by inputs such as this Open Innovation 2015 Yearbook and the Orchestrating Innovation Ecosystems book (describing the activities of Espoo Innovation Garden), both ACSI and Conference participants will be invited to reflect on, learn from and actually use best practices from around the world. A hackathon will also be organised in parallel with the Conference, to enable the thinking-power and participation of people around the world to be part of the working process. The *OI 2.0 Conference* is a gathering place for innovation thought leaders, a showcase for innovative practice, and an instrument for change. It functions to stimulate awareness and understanding of good practice, and enhance the desire for concerted action. ACSI is a proactive hands-on instrument for addressing specific societal innovation challenges in an open, international and self-organising context. For Conference participants, ACSI serves both as an effective example of how to address concrete issues and a stimulus to do so themselves. Both are programmes for entrepreneurial discovery, 'events' embedded in practical prototyping, experimenting and co-learning processes aimed at taking good ideas to practical realisation in society: ACSI is framed as the starting-point for a rapid realisation process, and the *OI 2.0 Conference* framed as a process of hands-on discovery learning and entrepreneurial prototyping.

Together, the two complement and enhance each other: ACSI creates early prototypes and brings them to the immediate attention of a vastly larger audience of people participating in the hackathon and innovation specialists attending the Conference, who can help to improve the ideas and take them further. In addition this will inspire Conference participants to define good ideas of their own, find appropriate partners, and create and test prototypes in the weeks that follow. Together, they bring the spirit of entrepreneurial discovery and open innovation into the sphere of hands-on practice.

The events of June 2015 should also be seen as part of a three-year process of entrepreneurial discovery in which participating people, cities and regions are working together to deepen understanding of how to implement Smart Specialisation Strategies and Open Innovation 2.0 in practice. Hands-on practice in the European innovation ecosystem is to be strengthened through a series of ACSI camps, OI 2.0 conferences and other activities throughout 2015-17, and integrated steps towards an innovative Europe will be taken together.

Sketching the larger context: 2014-17

The larger context of the ACSI and OI 2.0 conference is an entrepreneurial discovery process which began for Helsinki Region at the Smart Specialisation Strategies partnering conference held at the Committee of the Regions in June 2014. Helsinki Region, the region of Valencia and the Province of Utrecht were three of the event's organisers. More than 200 people from across Europe used interactive work forms — bench-learning, purposeful conversations and working with virtual worlds — to explore what RIS3 collaboration could mean for their regions, the importance of Open Innovation 2.0, the role of universities in entrepreneurial discovery, and issues like low carbon economy in urban planning, Europe's industrial renaissance and e-health. Taking the best ideas and introductions to potential partners, back home, the process moved further.

By the end of 2014 the Helsinki Region had defined its Smart Specialisation Strategy in detail, and in February 2015 more than 60 people came together in Espoo to discuss options and opportunities for realising the strategy with a broad group of local and international stakeholders. At this three-day bench-learning conference seven collaboration projects — both new ones and others already in progress — were presented and worked on.

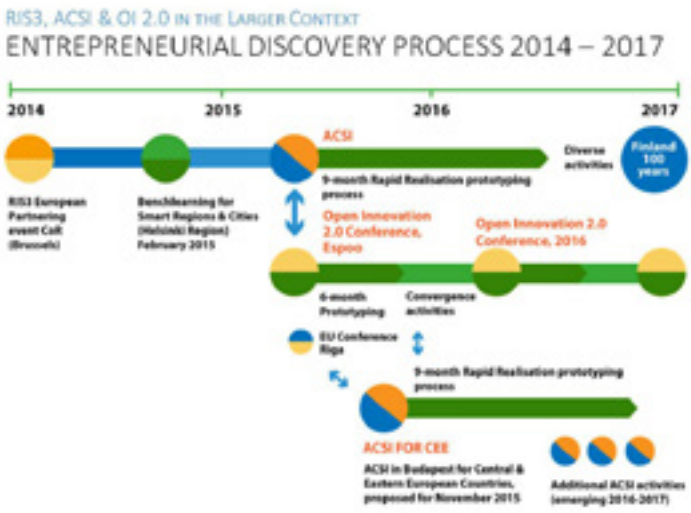
The ACSI Camp and OI 2.0 Conference in June 2015 are the next activities in this process. While the camp and conference will lead to diverse prototypes and project proposals to be developed further in the coming months, directly afterwards the first work-in-progress results will be reported at the EU Digital Agenda Assembly in Riga. The story of entrepreneurial discovery will be taken further, and opened for more people, as well as regions and cities to join.

The intention is to hold more societal innovation camps later in 2015 and early 2016. An ACSI for Central and Eastern European countries has already been proposed. There will also be spin-off workshops and process labs planned to enhance the co-learning part of the discovery processes. Diverse EU organisations have expressed interest in processes like these, and the Committee of the Regions intends to work together with the European Commission to support practical steps for moving forward. The results of this larger process will impact Horizon 2020, Digital Agenda and the practice of realising RIS3. The nine-month rapid realisation process prototyped here could be a model for implementing smart specialisation in cross-border and trans-regional partnerships.

Many of the European Entrepreneurial Regions will begin disseminating their best practice lessons this year. New OI 2.0 activities in 2016 and 2017 will provide possibilities for learning and working together. In addition, Finland celebrates 100 years as an independent nation in 2017: an opportunity for its many pioneering innovation-based regions to organise open collaborative activities to engage the rest of Europe.

Once the EU succeeds in using its different financial instruments to focus on addressing societal challenges in an integrated and systemic way, the basis for building Europe's renewal capital will be laid.

Figure 5: Entrepreneurial Discovery Process 2014-2017



Entrepreneurs have changed the world, and will continue to do so

What will these orchestrated processes mean for Espoo, for Helsinki Region, and for the European Commission?

The ACSI process will develop new perspectives, promising possible solutions and prototypes for testing in practice. The nine-month process of Once the EU succeeds in using its different financial instruments testing and improving the prototypes should lead to one or more ideas ready for realisation. The entrepreneurial discovery process will engage hundreds of stakeholders, allowing their buy-in and broadening ownership of the results. They will make discoveries, and profit from what they learn. In the course of the nine months, they will practise new skills and develop new abilities, acting in the spirit of the new mentality, trying it out, making it their own. The experience will make the mindset more accessible to more people, more common good within the ecosystem.

People and their organisations will have the experience of prototyping, experimenting, thinking in new ways, working differently — faster than they have been used to — and moving promising ideas into practice. Some of this experience will be used again in the next projects. The learning will belong to both the individuals involved and to their organisations. The city, region and commission will be richer for it. And fitter for tackling new challenges the next time.

The actual results — the ideas put into practice — will be realised faster and have a running start at creating outcomes and impact that matter to people and make the ecosystem better. Some societal challenges, at least after a few years, will become less acute, and less challenging. And we will have learned more about how to stimulate and support societal innovation, more about how to orchestrate entrepreneurial discovery processes in the challenge innovation ecosystem, and how open innovation thinking can influence the world.

The conference will be a service to participants, their communities, networks, regions and countries. People will take their new insights and ideas away, and develop them further where they live and work. Not all of them will come to fruition, but some of them will, and here too it is the experience of their process — the new ways of thinking and acting, and the mentality that drives it — is an important part of societal gains. We expect that the knock-on effect will be great. The baton will be passed from the policy-makers, planners and advisors to the practitioners, innovators and ordinary citizens, and they will run with it, making innovation more practical, accessible and doable. Hundreds of people in diverse cities and regions across Europe will have experimented with putting the action points for Open Innovation 2.0 into practice, learning together what works in which situations and why.

Bold steps will be taken, and successful or not, in a year's time we will know more. There will be new projects and initiatives. More people will have the taste for co-creative collaborative and entrepreneurial discovery, and Europe will be several steps closer to developing widespread innovation literacy. The thinking renaissance will have begun. And ideally, conferences will never be the same.

It is clear that successful entrepreneurs have changed society throughout history, and they will continue to do so. Entrepreneurial discovery can be seen in the context of a societal innovation camp, or an open innovation conference, stimulating and supporting people to move forward together on the good ideas they have, prototyping quickly, failing

early, learning constantly and scaling broadly when they have something that works. These processes are powerful mechanisms to drive innovation, turning demand into supply and knowledge into value. The same is true in the realm of cities and regions and their smart specialisation strategies. It is the entrepreneurial discovery spirit that is capable of engaging Europeans from all regions, and all ages, in building a better world together.

The conference conclusions of the Committee of the Regions Workshop on Innovation Union (held in November 2013) state that ecosystems with a common vision are essential: they need shared vision, share values, self-knowledge:

'Europe needs to support entrepreneurial spirit in its many forms: entrepreneurial discovery for people of all ages, [and] high-expectation start-ups in business and society... Innovation is about people, [and] involving citizens is the key to innovation... When people connect, ideas connect — and that's where innovation begins.' [10]

The message is clear: Europe needs this pioneering spirit, and the skills and competences it requires. The mindset can be learned and the skills improved by practise, as governments, businesses, universities and individuals learn to drive their own open entrepreneurial discovery processes.

This article gives an indication of how this will continue to emerge in the coming months. With small steps and bold steps that we can develop the renewal capital that Europe calls for, and support the thinking renaissance and entrepreneurial spirit to maintain it. These are stepping-stones for co-creating the new European narratives for the next decade, and building a Europe of excellent opportunities, co-created by its own citizens.

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Open Innovation 2.0 Creates New Innovation Space

Introduction

This text elaborates the new innovation space for creativity, which is essential when we try to maximise the impact of modern innovation practises, notably Open Innovation 2.0. Open Innovation 2.0 has some fundamental principles, which lead to needs for new skills among all the actors in the innovation process.

Modern innovation spaces span beyond clusters mainly in two dimensions: firstly, the traditional triple helix innovation model with enterprises, research and public sector players (being often top-down) is replaced by the co-creative quadruple helix innovation model where users have an active role too, in all phases of the innovation, from the early ideation to the co-creation of solutions. Secondly, the ecosystem drives for multi-disciplinarity rather than clusters, which tend to be quite monolithic.

The innovation ecosystems are breaking from the past linear innovation model towards a mash-up process creating positive sparks across the stakeholders and the different disciplines too. The key is to have very rich sources of inspiration, let ideas merge, and let them be experimented and prototyped in the real world, in scalable settings.

Openness is very important, as it enables and fosters the much-needed sparks of ideas in rich environments. Thus, open platforms build an essential element for ideas to be developed and prototyped in the real world.

One issue however remains: how to catalyse the creativity of all actors and to harvest the most potential ideas in order to be nurtured forward? Is crowdsourcing in its different forms the right way to progress? In this article, it is suggested that the power of crowds together with experimentation and prototyping might be a solution for better, and even radical, solutions.

Open Innovation 2.0

Open Innovation 2.0 was published as a new innovation paradigm in a white paper by Curley and Salmelin, at the Open Innovation 2.0 2013 conference in Dublin. The original paper was elaborated further in the Open Innovation 2.0 Yearbook 2014.

The twenty characteristics of Open Innovation 2.0 are the foundation of the proposed approach to increase creativity in innovation processes *(Figure 1).*

Figure 1: Twenty characteristics of Open Innovation 2.0

The quadruple helix is essential as only by involving the users as active agents from the beginning of the innovation process can we create genuine new markets for products and services. And, by involving the citizens (as customers) for the new developments, we also see at an early stage which elements of the idea are successful and scalable, and which parts just simply do not scale up. This in turn helps to adjust the innovation process correctly and does not squander time and resources on the least successful paths.

A participatory and co-creative approach is also essential when we look at the very strong assets we in Europe have in the most advanced, demanding and creative communities of users.

To find out what is successful and scalable at an early stage we also need to bring the ideas very early to the real-world settings with strong interaction in the quadruple helix innovation model. This EAR (Experimentation and Applied Research)

approach is well described but rather seldom used. Action research also illustrates the approach well. The simple idea is to have rapid prototypes and experiments in the 'real world' to filter out the bad ideas from the good and also aid scalable ideas to turn into real innovation.

Fail fast — scale fast. With all the stakeholders involved.

Experiments with curiosity are the drivers for new. This requires courage, as traditionally failures give a too strong label to the actor. Risk taking and risk management are important, but likewise daring to do experiments even with disruptive approaches is the game changer. Experiments and rapid prototyping reduce the risk to tolerable levels, and they are driving for the new. And, we need to remember that innovation is about daring to seek and find the unexpected. Innovation cannot be planned; only the conditions for finding it.

In a knowledge society, the products and services are increasingly intangible. Often the tangible products get their additional value through intangible components like services, or the tangible products are the access devices to services. The servitisation is quite an interesting trend affecting the lifecycle design of traditional products too.

Implementing Open Innovation 2.0 through engagement platforms

Creating engagement platforms in different product and services areas interestingly changes the economies of innovation too. We are approaching a zero marginal cost for innovation. E.g. developing a new app costs almost zero and the trials on the market on platforms are almost free. This means that a wide spectrum of ideas can be tried in affordable engagement platforms, where the risk of failure is not that costly. What is also interesting is that the scale-up cost is likewise close to zero! These kinds of environments lower significantly the barrier of entrepreneurship, provided that other e.g. legal conditions are favourable.

Interlinking the zero marginal cost drivers with experimentation clearly indicates the feasibility of wide spectrum prototyping and trials, with the selection and scaling up of those solutions, which are more successful in real world environments with real people.

One of the new trends is crowdsourcing (beyond crowdfunding). Crowd processes can bring good, disruptive ideas or reinforce some solutions when used properly. But, what is the role of experts in developing, filtering and selecting solutions to be prototyped? Will we be led by amateurs, i.e. the synthesis of the crowd opinion? The answer is no, if the process is right and we drive a variety of different experiments to see how they work in real world. Hence what we need is to elaborate more on the new innovation space with bridgers and curators.

New professions: curators and bridgers

When looking at the connectors in the new ecosystems we can clearly identify changed skills profiles. The role of persons having deep knowledge on a specific area, the so called I-shaped persons will have an important role in providing exactly that, deep knowledge. What, however, is increasingly needed are the T-shaped skills profiles where experts have not only specific knowledge but also wider contextual perspective to connect the speciality to a wide range of applications. We should go even further in our thinking: the connectivity and skills to ignite cross-disciplinary ideas becomes the scarce resource in the innovation landscape.

Inspired by Prof. Leif Edvinsson in the Leonardo Award 2014 workshop these new professions can be described as curators and bridgers. Curators focus on maintaining the quality of the Once the EU succeeds in using its different financial instruments contents and enriching it to be used and interlinked by bridgers to other disciplines. Bridgers are socially well connected, extrovert and most importantly inherently interested in 'everything', thus being able to make connections in spontaneous and unusual ways.

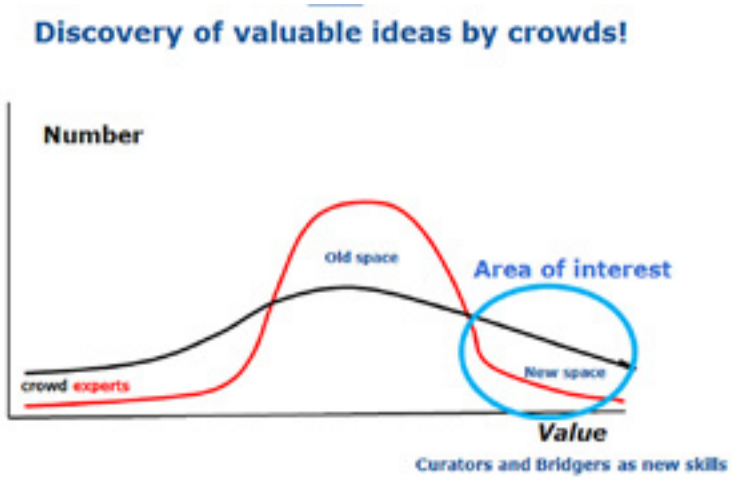
Our curricula do not recognise these new skills yet. Where do we train these kinds of people, and more importantly how do we find them. This approach reinforces both the connectivity and the special knowledge in collaborative, self-configuring environments. Will the companies be able to capture the talent and the connections in timely manner, changing dynamically the team compositions depending on the tasks and the stage of the tasks they are performing? Do organisations have the capability to break outside their boundaries, or even break the silos inside? The winners will capture the dynamics and success will be measured by the ability to change. Driving by tasks, not organisational structures seems to be the key in innovation. An analogy for this can be found from the ideas of virtual/holonic/fractal companies from the late 1990s, but the granularity of the entities are now going down to individual competencies.

Discovery of valuable ideas by crowds

It is shown that if experts are asked for a solution for a problem, there is good convergence of the ideas and the value of the idea is relatively good. Executing this idea is a safe (but conservative) bet as the opinions are based on past experience in the very field.

If asked to a crowd it is not unexpected that the answers have a very wide spectrum, and that the peak is not necessarily at the same place as those of the experts *(Figure 2)*.

Figure 2: New innovation space for Curators and Bridgers to keep the connectivity and quality of the knowledge



However, what is interesting is that very high value discoveries are more numerous in the answers of the crowd, indicating a new innovation space. A key question prevails: how to extract from those responses the high-value ones and not invest in the mediocre or low value ideas?

The Open Innovation 2.0 approach can again be extremely valuable as bringing those ideas at a very early stage via rapid prototyping (after initial screening) to real-world acid tests the most promising ones can be identified and brought to the next level. Experimenting in nearly zero marginal cost environments with real users, and taking their feedback in a co-creation mode means a safety net for even the craziest ideas. Only doable and scalable ideas move up in innovation value. Others can be killed with relatively low cost and high confidence at very early stages.

One of the characteristics for this new innovation space is that it has a strong need for both inter and multidisciplinary bridgers, curators keeping the quality of the knowledge.

The innovation ecosystem is described as being open for new ideas and one that has the courage to test and prototype ideas with all the actors in real world. It also has the courage to early filter out the less promising ones: without describing the source of the idea as a failure but more taking that as gaining experience. These ecosystems have also different rewarding mechanisms than only monetary. It can be recognition in the community, in the area, orchestration responsibilities etc.: all based on gaining reputation.

This new innovation ecosystem is self-directed and it is based on the common interest of all actors in the quadruple helix to discover the unexpected. Often the approach needs the open engagement platforms enabling full spectrum prototyping.

Conclusion

Open Innovation 2.0 is a promising new paradigm for Europe. It drives for new approaches having all the stakeholders involved from the start, and it advocates for searching for the unexpected. I am very happy to see that in developing new innovation policy and instruments, this approach is seriously coming into consideration, as the response to modern innovation dynamics is increasingly becoming critical.

New open innovation ecosystems require not only a new mindset, which can be taught by learning and doing the prototypes, as well as engaging the stakeholders to the process and also by enabling infrastructures. The Digital Agenda for Europe and the Single Digital Market are important tools for the scale-up. In addition, we need to have those open innovation hubs practising open innovation in its different forms. The regions will develop their own smart specialisation strategies, and hopefully bring them further towards taking on board modern innovation, like Open Innovation 2.0. Certainly, with this engagement of all stakeholders, there is a lot better possibility to capture the best ideas, select the scalable ones and bring prosperity to the whole of society.

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The New Era of Crowdsourcing — Industrial Crowdsourcing

Introduction

The open innovation paradigm emphasises the importance of the efficient use of all available knowledge and information. In addition to knowledge inside company borders, it emphasises the significance of particularly the knowledge residing outside company borders, because valuable innovation-related knowledge is being increasingly widely distributed to different actors, organisations (e.g. companies, customers, suppliers, universities etc.) and communities.

Crowdsourcing is a phenomenon which is not a fully new one, but quite clearly, its significance for different industries has increased strongly during the last few years. Howe [1] defines crowdsourcing as an *'act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call'*.

Generally, crowdsourcing has been used mainly by consumer-sector companies, and the main applications have been the outsourcing of relatively simple tasks, such as marketing videos, photographs and simple design tasks, which have no need for very in-depth expertise from the crowds. The idea of crowdsourcing by business-to-business companies and companies developing complex industrial products for other companies has been considered irrelevant and even absurd. This is probably at least partly due to B2Bs not being able to locate sufficiently large and competent crowds for such tasks, or existing crowdsourcing approaches and competences that would allow the crowdsourcing to be extended to their proper use, for instance by handling the related challenging IPR issues.

So, while previous crowdsourcing activities and crowdsourcing research has focused strongly on crowdsourcing related to the consumer sector companies using it, and the use of consumer-types of crowds in the crowdsourcing of simple and relatively little in-depth or specialised expertise — requiring tasks, such as t-shirt design, quite recently — during recent years — crowdsourcing has been discovered [see e.g. 2] to have significant potential also in the sourcing of highly professional tasks, the development of quite complex products, and thus increasingly, also industrial manufacturing companies and business-to-business companies have found crowdsourcing useful.

Therefore, it is well-grounded to state that crowdsourcing has recently entered a new phase which could be called the new era or new wave of crowdsourcing — the era of Industrial Crowdsourcing. Many pioneering companies have quite recently shown that even innovation-related tasks that require very in-depth and specialised expertise can be crowdsourced within certain conditions. Such tasks are typical in the development of complex business-to-business products and services.

In the present report, we focus strongly on this new era of Industrial Crowdsourcing by focusing on crowdsourcing activities of the above type in companies that manufacture industrial products and services. Additionally, we focus on crowdsourcing in the business-to-business sector companies, which were earlier commonly thought to be a very challenging or even impossible target for crowdsourcing activities. We argue that the use of crowdsourcing in the development of complex products requires novel types of skills and competences from the crowdsourcing company and the potential crowdsourcing intermediary, as well as dedicated crowdsourcing platforms and crowds themselves.

New era of industrial crowdsourcing

The crowdsourcing of industrial companies and companies manufacturing industrial products for other companies, Industrial Crowdsourcing, can be described as the new era for crowdsourcing for several reasons.

During the last few years, many things have taken place simultaneously to make crowdsourcing possible, on a large scale, for industrial companies. First, many crowdsourcing platforms have been founded that are dedicated to the crowdsourcing of industrial companies: for instance, GrabCAD, Atizo, TopCoder, uTest and Solved are all platforms that did not exist a few years ago, and have been designed and dedicated to specific, even very complex and expertise-intensive tasks related to industrial crowdsourcing. Such platforms have also matured only recently to the point, regarding their operational processes, technologies and competences that large scale crowdsourcing can be carried out feasibly and in a competitive way also from the viewpoint of industrial manufacturing companies [e.g. 3].

The crowds of the above crowdsourcing platforms consist of very professionally operating industry experts from various industries and representing various areas of expertise, with world-class in-depth and specialised expertise on various topics that enable industrial crowdsourcing, including design and CAD expertise and manufacturing expertise, etc [4]. In addition, good

and well-reported examples of pioneering industrial companies from many industries having successfully used crowdsourcing to their benefit in the sourcing of the development of even very complex products, services and systems have been reported in the last couple of years. Furthermore, the value creation approaches, models and success factors of industrial crowdsourcing have recently been academically studied and are at least somewhat well understood, and these have been adopted and exploited as models by other companies, as well.

Accordingly, some of the leading consultancies such as Gartner and Accenture that have investigated crowdsourcing have recently come to the conclusion that crowdsourcing is now a phenomenon which is among the most central phenomena that will have a significant impact on the ways that manufacturing companies will carry out their business [3,5]. General Electric is an example of a large multinational industrial company that has clearly noticed the business potential for crowdsourcing, and claims even that 'A Third Industrial Revolution' will be essentially based on crowdsourcing and digitalisation [6].

Several new crowdsourcing platforms feasible for industrial crowdsourcing have emerged that have rather recently gained a critical amount of crowds with in-depth expertise for the benefit of industrial crowdsourcing. InnoCentive is the most widely-known general-purpose crowdsourcing platform, but unlike the other presented crowdsourcing platforms below, it is not specifically designed for the needs of industrial companies. Other crowdsourcing platforms more focused for the purpose have been targeted e.g. to match the specific needs of industrial companies in software development (e.g. TopCoder), mechanical engineering (e.g. GrabCAD), cleantech expertise (e.g. Solved), testing of software and hardware products (e.g. uTest), ideation and concepting (e.g. Atizo) or pre-purchase crowdfunding (e.g. Kickstarter), *see Table 1*. From some platforms, industrial companies can reach a vast number of experts in specific field (e.g. more than 1.5 million mechanical engineers in GrabCAD), while others provide access to a smaller crowd of world-class experts (experts e.g. in the area of environment, energy, mobility, construction and design related to cleantech in Solved).

Table 1. Examples of industrial crowdsourcing platforms, crowds and industrial case companies [7,8,4,9]

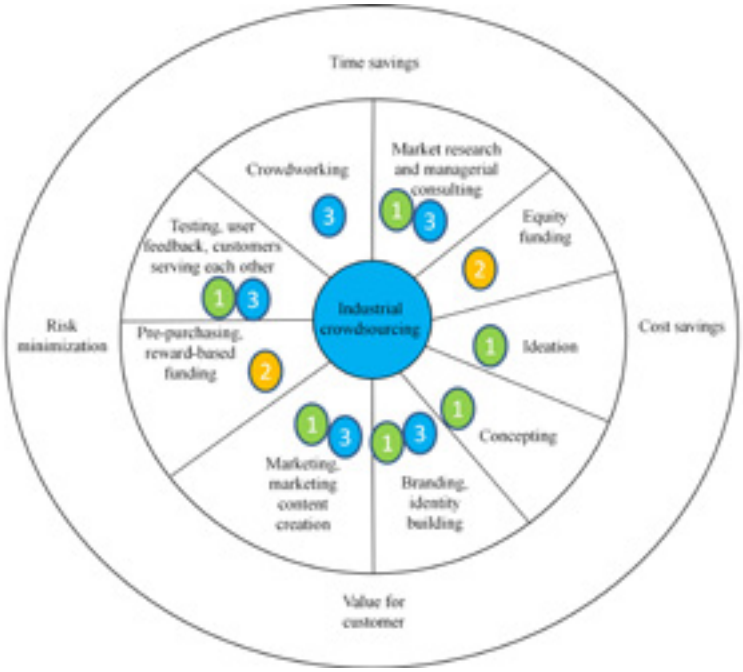
Crowdsourcing platform	Crowd	Industrial case companies
InnoCentive (http://www.innocentive.com/)	> 300 000 registered users, additionally a network of 13 000 000 experts	EMC, Flextegrity
GrabCAD (http://grabcad.com)	> 1 500 000 mechanical engineers	GE, Konecranes, Lürssen Werft, Sovella
Solved (https://solved.fi/)	> 500 world-class cleantech- professionals	YIT, BMH Technology
uTest (http://www.utest.com)	> 150 000 software testers	Numerex
TopCoder (http://www.topcoder.com	> 600 000 software developers	Praxis
Kickstarter (https://www.kickstarter.com/	Millions of backers of projects	AQuickCNC, Formlabs, Autonomous Marine Systems
Atizo (https://www.atizo.com/)	Thousands of concept builders	Pago AG

The Ferris wheel of crowdsourcing

Next, we present the Ferris wheel of crowdsourcing and give examples of current interesting pioneering outlier companies [10] and applications of industrial crowdsourcing. In *Figure 1*, crowdsourcing is presented as a Ferris wheel.

The Ferris wheel describes the major approaches where crowds can be used to create value (innermost sphere 2) for the various business development needs of industrial companies. The outermost sphere (sphere 3) describes the added value derived from the crowds. The Ferris wheel model for crowds creating value for industrial and manufacturing companies consists of three main crowdsourcing-related concepts: (1) crowdsourcing, (2) crowdfunding [11] and (3) crowdworking. These concepts are referred to by numbers 1-3. These concepts are partly interrelated and intersecting. We will describe in more detail the major crowdsourcing-based functions related to the above concepts, using examples from various industrial companies.

Figure 1: The Ferris wheel of crowdsourcing



Next, we provide a number of interesting companies and related examples in this article, to a large extent from the viewpoint of industrial companies, to clarify the current potential of crowd-based value creation for industrial crowdsourcing. We shall also dismantle the crowd-based major functions of the Ferris wheel shown in Figure 1.

Market research and managerial consulting

The starting point of this Ferris wheel is market research and business consulting. Crowds are expressing their needs and aspirations on many levels, all the time on the Internet, e.g. via social media. All the new knowledge published on the Internet in digital format is there for anyone to discover and immerse oneself in. Traditional market research companies and business consulting firms have noticed this, and are nowadays using crowdsourcing as a way to produce findings while simultaneously protecting their old-school offerings. But new challengers are coming to the market research and managerial consulting markets. Regarding the disruption in managerial consulting, there are already several players in the market. Paid crowdworking in consulting with the wise, diverse and distributed crowd is like a school book example of Surowiecki's thoughts [12], representing a true alternative for global consultancy. Companies like Innocentive, GLG, 10eqs and Solved [9] are examples of companies who are basing their offerings partly or totally on paid crowdworking — and getting a growing attention of clientele that has traditionally been in the tight embrace of the old 'big –five-type' strategy consultants.

As an example of new type of highly complex crowdworking in the construction industry, the company YIT, the largest residential construction company in Finland, used Solved (https://solved.fi/), a crowdsourcing intermediary company focused on cleantech advisory services, to develop a new residential area-related concept 'Net Positive Residential Area', including solutions for smart energy systems, energy and resource efficient design, sustainable materials, sustainable lifestyle shared services and goods, smart waste management, and water efficiency and mobility. The challenge included the following tasks: defining the preliminary parameters for targeted residential areas, co-creating a ready-to-use roadmap with feasible solutions and related business models, and support in realising such a concept. The concept was co-created by a crowd of 12 experts with a large variety of different areas of expertise from Solved's network of 500 world-class experts from all over the world involving 200 companies from various fields of expertise together with YIT's project team.

Crowds participating in equity funding

When it comes to funding ones business endeavours, the crowd can help — and it often will! Equity-based funding [11] means that an individual contributes money, and as return s/he gets shares of a company, which often — but not always — is a start-up. Equity-based crowdfunding represents an interesting opening for Europe, as in many EU countries the legislation is enabling it, whereas in the US, that was not originally the case: in 2012 US president Obama signed into law called The Jumpstart Our Business Start-ups Act or JOBS [13]. Some of its parts are still

pending. The focal point of the act is crowdsourcing and start-up community-related new rules and regulations; topics that have also been in the rising interest of the European Commission in Europe, and the Internal Market and Services DG has recently established a group to assist the Commission in developing policies for crowdfunding to help it to flourish while taking into account the interest of contributors (www.crowdfundinsider.com).

Currently, equity-based crowdfunding 'matchmaking' platforms vary from language and geographical market perspective in Europe; e.g. Crowdcube is an UK-based crowdfunding service, while FundedByMe originated from Sweden and is now active also in Finland, Denmark, Germany and Spain. Invesdor, Venture Bonsai and Vauraus Suomi are active mostly on Finnish equity-based crowdfunding markets. In terms of the size of the market, for example the three biggest crowdfunding companies in Finland have raised together over EUR 20 million equity funding. In comparison to GBP 84 million of equity funding in UK according to the UK Alternative Finance Industry Report 2014 by Nesta and the University of Cambridge [14].

Ideation and concepting — the typical concepts in engaging the crowd

Ideation is one of the most common application areas for crowdsourcing; one invites different audiences and exploits them for idea brainstorming activities. Then one cross-pollinates the crowd with a different experience landscape by a getting different, unexpected solution [12]. However, there is a fine line between doing this seriously [and honestly] and marketing campaigns where you get the audience excited but nothing actually happens after that. If idea crowdsourcing is part of company's true innovation and renewal endeavours, the company needs to know what to do with the ideas — how to embed them into the core of its business development and innovation practices. E.g. Atizo (http://www.atizo.com) is an example in EU for idea crowdsourcing, where multiple consumer brands but also manufacturing companies (e.g. Pago AG) are ideating together with the audience.

Using crowdsourcing for concepting can be organised for example as engineering competitions or be a continuation of engaging the crowd — i.e. potential users — to the next phase in the innovation process. In the later case, if wisely used by e.g. presenting concrete, alternative concepts to the crowd, one gets valuable feedback from the real users. One has to be thoughtful in building up the motivation for the crowd to contribute continuously [15], so that the minimum viable product sees the daylight of its audience. Estonian-founded crowdsourcing start-up GrabCAD (http://grabcad.com/), which was acquired by Stratasys, is a an example of a crowdsourcing platform and community that has been used by several manufacturing companies (e.g. Konecranes, Sovella, Lürssen Werft*)* in Europe to crowdsource conceptualisation of even quite complex industrial products.

As an example, Konecranes, a globally leading overhead crane manufacturer and provider of lifting solutions and service networks, used GrabCAD to crowdsource concepts for an indicator for detecting chain wear in their chain hoist. The Chain Wear Challenge was held from 30 October 2012 to 15 January 2013 and resulted in 43 solutions from the crowd of mechanical engineers, with a cash awards of USD 6 000 for the best designs. The jury for deciding the best solutions consisted of both Konecranes and GrabCADs employees. The engineering challenge can be considered as a concrete yet professionally a very demanding task, representing a functionality that has effects to the safety of Konecranes lifting products [16].

Marketing content with the paid crowd

When building up a new organisation (non-profit, an ecosystem, a company) one usually needs a logo, tone of voice and a brand to start with. Resources are often scarce, especially in the beginning of something new, and yet one should kick-off identifying and influencing the target audience. Crowdworking services can help i.e. in creating a logo, making a design for a website, or getting photos or audio as content. Usually these communities have tens (e.g. AudioDraft) or hundreds of thousands participants (later 'crowdworkers') (e.g. Scoopshot, 99Designs and many others). Currently, the most typical way to orchestrate the contribution of the crowd is that the crowdworker takes part in a challenge or a competition that the customer (i.e. the new organisation) has defined. There is no employment relationship between the crowdworker and the crowdworking service or between the crowdworker and the one posing the challenge.

When continuing towards marketing efforts in digital media (especially in social media) and understanding the quest for authenticity that the audience demands nowadays, why wouldn't the organisation ask marketing-like content e.g. good-enough social media marketing videos, audio and other content — to be produced by the crowd it has 'earned'? By the word 'earned' it is meant in the context of digital services where there one nowadays makes a distinction between paid, owned and earned media [17]. Hundreds of thousands crowdworkers can 'speak' the visual and oral language of the brand — instead of traditional advertising, digital marketing or strategic influencing and communication, it has been found that earned

media (e.g. word of mouth) is the most trusted source of information [18].

Services like eYeka, from EU, is operating in 12 languages for truly localised content, or US-based Tongal — which started from the supply point of view: Hollywood freelance manuscript writers are often either overloaded with work for periods like 12-24 months and then are unemployed for longer or shorter times, so they found a new channel in which to work. In crowdworking there is no fixed number of workers to start with.

Crowds funding product development

When the journey of the company continues, and it wants to test the attractiveness of its product or to invite crowds to co-fund the production, pre-purchase crowdfunding, as one form of crowdfunding, has gained a lot of popularity in recent years. Pre-purchase crowdfunding is in the sweet spot of combining earned media marketing (word of mouth i.e. the crowd contributes significantly to marketing efforts) and crowds contributing with money. As crowds vary, there are currently many such matchmaking platforms all around the world, based also on language preferences. The most known and oldest in the English speaking world are US origin Indiegogo and Kickstarter. However there is a boom happening everywhere where matchmaking platforms are being ramped up, as the costs to enter to the markets in the Internet economy are marginal. While pre-purchase crowdsourcing has been popular in consumer markets already for years, manufacturing companies in different industrial sectors have also begun making use of pre-purchasing in both early phases of product development as well as ramping up their production.

In Kickstarter for example, pre-purchasing has been used to fund the development of industrial products such as a modular desktop CNC machine [19], drone (autonomous robotboat) [20] and 3D printer [21]. New services have also become available for those companies that are planning to launch a funding campaign of an industrial product on Kickstarter, Indiegogo or Fundable, but are unsure if the product can be made at scale, what will the product cost and how much money needs to be raised or how long it will take to deliver the finished product to the backers. DragonInnovation (https://www.dragoninnovation.com/) is an example of such a service provider, which provides services for prequalifying the manufacturability of products from a crowdfunding campaign and in supporting the factory selection process and onsite factory project management for the funded product.

The best help desk — peer-users, the wise crowd

One of the oldest ways to make crowds work for a company's brand is inviting users and existing customers to test, give feedback and support each other in using the products and services that the company is providing; this is where customers serve each other and contribute to product development and go-to-market strategies. Nowadays, many software and consumer electronics companies say openly that they are not the experts in the usage of their products and services, as their audience knows best what to do with 'stuff they have bought'. Memes evolve and companies use the imagination of their audience in communication and act as a platform or an ecosystem builder between their audiences.

As an example, when making Internet search enquiries for a specific (software or electric device usage related) problem, the users do not end up at the official brand Q&A sites as the first hit, but find these communities, as the companies promote those sites rather than their own brand site. Examples vary from Microsoft to hardware and special hobby groups like the ones actually run by the brand itself, Suunto, a Finnish origin global manufacturer and marketer of sport watches, dive computers and precision instruments. Suunto is facilitating a sports community Movescount, where active, like-minded, result-orientated people share information about their experiences in extreme sports, provide user support to each other and to wider audience and develop apps for the ecosystem platform Suunto provides them with, and with this behaviour, while the company can increase user experience and brand loyalty, simultaneously the users feel they get more value for the money and most importantly, can express themselves better.

Recently, also industrial companies have started making use of communities and services for crowdsourcing testing of their products. For example, Numerex a company focused on the machine-to-machine (M2M), business-to-business market made use of uTest (http://www.utest.com/); a professional network of 150 000+ testers and QA professionals in a crowdsourcing complex testing of both software and also hardware of their product for tracking vehicles and assets.

Paid crowdworking — the new way to contribute, share and live

The last but not the least section in the Ferris wheel is participating in crowdworking, co-production. Completing volunteer-based crowdsourcing, a paying crowdwork industry is now quickly growing in scope and ambition: 'Crowdwork today spans a wide range of skill and pay levels, with commercial

vendors providing access to a range of workers and focused support for various task [22].'

There are great examples already emerging, especially in Asia, where crowdworking and new architectures of contributions generate employment [23]. Zhubajie, internationally known as Witmart (http://www.witmart.com/) states that it has more than nine million crowdworkers and by that it's the largest crowdworking site in the world. Microtask, a Finland-US based service is specialising low-skill tasks with a large reach.

Conclusion

We have described and argued here that crowdsourcing has entered a new era quite recently — the era of Industrial Crowdsourcing. We have presented related examples of use cases and crowdsourcing platforms that have come up within the very last few years.

The examples and many others have demonstrated that even tasks related to the development of very demanding business-to-business products and solutions can be crowdsourced in many innovative ways. In these cases, however, successful crowdsourcing usually requires several new types of competences, which can be achieved partly via intermediaries, but also own efforts are often required. The examples also show that crowdsourcing can help to achieve significant results and benefits in the case of industrial manufacturing companies, which in most cases match or even top the results that would be gained by completing the tasks internally or by outsourcing them by more traditional means. Quite often, the crowdsourcing approaches have resulted in very innovative and out-of-the-box types of solutions that very probably would not have been reached by traditional approaches. These outcomes are due to various mechanisms behind the so called Wisdom of Crowds and Collective Intelligence concepts, which emphasise particularly the heterogeneity of participants, their backgrounds and their expertise, which crowdsourcing platforms enable with much more ease than the traditional methods.

The various outlined crowdsourcing approaches and industrial company examples described in this paper have several significant implications for the renewal and competitiveness of manufacturing companies in Europe and elsewhere. As we are dealing with a new and potentially a disruptive change phenomenon, industrial manufacturing companies should certainly no less than follow carefully the developments in the area of industrial crowdsourcing, and try to be aware of how the new trends in crowdsourcing impact their industry and what the competitors are doing with crowdsourcing. But they should also be aware that the bold companies that start early to experiment with and adopt crowdsourcing practices themselves in their business may be the ones that gain an edge, which could be tough to catch up with by the latecomers.

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Research and Innovation Programmes Shaping Ecosystems for Open Innovation — Some Lessons

Abstract

This contribution investigates the role, organisation and functioning of European research and innovation programmes in fostering innovation ecosystems that generate new markets and business. Publicly funded research and innovation programmes can be interpreted in terms of systemic innovation instruments, addressing societal challenges and driving economic development in specified impact areas. Based on cases taken from the European Commission programmes in the domain of Future Internet and ICT, the paper identifies the required key conditions, resources, structures and processes that need to be set in place and evolve over the lifetime of the programmes. The paper confronts practical experience and insight gained in Future Internet and ICT programmes with scientific literature on systems of innovation and policy instruments, and results in recommendations for future planning of effective systemic innovation instruments.

Introduction

The European Commission's 2020 growth agenda has set the ambitious goal of the Member States investing 3 % of their GDP on research and development by 2020. Information and communication technologies (ICT) have been considered as the key enabler to accelerate growth, equality and sustainability, and consequently ICT research and digital single market development have become priority areas in the European policy agenda. The recent launch of several industry driven large-scale research and innovation programmes reflects the shift in the European policy implementation approach towards systemic innovation and towards the creation of hybrid innovation ecosystems. Research and innovation programmes have evolved from technology- and supply-side-focused initiatives toward broader cross-industrial and cross-policy programmes, involving all triple helix parties, and emphasising demand-side stimulation and societal and economic elements, rather than just technological impacts. In this context, the High Level Group on Innovation Policy Management [1] presents recommendations on shaping the EU Innovation Ecosystem, emphasising the importance of partnerships and social innovation as new ways of innovation governance.

Given the multi-disciplinary and cross-industry characteristics of the European programmes, these programmes could be termed 'systemic instruments' [2] where the objective is to engage and mobilise a wide range of stakeholders to tackle shared challenges. With the increased complexity of the thus created networks or ecosystems, it is important to understand how effective these programme instruments are as initiators of, or stimulus to, mobilising existing ecosystems, how the ecosystems evolve and operate, how they foster collaboration, and how they achieve the targeted long-term impacts. Current programme evaluation methods have been criticised for being too mechanistic and focusing on ex-post evaluations of the programme outcomes. Less emphasis has been devoted to how programmes create communities and ecosystems, to the internal dynamism of the ecosystems, and to the critical structural and operational conditions that are required in order for the programmes to fulfil their objectives as systemic policy instruments and foster long-term collaboration with third parties.

The aim of this contribution is to enhance our understanding of how research and innovation programmes may act as systemic policy instruments in the European context. For this, we are looking at both theory and practice. After a short overview of the issues, we first review some theoretical approaches related to systemic policy instruments, in particular covering the literature regarding systems thinking, transition theory, platform ecosystems and innovation management. Second, we take a look at practices in European RDI programmes in analysing the role of policy instruments to create effective innovation ecosystems for societal impact, and identify several open issues related to the desired and actual characteristics of such instruments.

Combining the practical and theoretical insights, we develop a holistic analysis of the role and capability of systemic instruments to create effective innovation ecosystems. The analysis centres on ICT-related programmatic instruments due to their pivotal role in European innovation policy but also draws from experiences in other areas.

Policy instruments fostering innovation ecosystems: issues

With digitalisation and the thus enabled new business dynamics the link between innovation policies and national innovation systems has raised significant interest. Over the last decades, innovation policy approaches have evolved from sectorial, supply–orientated technology policies towards broad-based and increasingly challenge-driven innovation policies. Policy focus has further evolved from technological research and development

towards promoting service innovation and currently societal renewal. This broadens the policy scope significantly towards the adaptation side and towards demand-side policy instruments, and ultimately toward systemic innovation policies as combination of supply- and demand-side instruments. The perception of the role of industrial and other societal actors such as grassroots communities has also evolved, and both policy and other actors share a heightened interest for joint development and innovation. A relatively new objective for innovation policy instruments is to help establishing innovation ecosystems. Interesting examples can be found in several regional and national innovation policy instruments, like Industry 4.0 in Germany [3], Top Sectors Public Private Partnerships in The Netherlands [4], or the SHOK Centres for Excellence in Research in Finland [5].

The importance of creating effective innovation ecosystems is recognised in European-level practice as well. Representative examples are e.g. 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. It is increasingly recognised that due to the intense technology, market and actor dynamics, innovation ecosystems are in continuous change. Neither top down nor bottom up approaches alone are sufficient to resolve 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.

Environments within which RDI programmes function are characterised by technological, market and political uncertainties which are multiplied by the requirements for openness and transparency while operating with public funding. Decisions taken during the preparatory and early stages of RDI programmes may determine the impact and results to a large extent. Thus the design and implementation in early stages merit close attention. During the shaping and implementation of an RDI programme, the RDI programme ecosystem is evolving and gradually becomes more closely intertwined with the surrounding socio-technical ecosystem. This way an RDI programme evolved in its ecosystem environment establishes a 'living lab' within societal contexts, and provides the foundation or platform for addressing societal challenges.

In order to better understand the phenomena at stake, the following questions are addressed:

- Which are the critical characteristics of RDI programmes (such as governance structures, partnership models) stimulating the creation and evolution of successful research and innovation ecosystems?
- How to identify the 'design characteristics' of such programmes, and how to measure the effectiveness of such research and innovation ecosystems as a sum of their parts?
- What are the implications and gained insights of considering RDI programmes as systemic instruments in the context of research and innovation ecosystems? How to address systemic issues such as 'decision flexibility' (room for manoeuvre) and 'resilience'?
- What are the key bottlenecks and barriers for further development and sustainability of the innovation ecosystems?
- How may systemic instruments concepts and insights gained from RDI programme cases help us to enhance the design of effective RDI programmes in the future?

From systems of innovation towards systemic innovation instruments: theory

A concise discussion of theoretical approaches to understanding systemic policy instruments and innovation ecosystems may help us in understanding the design, implementation and effectiveness of such instruments. With the changing policy landscape over the last decades, research on innovation policies has matured significantly in recent decades, shifting from neoclassical analysis and Systems of Innovation theory [6], [7] towards Open Innovation paradigms [8]. Broader socioeconomic approaches incorporated political, social, cultural, regulatory and environmental variables into a multi-disciplinary analysis [9]. Despite these developments, current research has been criticised for the lack of attention to socioeconomic outcomes [10] and a focus on the final phases and ex-post evaluations of innovations [11]. The main part of the debate on innovation impact on economic growth centres around technology and infrastructures [12], is failing to appreciate the underlying institutional, capability and learning-related aspects. With globalisation and the increasing complexity of societal challenges, policy focus is shifting from national level increasingly to supra-national contexts and sectorial policy frameworks [13].

Modern innovation literature strongly emphasises the early involvement of users and a diffusion of innovations in networks [14]. The increasing tendency towards openness of innovation networks has also promoted interest in emergent and self-steering network governance, making it difficult to predict their evolution. Within this context of open, networked innovation, the nature of innovation

policy instruments as well as the role of the State versus other actors within ecosystems of innovation has received a lot of attention. This is exemplified by the recent challenging work of Mariana Mazzucato [15], demonstrating that public funding of research and innovation by risk-taking 'entrepreneurial states' has played a key role in promoting technological innovation, and bringing forward that innovation ecosystems are required that build upon symbiotic, rather than parasitic, public-private partnerships to sustain the impact over the longer term.

Several academics have proposed the concept of 'systemic instruments' in innovation policy [2], [16]. This stream of work investigates the structure and function of policy instruments, in particular the organisation of innovation systems, the management of its interfaces across sub-systems, the capability for visioning, learning and experimenting, and the demand orientation. This work is useful as a conceptual framework for analysing systemic problems. However there remains a need to better understand the role of decision-making, planning and common visioning mechanisms in practice, as well as the role of cross-organisational culture differences, which affect the evolution of multi-actor innovation ecosystems.

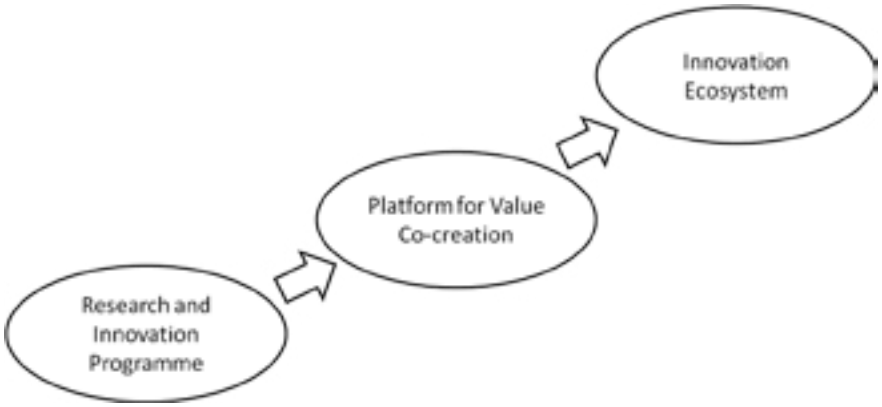
The literature on industrial networking and ecosystem platforms provides a lot of interesting insights in the functioning of innovation ecosystems. Over the past 20 years, research has been carried out on various themes related to the positions, processes, structures and relationships of network actors. It builds on the premises that industrial networks are emergent systems, advancing all parties economic and societal interests [17]. The relations and distribution of knowledge and resources is asymmetric, and the participants select their position in the network according to their strategic objectives for the collaboration. Industrial networks have now evolved from closed networks built around an anchor firm toward open ecosystems, around technology platform with complex inter-organisational relationships. Value is created as a cumulative value of the partners resources in transactional and transformational activities. The parties' value propositions are intertwined, so the companies must adopt strategies that benefit the whole ecosystem. Critics of economic network analysis claim there is too little focus on environments external to the ecosystems and lacking attention to the inter-organisational processes.

Recent research trends account for these weaknesses and apply multi-disciplinary research on technology platforms as a representation of emergent industrial networks. Platform research concentrates on typologies, launch mechanisms, strategies and governance [18]. Platform ecosystems are considered as evolving organisms that cannot be purpose built and rigidly managed, but rather considered as sets of resources that can be orchestrated towards a common goal. Technology platform literature takes the position that independent components of a platform are in a complementary relationship and form a system. The systems build around boundary objects, which in these cases would be a technology platform or a standard. This analogy applies for the European ICT programmes, where the ecosystems are built around joint technology development activities, or a physical platform (Future Internet PPP). Platform ecosystems literature emphasises the role of a focal actor for the business networks, who is typically the platform owner [19]. This applies also to the European Programmes, where the CSA type second-order organisations orchestrate ecosystem development and steer for joint outcomes.

Technology platforms can even be seen as a new representation of the open innovation paradigm. The platform owner's interest is to promote a platform for users and developers, to make the platform offering more attractive. The ecosystem can consist of various types of offerings and business models, while the platform owner defines the interface and quality criteria for the inputs. Thus, the created ecosystem creates a new value logic and opportunities for entrepreneurs and SMEs to build on the ecosystem offering, or use it as a channel to reach a broader customer base. Open and closed platforms have different orchestration needs [20]. This proposes that as the programme-initiated platform ecosystems evolve and become more open, the governance structures should be adjusted accordingly. This has been the case in the programmes, but sometimes it is in reaction to challenges rather than proactive, as we will discuss this in sections below in more detail. These challenges are pertinent also in the innovation ecosystems formed in the European research programmes. Early stages are critical, while difficult since the joint culture, discourses and trust have not been built yet. On the other hand, early user involvement is desired, even if the offering is limited, non-validated and the network externalities not yet visible. In many cases the platform owner decides the rate of evolution of the platform [21].

As an over-all conceptual picture of the development towards innovation ecosystems as emerging from literature we suggest a transition pattern (Fig. 1). Research and innovation programmes triggered by emerging disruptive technologies evolve towards the establishment of platform ecosystems, which aim at facilitating business networks and co-creation. Grounded in such platforms the development continues in shaping wider sustainable innovation

Figure 1: Development pattern towards Innovation Ecosystems



ecosystems. The next section discusses some elements in this evolutionary process drawn from the practice of European research and innovation programmes.

Evolution of research and innovation programmes and PPPs in practice

The European Commission's main instruments for implementing jointly agreed research priorities have since 1983 been the Framework Programmes (FP). In an attempt to respond to the US and Asian developments, the funding schemes increasingly emphasise systemic, large-scale projects, innovativeness and the analysis of the societal and political contexts [22]. For ICT innovation in particular, the fundamental unpredictability of products and services usage has revealed a clear demand for European-level research. With the Horizon 2020 EU policy framework, the Commission has responded to the challenge by establishing more open and networked forms of collaboration between industrial, government and academic stakeholders on the one hand, and the public sector on the other. Consequently, the Europe 2020 Innovation strategy and its European Union Flagship Initiatives emphasises the investments not only in corporate R & D and science and technology-driven research, but also on public-private collaboration and innovations to address the major societal challenges.

Some recent RDI programme evaluations reveal that the European research funding programmes have not been as effective as anticipated in terms of their technical, societal and economic impact ([22], see also [1]). Despite the broad-based agenda setting for the Frame Programmes, to date, the programmes have been predominantly explorative research instruments, whereby a significant amount of scientific knowledge has been created. However, the programmes have been increasingly criticised for the lack of exploitation capability and impact on the markets and actors outside the research consortiums. The Commission has addressed these identified challenges through incremental improvements in the administrative structures and focus of the programmes, but more radical change and renewal has been called for [23].

New approaches and gradual improvements are being experimented with. Representative examples of such approaches are the Public-Private-Partnerships (PPP) for research. The programme focus on the research PPPs springs from putting market development more at the forefront, where the private sector is increasingly taking on activities previously considered as the responsibility of the State. In this view, the State becomes the 'buyer' rather than the supplier of the services [24]. With this, the public sector participates in research partnerships on the one hand, as a service contractor, implementation accelerator and co-creator, and as a regulator on the other [25]. The new PPPs for research simulate real market environments, where the public sector participates in a co-creation process with the private sector, and thereby can experiment and simulate the changing roles and relationships among the actors. It remains to be seen whether these market-orientated developments generate the kind of 'symbiotic' public-private partnerships and ecosystems proposed in [15].

The recently launched European Commission PPPs for research aim for sustainable European-level impact, not only on technological development, but also on the societal front in the form of increased harmonisation and standardisation, accelerated market acceptance and creation of a solid evidence base for European-level policy recommendations. Simultaneously, the programmes are expected to initiate meaningful multilateral conversations with counterparts around Europe, and thus create innovation ecosystems. Research PPPs differ from normal collaborative projects in the FP7 in that industry has an important role in developing the multiannual Roadmaps. Unlike the Joint Technology Initiatives (JTIs), the PPPs have not been set up as legal entities. Research PPPs have the potential to address the whole value chain and renew companies' confidence to invest in long-term

research with a pre-defined budget and ensured continuity. The PPPs also place increased emphasis on short-term impact and exploitation.

The first evaluations of the PPP initiatives, 'Factories of the Future', 'Green Cars' and 'Energy Efficient Buildings' found that the research PPPs have been an effective response to the financial crisis of the time [26]. However, it was also assessed that they are unlikely to achieve the aim of making a difference to the competiveness of European industry unless given longer-term support. The researched PPPs have facilitated closer working relationships between the Commission and industry for setting goals and longer-term research roadmaps. It was further realised that much tighter collaboration between the stakeholders is necessary for achieving the targeted industry level transitions and impact.

Particularly on the programme governance, the current informal arrangements were considered to lead to some uncertainties and insufficient transparency of the processes. Programme reviewers recommended to further formalise partnerships and to define partners' roles in more detail. Governance structures should involve broader sets of different stakeholders and include complementary macro-level competences e.g. foresight, emerging technologies, commercialisation of research results, and should be coordinated through a CSA type of organisation acting as a single reporting point to the Commission.

The analysed PPP programmes represent the current state-of-the-art systemic policy instruments, collecting all relevant parties to a large scale, longitudinal collective action. The programme agendas are constructed based on broad-based public consultations, expert reviews and industrial and governmental consensus meetings in order to ensure relevance, as well as rational and true incentives for all parties. The evaluations point out that the programmes have evolved in the right direction with increased impact and relevance, and capacity for renewal and ecosystem creation.

Shaping innovation ecosystems for the future Internet

Within the domain of the Internet and ICT it is instructive to compare three examples of large-scale research and innovation initiatives that have been organised along very different principles: the Future Internet PPP (FI-PPP), the Future Internet Research and Experimentation programme (FIRE) and the EIT ICT Labs. These cases are highly different in terms of the scope of activities and results, funding and governance models, positioning within the Future Internet landscape, and activities orientated towards establishing an innovation ecosystem. We analyse these initiatives in terms of their internal design, structures, governance and processes, as well as their integration and engagement with the surrounding broader European ICT community.

Table 1: Current RDI programmes compared in the domain of ICT

	FI-PPP	FIRE	EIT ICT Labs
Main research and innovation themes	Open cloud based platform of APIs for developing new collaboratively created services for various application areas	Federated testbed facilities for research, validation and adoption of Future Internet technologies (networking, mobile / wireless, IoT).	Wide range of technologies and application areas. Specific focus on acceleration, incubation as well as education.
Actor network development	First phases closed, emphasizing value creation among program partners, third phase open, focusing on broad based adaptation and use.	Initial focus on academic experimenters, currently widening towards SMEs, industry, new initiatives (5G). Open access and open calls attract facility users and experimenters also from business.	Strong focus on community building and knowledge transfer. Actor network is built around node networks across Europe, and includes industry, SMEs, academia.
Program design and project development process	Industry level initiative. Technology platform project, use case projects and facilitation and support action. Collaboration agreement between all program partners. Structured rules for third party participation.	Research and experimentation oriented initiative driven by the Commission in consultation with FIRE community. Facility projects and research projects as well as coordination and support actions (CSAs). Project specific contracts.	Strategy process with all actors involved. Run as a company with a CEO, executive steering board and management committee.
Program implementation	Implementation in three two-year phases.	Project calls as a part of FP7, H2020; continuity with varied lengths of projects.	Sustainability ensured by independent nodes with own funding, regular funding calls.
Results	Platform and tools for smart applications development. Open stack of APIs available for developers and entrepreneurs. Validated technologies. Platform ecosystem development.	Testbed facilities responding to evolving academic and industry needs, experimentation tools and methodologies, European-wide federation of testbed facilities	Educational programs, research projects, portfolio of business acceleration services, like accelerator, incubation and mentoring
Governance and decision making structure	Rigid and structured governance mechanism, documented in the collaboration agreement.	Based on Work Programmes and projects. Strong orientation on individual projects. Loose inter-project alignments.	Co-location centers with own governance, joint issues in centrally governed boards with participation from all partners.
Societal interfaces	Target for real life implementations, living lab type test environments. Public sector driving adaptation through PCP measures.	Strong links with universities and academic experimenters, and education. Increasingly linkages established with related Future Internet initiatives.	Intertwined with universities educational programs, local innovation communities, living labs and SMEs.
Program and ecosystem creation	Ecosystem building via use cases in thematic domains and in ICT domain. Engaging SME entrepreneurs, startups, developer communities, public sector activities e.g. smart cities.	Traditional focus on ecosystem building with research players. Increasing collaboration with other Future Internet initiatives may broaden scope for ecosystems building.	Focus on building local ecosystems around co-location centers and thematic networks around various research themes.
Program and societal impact	Validated use cases of cross-industry collaboration on shared technology platform. Opportunities for SMEs and entrepreneurs.	Establishing a core infrastructure of federated testbeds as a resource for users (academia, research institutes, industry, SMEs).	Strong impact on local level, seeking for more collaboration with other ICT initiatives and impact on the EU level.
Sustainability and exploitation potential	Institutionalizing the program management as NGO, results further worked on in future PPPs, like 5G	Testbed facilities sustainability considered to largely depend on public funding. Increasing collaboration with other initiatives aim at broaden the sustainability base.	Institutionalized structure, strongly independent partners where EIT ICT Labs funding only complementary.

The main message of these cases is that different organisational forms for research and innovation programmes lead to different but significant technological and societal economic outcomes and functional ecosystems. Given the different programme structures it still can be said that each of them target societal goals and engage actors within broader European ICT research and innovation communities. The European Commission and stakeholder communities are also heavily involved in the implementation of each of the programmes. In the following we address some main characteristics of the programmes in order to learn some initial lessons on how programmes may lead to effective innovation ecosystems.

Enablers for innovation ecosystem building

Taking into account the viewpoints presented above both from theory and practice, in our view key 'enablers' for the transformation of research and innovation programmes into effective innovation ecosystems include the governance structure of actor networks, the shaping of collaboration processes, the building of programme communities and the formation of platforms laying the ground work for sustainable innovation ecosystems.

Actors and networks

Actor profiles differ significantly for the three cases. The FI-PPP is an industry-led initiative and 70 % of its composition consists of companies, whereas FIRE represents a typical research-orientated programme with less than 50 % corporate partners. In the EIT ICT Labs there is specific focus on accelerator and incubation activities, and thus participants in the projects include significantly start-ups, entrepreneurs and innovation agencies. The co-location centres are affiliated with universities. Different actor profiles result from the different positioning of the programmes in the innovation value chain. FIRE is more involved in the early stages of innovation, whereas FI-PPP and EIT ICT Labs operate closer to market, and have a strong focus on SME engagement and a broad user base. Vice versa as well, the participant profiles and credibility as business partners in turn shape the development of the ecosystems and the new parties' decisions to choose these ecosystems. From these experiences it appears that one of the key conditions for building successful innovation ecosystems is to include all major actors in the field. Relevant and high-quality partners attract better partners, accelerate learning and lead to better results and impact. The diversity of partners builds on the holistic view to the challenge at hand, and adds to credibility and later acceptance and adaptation of technologies. Especially in the FI-PPP the partner organisations represented the state-of-the-art companies in the field. A peculiar observation was the number of organisations new to the EC programmes (30 %). However, a new level of challenge was identified: the representatives from the organisations did not always have the mandate or relevant experience to the activities they were assigned to. This lead to delays in decision-making and somewhat watered down programme-level outcomes. Further challenges were caused by the partly conflicting goals of the i) organisations, ii) projects and iii) the programme.

Collaboration processes

The main differences lie in the intensity of the activities and closeness of the relationships among the actors. In FI-PPP all the parties are bound by a collectively agreed collaboration agreement, which stipulates the rights and responsibilities of each party. This enables closer collaboration and exchange of data. Furthermore, the partners share a boundary object, the Technology Platform, and thus it constitutes a more tightly intertwined ecosystem. The programme outcomes are concrete products, and thus the outcome is easier to evaluate in economic terms. The governance structure is rigid with monthly meetings and clear decision-making rules and structures, which imply that there is strong emphasis on achieving programme-level impacts in addition to the impacts on an individual project level. The responsible party for orchestrating for these programme-level outcomes is a dedicated CSA project. The FIRE community has been built over a longer period of time, and shaped by the changes in the ICT development landscape. The ecosystem is more homogenous in terms of core actors, but it also involves a significant amount of third parties on ad hoc bases. As such the ecosystem can be considered more self-steering or emergent, and there is no central party orchestrating overall programme-level outcomes. Especially in the early stages, ecosystems require rules and rigid governance in order to build solid foundations for collaboration. This involves vision building, framework for progress evaluation, quality criteria and rules for participation. With this the mission and value proposition can be articulated for potential parties. This implies that effective ecosystems require a focal actor that orchestrates the collaboration and maintains the momentum. In the FI-PPP the programme collaboration was operated by a CSA action, as a Programme Office. The challenge with the set up was the unclear mandate of the CSA. The role was to initiate collaboration around different themes, but then the topics and decisions would come from the participating companies. However, with the lack of trust and steering in the early stages of the programme, decisions were not made. The challenge was highlighted by little allocations of resources for programme-level activities,

since this was not budgeted, even a contractual obligation for the first phase projects, and not followed up and requested in project reviews.

Platform development

The Future Internet PPP is an excellent example of initiating ecosystem development within a programme, enabled by the FIWARE software platform. Still there remain challenges in synchronising technical platform development and the creation of innovation communities based on the platform. As we noticed, the platform owner decides the rate of evolution of the platform. This was seen also in the Future Internet PPP, where the progress of the platform project FIWARE was pivotal to the progress of the other projects. In the evaluations it was agreed that the platform project should have been started before the Use Case projects, so that there would have been more technologies available to start with. Similar issues were encountered with the set up 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 offerings. Such delays may cause lack of impact. EIT ICT Labs has since focused on mobilising the community with frequent calls and tenders. For the FIRE community the boundary objective can be the ICT software and applications test beds and facilities, which would thus constitute the platform for activities. With numerous very different set-ups it has been challenging to stipulate common rules, quality criteria and performance indicators on a programme level. Rough generalisations dilute the criteria and their purpose.

Programme communities and ecosystem relationships

We observe very different outcomes in terms of innovation ecosystems. Apparently, the preparation phase and early stages for cementing the structures and processes for collaboration are critical. As an example, FI-PPP had the 'consensus workshops' before the programme started to agree on joint planning of collaboration structures. Many elements and enablers for programme success — or failure — are set in the very early stages, or even before the programme started. FI-PPP includes several thematic 'sub-ecosystems', which collaborate with industry partners in that specific domain, as well as local partners that operate in the countries and areas where pilots take place. These ecosystems are likely to remain stronger after the lifetime of the programme, since they have more specific joint objectives and agendas. EIT ICT Labs partners include a variety of different actors with their own focus areas. The co-location centres are firmly grounded with the local ecosystems, which remains the priority for the activities and impact creation. The collaboration with other centres is project based and builds on knowledge sharing and interest in niche development initiatives. Ecosystems come in many forms, depending on their mandate and objectives. The FI-PPP programme had numerous objectives on various levels, which led to the formation of numerous ecosystems consisting of the core partners to the programme and other stakeholders. Ecosystem development was quite formalised and collaboration structured with new partners joining through funding calls and pilots. This model worked in the early stages while the platform and offering was being built. New models for engagement were needed to trigger broader use of the technologies. Barriers for use were caused by the unclear sustainability plans. Since the future updates and maintenance of technologies was not clear, commitment to use was lesser.

Conclusion

The aim of this paper was to explore the conditions that enable research and innovation programmes to initiate sustainable Innovation Ecosystems. So far this topic has not yet been thoroughly investigated as theoretical research into innovation systems and policy instruments has been relatively disjunctive from the practice of large-scale research and innovation programmes. Also cross-links between the different scientific domains in innovation theory are still lacking. With the fast-changing practices of industry networks and open innovation, researchers struggle to keep up. As an example, the more established literature on innovation policies and systemic instruments is fairly isolated from emerging literature regarding platform economics and open innovation.

Still, several results of theoretical studies are valuable and should be considered in the future design of programmatic instruments. First, the work on functions of systemic policy instruments correctly emphasises the role of structures and processes for organisation of innovation, learning and experimentation platforms, demand articulation and other conditions related to knowledge exploration and exploitation. Second, the literature on platforms provides important concepts and findings such as the role of platform orchestrator, correlation between the frequency of interactions and results, and the creation of innovation communities and partnerships based on mutual advantage in all stages of the co-creation process. Third, innovation literature emphases the early involvement of users and patterns in technology adaptation, that can help upfront planning of investments and returns. We consider the formation of platform ecosystems an important transition phase in the development of programmes towards innovation ecosystems and recommend that the design of future research and innovation programmes integrates these and

other key enablers to facilitate innovation ecosystem creation.

As a final comment, the organisational, human and cultural aspects of how research and innovation programmes effectively function as temporary organisations should receive more attention. Designing a governance model guiding effective multi-party collaboration in such programmes is an important aspect. Another key aspect is building a programme community grounded in trusted relations and commonly shared vision among the participants.

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Open Innovation and Its Implication for Universities

Abstract

The article analyses open innovation trends and drivers affecting universities. Driven by open innovation universities are placed in the centre of innovation ecosystems and are playing an ever-active role in knowledge creation, exchange and transfer. Whilst there are similar effects of openness on all organisations, universities have to consider specific factors in adapting to the open innovation paradigm. Such factors include a specific focus on knowledge co-creation and use-inspired research, the need to develop value networks, focus on stronger IP management, the need to review their curriculum to respond to new skills and market demands, the rise of open education platforms and social media, community engagement and crowdsourcing.

Introduction

Open innovation (OI) is a strategy adapted by companies in order to allow the flow of information, ideas, knowledge, capabilities and resources in and out of organisational boundaries [1].

The open innovation term was coined by Henry Chesbrough who defined the concept as follows: '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' [2].

A recent search of Google trends produced about 85 million results in less than a second [3] with high regional interests from South Korea, Finland, Denmark, Austria, Switzerland, Germany and Sweden. Such strong interest in open innovation can be potentially linked to the growing global success of South Korean businesses (e.g. LG Electronics, Samsung) and design-led innovation practised by Scandinavian companies. Further research is required to establish a more accurate correlation.

There is also a strong interest from an academic community studying open innovation. A research led by Professor Gann demonstrated a growing interest in the open innovation phenomenon over the last 10 years [4].

As a result we are observing a trend which is reshaping the R & D process from in-house R & D to an open model where ideas flow in and out of organisations to advance the development of new technologies. *Table 1* summarises key trends in innovation before and now.

Table 1: Innovation before and now

Innovation process before	Innovation process now
R&D focus	S&D and/or A&D
Technology driven	Business value driven
Knowledge ownership	Knowledge access
Product orientation	Business model orientation
Engineering job	Everyone's job
Market push - technology driven	Market pull - need driven
Closed innovation	Open innovation
Calculated risk	High risk investment

Companies are now adapting new processes and business models, shifting from traditional R & D (research and development) strategies to S&D (search and development) and A&D (acquire and develop). Examples of such approaches are the P&G Connect & Develop and Shell GameChanger programmes. Business competitiveness no longer depends on companies' internal capabilities but on their ability to absorb, adopt and exploit external knowledge and resources. The ability to stay agile and recognise market trends and needs is becoming a question of survival. In addition there are stronger opportunities to experiment with potentially risky technologies outside the company's boundaries using venture capital support and finances.

These changes affect all organisations and institutions including government, public institutions and universities. Therefore it is important to understand the implication of open innovation on organisational development and growth.

Open innovation drivers affecting universities

While companies are reshaping their organisational boundaries, universities are playing an ever-increasing role in contributing to knowledge-based economies.

The Knowledge Economy Index developed by the World Bank [5] considers education and innovation factors in measuring national effectiveness in developing knowledge-based economies. The Global Competitiveness Index (GCI) developed by the World Economic Forum [6] also measures education and innovation factors as fundamental for national competitiveness and economic sophistication.

According to Chesbrough there are a number of factors which drive open innovation and affect the way organisations operate. Universities are not the exceptions and are affected by similar trends including:

- **information, capital, people are becoming global assets**

The mobility and availability of highly educated people and researchers has increased over the years. As a result, large amounts of knowledge exists outside the research laboratories of large companies. In addition there is an increasing trend of employees moving between industry and universities or keeping dual appointments. This results in knowledge flows between universities, companies and external stakeholders;

- **knowledge is becoming a source of competitive advantage**

This trend positions universities as key partners for industrial companies and places them in the epicentre of regional and national innovation ecosystems;

- **technology pace is increasing**

This drives universities to transform from classic academic institutions with an ivory tower mentality to entrepreneurial institutions proactively managing their knowledge. Universities are building and managing strategic partnership and alliances with industry and technology companies;

- **IP management is becoming a vital component of universities' strategies**

Universities are becoming more business savvy in order to protect, manage and profit from their proprietary knowledge;

- **innovation across the entire value chain**

This process positions universities as a key contributor to regional innovation and competitiveness. In the era of open innovation universities play a more strategic and wider role as suppliers of an educated work force, knowledge, expertise and emerging technology. At the same time universities act as partners and customers of regional services, SMEs and large companies;

- **growth of venture capital markets**

This trend makes it possible for promising ideas and technologies to be further developed outside universities thus allowing universities to profit from their knowledge and research outputs;

- **customer expectations are increasing**

Universities are also affected by increasing customer sophistication, increased transparency and digitisation. Such trends force universities to adapt innovative marketing strategies embracing social networks, interactive websites, intranet and content marketing techniques in order to enhance their conversation with potential students, staff and public;

- **pressure on universities to demonstrate impact from their research**

All economic players experience a growing economic and fiscal pressure. As publically funded institutions, universities are required to demonstrate impact from their research. There is a growing public scrutiny of government funding, which places additional pressure on universities to carry out cutting-edge research balancing between pure academic curiosity and translational outcome. For example, research impact has been included in the new REF (Research Excellence Framework) assessment, which is the system for evaluating the quality of research in UK higher education institutions [7].

Open innovation university

To respond to global open innovation challenges universities need to open up their business models and review their processes in order to facilitate open innovation interactions. There is a global rise of innovative and entrepreneurial universities which are opening their organisational boundaries to play an active role in regional and national development. We will define such universities as Open Innovation Universities.

A typical open innovation university infrastructure includes the following functions: strategy office to monitor international trends and benchmarking; marketing and communication department to interact with stakeholders and public; alumni relationship office; research office to monitor and develop funding opportunities; technology and knowledge transfer offices; education technology structures to develop education and learning products; industry liaison office for developing partnership with

commercial companies; enterprise infrastructure focusing on entrepreneurship agenda within the university and professional and executive education units offering commercial programmes. An open innovation university infrastructure is closely connected to government innovation initiatives, policies and research assessment strategies. *Figure 1* depicts an organisational structure of an open innovation university.

Figure 1: Open Innovation University organisational structure

To respond to an Open Innovation agenda, universities are further adapting their strategies, processes and policies in order to develop innovative and sustainable business models. Key trends in universities' open innovation practices include:

- knowledge co-creation and use-inspired research;
- developing value networks and ecosystems;
- need for stronger IP management;
- need for developing new skills and capabilities in students;
- open education programmes, e.g. MOOCs, SPOCs;
- increasing use of social media;
- community engagement and crowdsourcing.

We will now consider these trends in further details.

Knowledge co-creation and use-inspired research

In its Global Information Technology Report 2010-11, [8] the World Economic Forum provides ranking of university-industry R & D collaboration based on a survey of senior leaders from the industry. According to the survey the top five countries ranked by executives include the USA, Switzerland, Finland, UK and Sweden.

The ease of doing business between universities and industry is a key factor in pursuing an open innovation agenda. Both university and industry represent inherent differences in their goals and organisational cultures which can affect the effectiveness of knowledge and technology transfer between partners. Such differences include:

- differences in time horizon (long term vs short term);
- differences in confidentiality (open source publications vs competitive nature);
- organisational differences (curiosity-driven vs problems-solving);
- a different approach to IP.

Table 2 depicts the key differences affecting university-industry partnerships.

Table 2: Cultural differences between academia and industry

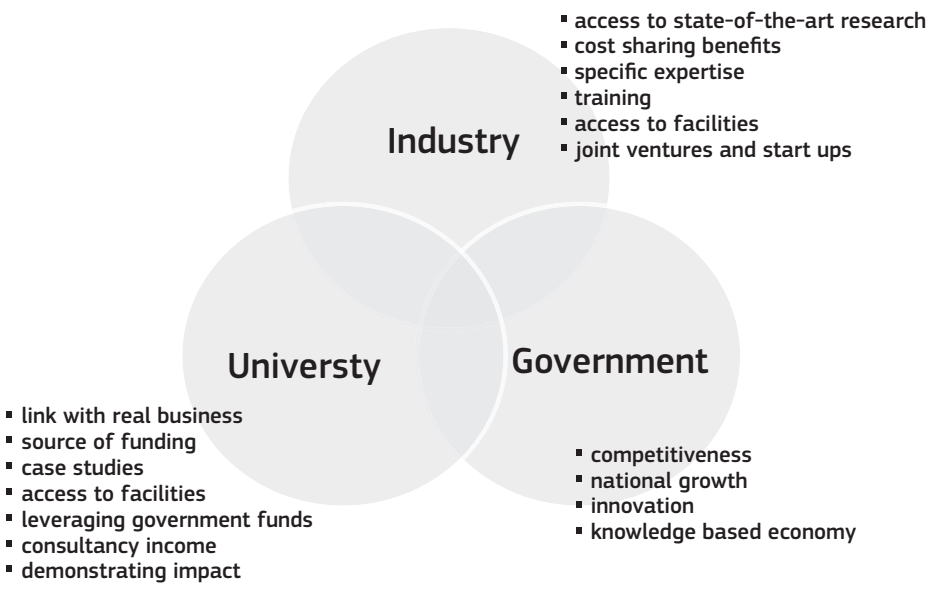
Parameter	Academia	Industry
Responsibility	Social responsibilities	Shareholders responsibilities
Research type	Basic research	Applied research
Output	New knowledge	New product
Research orientation	Curiosity-driven research	Problem-solved driven
Openness	Publication & openness	Ownership & confidentiality
Cultural mindset	Sharing	Control
Research strategy	Scientific freedom	Technology roadmaps
Time horizon	Long-term	Short-term

A traditional role of university research is to conduct fundamental pre-competitive research while industrial labs carry out technology development. The UK Science & Innovation investment framework [9] proposes a research model to combine fundamental and applied research 'to bring together public and private funding and research talent to work on major research challenges with major societal impact.'

The proposed model refers to the Pasteur quadrant and was proposed in 1997 by Donald Stokes [10] who wrote a book for science policymakers to provide a new way of looking at the relationship between science and technology. The main purpose of the book was to analyse, critique and eventually rethink the linear model of the relationship between fundamental science and technology development.

More recently Etzkowitz [11] proposed the triple helix development strategy which is becoming a powerful national tool to develop innovation mechanisms and build stronger links between private and public research sectors. Key elements of the triple helix model are government, university and industry with overlapping interaction mechanism and a free circulation of elite between these areas. The mutual benefits of such interactions are shown in *Figure 2*.

Figure 2: Triple helix model and the benefits to partners



Examples of successful university-industry partnership include the IBM Open Collaboration Research Programme (OCR) [12], long-term grand challenge programmes (e.g. Royal Dutch Shell and Imperial College London), shorter idea labs programmes (e.g. HP Laboratories' Innovation Research Programme) [13].

Developing value networks and ecosystems

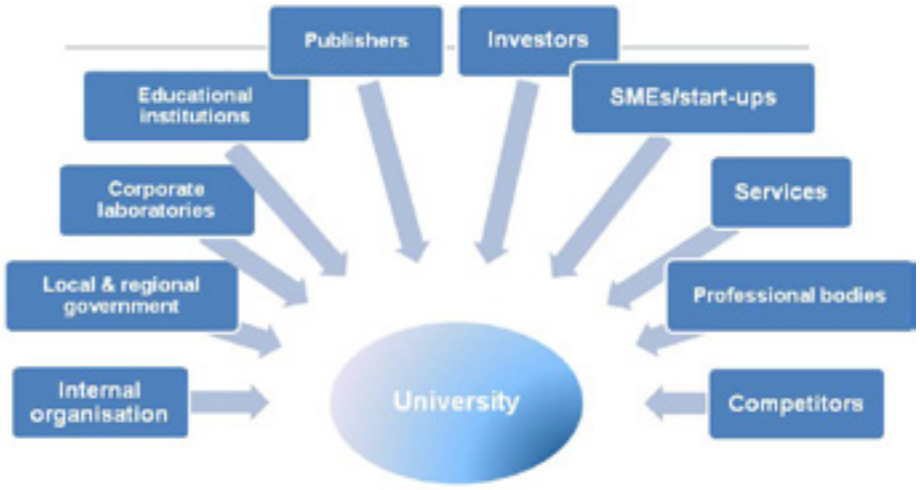
The European Commission report on improving knowledge transfer between institutions highlights strong European research base. At the same time it states that despite its high-quality research,

Europe has a relatively low commercialisation rate [14]. This so-called European paradox results from a number of reasons including a less systematic and professional management of knowledge and IP, cultural differences between business and science communities, lack of incentives, legal barriers and fragmented markets for knowledge and technology.

In 2010 entrepreneur Hermann Hauser produced an influential report, The Current and Future Role of Technology & Innovation Centres in the UK [15], which identified best international practice and made recommendations for long-term investment in a network of the UK technology and innovation centres which would 'deliver a step change in the UK's ability to commercialise its research'.

To achieve the goals, the UK Government Technology Strategy Board has been implementing a number of schemes to accelerate knowledge and technology transfer. Some of the schemes, e.g. Catapults network [16], Small Business Research Initiative (SBRI) [17] are specifically aiming at universities and developing value networks and partnership with large businesses and SMEs. For example, Catapults centres accumulate expertise in specific technology domains to accelerate the rate of innovation and commercialisation of new technology and to enable the development of innovation value networks. Figure 3 shows the position of a university within an open innovation value network as a hub of innovation dialogue and activities. Universities are playing a critical role as a key source of technology landscape mapping, trends and technology scouting [18]. In parallel, companies are increasingly adapting a systematic technology scouting process building strategic partnership with universities.

Figure 3: The position of a university within an open innovation value network



Need for stronger IP management

Open innovation imposes new challenges on universities. They need to find a fine balance between sharing their knowledge via scientific publications and conferences whilst trying to protect their inventions, manage intellectual property and benefit from its commercialisation.

According to the Association of University Technology Managers (AUTM) universities provide a significant economic impact from their research [19]. According to the AUTM reports university licensing increased the USA's gross industry output by USD 836 billion (1996-2010), university technologies supported an estimated three million jobs in the economy (1996-2010) and technology transfer contributed to creation of 671 new companies and 591 new products in 2011 alone.

There is an observable trend within universities to review their research strategies focusing on developing core expertise and high impact technologies. Most successful universities run their own Technology Transfer Offices (TTO) and have strong teams of technology managers. One of the UK's leading companies in technology transfer — Imperial Innovations — grew from the TTO to become the first UK university commercialisation company to complete the IPO.

Imperial Innovations' business model includes all elements of technology commercialisation from technology scouting, IP management and investment into promising technologies. From 2006 the company invested GBP 143.1 million and raised GBP 474.2 million for its portfolio companies [20]. It acts as an early stage investor and plays a role of an open innovation

broker between Imperial College, researchers, external companies and wider market communities.

Some of the lessons from Imperial Innovations in the open innovation era include [21] (i) an innovative way of running a traditional TTO model, (ii) continuing support of promising start-ups, (iii) open partnership with industry based on framework agreements and broad principles and (iv) an entrepreneurs-in-residence programme.

University approaches to managing their IP portfolio range from open access initiatives to technology commercialisation programmes.

The Easy Access IP [22] is a growing initiative of more than 20 universities worldwide to offer free licences for their technologies to industry. The project aims to have more research translate into economic benefits and create more jobs.

At the other end of the continuum are university funds [23], which act as venture capital to spur innovation, entrepreneurship and economic growth. According to the Thomson One database there were 26 university funds established between 1973 and 2010 [24]. The main objective of such funds is to invest equity capital to university technology companies and speed-up commercialisation processes within universities.

Another development in university innovation management and enterprise are collaborations between universities to expand the pool of technologies, expertise and capacity. For example, the SETSquared Partnership, which recently named the top university business incubator in Europe. CETSquared is the enterprise collaboration between University of Bath, University of Bristol, University of Exeter, University of Southampton and University of Surrey [25].

New skills, programmes and learning technologies

The spread of open innovation and a greater permeability of organisational boundaries place new demands on skills and capabilities of employees. Universities need to respond to new requirements and prepare students who are market ready to embrace open innovation. There is a growing trend to develop T-shaped people with a core expertise and the ability to collaborate across disciplines.

A further emphasis is placed on incorporating entrepreneurship, creativity and innovation management subjects into university curriculum across subject areas.

For example, the University of Sidney [26] has been reviewing its curriculum, placing the emphasis on integration of education and research, developing creative and flexible thinkers, fostering enquiring minds, developing leadership and communication skills.

LSE100 [27] is an innovative course offered by the London School of Economics and Political Science (UK) which is teaching students to explore social science thinking from different perspectives, e.g. economics, law, politics, history to develop critical thinking capabilities.

The University of Aberdeen has introduced Sixth Century Courses [28], a range of innovative courses introducing students to the breath of disciplines and developing flexibility, versatility, multidisciplinary thinking, critical thinking and effective communication.

Similar trends are observed in business education. The HBR Blog Network [29] has recently argued for revisiting business education placing emphasis on holistic thinking, global perspectives, technology, entrepreneurship, creativity and the ability to make decisions affected by complexity and chaos.

A greater openness of university education programmes is further manifested through a rising choice of courses on MOOCs platforms (e.g. Coursera [30], edX [31], Udacity [32], Khan Academy [33] and Iggy [34]).

One of the ways that universities transfer their knowledge to public and business sectors is their continuing professional development courses and executive education programmes. Open Innovation places additional challenge on the content, design, marketing and delivery methods of CPD and ExecEd programmes.

University marketing in the age of open innovation

Open Innovation brings new opportunities and new challenges to universities in promoting their education programmes, research outcomes and engaging with students, researchers, industry and wider community.

The use of social media by universities is on the rise with many leading universities having hundreds of thousands followers on their social network pages. For example, the Massachusetts Institute of Technology has 170 000+ followers on its Twitter page [35], more than 600 000+ likes on its news page on Facebook [36] and 650 000+ subscribers on its Open Course Ware page on YouTube with millions of views [37].

A greater transparency and openness in communication approaches results in new technology and trends in developing universities websites. Universities are reshaping and restructuring their websites

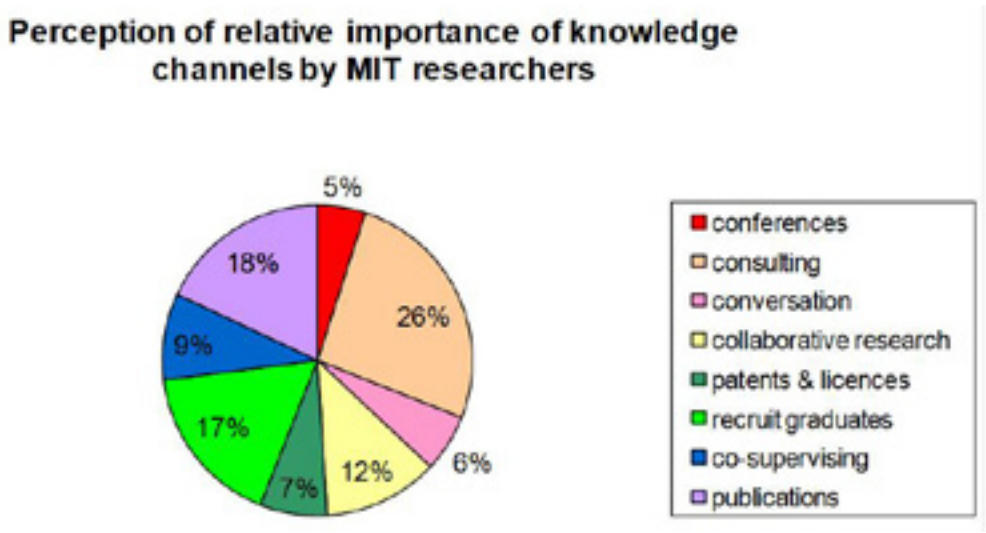
around end users and communities (e.g. students, staff, alumni, industry, media, etc.) as well as key activities and features (e.g. innovation, fund-raising, campus life). Innovative marketing campaigns and tools are following industry trends shifting from service and expertise marketing to content marketing featuring video, podcasts, blogs, elements of gamification and community events.

For example, Imperial College London holds an annual Imperial Festival to show case its cutting-edge research, demonstrate technology and cultural events to public, community, staff students and alumni [38]. The event gathers thousands of visitors and is becoming a prominent feature in the university diary.

Universities are gradually exploring crowdsourcing and crowdfunding opportunities. While there is a need to pay some scrutiny to funding sources there are new crowdfunding platforms which are dedicated to education and research, e.g. the Hubbub platform [39].

We estimate that community engagement and crowdsourcing will continue to rise while universities build experience and confidence in using new tools and solutions. External channels for knowledge transfer have been already embraced by researchers. A study at MIT revealed researchers' perceptions of the relative importance of knowledge transfer channels. According to the study consulting and conversation channels resulted in staggering cumulative 44 % (*Figure 4*).

Figure 4: Perception of relative importance of knowledge transfer channels by MIT researchers



Conclusion

Open innovation is affecting the way universities operate, collaborate, exploit their knowledge and technologies as well promote their services and expertise. It is fundamental for universities to find the right balance between openness and knowledge commercialisation in order to perform their mission, increase sustainability and remain competitive.

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How to Combine Openness and the Protection of Research Investments in University Inventions — US and Nordic

Views

Who owns the rights to university inventions and under which terms? This is a classic IPR question and the answers may vary very much depending on the chosen IPR system and the background values. In this article my intention is to discuss some basic ideas of two systems — the US and the Swedish system — and make reflections in relation to the Finnish system. The ideas and issues are, however, common to all legal systems and also highly relevant regarding the EU policy. The chosen systems represent 'opposite ends' in IPR allocation, as the US system is university-based and the Swedish system is researcher-based. However, both systems seem to produce successful outcomes.

In the Finnish system, ownership of university patents is regulated as well as copyrighted in relation to computer programming. Regarding the other types of rights (e.g. artistic copyright, design rights), the system relies on contractual freedom. In universities, the issue is subject to rather sensitive debate on the balance of interests between the researcher, the university and the societal interests, including also the interests of the surrounding business community and companies.

The researcher as a stakeholder wants protection for his/her creative work and wants credit for scientific career through being acknowledged as the inventor in scientific publications. Most often, the researcher does not mind at all about gaining economic benefits in the form of royalties or other forms of extra compensation as an entrepreneur (the rising value of start-up equity for example).

The university as a stakeholder has a mission to maintain a high level of research and education, and a need to develop new sources of financing through technology transfer. The university also has the duty to disseminate knowledge and make sure that the new knowledge is widely used. The societal interests may include a high level of education, benefits of the newest technology to the society and a general high level of well-being. It is in the society's interest that knowledge is spread and left not only to high-level specialists to ponder.

The interests of businesses as research stakeholders are naturally the use of inventions for commercial innovations. Depending on the background philosophical motivations behind the university IPR system, this is sometimes seen as contrary to the basic tasks of the university — the greater the university's freedom and distance from business companies is, the better the overall system. In the classic university philosophy of e.g. Robert K. Merton, the independency of the university is among the highest values of the university system [1]. The business interests of companies may be seen as contradictory to this. Yet, especially in the US system, the dissemination of knowledge does not only mean publishing articles in scientific journals, but may also be expanded to dissemination of the industrial products based on new knowledge.

Patenting may also be seen as contradictory to the universities' basic mission to encourage the free flow of new information — on the other hand, patent databases are the largest collections of public, free-of-cost technological information. The US system allowing a 'grace period' for inventors to maintain their right to patent despite early publication seems especially suited for the researchers' interests in combining the best of both worlds, i.e. publication and the protection and use of IP.

In the following, I shall shortly describe the Finnish system and then, compare it to the US and Swedish systems. The US and Swedish system have been chosen because, apparently, they represent opposite ends of the spectrum, the US system being heavily concentrated around university ownership of IP, and the Swedish system representing a researcher-centred system. The Finnish system has elements of both, which however is not necessarily an asset; it is my intention to show that developing the Finnish system towards clearer concepts of ownership would probably benefit the transaction system and allow for wider dissemination of the inventions.

Finland — basic principles of university IP

Universities' duties

According to the Finnish Universities Act (para. 2, 558/2009, unofficial translation), the mission of the university shall be to promote free research and scientific and artistic education, to provide higher education based on research, and to educate students to serve their country and humanity (I shall later refer to this definition as 'the core mission'). In carrying out their mission, the universities must promote lifelong learning, interact with the surrounding society and promote the impact of research findings and artistic activities on society. The issue of university inventions is particularly relevant regarding the last part, i.e. promoting the impact of research findings and artistic activities on society.

According to Section 3 of the Act, the universities shall have autonomy with a view to securing the

freedom of higher academic and art education. Autonomy entails the right to decision-making in matters belonging to internal administration. The universities are given an opportunity to express their opinion on proposed legislation concerning their issues.

The universities are divided into two main categories (Section 5 of the Act), the foundations (Aalto University, Tampere University of Technology), which are also governed by the Finnish Foundations Act (109/1930) and corporations under public law (public universities). The public universities are independent legal persons. The public universities may undertake commitments, obtain rights in their own name and possess movable and immovable property. A university may pursue business activities which support the performance of their core mission (as in Section 2 of the Act).

In the following I shall concentrate into the main elements of the Act on the University Inventions [2] made at Higher Education Institutions (369/2006) and the Act on the Right in Employee Inventions (656/1967).

Basic principles of the Act on the Right to University Inventions (369/2006)

The Act on the Right to University Inventions regulates the protection and rights of patentable inventions created by employees of the Finnish universities. The allocation of rights regarding the research-initiated IPR depends on the nature of the research.

The main categories are 'open research' (the 'business as usual' type of research carried out in universities) and 'sponsored research' [3], which refers to outside financing of the research. Open research is done (Act, Sec. 3) under employment in the university, without outside financing or contractual partners. Contract research is a research service carried out for remuneration. Contract research may involve partners outside the university either as researchers or financiers.

The main principle is, unless otherwise stated in the law, that the creator has the same right to the invention as any other (stand-alone) inventor. The inventor has a right to be recognised as the inventor. The inventor must inform the university about the invention. The inventor has a right to equitable remuneration regarding the rights that are transferred to the university. In the Finnish system, the essential criterion is whether the invention or research result was produced in open or sponsored research.

Open research

The university can (the Act on University Inventions, Section 6) take the rights to an invention created in open research under certain conditions. If the inventor has not published, within a time period of six months from informing about the invention, the invention, or informed the university in writing of the intent to utilise the invention, the university can take the rights to the invention. Before taking the rights, the university must enquire whether the inventor intends to utilise the invention himself. If the university misses the six-month deadline after being informed of the invention, the university is deemed to have waived its right to the invention.

Despite the expression 'university can take the rights', the procedure in all its complexity is in practice a voluntary affair to the researcher. The researcher has no reason not to proceed with patenting by himself if there is any hope of having the invention commercialised. The researcher's own activity and actions in exploiting the invention rule out the legal rights of the university. In comparison to the US and Swedish systems (see later in more detail) the Finnish system in this sense is some kind of hybrid of the university-centred model (US) and the researcher-centred model (Sweden), leaving however room for speculation, the Finnish model is designed to be clear enough to support quick transaction processes and efficient utilisation of the invention.

It is a matter of opinion, whether this type of research is in fact 'open', as the proprietary result (IPR, patent) remains with the researcher. As we will see later, there is also some logical tension present: if the state finances the research, the equipment and all facilities, why should the state be happy with the researcher gaining the rights?

Sponsored research

The university has the right to redeem the rights relating to sponsored research within a period of six months from the invention disclosure by the inventor. If the university does not claim the right within this timeframe in a written manner, the university is deemed to have waived its rights to the invention. After the university has made the claim to the invention, the researcher is obliged to sign the transfer agreement.

Inventions in employment

The law on Inventions in Employment (656/1967) concerns the allocation and protection of rights to inventions made under conditions of employment, i.e. working for someone else (usually a company). The main principle is the following (Section 4): If

the invention is created as a result of the employer's line of work (the work he was agreed, commissioned or ordered to do), or while essentially utilising experience gathered in the employer's service, the employer may, wholly or in part, claim the right to the invention.

The legal precondition is that the use of the invention must be within the employer's line of business. There is one exception to this rule — if the employee was specifically ordered to carry out a specific task. In certain special circumstances the employer may gain a right to use the invention, even if there is no IPR exclusivity transfer.

The inventor must make a disclosure of the invention to the employer. The employer must claim the right within four months of the disclosure. The employee has a right to equitable remuneration.

Comparing legal principles — inventions in employment vs university inventions

The acts described above have common features and partly a common philosophical background too. There are however some important differences: it can be said that the University Inventions Act leaves it essentially for the university and the inventor to agree who will be the owner of IP and the primary responsible for the utilisation of the invention. The second feature drawing attention is that the university gets the rights primarily in sponsored research, which could be regarded as somewhat contradictory to the idea of incentivising investment to research.

A researcher, who is employed by the university, is working under conditions of open research. He has the privilege of exploiting his inventions and gain the rights for himself. To actually benefit from this, a great amount of commercialisation skill and commercial activity is required. Passivity during the process — intentional or not — may lead to the rights being transferred to the university.

Comparing this to the Inventions in Employment Act leads to several conclusions: in regular employment, the position of the employer is stronger, provided the exploitation of the invention belongs to the line of business of the employer. Roughly speaking, the inventions created in employment belong to the employer in lack of important contradictory arguments. In modern research and development, the invention is not necessarily a byproduct, but the result of conscious effort to create something new for commercialisation purposes. As a rule, the creation of inventions is the reason for the hiring of the inventor in the first place. The employer is investing — and taking risk — for the R & D in order to create competitive advantage for business purposes.

The notion that the universities would be *investing* into research, is not common to the Finnish higher education ideology. State funding has the intention to enhance high-level research and education. Even the researcher is not seen as an employee, but a torch-bearer for research and civilised or even sophisticated society. The idea of keeping the researcher in the driving seat regarding rights allocation is an illustration of this principle. The idea of an independent university in the sense described in e.g. Robert K. Merton's philosophy is very close to home in the Finnish value system [4]. The idea more common in both the US and Swedish systems, that commercial dissemination of inventions counts as duties of universities, seems remote to the Finnish ideology at least on the level of jurisdiction and administration. It is however one of the central arguments in this article, that commercial dissemination is in fact part of the dissemination of scientific inventions, and therefore an important part of the tasks of universities.

If we think of the universities as independent and autonomous units, it would be relatively easy to change the argument towards the idea of research funding as investment; the university makes an investment into intangible assets, namely research results and findings. Like any investment, this could be successful or lead to failure. This could make the universities more free to judge where to invest, but at the same time, the ultimate financier would set targets not necessarily scientific but economic. This position would also mean greater independency and responsibility for the university as rights holder, rights owner, licensor and start-up/incubator. The situation today in Finland is however very different, as the State essentially finances research, the results of which remain in the ownership and control of the researcher.

The other issue regarding the University Inventions Act regards the position of sponsored research. The idea of strengthening the university's position in this area seems rather peculiar, as this most certainly should reflect on the interest of the investor to participate — if the result is awarded to the university, why should a private company invest into such results? This is, in my understanding, not the case, however. According to some specialists, commenting on my initial drafts of this paper, there are in fact two kinds of sponsored research — one sponsored by state research institutes other than universities, and then actual business company funding. The law is applied in the former but the

latter stays within 'contractual freedom', as the expression goes. The issue is therefore diminished into the question, should not the law better reflect the actual practices in use in universities which it does not seem to be doing at the moment.

USA — the university-centred system

In this section, I shall make some observations regarding the US system. I shall take the Harvard Office of Technological Development (OTD) as a benchmark. OTD is an organisation specialising in technology transfer, commercialisation and licensing. OTD operates under Harvard University's supervision [5].

The starting point of the policy of OTD is that all stakeholders, the university, the inventor and the publisher of the article, should benefit from the system. The policy does not concern the researcher's right to publish his research results. However, the publication must be carried out in agreement with the university. The invention must remain patentable; too early publication may jeopardise patentability, even if the benefits of a 'grace period' are available.

The system of rights management has basically the same elements as the Finnish system. There are however some differences. The general principle is that the legal position of the university is stronger than in Finland. The university owns the results created with research utilising the university's resources. It is the university that has the right to agree on the rights and the use of the IP. In the case of OTD, the Harvard University has authorised the OTD to use some of the university's powers.

The inventions in the Harvard system are divided into two categories, 'supported inventions' and 'incidental inventions'. Supported inventions are inventions created on the basis of agreement between Harvard and a third party, financed by Harvard (direct or indirect) or created using Harvard's equipment, facilities or other research assets. Incidental inventions could also be called 'other'.

The inventor has an obligation to inform the university about the invention. OTD defines the category in which the invention will be positioned. Harvard has ownership of all supported inventions. Incidental inventions are owned by the inventor. In the case of supported inventions, OTD applies for a patent and carries the costs of patenting. OTD makes the decision on the commercialisation of the invention, taking however into account the general (societal) interest to encourage the dissemination of inventions. According to the compensation policy, the inventor is entitled to compensation as a percentage of the income related to the patent [6].

If the supported invention is created on the basis of an agreement, the terms of the agreement however apply to the conditions of IPR and transfer of rights. Regarding incidental inventions, the university will have a right to use the invention for research and educational purposes, but this right does not expand to commercial use.

The inventor will keep the rights into all copyrighted material that was created during the research process leading to the invention. This includes artistic and literary material and also films and videos. Computer programming is an exception to this rule, as the computer programs belong to Harvard University as sponsored software inventions.

The Harvard system seems on the surface to bear likeness to the Finnish system but somewhat clearer and perhaps more sophisticated as to the definition of rights and the clarity of allocation. Less is left to negotiation on the allocation itself — negotiations seem rather to concentrate on the terms of use. As Harvard University tops all listings of the world's most prestigious universities, it is safe to conclude that even though there may be issues, the system is most likely supportive to the international success of the university.

Elements of US debate — Bayh-Dole criticism

In the US the debate on university inventions has continued for decades. The starting point was the passing of the so-called Bayh-Dole Act in 1980, which re-organised the use of university inventions and related patents. The university inventions were regarded as under-used, as they were technically federal property. This was basically sound from the point of view of the federation's tactical interest, but meant also that there was little incentive and thus use of the resource. There seems to be no real controversy regarding the views on Bayh-Dole's efficiency in this respect [7].

In the US, universities are considered to have an important role in disseminating inventions in society's interest. What is interesting from a European point of view however, is that this task is not seen as contradictory to the commercialisation of research results and IPR. In fact, the case seems to be quite the opposite — it is perfectly justified to consider a successful commercial adaptation to be part of the university's task because this is just another form of dissemination of the invention. My interpretation of US thinking is that it does not make very much difference whether inventions are disseminated in the form of scientific articles or in the form of successful end products [8].

The most important reason for active technology transfer is not so much the economic benefits but the quick and robust dissemination of the inventions in the societal interest. IP-based technology transfer is part of the universities' core missions, along with research, education and enhancing well-being [9]. The universities should create a clear mission for their technology transfer, which takes into account the principle of dissemination of inventions for societal benefit [10].

Technology transfer is seen as a very practical line of operation, where skills, contacts with business life and knowledge of technology are central. Technology transfer also comprises the evaluation of the proper and best use of the IP — whether it is best used as a core asset of a start-up or if the asset would be in better used in some large company's product assortment. In the latter case, the IP can either be licensed or sold [11]. For this purpose, an advisory board of industry specialists can be appointed to evaluate the invention and the necessary commercialisation steps [12].

However, the measuring of the Bayh-Dole Act's overall efficiency in enhancing innovation is very difficult. There is no comparison to an alternative situation — it is not possible to verify the benefits or shortcomings of alternative approaches [13]. The critics may be divided into two categories, those criticising the lack of empirical evidence and those who question the patenting system in overall terms [14]. The Bayh-Dole approach, which places the university inventions in the university's ownership, has been criticised e.g. on creating a double incentive: first, the state finances research from state resources, secondly, exclusivity for the use of results is granted [15]. Despite the critique, it is fair to say that the Bayh-Dole Act literally 'exploded' the amount of patenting to a completely new level [16].

Bayh-Dole supporters underline the fact that having a patent-based incentives system encourages investment into expensive, complicated and risky research projects. Monitoring patent data, especially applications, gives an indication of the direction of technological development, which information in turn helps planning research investments also from society's point of view [17]. Bayh-Dole produces efficiency benefits, because business companies are usually reluctant at investing in early-phase R & D. The result may also be of too general nature for private companies to develop [18].

Sweden — researcher in the centre

Swedish universities do well in international rankings. In the Shanghai-ranking 2014 Karolinska Institutet scores highest of the Swedish universities at rank 47, Uppsala 60 and Stockholm 78 [19].

Swedish University Law (Högskolelagen 2 sect., amended 119/2013) defines education and research as the core missions of universities, but in addition are the interaction with and giving information about research to society, as well as making efforts in order to have the research result used for a 'beneficial' purpose [20]. The definition of utilisation uses the Swedish word 'nyttan', which can be translated as 'benefit' or 'gain' for the society. This is a very broad concept — 'nyttan' could mean use or benefit in educational, but also in an economic sense [21].

In Sweden, the IPR allocation is based on the strong position of the inventor [22]. Some evaluations claim the Swedish system as State-centred in comparison to the US system [23]. I do not have data on this, but a common view is that in general, the development in Europe is likely to have moved towards university-centrism during the past decades. This is at least the case in Finland and Denmark.

Karolinska Institutet [24]

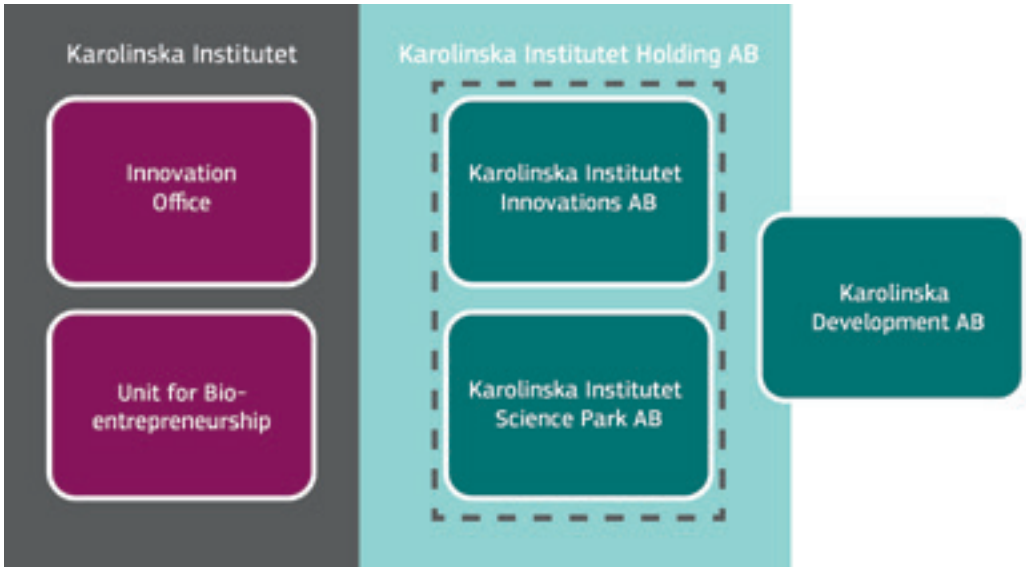
In Sweden universities are a part of public administration. The laws governing public institutions cover also universities, like e.g. the law on public information. As a starting point, the universities cannot operate in the market or foster business activities due to their nature as part of the State's administration. For this reason, in the year 1995 Karolinska Institutet (KI) founded a separate holding-company (KI Holding AB) to take care of commercialisation-related activities. During the years 2008-2009 KI received more funding for commercialisation and formed new daughter-companies under the holding-company.

Karolinska Institutet has an Innovation Office, who studies projects being carried out in KI and evaluates them. Unit for Bio-entrepreneurship is concentrating on research and education concerning entrepreneurship. The 'mother company' KI Holdings takes care of economy and administration.

Within the ownership of KI Holdings AB exist three companies: KI Innovations AB is a company, who seeks investable projects from universities — not only from KI. The State owns all these companies, which are operated under the general direction of KI. Karolinska Development AB is a listed company under KI Holdings, which owns a large number of invention-based start-ups and operates on the basis of an exit-strategy — trying to make an exit of the start-ups with the highest possible price. The group of companies includes also a third company called SciLife Lab, which offers research facilities. SciLife Lab is co-owned by four Swedish universities.

Innovation system at KI

Figure 1: Karolinska Institutet's innovation system [28]



Karolinska has also a network of 200 experts from life science — companies. KI is going forward with new areas of life science. The KI model resembles the recent Danish 'node' strategy suggested for universities [25]. In the 'node', the main target is not exactly legislative development but rather developing efficient commercial practices, deepening know-how of TT and developing deeper relationships with related businesses.

How does the 'research-centrism' reflect to the Swedish system? This is a subject of more study, clearly, but it is quite fascinating to see that the Swedish system seems to have its own kind of efficiency benefits regardless of the IP being allocated to the researcher [26]. This is due to the fact that the researcher seems less dependent on the 'mother-university' but has the legal position, as the owner of the IP, to bring his invention to the commercialisation process of the national champion, i.e. KI. In a country the size of Sweden, this looks *prima facie* like an efficient solution in the life-science sector, albeit with the reservation that more data is needed for deeper analysis. Like in Finland and elsewhere, the Swedish universities however do not seem satisfied with their system but see that enhancing the universities' legal position in IP would be a desired direction in the future regarding university inventions.

Grace periods — Would they allow a combination of openness and patenting?

The US patenting system (as well as Canada, Australia and Japan) has a legal institution called a 'grace period', by which is meant the possibility for patenting even after publication. If the inventor or the successor (licence holder or purchaser) published the invention, an application for a patent can still be validly filed which will be considered novel despite the publication. Usually this right to post-publication application must be used within a period of 6 or 12 months [27].

Both the US and the Swedish systems have to deal with the tension between the researcher's need for a swift publication process for career reasons, and the need to protect the invention for patenting purposes. In Europe, this tension is particularly strong and leads to conflicts of interest. It is not the subject of this article to study the issue further, but the grace period institution seems to *prima facie,* if not solve completely, at least ease to a certain extent this tension. The grace period in Europe should indeed be evaluated also from an open innovation point of view.

Conclusions and ideas for further study

My interpretation of 'open innovation' as presented by Henry Chesbrough in his classic writings, is based on sound law and economics foundation, namely, in order to make transactions (sell, licensing, waiving the rights) of IP, there needs to be an institutionally recognised solid ownership of the IP to allow the formal transaction procedure. Open innovation is thus not 'happy hour', but controlled and intentional openness. I believe that this approach gives a logical path to uniting the interest to patent with openness — to be open, the patenting information

must be open (as it is in the 'grace period' system or will eventually be when the application leads to a grant) and at the same time, the temporary exclusive economic use of the invention must be possible in order to attract investment and thus encourage dissemination of the invention — or innovation in this phase, if you like.

The role of universities is probably changing slowly due to economic and technological development. It would make sense to see the universities' main task as investment to research, the protection and utilisation of which are important parts of the universities' societal functions. This would enhance independency and create a need for long-term planning of research activities from scientific and societal aspects.

The relationship between the researcher and the university needs a closer look. As the researcher is employed by the university, it could be questioned, what is the reason and incentive for having the researcher make inventions on public funding that will become his or her personal assets. Is this really the best way to incentivise the broad dissemination of inventions in society?

The Finnish case on sponsored research may need a closer look in the future. It would clearly make more sense to have the rights being agreed on a contractual basis rather than have the legal disincentive to make all thus-produced IP automatically the property of the university. In practice, this seems like a *desuetudo* or a dead letter of the law.

Debate and legislation on university inventions tends to concentrate on patents. However, this is not the whole picture of IP created in universities — there are copyrightable computer programs, content, literal and artistic material and design to look after, too. In Finland, there is an exception regarding computer programming — the IP of computer programming belongs to the employer, unless it is a university, in which case the rights belong to the programmer. The direction of the incentive should be better looked at in this case.

For further study, there should be more international comparative information to base conclusions on. From the Finnish perspective, the Swedish system of KI looks most interesting from practical point of view. The issue of the grace period should also be looked at both from the perspectives of international competition of patenting systems, and the possibility to encourage openness of the system — open innovation.

Finally, as important as law-making is, it seems that in the big picture, big issues tend to be less and less regulatory but rather issues of organisation, contractual skills, interaction with the business sector and other operational matters. At the same time, there should be intellectual flexibility to understand and evaluate the role of universities in changing technological and economic circumstances.

References

(1) Merton R., 'The key elements of university ideals: communalism, universalism, disinterestedness, organised skepticism' (source: Wikipedia).

(2) Translations available in English are unofficial. There are several unofficial translations available on the Internet with certain differences. One is titled 'Act on the Right in Inventions made at Higher Education Institutions' and uses slightly different translations in comparison to this text. Main principles and the purpose of the law are however clear in these 'competing' translations.

(3) The literal translation would be 'contract research' but I have chosen to use the term 'sponsored research' as a clearer English definition.

(4) Ilkka Niiniluoto, Risto Vilkko, Jaakko Kuorikoski, (2003) 'Talouden filosofia', Gaudeamus.

(5) Internet document 'Guidelines, Policies and Forms; Intellectual Property', Section I: Inventions and Patents, Harvard University, Office of Technology Development, printed 23.6.2014.

(6) Section V, Royalty Sharing.

(7) Merill and Mazza (2001), National Research Council of the National Academies: 'Managing University Intellectual Property in the Public Interest', Washington.

(8) This is compatible with the terms of the world's most prestigious science awards, the Nobel Prize. The will of Alfred Nobel speaks quite clearly, that the prize will be awarded to persons who have brought about the greatest benefit for mankind. This benefit need not be purely theoretical but can and indeed must be very practical.

(9) ibid. s. 2.

(10) ibid. s. 4. N.B., in the Finnish university debate it is often claimed that IPR privatises information and may even be contradictory to the interests of research (Marjut Salokannel, 'Tekijänoikeus ja tutkimuksen raaka-aineet', Koneen Säätiö 2014, p. 11). The patenting could slow the dissemination of technological knowledge. Granting exclusivity to an invention may at first glance seem to have this effect. There are however two counterarguments to be considered: firstly, the patent can be regarded as an agreement with the inventor, as granting an exclusive term for industrial use against publication of the patent and the background technological information. Patent databases are in fact the largest datebases of technological information available. Second, the patent can be used as an asset and even collateral for financing. Unless some kind of formal asset exists in a company, it may prove very difficult to maintain investor confidence, let alone make sure the competitive advantage allowed by the product can be somehow protected.

(11) ibid. s. 8.

(12) ibid. s. 4.

(13) McManis and Noh (2012), 'The Impact of the Bayh-Dole Act on Genetic Research and Development: Evaluating the Arguments and Empirical Evidence to Date. Perspectives on Commercializing Innovation', Cambridge University Press.

(14) ibid. s. 447.

(15) ibid. s. 444: 'At the heart of these criticisms is the argument that, while the purpose of granting patent protection is ostensibly to create incentives to innovate, recipients of federal funds arguably need no additional incentive to innovate. Thus, allowing private parties to hold exclusive rights to inventions that have been generated at public expense seems to require the public to pay twice for the same invention.'...s. 486: 'Contrary to the fears of many legal commentators, there are few signs that biotech patenting has impeded biomedical innovation'.

(16) ibid. s. 448.

(17) ibid. s. 445.

(18) ibid. s. 447.

(19) Of Nordic universities, the additional top 100 universities are Copenhagen (39), Oslo (69) and Helsinki (73).

(20) Högskolelagen 2 § 2 mom. (1992:1434, lainmuutos 2013:119): *'I högskolarnas uppgift ska det ingå att samverka med det omgivande samhälle och informera om sin verksamhet samt verka för att forskningsresultat tillkomna vid högskolan kommer till nytta.'*

(21) SOU 2005:95: '*Nyttiggörande av högskoleuppfinnigar*', s. 47: *'I dagens tekniskt högutvecklade och resultatinriktade samhälle skapas det förväntningar på ett nytt slags spridning av forskningsinformation, på forskningssamverkan och på att högskolan skall vara till direkt nytta för allmänheten.'*

(22) ibid. s. 4.

(23) McManis and Noh (2012) 'Perspectives on Commercializing Innovation', Cambridge University Press, (s. 449: 'The US model is very much focused on creating (economic) incentives for universities to commercialize their research output, whereas the Swedish model, which is similar to most European Union countries' models in some respects, is very much an attempt by the government to directly create mechanisms that facilitate commercialization').

(24) Main source for this part is an interview in Karolinska Institutet, Stockholm 29.10.2014, and the web-pages of the Karolinska Institutet.

(25) 'Tech Transfer in Danish Universities — what have we learned from ten years of trying to make money on research?' http://dea.nu/sites/default/files/Technology %20transfer %20- %20Summary %20 in %20English.pdf

(26) Coase R. (1960), 'The Problem of Social Cost, Law and Economics', This initial conclusion looks surprisingly correct from theoretical point of view, considering especially the so-called 'Coase Theorem' regarding the allocation of rights in economic analysis.

(27) Wikipedia, Novelty (patent).

(28) http://karolinskainnovations.ki.se/about/vision/

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CHAPTER II:

Open Innovation 2.0: Living Labs

Open Innovation Ecosystems: A Study on Matchmaking between Living Labs and other Organisations within Horizon 2020 Calls

Abstract

A new stage in the Open Innovation paradigm currently emerges in the form of networked ecosystems supporting the quadruple helix innovation mode as promoted by the EU Open Innovation Strategy and Policy Group (OISPG). However, one has to find out the proper way to identify collaboration opportunities among the diverse innovation ecosystems leading to innovative co-created values and technology artefacts adopted by users. Furthermore, the new EU research programme, named Horizon 2020 (H2020), includes several challenges that regularly launch specific calls for proposals (CfPs) on either research and/or innovation projects where consortia can apply. This article presents the preliminary results of a matchmaking experiment among Living Labs (LLs), acting as different regional/local ecosystems, and other organisations aiming to respond to CfPs of Horizon 2020 Challenges. This study confirms that the simplest physical artefact supporting matchmaking remains the most useful, efficient and attractive one. It reveals as well that combining both digital and physical matchmaking approaches appears to be the most promising solution. Finally, the findings are briefly discussed in the conclusion with a set of recommendations.

Introduction

The EU single market, compared to the US one, does not really exist yet. Similarly to the US single market, the EU has used a single currency since 2000 and has shared borders, at least for the EU countries engaged in the euro system and the Schengen agreement. In contrast with the US [market], the EU has neither a single language nor a common tax system. Indeed, since many EU countries were formed centuries ago, a diverse culture has prevailed amongst Member States. Hence, all EU project proposals have to include in their consortium partners from at least three EU countries. This specific rule is intended to make project consortia consider the potential impact at the EU level and future exploitation of the project results within the 'virtual' single EU market or at least within different EU countries, especially from regulation, linguistic and cultural aspects.

One could logically conclude that the identification of valuable partners from a minimum of two other EU countries is not something obvious. Instead, it is a rather demanding task. Traditionally, the European Commission (EC) Directorates, and more specifically their units, organise regular information days for specific call-for-proposals (CfP). These information days often include brokerage sessions where participants are invited to briefly present rough ideas and/or offered expertise. Besides the explanations about an H2020 CfP provided by EC officers during an information day, the brokerage session is more intended to offer to participants a source of leads for collaboration opportunities in terms of potential project proposals.

The H2020 CfPs receive a lot of proposals. This is a typical fact demonstrating that the national research and innovation programmes are substantially declining in most of the EU countries. The side effect is a considerable need for experts for evaluating all these project proposals that finally leads to low evaluation quality and a lot of frustration from proposers spending a huge amount of effort for finally being discarded on the basis of relatively loosely comments.

Hence, it is necessary for proposers that would like to pass the proposal evaluation stage to get great breakthrough ideas and a high level of proposal quality. However, they also need to set up a great project consortium based on an appropriate innovation ecosystem that could lead to a high EU impact level. Logically, the next big issue for proposers is to find out either potential opportunities to join an ongoing research and innovation proposal or potential relevant partners with common interest in H2020 challenges and topics to develop a joint proposal. In order to better understand the level of

the matching complexity, we set up an experiment comparing the response from participants in physical matching and brokering sessions with the usage of an online matching and networking software.

This empirical study was carried out in the context of the OLLD's matchmaking session that was held in Amsterdam on Tuesday, 2 September 2014. The OLLD 2014 event was organised by the European Network of Living Labs (ENoLL) and it was held from 2 to 5 September 2014. This study was intended to further explore online (CONEX) and offline (colour-coded) matchmaking sessions among LLs and other organisations participating to this event with H2020 challenges. The main goal of these matchmaking sessions was to provide every participant with a chance to identify collaboration opportunities in view of specific targeted action-lines of the H2020 Work-programme (WP). Another objective of this study was the user experience evaluation and the potential adoption of matchmaking services by LLs and other organisations members of ENoLL.

A previous study was carried out in the context of the same LLs event that was held in Manchester in 2013 with the objective to explore the feasibility and suitability of an online serendipity service (CONEX) to identify H2020 collaboration opportunities [6]. The results of this previous study provided interesting insights in terms of individual and organisational dynamic profiling for supporting serendipitous connections and an emerging matchmaking approach for systematically sensing collaboration opportunities.

Related theories and previous work

Open innovation, co-creation, innovation ecosystems and matchmaking

Beside Chesbrough's Open Innovation paradigm [1] and Ramaswany's co-creation approach and engagement platform [2], Curley & Salmelin issued the Open Innovation 2.0 (OI2) paradigm [3] arguing that the innovation process success is mainly dependent on how well assembled innovation ecosystems lead to successfully co-created and quickly adopted novel products and services. OI2 is based on extensive networking and co-creation across organisational boundaries well beyond traditional licensing and collaboration schemes [3]. Keeley et al. [4] explain that often the highest returns from innovation come from business model, ecosystem orchestration, user experience and brand.

Curley & Salmelin [3] also consider the user co-creation approach as a crucial part of the Open Innovation 2.0 paradigm and a key lever for quick adoption due to users' inputs contributing to bridge the gap between perceived needs and real needs. Interestingly, since 2006, the LL concept, compliant with the quadruple helix innovation mode, was gradually applied within EU projects for involving all stakeholders, especially users and policy-makers, at the earlier stage of R & D and innovation. An LL is often defined as a user-centred open innovation ecosystem integrating research and innovation within a Public-Private-People partnership through an iterative design process [5].

Curley & Salmelin [3] consider LLs as a significant example of the open innovation ecosystem where users are engaged in co-creating value together with all project stakeholders. In contrast, test-beds, usually technology driven, involve users as observed subjects. An LL combines the User eXperience (UX) quality in co-creating, exploring and experimenting with users a product/service with the capacity to capture previous design experiences [7]. It means that within LLs, UX covers the entire design process. A recent survey among ENoLL Livings Labs [8] reveals that User Co-creation and User Experience constitute the top two LL practices for engaging users in the R & D process.

Matchmaking in the open innovation approach becomes an element of paramount importance [9] (Galbraith et al. 2008) in identifying collaboration opportunities. According to Holzmann et al. [10] (2014), matchmaking is more than searching for the right partner and a subsequent market transaction. They argue that a cooperation decision is a complex group decision-making process that may have direct impact on the technology platform and/or business model alternative that determine the future innovation direction.

People, concepts, networking and online serendipity

Beside the review by André et al. [11] of existing systems supporting serendipity in one form or another; we previously created a repertory table [6] presenting all related published papers from 2000 up to 2014. While most of the systems reported in this table for supporting serendipity address the 'chance encounter' aspect, only two address the 'sagacity' aspect of serendipity. We consider 'Information Encountering' as the main objective for those that provide links with relevant information; 'Serendipitous Connection' for those that use social media tools in the context of physical spaces or virtual spaces or even people connection maker (e.g. matchmaking).

According to Pallot et al. [6], it is the unplanned, unlimited and continuously growing size of the network connecting users and their salient concepts extracted from their content-objects forming diverse nodes of knowledge that provide chance

encounters and serendipitous connections. This approach is named People-Concepts Networking (PCN) and was designed during the LABORANOVA and ECOSPACE EU research projects. Concurrently, the PCN approach was implemented into a software prototype [6, 12, 13] named CONEX that operates as an online service. The CONEX server [6] provides machine-generated connections among individuals (e.g. researchers, practitioners), organisations (research labs, businesses) and targets (CfP from diverse research and innovation programmes).

H2020 partners search and opportunity finding

Ideal-ist was established in 1996 as an international ICT (Information and Communication Technologies) network. Ideal-ist with more than 65 ICT national partners from EU and Non-EU Countries, such as Associated States, Eastern European Partner Countries and Mediterranean Partner Countries and emerging countries like China, Brazil, India and South Africa. Ideal-ist is intended to support proposers in offering several services [14], such as opportunity finder and partners search through specific online tools and brokerage events.

On the Ideal-ist website, it is mentioned that 'Ideal-ist addresses ICT companies and research organisations worldwide wishing to find project partners for a participation in the Horizon 2020 programme of the European Commission. Ideal-ist offers a unique and quality-labelled Partner Search and other services helping to ease participation in Horizon 2020'.

In terms of empirical study on the Ideal-ist partner-search, beside the nine Ideal-ist success stories, about FP7 ICT projects who found partners through the use of the partner-search tool, available on the website, it seems that there is no available study. However, authors found a 2008 presentation providing some Ideal-ist figures [15], such as 313 partners searches published with a quality label, represent 8.4 % of the total proposals submitted in ICT calls, more than 14 000 responses generated; more than 90 % of the cases found suitable partners, approximately 80 % of the cases finally submitted a proposal and depending on the specific call; between 22 % and 42 % of these resulting proposals were evaluated over thresholds with an average score always over 11/15.

Research approach

The overall matchmaking strategy for this event was based on the competition between two elements, namely: online or digital matchmaking (CONEX); colour-coded badges, colour-coded room areas; one-to-many and one-to-one speed-dating sessions. The one-to-many speed dating sessions were intended to gather in a same discussion group all the participants sharing the same colour-coded H2020 challenge. This was intended to give group members a chance to briefly introduce their interests and get a chance to identify the most relevant participants for planning a subsequent one-to-one speed-dating session with them.

There were the following two possible identification components in the matchmaking process: (1) on the one hand, 'colour-coded badges' worn by all attendees that were intended to highlight their interests in terms of H2020 Challenges; (2) on the other hand, an online application tool (CONEX) offered a connection map (named 'My Network') providing a set of potential collaboration opportunities to every registered participant before, during and after the event.

The first one provided a source of identification of collaboration opportunities among attendees wearing the same colour-coded H2020 Challenge. The selected seven H2020 challenges were the following: Factory of the Future (FoF); Smart Cities & Communities (SCC); Personalising Health & Care (PHC); Leadership & Enabling Industrial Technologies (ICT); Meeting new societal needs (EURO6); Innovation Ecosystems of Digital Cultural (Reflexive6) and Resources to recycle (Waste).

The second one offered to participants, through private discussions, further exploration of all identified collaboration opportunities during the event or even after the event through asynchronous exchange (e-mail) or synchronous discussions (e.g. phone or online). A questionnaire was prepared and submitted to all attendees during the registration process for identifying their interest in H2020 challenges and 22 topics. 67 attendees of the OLLD 2014 filled in this questionnaire. The results were used for printing colour badges as well as initialising the CONEX H2020 profile of each of the 67 participants entered as CONEX entities. Twenty-two H2020 topics, which were considered as the most relevant ones for LLs applications, were entered also as CONEX entities. These selected 22 topics of the seven H2020 challenges were the following: WASTE4d, SCC1 and SCC3, REFLECTIVE6, PHC21, PHC25, PHC27, PHC28, PHC29, PHC30, ICT10, ICT16, ICT19, ICT20, FoF08, FoF09, FoF10, FoF11, FoF12, FoF13, FoF14, EURO6.

Furthermore, each of the aforementioned challenges and topics were documented in CONEX in order to provide a proper source of information to the ones that were not used with them, especially in terms of research and/or innovation actions as well as expected impacts. The matchmaking session was organised in the plenary room, which was split into several colour-coded areas according to the seven challenges, and had a first round of

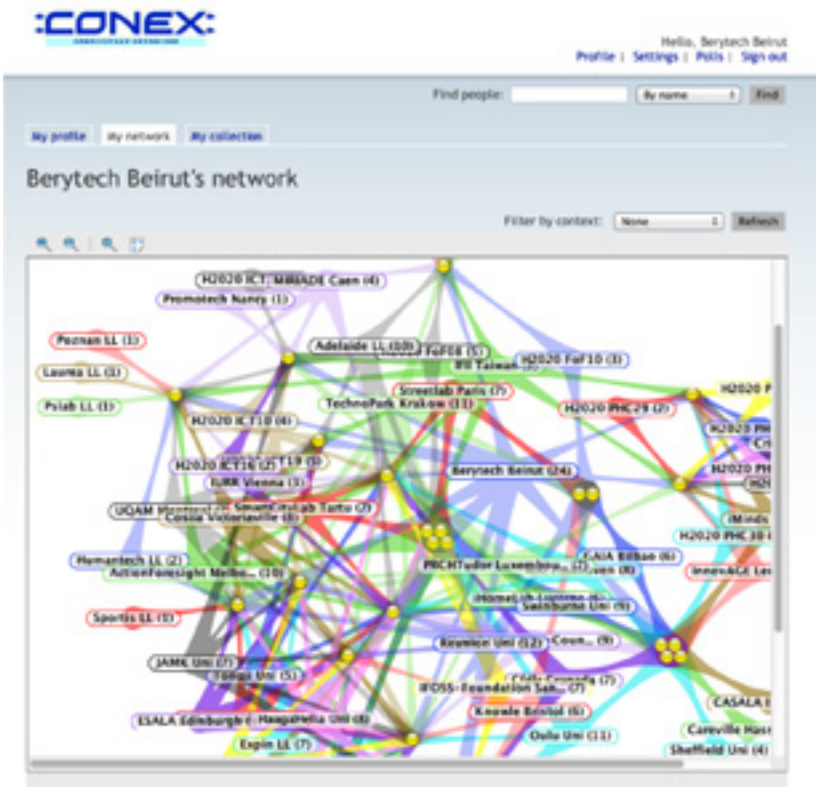
one-to-many speed-dating sessions and a second round of one-to-one speed-dating sessions. Hence, it was not mandatory for participants to have a CONEX profile in order to join the Matchmaking session.

Approximately, half of the first-day attendees had a CONEX account and profile. CONEX provided them with the possibility to look at their organisation's connections with other organisations and H2020 topics (see Figure 1) in order to identify potential collaboration opportunities. CONEX users, simply browsing their network map, were able to identify the most relevant participants they had to talk to as a top priority; keeping in mind that time-slots for discussing and exchanging ideas with others during an event are always quite limited. A web analytic approach was taken for counting the CONEX users and sessions before, during and after the event took place (see Figure 3). Later on, a rating survey was prepared and submitted by the beginning of December to the 67 participants that provided their H2020 interests among the seven challenges and twenty-two topics. This survey was intended to capture the matchmaking user experience in asking participants how they perceived the usefulness, newness, appropriateness and attractiveness of the overall matchmaking and its elements (colour-coded badges, colour-coded room areas, CONEX network map, one-to-many speed-dating sessions, one-to-one speed-dating sessions) through a rating scale with 1 (low), 2 (low average), 3 (average), 4 (average high) and 5 (high). An interview questionnaire was also prepared and is currently being used for carrying out individual interviews with the 17 respondents of the bipolar rating survey. The findings of these interviews and the correlation outcome between the quantitative and qualitative results will be presented in a follow-up paper.

Findings

CONEX 'My Network' provides to every participant a continuously updated connection map as shown in the Figure 1 below that presents a screenshot of all entities (organisations and H2020 topics) connected to one of the participating organisations. These connections are based on one or several tags, which are represented by yellow dots, linking entities and provide an indication on the potential common interest towards one or several H2020 challenges and topics. Then, based on the identification of common interests in the network map, participants have to talk to each other during the one-to-many and one-to-one speed-dating sessions in order to further explore these collaboration opportunities.

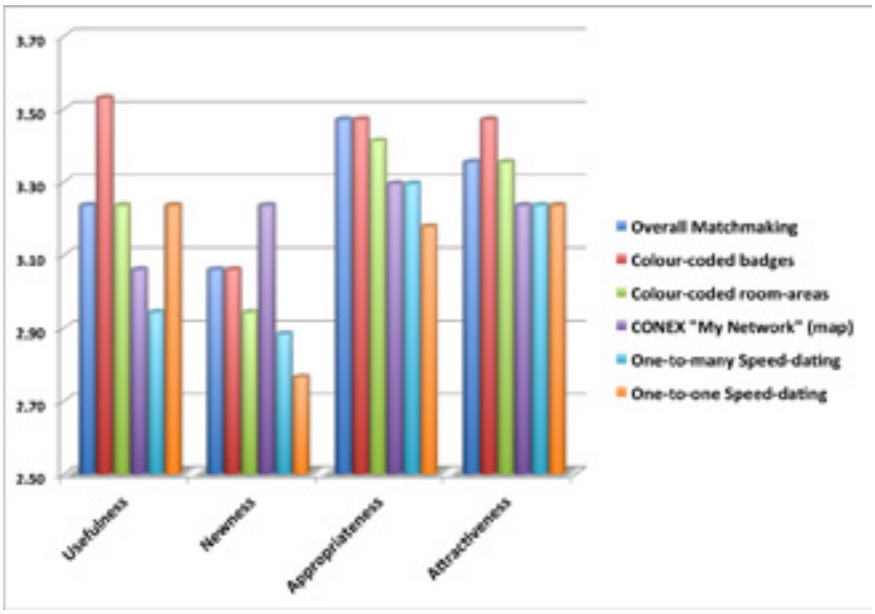
Figure 1: Example of network map showing connections between participating entities (organisations and H2020 topics)



The results, shown in Figure 2, reflect the rating scale from 1 up to 5, provided by seventeen respondents representing about 25 % of the sixty-seven participants. Regarding the overall matchmaking at the event, respondents perceived the matchmaking usefulness at slightly over average (3.24); the level of innovation in the matchmaking process as average newness (3.06); the effectiveness and efficiency of the matchmaking process as clearly above average appropriateness (3.47); the attractiveness of the overall matchmaking as above average as well (3.35). As for the colour-coded badges and room-areas, respondents rated them as follows: above average usefulness (respectively: 3.53 & 3.24), almost both average newness (3.06 & 2.94), above average appropriateness (3.47 & 3.41) and above average attractiveness (3.47 & 3.35).

Regarding the use of CONEX network map, respondents perceived an average usefulness (3,06). However, this is quite controversial as two of the respondents rated CONEX as highly useful while one of them rated it as low useful, which most probably means almost useless (to be confirmed during the interviews). Three of respondents rated CONEX as between average and highly useful and the larger group of nine respondents rated usefulness as average useful while four of the respondents rated the usefulness criteria as of low average. Finally, respondents rated the two types of speed-dating sessions as almost averagely useful (respectively: 2.94 & 3.24). The rating of the one-to-one speed-dating sessions was quite controversial as well, with one respondent finding it useless while two others rated it as highly useful. Four of the respondents rated this matchmaking element as low-average useful while only two of them selected rated it as useful. Interestingly, the one-to-many type of speed dating sessions has got five respondents giving the rating of average-high usefulness while the one-to-one type has got a lower number of this same rating with four votes. The largest group of respondents, seven of them, rated the two types of speed-dating sessions as of average usefulness.

Figure 2: Rating results of the matchmaking elements



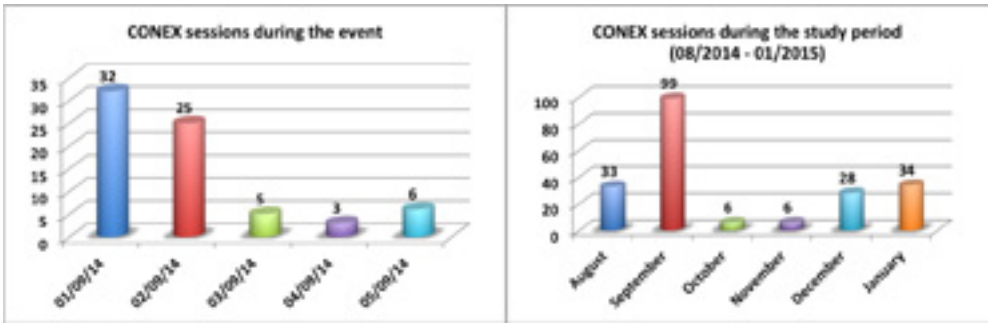
Regarding the use, frequency and intensity of CONEX, a web analytic tool provided several indications (see Figure 3) across the entire period of this study. Two bar graphs (see Figure 3), illustrate the generated sessions during the complete period of this study and the sessions generated during the event's week. Overall, there were 65 users that generated 206 sessions with 2 405 page views. On average, there were 11.67 pages accessed per session and the average session duration was up to 8 minutes. As for the visits, there were 28.6 % new visitors and 71.4 % returning visitors. Surprisingly, the matchmaking survey launched in the beginning of December has generated 62 CONEX sessions between December 2014 and January 2015. It can be assumed that the respondents were willing to take another look at their network map or further explore the CONEX features.

The 33 CONEX sessions generated at the end of August, most probably sparked the curiosity or the pre-event identification of the attendees to be approached as a top priority. The real intent was to establish an interpersonal relationship (people networking) and to discuss eventual collaboration opportunities. This identification of relevant attendees could be done through the analysis of the CONEX network map based on the number of tags involved

in connections with other organisations and H2020 topics. The highest CONEX activity was generated the day before the event took place with 32 sessions. The second highest activity has happened during the first day of the event with 25 sessions. This, most probably, occurred during the morning as the physical matchmaking sessions were held in the afternoon.

Considering the low number of 14 CONEX sessions generated during the remaining three days of the event, one could conclude that attendees have collected enough collaboration leads during the matchmaking sessions on the first day. It means that the overall matchmaking activity was good enough that every participant was quite busy with further discussing collaboration opportunities until the end of the event. This assertion has to be verified during the interviews.

Figure 3: CONEX sessions during the event and study period



The period from the end of August 2014 to the end of September 2014 represents the actual period of use for the CONEX experiment with about 130 sessions (see Figure 3 — left side). The remaining period from the beginning of October 2014 until the end of January 2015 illustrates the CONEX sessions that were generated well after the event took place. The right hand side of Figure 3 highlights the generated CONEX sessions during the week where the event took place from 2 to 5 September 2014. The highest number of generated CONEX sessions occurred during the day before the event started and in the morning of the first day before the matchmaking sessions were held.

Conclusion and recommendations

While Ideal-ist offers a 'partner search' feature to H2020 proposers having a clear picture of their project proposal and needed partners, the matchmaking approach is more intended to create systemised connections among potential proposers that lead to unsolicited collaboration opportunities and eventually new breakthrough ideas. One could conclude that the two approaches perfectly cover the full spectrum of proposers' cases in their willingness to identify collaboration opportunities and potential partners that would fit with their interest in terms of H2020 challenges and topics.

The comparison with the brokerage session during information days highlights the fact that listening to the presenters one after the other during the full half day is certainly not the best way to support participants' interactions and networking. Interestingly, our study reveals that a very simple artefact like colour-coded badges appears to be the most useful, appropriate and attractive mean for creating event attendees' opportunities to connect and interact. For sure, it works until they are in the same physical space and they are not listening to someone else or a presenter in a session room. Furthermore, it would be great to have the opportunity to explore and experiment the contribution of digital matchmaking (e.g. CONEX) with attending proposers as well as EC officers before, during and after an information day.

Our study highlights the fact that not everyone is well prepared for the use of an online matchmaking platform. One could anticipate that it is mainly due to the lack of physical presence and social interactions or that they are looking to have something different or other types of information. While the 'digital' approach of matchmaking (CONEX) is considered as the most innovative one, it does not appear to be the most useful one as it stands behind the rating of the colour-coded badges and one-to-one speed-dating. However, it should be noticed that speed-dating activities are not necessarily welcome by everyone. Interestingly, one participant rated these two matchmaking elements with the lowest possible score.

In contrast, colour-coded badges and speed-dating sessions offer much more opportunities of physical presence and social interactions due to their use in a physical space. However, at the same time, they both restrict the capacity to establish the most appropriate connections with other attendees. It means that the best matchmaking solution is most probably to combine the digital and physical approaches in a way that one could anticipate the selection of the most

relevant or promising interlocutors among all event attendees. One could even start the discussion about collaboration opportunities through asynchronous and synchronous technologies (e.g. e-mailing, Skype) right before the event takes place.

In terms of recommendation, this study also highlights the fact that networks (e.g. ENoLL) could offer digital matchmaking to their members, i.e. big or small market players looking for reliable LLs operating within the different EU countries and beyond. These selected LLs would contribute to better engage local innovation ecosystems and users in the co-creation of innovative ideas and to anticipate the potential adoption by users/citizens/consumers in the EU market. For example, in the H2020 Fast Track Innovation (FTI), proposers would particularly benefit from digital matchmaking with the LL community. Especially because SMEs do not necessarily have the resources (e.g. methods, techniques and equipment such as 3D printers or virtual, augmented and mixed reality platforms as well as sensors/actuators platforms) for anticipating, through iterative prototypes and experiments, the user experience and the induced adoption of technological artefacts by users. Matchmaking between FTI proposers and LLs would greatly help to engage users in the co-creation of value instead of just using them lately as observed subjects.

Acknowledgments

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Communities of Practice as New Actors: Innovation Labs Inside and Outside Government

Abstract

Open innovation emphasises the link between corporate strategies and external expertise in order to generate innovation. Yet, for capturing the entire innovation ecosystem across individuals and organisations, it is important to recognise communities of practice (such as enthusiastic hobbyists, users, bureaucrats or interest groups) and their creative potential for innovation more broadly. Innovation is increasingly generated outside the boundaries of firms or research and development organisations. Places such as innovation and creativity labs become crystallisation points for new ideas, creativity and novel economic practices. Labs are time-bound tools and provide open and creative learning platforms for experimenting with solutions. Governments still have to learn how to deal with these new developments, which happen also inside State institutions. We illustrate the new nature of innovation processes in these labs and show how this affects the role of government. To substantiate our claim, we distinguish six different lab types and discuss their main characteristics, involved communities of practice and the role of government. The first type of lab supports activities fostering innovation from within government as represented by the Danish policy lab MindLab, while the other five lab formats are examples of the vivid non-State innovation lab scene in Berlin. MindLab is a cross-governmental innovation unit in Denmark that involves citizens and businesses in order to address societal challenges. Berlin has become one of the most dynamic creativity and IT hubs in Europe and hosts over 50 innovation and creativity labs. All the presented lab types exemplify the changing nature of innovation processes moving beyond open innovation. Shifting our attention towards innovation ecosystems highlights the need to open existing innovation structures for communities of practice across the State/non-State divide to fully exploit local innovation potentials. Both State and non-State actors can interact to create innovative solutions.

Introduction

Governments have a central role to play in making regions and states more innovative. Yet, they are facing ever more complex innovation processes and ever more innovation actors. From high-technology graphene products and the gamification of e-learning to social innovation enabling active and healthy ageing, the domains innovation policies nowadays cover are immense and so are the numbers and the variety of involved people and organisations. Engineers, designers, social activists and many more are making products and services for our future. How can governments possibly deal with this increasing complexity and be truly 'entrepreneurial' themselves [1]?

We argue that governments ought to open their doors to these new and emerging communities; they are here to stay. This would, however, necessitate the adoption of innovation also inside governments and administrations. Governments have to find new ways of organising their activities and structures in support of innovation in the economy and in society at large. When doing so, they get a first-hand experience of collaborating with established and new communities of practice and learn to better understand how they think and work. Innovation, in this perspective, is essentially a two-way street between government and society.

An increasing number of new individuals and groups are playing an important role in contemporary innovation activities. Important innovations do no longer occur exclusively in isolated R & D labs with engineers looking for solutions to problems. Different people from various fields like industrial engineering, interaction design, programming, marketing or anthropology are often involved in the innovation process at some stage. In times of 3D printing, open source solutions and new forms of crowdfunding, even enthusiastic hobbyists face relatively low barriers to innovate. It is indeed the recombination of insights from different domains that creates innovation [2]. Given this plethora of new subjects of innovations, governments face the challenge of keeping track of these developments and using them to better design their innovation support and to tap the full innovation potential in their country or region. The emergent creative and innovative groups constitute new communities of practice (CoP) that go beyond advancing scientific knowledge and aim at applying knowledge; in fact, these communities have come to constitute a form of governance in itself [3]. Organisation theorists have used the concept of CoP to define 'groups of people who share a concern, a set of problems or passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis' [4]. While such communities have existed for centuries in the form of guilds and other professional groupings, we are now facing more complex groups crossing traditional occupational borders. Managing their varied knowledge in a systematic and sustainable way is a veritable challenge for the governance of innovation policies.

While it is clear that CoP have an important role to play in many spheres of social life, it is less clear how this role can be institutionalised in the innovation domain. Studies on learning in project contexts show that learning and innovation are more likely to occur in projects that are embedded in wider ecologies, i.e. in networks with longer term and stable relationships [5]. In other words, a deeper institutionalisation of project teams and related communities is necessary in order to create an institutional memory and trust for further collaboration. Trust, in turn, makes it easier to tap the tacit knowledge of the members of a given CoP, a major element of the knowledge bases for innovation [6]. Unlike explicit knowledge, which is formally codified and thus more easily accessible, tacit knowledge is based on direct practice and experience — like on the job skills — and cannot be easily codified. Tacit knowledge complements codified knowledge; to be able to articulate a novel idea in a collaborative effort requires an understanding of 'the other [group] members' problem-solving methods that can only be acquired through the experience of ongoing collaboration' [7].

Some communities of practice exemplify new modes of knowledge reflexivity within innovation processes. Reflexivity refers to the logic of how new knowledge is generated. For instance, scientific communities generate new knowledge by following specific (formal) rules and evaluation modes. Generating knowledge happens in purposefully organised processes (e.g. in a laboratory or in dedicated public or private R & D facilities and departments). This mode of reflexivity follows a 'push-logic' because the boundaries of existing knowledge are extended intently. In contrast, in a 'pull-logic' actors are facing a specific problem or task while performing a practice. These communities, e.g. interest communities, groups sharing a hobby or professional communities (such as 'layers' or 'biotechs'), seek to address these challenges by working with existing knowledge from different domains. Instead of pushing knowledge domains, these actors continuously cross and redraw the boundaries of knowledge domains and thus create novel solutions [8]. Traditionally, government has focused primarily on supporting a 'push-logic' for creating new knowledge by developing instruments and strategies to support targeted research and development, for supporting the market entrance of innovations or by fostering the link between academia and businesses. The 'pull-logic' requires a more problem-orientated approach to innovation and has been less on the radar of governments.

After having spelled out why new CoP matter as actors of innovation, we now come to the spaces where these communities interact, exchange explicit and tacit knowledge and build up trust for sustained cooperation. Laboratories are increasingly seen as an appropriate space where such an institutionalisation of CoP interaction can take place and they are mushrooming globally. Innovation laboratories (or labs in short) are physical or virtual spaces that support innovation processes at different stages. These spaces offer opportunities for testing and experimenting with ideas, business models and practices; they allow for flexible forms of cooperation in and across government, academia, research, business and civil society [9]. Labs are surely no new phenomenon, given their common usage in the natural and in medical sciences, for instance, for developing and testing treatments and pharmaceuticals, but also in 19th century agriculture to experiment with new fertilisers and breeds [10]. The principles of the design thinking movement and from behavioural economics have driven this latest surge of labs. Design thinking stresses the added value of out-of-the-box thinking [11] driven by inter-disciplinary collaboration and user-orientation resulting in prototypes of products and services. Behavioural economics pays attention to ways citizens and consumers can be nudged in the right direction by intentionally targeting unconscious behavioural patterns. Both strands of thinking are built on the assumption that various different disciplines (economics, psychology, design, etc.) are needed to fully grasp human behaviour. In this more modern understanding of lab, the Helsinki Design Lab was probably the first publicly founded lab in 1968. In the private sector, the Bell Laboratories founded in 1925 are arguably the first lab bringing together scientists from various disciplines pursuing groundbreaking innovations.

Labs can contribute to the creation of CoP, i.e. groups and networks of practitioners working on related issues and collaborating flexibly. Labs and CoP embody assumptions similar to open innovation, but also expand open innovation by integrating a greater variety of innovative protagonists. Likewise, they reflect the inherent contradiction of open innovation: in order to create something new, organisation have to first open up to external influences and then close down again to allow a secured space where the right people at the right moment can develop something new.

Both concepts, labs and CoP, emphasise the need for more open trans- and inter-disciplinary collaboration geared towards the co-development of new services and products together with users. Put differently, they both hail the 'neglected king', the customer [12]. But how do these two phenomena relate to each other and what is the role of

government in steering and supporting these processes? We summarise the six types of labs and their main characteristics in terms of CoP involvement, objectives, role of government and time horizon in the table below. As you can see, the main features differ across types. We can broadly distinguish between innovation labs inside government (*policy labs*) and those labs established outside government (*grassroots labs, co-working labs, firm-driven labs, academic-driven labs, as well as incubators and accelerators driven by investors*).

Table 1: Types of innovation labs and their main features [13]

	Lab features			
	CoP constellation	*Objectives*	*Role of government*	*Time horizon*
Policy labs	Civil servants and external experts e.g. MindLab (DK), Policy Lab (UK)	Improve public service delivery & contribute to systemic change	Main customer	Medium- to long-term, subject to political changes
Grassroots labs	Individuals and groups of like minded enthusiasts e.g. Jakarta Open Data Lab (ID), Chaos Computer Club (DE)	Experimentation in physical workshops, challenging implicit rules	Hands-off	Medium- to long-term
Co-working labs	Very diverse & changing CoP constellations e.g. Fab Lab Berlin (DE), RocketSpace (US)	Provide open spaces for work and inter-disciplinary exchange & partly thematic agenda	Hands-off, may contribute to infrastructure costs in start-up phase	Medium- to long-term
Firm-driven labs	Company employees & external experts e.g. Lego's Future Lab (DK), Bell Labs (US)	Feed results of joint activities into the company's innovation strategy	Hands-off	Short,- medium- or long- term, subject to firm priorities
Academic-driven labs	Researchers & external specialists (companies & users) e.g. OpenLab (SE), MIT Media Lab (US)	Early cooperation in innovation projects & in some cases spin-off companies	Public funding possible, often indirect if operating unit is publicly funded	Medium- to long-term, often subject to project funding and time horizon of partnerships
Investor-driven labs	Early stage entrepreneurs, investors & business developers e.g. Technology Incubator (IL), EIT ICT Labs (EU)	Make start-up companies succeed in globally competitive markets	Public co-funding	Short-term

In the next two sections we will discuss each type of lab, starting with policy labs driving innovation inside government followed by innovation labs outside government. The former we describe based on a single case study (MindLab) and the latter (labs outside government) we exemplify based on a Berlin-based study that identifies the variety of lab formats that are organised outside government.

Innovation from within government: policy labs

Over the past few years, we have witnessed a surge of innovation labs addressing public and social challenges across the globe. From Asia and Europe to the American continent, more organisations than ever are founded, seeking to drive public sector and social innovation. Many cover a broad array of

topics and they are very ambitious in this respect in their early days. The authors count roughly more than thirty of these labs worldwide that are independent or based at universities and government institutions. Often, these organisations are based inside ministries and other public administrations. In order to focus, we discuss in this section only the policy labs founded by the public sector, i.e. those trying to drive innovation from within administrations. Taking this criterion into consideration, we arrive at twenty policy labs with the potential to have sustained impact in the world [14].

What is the main rationale for these policy labs? Expert groups working on public sector innovation for the European Commission and the OECD recently underlined the pressing need for co-design and co-production of policies and new products and services [15]. The main spaces where such co-design and co-development is being organised have become labs or 'innovation units'. In their most ideal form, policy labs do not only address improved public service delivery, but rather seek to achieve larger scale systemic changes in the way administrations work. That is, they contribute to the opening up of governments to the outside world for collaboration, co-innovation and sharing resources in a transparent way, thus becoming a joined-up and integrated network organisation [16].

MindLab is one of the first public innovation labs with a significant outreach beyond its host country Denmark; it has indeed become a widely cited reference point for policy labs since its launch in 2002. Interestingly, its foundation was partly the response to demands by business scholars who wanted to see the Ministry of Business Affairs not only preach to others about innovation but to streamline organisational innovation in its own practices; this reference to the private sector may also explain why MindLab's set-up was inspired by a private innovation lab in a large Swedish insurance company [17]. The policy lab underwent two major reforms and has re-invented its approaches and main objectives. Since 2006, it evolved from its successful facilitation of starting innovative projects for organisational development in one ministry to become a cross-governmental lab working on user-driven public sector innovation and policy development. Providing an analysis of the daily experience of citizens and businesses with public services became the key added value of MindLab activities.

Now, three ministries (Business and Growth, Education, and Employment) and the Odense Municipality are MindLab's main stakeholders, main customers and provide the largest share of funding. External demand from international organisations like the OECD, the United Nations Development programme and the European Commission has been on the rise in the past few years. The core team currently comprises members from eight different disciplines ranging from anthropology and sociology to performance design. A relatively small core team assures continuity while new input is gained through a research manager keeping contacts to academics and external collaborators. MindLab started working on service design and is now increasingly moving towards more strategic policy issues and more systemic reform projects. Over the years, MindLab has built a community of practice encompassing civil servants and external experts. Most recently a group of specialists working on the implementation of reform projects and programmes has been set up. Regular events with speakers on relevant topics for the community of practice give space for informally sustaining the relationships that were built during projects.

Projects typically follow three steps once the public sector client has identified a project (1). MindLab conducts field research with citizens and/or businesses to better define the underlying problem. (2) Based on these first analytical insights, a discussion takes place with experts and public sector stakeholders (3). Proto-typing takes place together with citizens and businesses to create possible solutions. Throughout this process, civil servants are the primary experts (with possible support by external experts), while businesses and citizens are key informants for the problem definition and proto-typing.

Empathy and explaining the added value of the innovation lab's new approaches are critical elements for having successful projects. Empathy turned out to be equally important in dealing with the lives and everyday experience of citizens. Citizens have been willing to be part of early research feeding into policy discussions in MindLab. Researchers ask them about their own lives and how they use public services. When conducting this research, quickly patterns of actual citizen experience and perception emerge. Depending on the project, private businesses also serve as informants in similar ways that citizens do.

Explaining what is done and its purpose is an important element when dealing with public sector clients. Changing mentalities and opening up the public sector to new approaches is a long-term process. Especially in the early days of MindLab this required ongoing explanations to the stakeholders. Solutions developed in innovation labs are meant to facilitate and improve public services and not to question the quality of the work civil servants are doing. Success is evaluated by gathering feedback from participants and defining indicators at the beginning of each project. Qualitative interviews

and other tools to monitor processes and outcomes complement the evaluation.

By continuously reinventing itself, and by demonstrating and communicating its added value, MindLab has successfully established itself as a central policy lab in the Danish administration. Despite being owned by State institutions, it has retained its independence and creativity to develop new approaches for co-designing projects and policies together with their 'end-users', namely citizens and businesses. Maintaining and creating new dedicated communities of practice with diverse backgrounds and knowledge has contributed to making their innovation activities more sustainable. How does this example compare to non-State innovation labs? In the next section, we discuss the other five types of innovation labs.

Innovation labs outside government

At this moment, there is no comprehensive overview available on the number and variety of non-State innovation labs worldwide. The International Fab Lab Foundation lists about 331 fab labs worldwide, while deskmag, an international virtual magazine for co-workers and co-working spaces, counted roughly 1 800 co-working spaces in 2012. Besides the meanwhile quite established terms fab labs and co-working spaces, other terminologies for spaces are used to underline their creative and innovative potentials, such as 'MakerLabs', 'tech-shops' or 'hackerspaces'. Berlin seems to provide a fruitful breeding ground for founding labs, due to the high density of research and development facilities, the dynamic political and economic transformation subsequent to German reunification, a growing creative economy as well as a vibrant start-up scene. Therefore, the following sub-sections illustrate lab examples from Berlin to capture the possible variety of innovation and creativity labs without claiming to offer a comprehensive overview.

Grassroots labs

Grassroots labs offer an environment for creatively experimenting and collaborating with ideas and tools. The main purpose is to foster and indulge creativity. Most facilities therefore offer materials and tools that combine craft-based practices with technologies and arts. Often, private initiatives found grassroots labs. Both user communities and lab providers often dissociate themselves from commercial and profit-driven objectives, which is why many Berlin-based grassroots labs are organised as non-profit associations with collective ownership. They provide different forms of membership that are managed by a professional host. Teamwork, sharing ideas and practices is primarily subject to self-initiatives, although frequent formats such as workshops, seminars or group meetings encourage collaboration. In terms of topics, grassroots labs deal with a variety of societal topics and challenges, which is why these labs range from open garages, hackerspaces to upcycling initiatives.

c-base

c-base is a hackerspace founded in 1995 in Berlin's central district Berlin-Mitte. It is organised as a non-profit association (*c-base e.V.*) offering skill enhancement for hardware, software and network usage. The association had about 400 members in 2013 and is funded through membership and seminar fees, donations, cultural events and projects. Full membership costs EUR 17 per person, while firm membership starts at EUR 170 per month. Seminars and events address topics such as open source software, mobile applications or 2D/3D design. Non-members have restricted access to the lab facilities that comprise, for instance, a wood and metal workshop, a sound laboratory and a 3D printer.

Co-working labs

Co-working labs are similarly easily accessible for users and often have a particular economic focus or specialisation, such as media, design or software development. Similar to simple co-working spaces, which offer a flexible working environment for desktop workers, co-working labs additionally offer spaces, equipment, devices and services for inter-disciplinary and collaborative work addressing diverse mobile professionals (freelancers, micro-entrepreneurs, start-ups), most of whom work in creative industries such as design, media, arts or software development. Unlike the grassroots labs, however, co-working labs are organised as profit-orientated businesses.

The equipment of co-working labs usually comprises devices, machines and related software including for instance 3D printers, laser and vinyl cutters or CNC milling machines. Sometimes, more traditional workshop tools supplement these technologies. Co-working labs usually offer seminars or support for using the high-end machineries accessible in their facilities. Access to co-working labs is provided on a temporary basis as machines and working stations are usually rented at an hourly fee. Consultations and extra services are subject to further expenses. The labs usually offer flexible opening hours that include weekends as well. Therefore, these places witness a high fluctuation that leads to continuously changing users within these locations.

Although co-working labs address the benefits of collaborative work, interaction and exchange are usually not solely subject to coincidences but they are rather organised and moderated by the lab providers. Co-working labs offer thematic workshops on fabrication methods, various forms of training

in using hard- and software and further education within the fields covered by the lab. Co-working labs, especially those that register as fab labs and thus follow the international Fab Charter, are explicitly open not solely to entrepreneurs and small enterprises, but also to other groups, such as school and university students, tech-enthusiasts and tinkerers. The lab provider acts as a node that creates and steers learning and exchange among users and also works on embedding the lab within urban and regional innovation ecosystems.

Hardware.co-Lab, Berlin

The Hardware.co-Lab is located within the famous co-working space betahaus in Berlin-Kreuzberg. This inner-city area has undergone substantial transformation in the past 15 years. During the division of Berlin, the area was close to the Berlin Wall and therefore considered to be remote and peripheral. Triggered by key investments and projects (such as the creative and artist store Modulor or justmusic), the area around Moritzplatz has become revitalised and attracts especially creative, artists and related professionals. The co-working space betahaus was founded in 2009. The DMY maker lab, an annual international design festival, initiated the idea to establish a place that enables artistic and design-related activities in immediate vicinity to betahaus in 2010. A place for creating physical designs was meant to complement the desktop-based activities at betahaus. This was accomplished through the Open Design City that was opened the same year and accessible under the same conditions as betahaus.

Open Design City offered workstations, 3D printing, CNC milling machines, hardware tools and professional support for using the more advanced technologies. Machines and support were available at an hourly fee. Self-organised (DIY) initiatives as well as creative professionals have used the Open Design City. Regarding their own mission statement, they want to offer a collaboration space encouraging the sharing of tools, knowledge, ideas and skills. Various self-organised groups have used the space for regular meetings and exchange workshops.

The concept of Open Design City has been transformed and the space has now been operating as the Hardware.co-Lab since January 2015. Conrad Electronic, a German retailer of electronic products with stores throughout Europe, became a business partner and provides test equipment, tools and machines. More explicitly than before, the lab addresses innovative hardware start-ups and 'technology freaks' [18] and offers up to 10 workstations. Jörn Werner, Conrad's CEO, explains that Conrad aims at being closer to demand-driven innovations by supporting those who generate them. Conrad thus offers support in realising and marketing new ideas and products [19]. Using the lab is also more restricted than before, since users have to apply for a residency with their project. The lab team evaluates applications. Once approved, the applicant has to pay a full membership fee (EUR 159) and a desk fee (EUR 150). Additionally, the lab offers thematic workshops e.g. on soldering and building electronic gadgets [20].

Firm-driven innovation labs

Firm-driven innovation labs are facilities that are established by firms for implementing their open innovation strategy. Therefore, access to these labs is much more restricted and controlled in comparison to the lab types discussed so far. Firm-driven innovation labs are in many cases consciously established in physical distance to the original firm. Berlin seems to be a favoured location for temporary forms of firm-driven innovation labs, mostly due to the city's reputation as being creative and unconventional. With this approach, firms aim at fostering dynamic and flexible research and development outside the company's hierarchical structures.

Innovations generated in firm-driven innovation labs contribute to the implementation of the firm's innovation strategy. Thus, access to these labs is subject to a selection process by the hosting firms. Firm-driven innovation labs in Berlin are mainly working in information and communication technologies, media, design, and consultancy services [21]. Operators of firm-driven labs set up spaces for integrating external knowledge and talents, e.g. from small and medium sized firms, freelancers and experts. They bring their knowledge from creative industries, research and development institutions and universities into internal innovation processes in the firms. The labs' operators thus offer cost intensive equipment to users who otherwise would have no resources to set up comparable technology intensive environments. In some cases, firms operating a lab integrate lab users in their partner and customer networks, thus offering an additional incentive for individuals and organisations applying to such labs. At the same time, operators can temporarily internalise fresh knowledge not available in their firms. Firm-driven innovation labs facilitate a controlled, flexible and demand-orientated integration of competencies, specialised knowledge and talents into companies' innovation processes [S7].

UFA Lab, Berlin

The UFA Lab is run by a group of companies, including FremantleMedia, RTL Group and UFA Film & TV Produktion GmbH. Additional partners are, for instance, Google, YouTube and Apple who support lab users through workshops, lectures, coaching and training. The lab is located in Berlin-Kreuzberg. The lab's activities are focused on new technologies

and media content to generate novel solution for TV channels, production firms, digital special interest channels and online portals. Therefore, the lab's user community comprises the UFA company, technology firms, research and development facilities, media enterprises, students, graduates and freelancers involved in sectors such as new media, film, camera, film editing, scripts, graphic design, programming, game design and data visualisation.

The lab uses three strategic columns: (1) Blue Sky Innovations supports experience-orientated innovation projects for three to six months. Successful applicants can use the lab's equipment and infrastructure as well as support offered by six UFA employees. (2) Innovation projects are financed either by industrial partners, public funds or UFA. These projects are usually of larger scale and implemented by selected applicants, freelancers and UFA employees. (3) An agency offers services in cooperation with freelancers. Through these services, UFA is able to finance Blue Sky innovation projects. These three activity bundles build up a large community of partners and talents that UFA then can frequently activate for further projects and services.

Academic-driven innovation labs

Like firm-driven innovation labs, academic-driven innovation labs are an instrument to open the organisational and institutional boundaries of higher education and research institutions to more complex and inter-disciplinary actor constellations in innovation processes. Additionally, labs can bridge market demand and academic basic research. The labs identified in Berlin are primarily orientated towards technology-intensive industries such as ICT, design, music, games, software development, energy and automotives. Other disciplinary or sectoral specialisations are nevertheless also possible. Open Lab in Stockholm (opened in February 2015), for instance, aims at addressing societal challenges in the fields of medicine, engineering, natural sciences, social sciences, humanities and the arts [22].

Academically driven labs are set up either for implementing specific projects or for dedicated programmes. Hence, the duration of such labs depends on the duration of funding, but may range from short to long term. Sometimes, strategic partnerships are established (e.g. with multinational enterprises such as Deutsche Telekom AG or Daimler Benz AG) to circumvent the temporal fixation of academic-driven labs. Usually, such labs are funded through partnerships. The hosting academic institution is, however, the one operating and managing the lab. The strict project and programme affiliation limits the constellation of partners and participants — including industrial and other academic entities, research centres, students, companies, start-up firms, entrepreneurs, end-users and consumers — in these facilities.

Design Research Lab, UdK Berlin

The Design Research Lab belongs to the University of the Arts in Berlin (UdK). The lab facilitates inter-disciplinary design projects with the objective of bridging the gap between people's needs and demands, and technological innovations. The disciplinary focus is on smart textiles, human computer interaction and communities in digital societies [23]. The Technical University of Berlin and the Deutsche Telekom Laboratories (T-Labs) founded the lab in 2005. Since 2010, the lab has been running alongside the endowed professorship for design research at the UdK and is organised around research clusters on civic infrastructures, social innovation, embodied interaction, and connected textiles.

Besides PhD projects, the lab also implements projects funded by German federal ministries, European research and development funds and industrial partners. The projects lead to joint patents, subsequent projects, spin-offs and consultancies for enterprises (particularly for Deutsche Telekom). Although the lab is located in close vicinity to the UdK campus in Berlin-Charlottenburg, some activities such as living labs are implemented in other city districts to reach and integrate citizens as active experts in research and development.

Investor-driven labs

Investor-driven labs are testing arenas for new business ideas and business models. Some companies also exploit them to recruit new talents or to benefit from the competencies of the start-up community. Most investor-driven labs operate in the growth sectors of the digital economy. Entrepreneurs, start-ups and start-up teams are the main target groups of these labs. They are selected based on rigorous evaluation criteria such as feasibility, scalability, profit potential and potential returns on investment. Usually venture capital providers or large companies that are clearly profit and yield-orientated businesses manage investor-driven labs [S2]. In return for supporting lab users, investors receive a share of the start-up's turnover or, alternatively, the investing companies receive partial rights to the intellectual property of the beneficiaries' business ideas.

Investor-driven labs are organised in different models: Investors either provide an incubator, act as business developers or accelerators or they organise education programmes for entrepreneurship. Apart from capital — e.g. seed capital –, investors provide in-house co-working spaces and additional

infrastructure and equipment, offer coaching programmes with national and international industry experts, initiate networking events with (inter) national stakeholders and potential large industry partners for the start-up for a limited time span. Large multinational enterprises such as Deutsche Telekom AG, Deutsche Post AG, Otto Group, Bertelsmann AG, Axel Springer AG, ProSiebenSat.1, Microsoft and Google have heavily invested in these labs in the past years. They create a win-win situation for their beneficiaries and the investing company. While investors secure property rights in potentially innovative products and firms at a comparably low financial risk, the beneficiary learns through competition in labs and benefits from the investor's programmes, networks, distribution channels and markets.

Found Fair Ventures

Found Fair Ventures is an incubator and company builder founded by the investor Burckhardt Bonello in 2010 in Berlin-Mitte. The lab comprises access to seed capital, mentoring, access to business networks and working stations with a focus on online business models. Found Fair Ventures supports start-ups and start-up teams through different channels: Start-ups and teams with a product or prototype can submit their business plan (concept, team and market analysis) for feedback. Interns and entrepreneurs in residence are potential founders of new start-ups that are integrated in an existing start-up company of Found Fair for several months. As such they participate in an already ongoing founding process and thus learn by doing and interacting. Finally, venture partners are established companies that are either part of the expert network or function as partners for one of the internal start-ups. Start-ups located in the in-house co-working space benefit from the proximity to other start-up firms, either through collaboration or by competition. Start-ups additionally receive consultancy from Found Fair Venture's mentors.

Conclusion

Despite their great variety, all lab types discussed in this article share five key characteristics [24]. First, labs can be considered as *tools*. Each lab offers a physical environment equipped with desks, machines, computers, audio-equipment, materials and substances that can be flexibly arranged. These tools have no pre-defined function, but can be rather creatively employed based on user needs and ideas. The equipment set-up depends on the community that a lab wants to address. Second, labs *curate openness*. Collaborative creativity and innovation do not occur by themselves. Lab providers do not provide an entirely open and uncoordinated access to their facilities. Instead, they carefully arrange and manage 'collision spaces' [25] for unexpected, but creative encounters of diverse user groups. By setting the labs' agenda, by selecting available equipment and by offering specific services, lab providers establish a frame for a community of practice that they want to attract to their labs. However, communities of practice cannot simply be described by their organisational or institutional backgrounds. Third, labs are *learning platforms*. The carefully arranged collision spaces in labs offer a wide range of events, seminars, workshops, hackathons and pitches on topics that lab users encounter while developing and implementing their ideas. Usually, these learning platforms are based on peer learning that don't just foster interaction; they can lead to a continuation of that interaction through other forms of collaboration. Learning also takes place in highly competitive environments like in investor-driven innovation labs. Fourth, labs offer *creative freedom,* because labs are not designed to implement everyday routines. Instead, labs offer an environment for the user to experiment with ideas without an economic goal fixation by the flexible access and detachment from sheer economic profit. Lab users find a space that provides tools and services for like-minded enthusiasts and experts who first dedicate their energy to addressing a specific need, demand or problem. In some cases, this fosters demand-driven innovation that might lead to new businesses, but it can equally well result in social innovations, new forms of policies or problem solutions. Finally, labs are organisations that provide tools, spaces, technical infrastructure and know-how on a *temporary basis*. Though the lab itself is often built with a longer time span in mind, its key assets (equipment, partnerships, user constellations, dedication, etc.) are subject to continuous change. The time horizons in labs are defined by the duration of projects and programmes rather than by long-term business strategies of firms and governments.

Labs clearly have a two-fold effect. One the one hand, they attract a specific user community; on the other hand, they actively create communities of practice. The first effect is the result of the labs' alignment that attracts a certain group of users, independently of their organisational background. They are attracted to labs because labs enable them to deal with and work on a topic that has a special value to them. This may include their concern with certain societal challenges, such as socio-demographic developments; it might as well be based on their vision of better-designed policies addressing citizen needs as in the case of policy labs. This may include a community that is concerned with finding alternative approaches to environmental issues (e.g. up-cycling) or that seeks to explore the potential of digital devices, as in grassroots or co-working labs. Some will use the spaces for fulfilling own ideas, others for starting

a business or for rapid prototyping. Enterprises and academic institutions exploit labs to create a community that supports their open innovation strategy while investors attract a community of start-up entrepreneurs. Each lab provides a setting that activates 'knowing in practice' [26] across knowledge domains and thus also creates new innovative communities. These communities are characterised by generating pull-innovations, because their members are enrolled in collaboratively answering a specific demand or solving a problem. Additionally, these communities are characterised by a social constitution that comprises diverse actors affected by a specific topic: citizens, users, bureaucrats, interest groups, experts, partners, financiers, economic and academic stakeholder and students etc. This diversity facilitates avoiding blind spots in innovation processes.

On the government side, we only find very few examples that pay sufficient attention to the innovation dynamics in labs. One challenge, of course, is the role of communities of practice in innovation processes. In contrast to firms or academic organisations, governments have no clear addressee for policy support, since communities of practice are based on shared knowledge and concerns, rather than on organisational boundaries. The Danish MindLab is a good example of how governments can create communities that are actively involved in designing innovative policy solutions. Labs outside government have so far rarely been on the radar of governments. If governments succeed in integrating labs as complementary players in innovation ecosystems, governments will be better equipped to construct regional advantages for their innovation economies [27]. Labs are a tool and a methodology to integrate users, interest groups and concerned protagonists in defining the topics to be addressed and in finding user-centred solutions. This includes government, but it does not mean that governments have to initiate policy-relevant labs on their own. Governments have to grow slowly into this new role and they must pay attention to pull-innovation logics, as they become full partners in private and social innovation processes.

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Basaksehir Living Lab

Introduction

A Living Lab is an environment where developments are tested, improved upon and implemented in the surroundings designed to mimic their natural environment, through interaction with real users. A Living Lab is organised in such a way that its operation can be extended to any specific environment required by the development in question, for example a whole city, a factory or a house, a public service locale such as a school, a hospital or a park, or even agricultural land.

A Living Lab is a reproducible research and innovation model that is providing to add real value to the products and services that it handles. It allows real users to test the innovations under real-life conditions. In turn, the users actively help to create and optimise the technology based on their needs. For example, the trials of a technology developed to assist a sick or overworked secondary school pupil to connect to his/her classroom and keep up with the classes, are performed both at home and in the classroom. Feedback from both the pupil and teacher provides the developer with the necessary information to effectively and accurately amend it in accordance with market demands.

The first Living Lab of Turkey opened its LEED Gold certified doors in 2014 in the Basaksehir Municipality of Istanbul. The vision of the Basaksehir Living Lab is to create a modern face of Istanbul situated in the developing Basaksehir Municipality, which is fully integrated with Istanbul's social, cultural and economic life, and will attract people thanks to its organised urban concept. In the rest of this article, I will describe why the Basaksehir Municipality was a strategic choice to establish Istanbul's first Living Lab and outline the areas of development that will initially be undertaken at the Living Lab.

Location

Istanbul is a metropolis located on two continents; it stretches over 50 km on both the European and the Asian sides of the Bosphorus channel, which connects the Black Sea and the Mediterranean. Istanbul has been the most populous city in Europe since 1980, with a current population of 14.2 million. Historically, Istanbul was the seat of the Eastern Roman and the Ottoman Empires. The relatively undeveloped but rapidly growing Basaksehir Municipality is starting to attract attention as a popular new district of Istanbul. Decision-makers in Basaksehir are working to mobilise its potential and raise the living standards of the region while also increasing economic productivity to compete with the better-established neighbouring municipalities. Below is a list of features that make Basaksehir a strategic choice for a Living Lab: it is only 14 km away from Ataturk International Airport, the hub for transfers between East-West, North-South.

- New International Airport (41 km away) is under construction and will be operational by 2017. The new airport will be one of the largest in the world, with a passenger capacity of over 100 million [1];
- It is situated near many national and international companies, institutions, technical universities, research centres and techno-parks;

- All major motorways pass near the city boundaries (E5, the Trans-European Motorway, the 3rd motorway). High-speed railways will connect the European and Asian railway systems to the new airport. Efficient public transport systems are already in place (metro, light rail tram and city bus systems);
- Two major international exhibition centres are located within a 10 km radius;
- The largest Organised Industrial District in the world is running on the border of Basaksehir. It has 30 000 small and medium-sized enterprises (SMEs), which employ 300 000 workers and have yearly exports of EUR 8.5 billion [2];
- There are large stadiums, one of which was built to the capacity of the Olympic Games. The area of Basaksehir region is 6.5 km by 22.5 km = 146 km² [3];
- Basaksehir is nearly equidistant from the Black Sea and the Marmara Sea. An artificial canal running parallel to the Bosphorus (150 metres wide and 25 metres deep) will be dug through Basaksehir. The cost is projected to be around USD 40 billion. This canal will attract talent from all over the world to the region during the next decade;
- There are two technical secondary schools that are considered to be two of the best in their fields in Turkey;
- The largest public hospital complex in Turkey is under construction and will cover an area of over 780 000 m² and include a sports hospital [4].

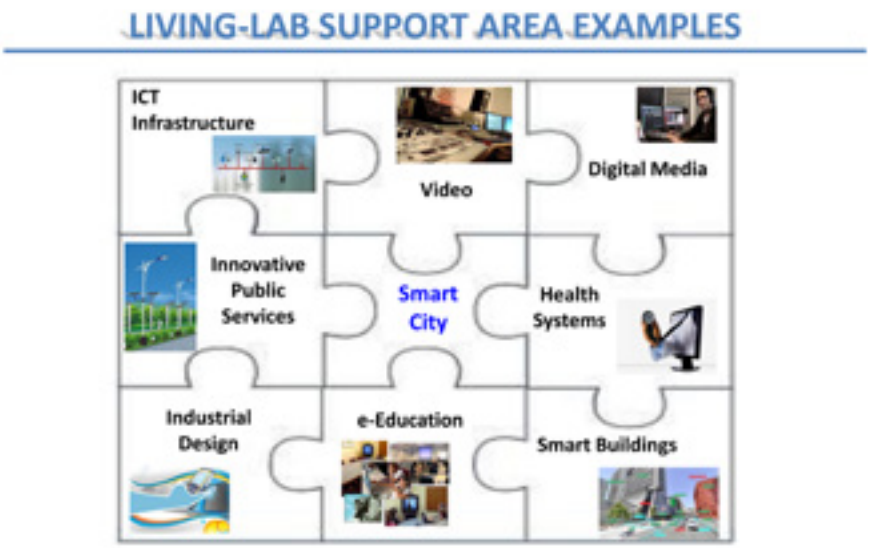
The cooperation between the municipality and the Living Lab

The municipality aims to create a sustainable smart city based on ideas facilitating human life and citizen satisfaction, in which all the inhabitants benefit equally from modern public services. The population of Basaksehir is 400 000 and is expected to double by 2020. In light of this rapid growth and the high budgetary allocation of the Turkish government to research and development (R & D) and innovation, the Basaksehir municipality is eager to focus its efforts on the Living Lab.

The municipality welcomes the concept of pioneering smart cities, and the Living Lab guarantees the presence of qualified human resources. This will channel the dynamism of the companies based in Istanbul, as well as attract foreign companies to the city.

What the municipality has done in the field of ICT is an indication of what can be done elsewhere in the future. Some of the successful implementations are an operative Living Lab, 1 Gbit/s Internet Connection, Support Card, Call Centre, Establishment of a Police Mobese System, Municipality Management Information System (YBS), Electronic Document Management System (EDM), Digital Archiving and GIS [5].

Basaksehir Living Lab — The Focus Areas



The focus of the Basaksehir Living Lab is to provide an environment for developing ICT products and services such as;

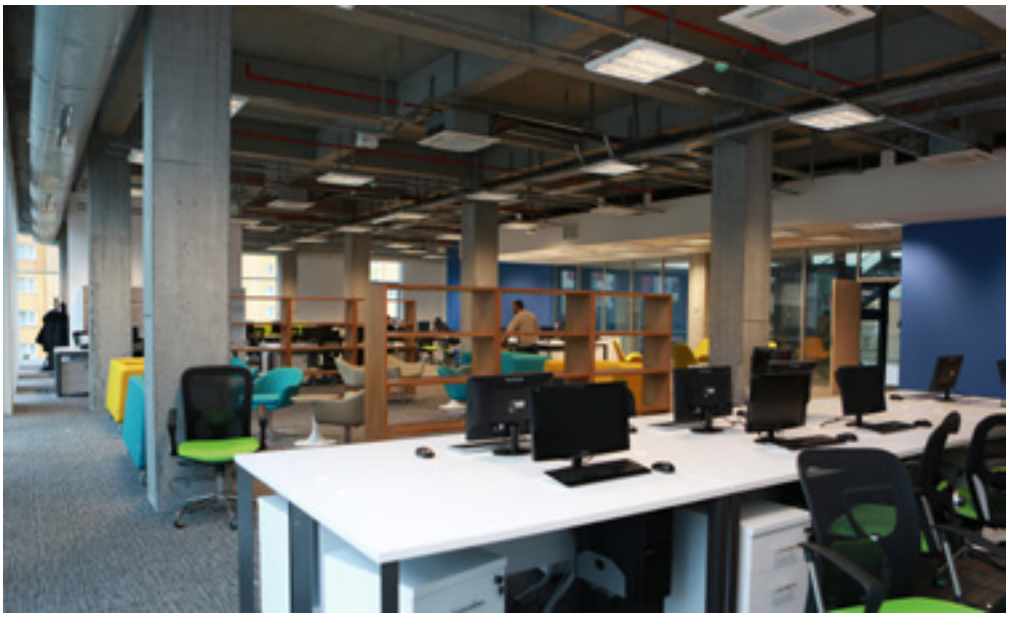
- Smart cities;
- Mobile applications;
- Robotics;
- Wireless communication technologies;
- Mobile health;
- E-Education;
- Sensor technologies;
- Renewable energy;
- Wearable technologies;
- 3D printing technologies;
- Augmented reality and virtual reality;
- Design and innovation, entrepreneurship schools.

Basaksehir Living Lab Innovation and Technology Centre

The Basaksehir Living Lab Innovation and Technology Centre building is constructed in Basaksehir and has a 3 500 m² covered area and includes the following areas and facilities:

Living Lab Incubator

The incubator is a workshop and office environment where any kind of equipment, software and hardware that can enable individuals with creative ideas or small enterprises to make developments is available. There is an electronics laboratory and a 'design factory' with rapid prototyping capabilities, a conference hall, separate meeting rooms and a large unified working area.



Living Lab User Experience Centre — Showroom

The Living Lab User Experience Centre is the environment where new technological products and services are shared with users and business partners and where feedback is received. It can be used by entrepreneurs and established business partners.

In addition to the Showroom, the User Experience Centre contains a seminar hall and design experience site where 3D printers are available. The seminar hall is a flexible area and includes cutting-edge, interactive smart education technology provided by WALLRITE SCANDINAVIA.

Living Lab Social Area

The Social Area is a green area located in the penthouse of the building and is used for dining, relaxing and social activities.

At the forefront of technology and innovation

The Basaksehir Municipality is at the forefront of ICT competency growth. Thanks to its present infrastructure, it can effectively deliver IT services to the public and carry out projects to launch future services. Some of these projects are listed below:

- High-speed broadband infrastructure (1 Gbit/s symmetric connectivity to each new flat in the municipality);
- Free public access to information services; i.e. Wi-fi points, IP TV;
- Providing all public services, especially security, health, education and economic services through web portals and applications;
- Becoming a pilot area for new technologies such as 4G and 5G, WiMAX, IPTV, Wi-fi points and Basaksehir mobile applications;
- Implementing safety surveillance with networked tracking systems.

Contribution of Basaksehir Living Lab to innovation and entrepreneurship

The incubation and experience centres at the Living Lab allow ideas to turn into products and services. The services that the Living Lab offers are not limited to the facilities within the physical building. Thanks to partnerships established between the Living Lab and other organisations, additional services, such as the following, are offered:

- Bringing together entrepreneurs and investors;
- Coaching of SMEs for the market;
- Supporting the development of business models and bolstering relationships with the finance sector in order to obtain financial resources;
- Helping with business presentations;
- Legal support during company establishment.

However the most vital issue is that entrepreneurs have environments to test their products and have the opportunity to adapt their highest-scoring products to the market through the feedback that they receive from users.

Furthermore, thanks to Basaksehir municipality joining the European Network of Living Labs (ENoLL), many Living Labs around the world can be used as practical test environments, and the opportunity to present products on international platforms will arise.

The Executive Board Committee of ENoLL has decided during Open ENoLL 2014 and General Assembly in Amsterdam (3-6 September 2014) that Open ENoLL 2015 and General Assembly will be organised at the Basaksehir Living Lab between 25-29 August 2015. Around 500 Living Lab managers from five continents (representing around 440 Living Labs) are expected to participate.

Since the Living Lab accelerates the R & D process and market entry, smaller investments provide faster responses, as other LivingLab examples have shown. This will increase Turkey's competitiveness in the global market.

Innovation Competition

The Turkish Export Assembly (TIM) is organising an 'Innovation Week' every year at the beginning of December in Istanbul. This three-day event attracts 45 000 participants. Basaksehir Living Lab has organised an 'Innovation Competition' among primary and secondary schools as well as university students with TIM and IOSB (Ikitelli Organised Industrial District) for the Innovation Week. 200 innovative projects were submitted and the jury has chosen nine projects from each age group to be rewarded [6].

Main activities of Living Lab during 2015-16

People Olympics

In 2015, 1 200 citizens and in 2016 10 000 citizens will participate in what is called the People Olympics. The 2016 People Olympics will start concurrently with the Rio de Janeiro Olympic Games and will go on for a whole year. The primary goal of the People Olympics is to increase awareness of a healthy lifestyle and encourage people to make exercise a part of their daily personal and family routines. The Living Lab approach to this event will focus on the use of

immediate mobile feedback from various measurement devices and applications developed there. An important aspect of health that the Basaksehir Living lab wants to consider is fasting, and people will be educated about different methods of effective and healthy fasting [7].

Education

The public education programmes for 2015 were planned with all age groups in mind. The following is a sample of the programmes being offered:

- Coder Dojo/Scratch;
- Robotics and rapid prototyping with Lego bricks;
- Simple and advanced circuit design (for example, designing a digital clock, Arduino);
- 3D modelling and 3D printing;
- Augmented-reality stepping stones;
- Digital accessibility for the handicapped/disabled;
- Empathy training for disabled caretakers;
- Take Responsibility for Your Trash Foundation;
- Smartphones and e-government .

Workshops

The Living Lab will organise public workshops and forums in 2015 in a plethora of fields that touch our lives. Again, a sample list is presented below:

- Parks and recreational areas;
- Posture and ergonomics;
- Changing spaces and enriching urban identities;
- What makes a smart city?;
- Storytelling in product design;
- User interfaces;
- Presentation techniques and mock-ups.

Conclusion

On five continents, hundreds of cities are competing to become recognisable brands, and the concept of the municipality is being recreated. It is not a coincidence that Living Labs started buttressing the idea of the smart city. Living Labs aim to improve the living standards of citizens by improving education on all levels, facilitating adaptation to the digitalisation of services, facilitating a healthier lifestyle and emphasising the connection between arts and innovation. In short, Living Labs are an indispensable part of becoming a sustainable smart city. In this regard, the Living Lab is contributing to Basaksehir's goal of becoming a brand, and is becoming a leader among the Living Labs that will be established in different urban centres across Turkey.

In closing, I quote from Dr Geert Hofstede:

'We need to remember that there is a supercomputer between the ears of every human on this planet. Train him/her well, and they become a key part of the knowledge economy.'

The Basaksehir Living Lab provides equal opportunity to all who visit, in order to optimise the use of mental resources by rallying the resourcefulness of the whole region.

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CHAPTER III

Open Innovation 2.0: Smart Cities

Smart Lighting Solutions as a catalyst for Smart Cities: *Practical Challenges of Ambitious Innovation Partners*

Abstract

Cities strive to improve quality of life for their citizens and see opportunities in new ICT-based technologies. Public lighting and public lighting infrastructure can play a significant role as a stepping stone to achieve the ambitions of cities to become 'smart cities'. New technology enables cities to offer a wide range of intelligent and integrated services to benefit both individual citizens and society at large. The main challenge is how to create and implement new technology solutions serving the needs of people. This requires a paradigm shift towards the continuous innovation of services for people. Practical projects indicate four paradigm shifts: (1) from products to service; (2) from technology to people and society; (3) from individual products to adaptive platforms; and (4) from one-off results to continuous innovation.

Ambitious cities and projects encounter practical implementation problems that can only be overcome by radical new approaches and corresponding boundary conditions. Changing roles for all partners — industry, municipalities, knowledge organisations and citizens — can be identified. The technological development should aim to provide a platform in which all partial solutions can be integrated, and that is open to the development of applications. The starting point should be the people and other stakeholders who will benefit from the value created. A 'designerly' approach facilitates citizens in participating as experts on their own quality of life. The main challenge is in the co-creation process in the ecosystem: all partners will participate in the path of innovation, embracing the uncertainties in the outcome and jointly seeking opportunities that deliver the best value for all partners.

Introduction

Cities strive to improve quality of life for their citizens and see opportunities in new ICT-based technologies. At the same time companies are looking for ways to create a sustainable business in the smart city domain. Many companies approach cities to offer technology solutions, resulting in a large number of pilot projects for smart cities [1]. In many cases these solutions are only a part of the desired integrated system, e.g. the role out of extensive sensor networks to collect all kinds of data. However, for a truly smart city solution, just collecting data is insufficient. Smart solutions should have a real impact on quality of life by providing answers to real societal needs. Smart lighting projects have an advantage, since light adds an actuator to the system to influence quality of life. This means that public lighting and public lighting infrastructure can play a significant role as a stepping stone towards achieving the ambitions of cities in becoming smart cities. As we described in the previous yearbooks, the lighting domain is in a transition from a hardware and product-driven industry to a full solution and service-driven industry. The new, disruptive technology creates possibilities for adaptive lighting and smart services that have not been possible before. Technological developments include an upgrade of the public lighting infrastructure and system by connecting to ICT solutions. The resulting growth in the availability of data from sensors and controls creates many new service opportunities. This enables cities to offer a wide range of intelligent and integrated services that will benefit both individual citizens and society at large.

The main challenge is how to create and implement new technology solutions serving the needs of people. How can we ensure that the technology contributes to making the city an attractive place to live?

A change of paradigm

Moving beyond the functionality of products to providing value for citizens and society with service innovation not only needs technological developments, but especially it needs a change of mindset for all participants in the quadruple helix — a fundamental mind shift towards continuous innovation of services for people. This paradigm shift, also described by Curley and Salmelin [2], involves changing perspectives of all partners in the quadruple helix. However implementing such new working approaches is no easy task. In realising smart lighting projects as part of the implementation of the vision and roadmap urban lighting Eindhoven 2030 [3] the TU/e Intelligent Lighting Institute, the city of Eindhoven and industrial partners experienced new practical challenges. We will explain the change of paradigm through four mind shifts occurring in parallel, illustrated by practical projects.

A shift in focus: from products to service

The dominant business model in the lighting and ICT industry has mainly been hardware-based: selling products such as lighting posts, luminaires, sensor and routers. The innovation question focused on how to create new technology and new functional products. But today a shift is needed towards smart, ICT-based lighting as a value-adding service.

This shift from products to services will be illustrated by the Amsterdam Smart Lighting project, in which an adaptive lighting solution is designed and implemented for Hoekenrodeplein, a square in Amsterdam. This project is a collaboration between the city of Amsterdam, Philips, Cisco, Alliander, KPN and the TU/e Intelligent Lighting Institute. Hoekenrodeplein is located in ArenAPoort, and provides a unique environment with a diversity of entertainment, shops, sports, restaurants and bars. The Ajax football stadium, several music stages and a large cinema are just a few examples of event locations in ArenAPoort. Residential and business areas are also included.

In the redevelopment of Hoekenrodeplein, three ambitions were identified for the area: increasing sustainability, safety and hospitality. The proposed lighting solution is an adaptive lighting system that creates the right ambiance for any moment. The lighting scene adapts to time, weather, number of people, the spread of people, and their needs at the moment and the desired atmosphere.

The smart lighting system consists of a set of LED spotlights that enable different light scenes by adjusting the light levels for the individual light sources. The system uses cameras to count people on the square and monitor their locations. In this way the system can adapt the light scenes to the use of the square, for instance commuting during the morning and evening rush hour or leisure activities at weekend evenings. It can adapt by dimming the light when there is nobody around or by lighting up the areas in which people are present to create a pleasant atmosphere. During events the system provides an inviting light scene to attract people to come or to stay longer. When it is very busy the system can be geared up to a higher light level, enabling surveillance of the crowd for security reasons. The adaptive lighting system provides the service to create the right ambiance for any moment

Figure 1: Adaptive lighting at Hoekenrodeplein creates the right ambiance for any moment (designed by Philips)

The Amsterdam Smart Lighting project illustrates the mind shift towards service-driven thinking. Technically, the adaptive lighting system consists of lighting posts, luminaires, cameras, sensors and Wi-Fi connectivity. In functionality this enables any possible lighting scene, creating new design opportunities that address the innovation questions at different levels. If the system can create any desired ambiance for any moment, then what ambiance should be provided at what time? How can we turn ambiance creation into a meaningful application? Who are the users and other stakeholders, what are their needs and when do they experience them? And what ambiance suits these needs best? In other

words how can we develop meaningful solutions that add value to the (local) people?

For Hoekenrodeplein these challenges have been solved by realising the adaptive lighting system first, with a set of ambient lighting scenarios. After the installation, independent research is being carried out to validate the scenarios. Using the outcome of the research, the scenarios can then be tuned to achieve the desired impact on the defined criteria of sustainability, safety and hospitality. The shift in focus from products to services makes it possible to continuously innovate without further investments in the hardware infrastructure.

A shift in focus: from technology to people and societal needs

The changing focus to services requires a second mind shift to a focus on people and societal needs. There is a need to get a deeper understanding of the different stakeholders' needs in relation to good quality of life to enable the definition of meaningful solutions.

The shift towards a focus on people and societal needs is illustrated through the ENIGMA project [4]. ENIGMA is a European-funded project that aims to implement a joint transnational pre-commercial procurement (PCP) procedure in the field of public lighting. The project is coordinated by the City of Eindhoven, and has five partner municipalities (Eindhoven, Malmo, Stavanger, Espoo and Bassano del Grappa) cooperating on procuring innovation and testing innovative ICT-based lighting solutions in a real-life environment. The TU/e Intelligent Lighting Institute facilitated the first step in the project: defining the desired societal impact for the intelligent lighting system and the common and specific needs for the different pilot areas of the five cities.

The challenge in defining the societal needs and the desired societal impact is twofold. First of all, all cities appointed a specific pilot area in which the results of the project will be implemented. Each pilot area has its own dynamics, stakeholders and context. In-depth understanding of the specific needs of the stakeholders in the pilot area is needed, as well as good understanding of the city's policy with its strategic ambitions for the city as a whole. Secondly, all five pilot areas differ in functionality (a busy area near a railway station, a school area, a park in the city, a university campus and a historic city centre). For this project it is important to identify a common ground for all cities on which to define the specifications and desired societal impact, to be able to procure an innovative solution that meets all needs simultaneously.

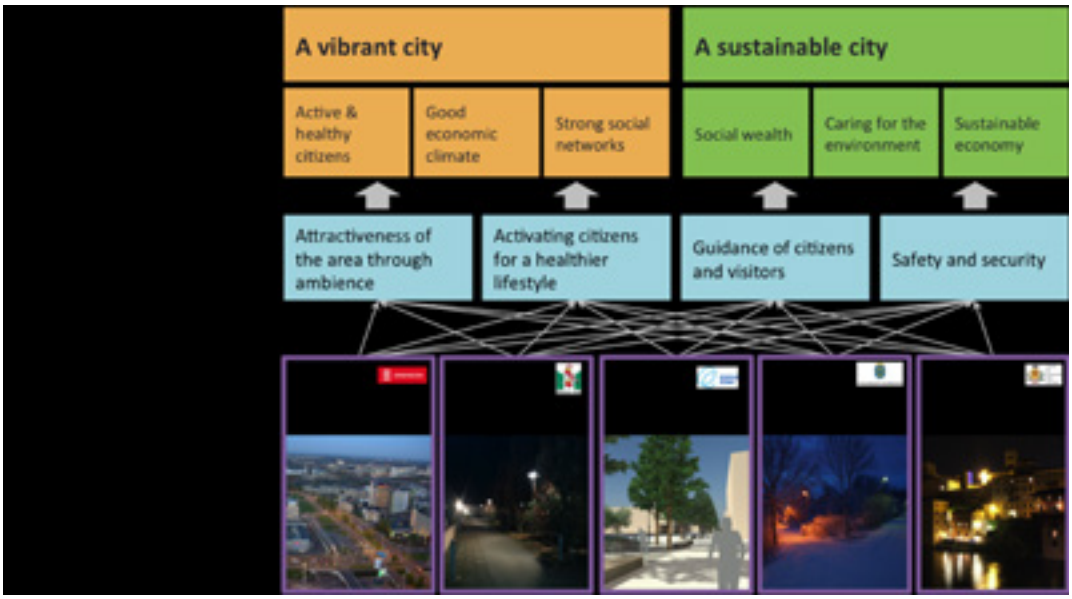
To gain an understanding of the strategic ambitions and societal needs in the pilot area, Deep Dive Workshops were organised in each of the five cities. These consisted of four sessions, as shown in Figure 2. External stakeholders included residents, police officers, employers, hotel owners, representatives of citizens, scholars etc. All information and insights from the four sessions were combined, and these led to a coherent overview of the desired stakeholder needs in relation to the cities' strategic ambition.

Figure 2: The identification of societal needs with all stakeholders in the ENIGMA project

With the coherent sets of needs for each city and its pilot area, the second challenge was to reach common ground for the five cities. At a strategic level the cities share a common ambition: becoming vibrant and sustainable cities. On a deeper level there are also shared societal needs. For example, one common need is 'guidance of citizens and visitors'. This can be defined in more detail for each

pilot area, e.g. for the university campus area in Espoo this translates into 'offering guidance between the public traffic lines (e.g. transition from metro to bus station, which lines leave from where, lighting indications showing when the next bus/train will arrive etc.)'. For the railway area in Eindhoven it means 'providing collective routing and guidance in case of special events and police request (crowd control)'. Or for the historic city centre 'dynamic and interactive lighting able to drive visitors and tourists through the city gems as well as providing services to residents (such as driving directions highlighting restricted car areas, car parks, cycle paths, the presence of bike sharing, ongoing events, services, commercial indications)'. Since the societal needs were described in the same way for each area, the cities had a shared language to discuss the specifics and commonalities. This catalysed the process of defining the right level of description for the common needs.

Figure 3: The step from societal needs to common societal needs and ambitions in the ENIGMA project



Traditionally cities would procure lighting systems by specifying the functional aspects of lighting (light levels, light distribution, colour temperature, light source technology, type of luminaire etc.). It is perceived as a great challenge to turn the process around and identify the societal needs. This leaves more space for creative solutions by designers and industry. The cities struggle with the process for different reasons: it is a new working approach, and it requires a different kind of thinking, but it also means that it is much less certain what solutions they will eventually get when creativity is allowed into the process. The ENIGMA project illustrates the mind shift to a focus on people and societal needs, to identify new possible and desired solutions for intelligent lighting systems, and not only taking technical (contemporary) solutions as a starting point. In the process it is important to engage all stakeholders and listen to their specific needs. However it is equally important to redefine the identified needs so they address the societal needs for the city above the individual preferences of stakeholders. The public interest has to be addressed at the right level.

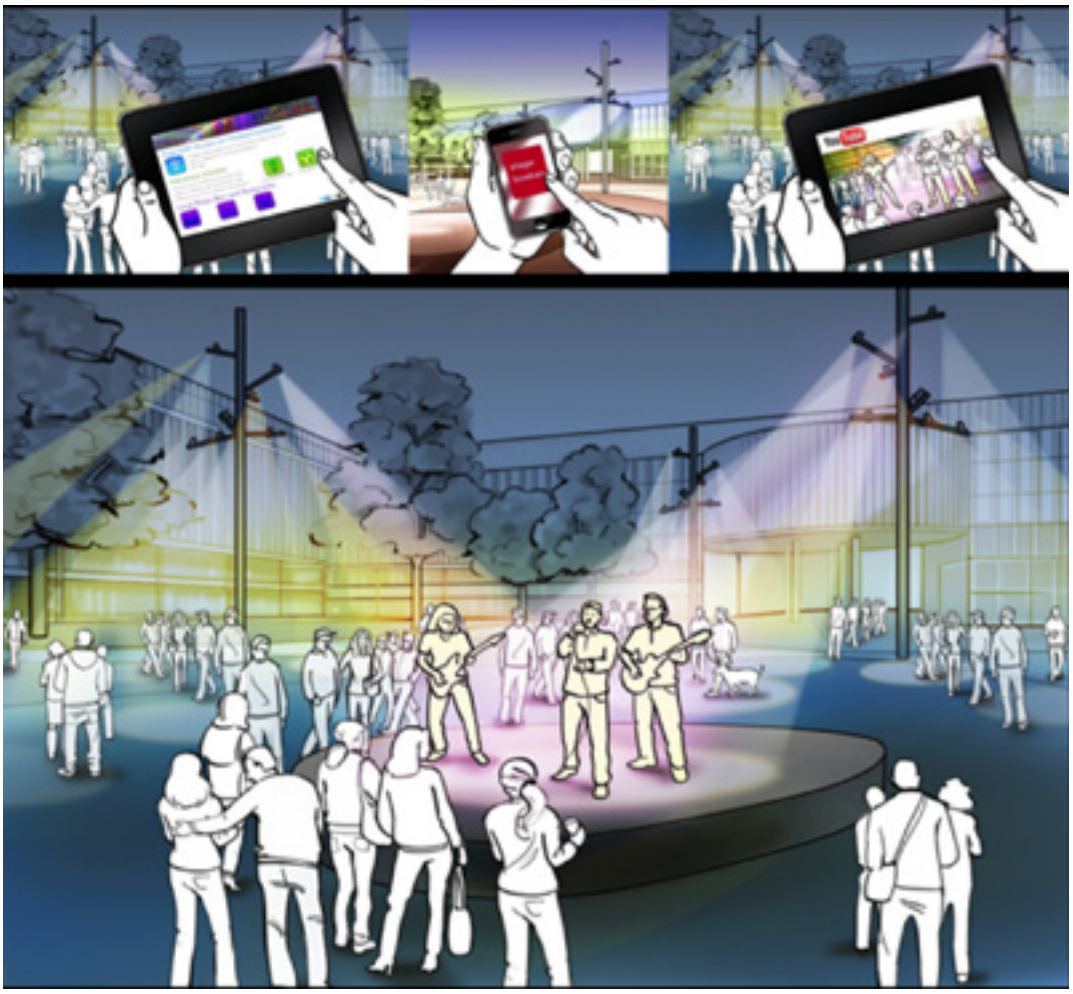
A shift from individual products to adaptive platforms

A market exploration of the current state-of-the-art in lighting and smart city solutions shows that increasing numbers of products are available. However, from the perspective of societal needs, they all offer only partial solutions. To really address societal needs and improve the quality of life in the city, all the partial solutions such as lighting, sensors, cameras etc. need to be integrated in a platform. Only then can innovations emerge that were not possible before.

What this means is illustrated by the Amsterdam Smart Lighting project. The adaptive lighting system installed consists of luminaires, cameras and Wi-Fi. But when looking at the societal need to improve the perceived hospitality in the square, more ideas could be generated based on the adaptive lighting system. A creative session on solutions to increase this hospitality level resulted in the idea of providing a virtual stage for street performers. This ties in closely with the context of the square in which large music events

are often held in the Ziggo Dome, Heineken Music Hall or Amsterdam ArenA. The presence of adaptive lighting technology enables the creation of such a street performance stage without extra investment in the infrastructure. This virtual stage provides a podium for local talent. Airtime can be booked on an app or portal, and will offer preselected time slots for performers on a real spot on the square, marked out by spotlights and at the same time being streamed online by the video cameras. This new service is interesting for the performers, and also time attracts crowds and increases the attractiveness of the area. It will therefore address the need of direct

Figure 4: The concept of a street performer's music stage at Hoekenrodeplein (designed by Philips)



users as well as the overall ambitions for the entire redevelopment project of the square.

The concept of the street performer's music stage of the Amsterdam Smart Lighting project illustrates the mind shift to the development of an adaptive platform for smart lighting and smart city solutions. Such an adaptive platform integrates the current fragmented solutions into a 'Lego-style' platform that enables the building of various systems, each dedicated to the specific context. The system is also upgradable to meet future needs — for example in the Hoekenrodeplein case, in which first the adaptive lighting is implemented, and later the virtual music stage will be added. Such a system requires open interfaces to allow other building blocks to be integrated.

At the same time the new services that can be designed on top of the platform introduce new business and new business models. The proposed street performers' music stage is of interest for performers, for the public, for entrepreneurs (such as café and restaurant owners) in the area, and for the municipality. The idea allows for a range of business models: bar owners can rent it for their customers, visitors to the square can pay a fee to use it, or organisers of larger music events can provide it as

a service to their customers. It is not clear (yet) who would be the logical operator of the new service; for example would this be one of the large companies involved in the project, or does it require a local entrepreneur? Or — in the start-up phase — could it be the municipality? It may well be that the municipality would have to operate it (temporarily) to facilitate the market launch, and to demonstrate the impact and viability of such a solution to the stakeholders before the market takes it up. Such a role to spark and promote the development and exploitation of new and innovative services falls outside their traditional responsibility (and comfort zone) of the municipality, but is important to achieve the goal of becoming a vibrant and sustainable city.

4. A shift from a one-off result to continuous innovation

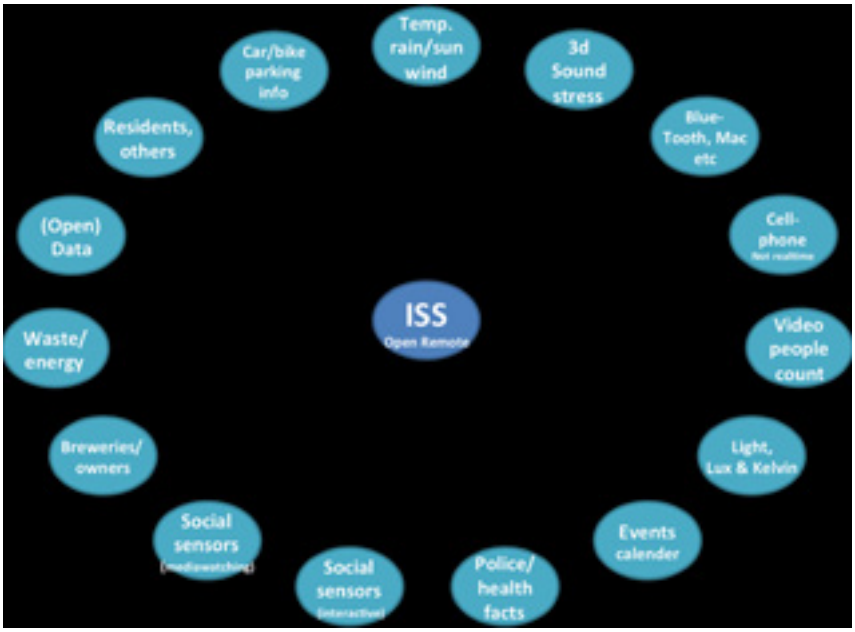
Smart lighting solutions are by their nature more flexible: the integration of ICT in an LED-based lighting system allows for dynamic lighting scenarios and interactivity through various sensors and controls. This is an important advantage, especially since the innovation process still involves high levels of uncertainty. Although artificial lighting has been available for over a century, it is only in the last few decades that the digitisation of lighting has enabled variations in light levels and colour. There has still been little research into the effects of varying lighting scenarios on human well-being and behaviour. So innovation processes that look for potential solutions that may influence well-being and behaviour are still highly uncertain. In addition, new hardware and software will become available over time allowing new functionalities. To ensure that the system has a sufficiently long economic lifetime, it will need to be able to include new and at present unknowable modules. Also the context of urban spaces will change over time. With aspired infrastructure life-cycles of well over a decade, it is uncertain what the future context will be. To embrace the uncertainty in this innovation process, there is a need to shape the solution in a way that it is flexible and adjustable, to enable continuous innovation based on progressive insights, changing contexts and new opportunities.

An example of a project that aims for a continuous learning environment to find ways to influence mood and social behaviour is the Stratumseind area, a large inner-city entertainment area in the city of Eindhoven in which a living lab has been set up to explore the opportunities for innovative lighting solutions that will improve the atmosphere and reduce the escalation of aggression. The project is part of the portfolio of projects to achieve the smart lighting ambition in Eindhoven [5]. In this living lab, a scientific research project called De-escalate aims to provide fundamental insights into human behaviour, but also to deliver lighting schemes that are applicable and effective in real-life conditions through evidence-based lighting design.

Figure 5: Dynamic lighting scenarios to influence people's mood and behaviour in the Stratumseind area

For this purpose a living lab has been set up in which Philips provides intelligent lighting hardware, Open Remote provides an open source software platform to integrate lighting and open data from various sources is used together with data from large numbers of sensors from various suppliers. The platform integrates solutions from multinationals and SMEs, as well as from small local start-ups. The resulting integrated sensor system allows for continuous monitoring and learning. And as it is built on the open source principle it also allows for the integration of new sensors as they become available on the market, for example solutions for mood sensing.

Figure 6: Sensor system integrating solutions from different suppliers to collect all kinds of data in the living lab



In the first phase of the project the emphasis has been on the realisation of the hardware and software infrastructure. In the second phase the system is used to explore the impact of different dynamic lighting scenarios on the mood and social behaviour of people, with the ultimate aim of increasing the atmosphere and perception of hospitality in the street and to reduce the number of incidents of aggression. Shorter experiments go hand-in-hand with longitudinal research to gain an understanding of the longer-term effects of different dynamic lighting scenarios.

Furthermore, next to the scientific research on the effects of lighting on behaviour, the living lab is also used to develop new lighting applications. For this purpose, 'hackathons' are organised in which visitors from the entertainment area are also invited to participate in the development of apps and lighting scenarios. The open set-up of the living lab enables easy exploration, using the ideas developed in the hackathon in real-life settings. This will speed the development of the best ideas in business, either by small (student) start-ups, in SMEs or even integrated in the platform by multinationals. Different business models can co-exist in such a platform, however since many of the partners have invested time and money in the set-up of the living lab, they have been granted priority in the exploitation process. Such arrangements to share investments and revenues are important in creating open ecosystems of this kind. Next to the challenges in finding sustainable and scalable business opportunities, there are also challenges in how to deal with privacy and ethics. Current regulations, such as those for the use of CCTV cameras, are insufficient for a multi-sensor, open data, public area living lab set-up. New ways of dealing with such challenges need to be developed along the way.

New organisational practices are needed

The described projects illustrate the paradigm shift that the urban lighting domain is currently experiencing. Ambitious cities and projects are encountering practical implementation problems that can only be overcome by radical new working approaches and corresponding boundary conditions. Moving towards continuous innovation of services for people, and for that purpose integrating a 'mash-up' of products and services from different organisations, require changes in the ecosystem for innovation as well as in the roles of all partners within the ecosystem simultaneously.

A changing ecosystem

Every player in the domain of urban lighting and smart city development is going through a change process towards new roles and responsibilities far beyond the traditional roles of the municipality as a customer and businesses as the suppliers of products. The ultimate aim is to offer more value to more stakeholders, thereby significantly improving the quality of life in cities through new innovations. Next to the aspect of putting the citizens at the core of the innovation process, as referred

to earlier, it also requires new thinking on investments and depreciation, maintenance contracts and product life-cycles, as well as respecting each other's business models and shared value creation. The key aspect in the new ecosystem is real co-creation. As referred to in the white paper by Curley and Salmelin [2], this requires a shift away from a focus on the performance of the organisation towards optimising both the performance of the organisation and the social conditions. It involves the creation of shared value, sustainable prosperity and improvements in human well-being. For this purpose, ecosystem-centric cross-organisational innovation has to take place. These ecosystems allow large and small businesses, governmental and public organisations, academia and private individuals to co-create novel products and services. The shifts described above also make it important to ensure that the business models support sustainable exploitation of the system by integrating societal and economic interests. Such business models need to be developed and implemented through a transition from the existing to the desired business model.

This quadruple helix innovation approach is most successful when there is a shared vision and shared value is created. The projects shown as examples demonstrate that starting from a societal need is a good way to create a common vision on the desired impact of an innovation. A joint aspiration enables the different partners to contribute from their own strengths and perspective. However, for this new ecosystem to develop and flourish, each partner is also going through a change process.

A changing role for industry

The industry, lighting as well as ICT, has traditionally focused on research into new technological solutions and the development of new products (e.g. light bulbs, luminaires, sensors, routers, software). The results of this technological innovation process were off-the-shelf products, fulfilling the regulations set by governmental and public organisations. In the European tendering processes, customers (such as municipalities) would indicate the functional requirements and the industry would then respond with tenders based on their existing products. But in the new ecosystem the industry is involved in the quadruple helix co-creation process, which starts by identifying the end-user needs, followed by the development of integrated solutions made up of products and services.

Starting from the end-user needs often leads to the co-creation of innovative solutions (products and services) that exceed the boundaries of contemporary lighting solutions and lead to lighting as a value-added service. This co-creation process drives structural changes far beyond the scope of what any one person or organisation could achieve alone. Moreover, these may very well include the development of an adaptive platform in which all partial solutions (from different organisations) are integrated.

Although this is often perceived as contra-intuitive, the development of such an open and adaptive platform is an enabler for companies in their business development. As the example projects show, the needs are very specific in their local contexts. To scale and develop a (world) market, there is a need for common service and application platforms that can be adapted locally, but that will still be affordable because of the broad application area. It also enables the integration of specific products from small and medium-size enterprises (SMEs) into a more common and globally scalable platform. Innovative SMEs often have dedicated high-tech solutions for specific functions (such as the 3D sound sensors or social media analysis algorithms in the Stratumseind example). The integration of such dedicated solutions enables new functionalities that are beyond the scope of traditional lighting system. An open, adaptive platform enables the rapid integration of new modules to provide new services.

The shift from a focus on products to integrated services also creates the opportunity for recurring revenues in service development. Services typically have shorter life-cycles than the supporting products and platforms. A combination of a flexible, adaptive platform with continuous service innovation enables simultaneous exploration and exploitation of new services. A smart system enables continuous monitoring and learning, dealing with the impact of the services on the quality of life in cities. As stated earlier, to create a sustainable ecosystem the business models should ensure the integration of the societal and economic interests of the different stakeholders.

The system integrator has an important role to play in the urban lighting ecosystem. As long as current industrial partners offer propositions from a single business perspective, there will be no integrated solution for the societal need. In the example projects there is a lack of a partner to take the responsibility for integrating the mash-up of products and services from different organisations into a total solution. In this situation, the partners in the projects will hesitate to take full responsibility for each other's products and services. Ideally, the ecosystem should include a partner that is independent of the different partial solutions, partial needs and involved organisations, and instead focuses exclusively on the successful

implementation of the best-value solution for the identified societal need.

An example of how collaboration in the quadruple helix also supports industry is the Green Deal. In the Green Deals, the Ministry of Economic Affairs in the Netherlands is taking concrete steps towards a sustainable economy. This will bring together more green energy with economic growth, and with projects that pay for themselves. The Green Deal helps to overcome obstacles (such as confusion about licences, lack of collaborative partners or ambiguous regulations) and achieve results quicker.

A changing role for municipalities

In urban lighting, municipalities traditionally focused on guidelines and specifications to enable them to choose the right products for their project. Their new primary, future-proof role is to safeguard the public interest in the co-creation process that starts by identifying the societal needs in different areas of the city. No other party in the urban lighting innovation process will safeguard the public interest. The city thereby acts as the representative of the citizens and society. There is a need for new citizen participation practices that acknowledge citizens as experienced experts on their own needs, and actively facilitates them in the design, and in thinking of new possibilities and future services.

Next, municipalities have an important role in creating lasting prosperity. The right policy decisions at this stage will accelerate the creation of both business and societal value through innovation. As indicated by Curley and Salmelin [2], the task of the public sector is to create the environment for Open Innovation 2.0, in which the mash-up of required components can happen in a frictionless environment, bringing in the fuel for the innovation process, for example by procuring innovative products and catalysing innovation and experimentation. The City of Eindhoven has a long tradition of open innovation and triple helix innovation in the Brainport region, and is actively opening living labs for smart lighting solutions. These will make space for innovation, enabling the desired paradigm shift [3]. The city also aims to create (economic) hotspots for smart lighting businesses.

In this role the municipality transforms itself in three ways: 1) from being a client, evaluating the bids in a tendering process for functional products; 2) to being a lead user, putting the city forward as a test bed for suppliers to pilot innovative products; and 3) to involvement in a full co-creation partnership. In the co-creation ecosystem, all partners are expected to participate, to take part in the responsibility and to jointly take risks in the uncertain route of innovation.

A changing role for knowledge organisations

Many relevant aspects in the relationship between open innovation and academia can be found in the context provided by the concept of 3rd Generation Universities. The framework of 3rd Generation Universities, as proposed by Wissema [6], describes the transition of Western (European) universities over the past millennium. He distinguished three generations of universities that are markedly different with respect to their positioning in society and their working approach. The first generation, starting with the universities of Bologna and Paris in the Middle Ages, was aimed at providing a kind of universal knowledge, defending the truth through education in Latin, provided by professionals in colleges that used methods from scholastics and arts. The second generation, starting at around 1700 and often referred to as Humboldtian universities, were aimed at exploring nature through research, conducted by mono-disciplinary professionals who applied scientific methods and were organised in faculties. For the last thirty years we have now had the concept of third-generation universities, which aim to generate value from knowledge by supporting multi-disciplinary academic entrepreneurs in turning knowledge into services and products that impact society.

The transition from one generation to the next can be described in terms of how knowledge is handled. The first generation transfers knowledge through education, the second generation in addition extends and expands knowledge through research, and the third generation in addition transfers knowledge into value. It is important to note that the subsequent generations build on the assets obtained by their predecessors. Third-generation universities combine education, research and value creation. However, the way they are organised and their positioning in society are markedly different. The first generation was open, but through the use of Latin only those who had mastered that language could participate. The second generation was limited to the scientific elite in every specific domain that could understand the often complex methods of investigation that were used. And the third generation again is open in its efforts to generate value for society. These universities consequently need to build on the insights gained from their target group, and in addition they need to understand how the academic knowledge can be effectively transferred to those who can create value from it. Many universities still operate at the level of the second generation. A true third-generation university applies a different approach to the working methods used by the previous generation.

Exploitation of knowledge should be a core business, and should become a third objective in addition to education and scientific research.

Universities should be eager to operate in an international and competitive market. They should be willing to collaborate with many partners and institutions at various levels, to use transdisciplinary research organised in institutes, and to run their business in a professional way, becoming less dependent on direct state financing and state interference.

As an example, Eindhoven University of Technology has expressed the wish to become a third-generation university. Its positioning in the Brainport region, which has been widely recognised as one of the 'Smartest Regions of the World', and its strong record in working together with industry provide the university with the knowledge and experience to make the required transition. In addition, the university is exploring ways to get more deeply involved in activities that take place at the level of the municipality of Eindhoven. Many of the newly defined projects relate to Smart Urban Life, and use the city or parts of it as genuine Living Labs. Multi-stakeholder concepts are applied to maximise the impact generated by the transferred knowledge. New business models are explored, and it can be safely stated that the municipality has moved from the role of facilitator to that of a participant in the Brainport innovation ecosystem. The most interesting asset resulting from this development is its amazing impact on young, talented people. We can safely state that it attracts a new breed of professionals who want to dedicate their talents to serving society with meaningful solutions, and this is a great facilitator in achieving open innovation.

In the new generation, knowledge institutes, citizens and other stakeholders are intensively involved in research and education with the aim of co-creating meaningful solutions. Although governmental policies such as the recently published vision on science of the Dutch Ministry of Education support these ideas, the associated transition also poses challenges to scientists and educators. For example, applying scientific rigour in such collaborative research projects in 'the outside world' is more challenging than when it takes place in traditional laboratories, and it is also more difficult to get multi-disciplinary scientific research published than mono-disciplinary. Knowledge institutes will need to adapt that their working approach benefits from and contribute to the ecosystem.

A changing role for citizens

Traditionally the role of citizens has been passive: the city, and with it their lives, was largely designed for that role. But today there is a strong drive towards participative citizenship at all levels of society. Especially when it comes to societal challenges, the notion that the involvement of citizens is required is now translated into participative processes, while sometimes solutions are even designed in co-creation processes. This is important because there are no blueprints for the desired solutions. It is also impossible to write clear specifications for the desired solution. So the only way to create a solution that fulfils the (often unarticulated) needs of the stakeholders is to jointly embark on a co-creation process to explore possible solution spaces. In this iterative process the needs become clear, when all participants play their roles in finding a synergetic solution that fits in the specific context. Each context is different, but as shown in the ENIGMA project, the solution (when adaptable and flexible) can be based on a common platform.

One very important advantage of the flexible and adaptive platforms referred to earlier is that they also allow the on-site co-creation process with citizens after the installation. As the example projects also show, the systems are flexible and very different lighting scenarios can be designed without changes to the infrastructure. The co-creation of desired lighting scenarios can therefore take place in real settings, in which different scenarios can be experienced once the systems are up and running.

As referred to above, in the quadruple helix model there is an important role for the citizens. They are experts on their own needs, but require facilitation in being involved in design, new possibilities and future services. Co-creation of meaningful innovations requires strong involvement by citizens, far beyond the frequently cited 'one-directional participation' in which ideas are simply presented to citizens. True involvement in dialogues to really understand the needs is a different process. New ICT solutions can enable further enrichment of the co-creation sessions, for example by offering virtual reality experiences of new dynamic lighting scenarios to citizens during the co-creation process. Technologies like this will enable citizens to experience solutions without large investments in technology infrastructure.

The role of municipalities is to serve the co-creation process. This implies making it possible, but also ensuring that the public interest is guarded in the process. It also requires from citizens that they take up their role and take responsibility for their environment. It is not sufficient to complain if something is not right: more and more citizens will need to be involved in actively developing alternative solutions that are in line with their needs.

New regulatory frameworks are needed

The new paradigm also requires a radical revision of the boundary conditions, including the technology frameworks. New regulatory frameworks are needed that not only acknowledge co-creation, but also facilitate it and help to address the inevitable need to deal with uncertainty.

Contemporary tendering processes and regulations are insufficient to support co-creation processes. Tendering processes emphasise risk management, based on rational problem-solving, stating that all information will be available in advance to support decision-making. In tendering processes, decision-making is based on a reduction to clear functional requirements. Even pre-commercial procurement processes, such as those applied in the ENIGMA project, are not really suitable for the more complex situations, such as those regarding the procurement of innovative smart lighting and smart city platforms and services that start from the desired societal impact.

Innovation inevitably introduces ambiguity based on reflective practice. The aspired societal impact may be clear, but how to achieve the desired result is not. Co-creation in the innovation ecosystem requires new regulatory frameworks that acknowledge the inevitable high uncertainty level, allow risk-taking and open up the dialogue needed to deal with them. The basis of the partnership must be trust and respect for each other's power to innovate. Award criteria on the outcome are difficult to set up, since the co-creation aims for a joint explorative process with an end-result that is not yet known.

Another topic to be reframed in a co-creation setting in which the partners innovate together is intellectual property (IP). Commercial partners often fear open innovation processes, in which the ownership of the IP may not be clear. Since current business models are often based on the ownership of IP, this hampers cooperation. As stated earlier, the creation of an adaptive platform for intelligent lighting and smart city solutions can create a platform which several businesses can use to scale their product or service. For such a platform to succeed, the building blocks can still contain IP for different organisations, but the interfaces between the building blocks need to be open. In the ENIGMA project the requirements for such a platform are identified as:

- Adaptability; the platform needs to be adaptable in order to enable changing the lighting settings according to the varying needs of diverse users and contexts. It provides the right light at the right place at the right time.
- Interactivity; the platform needs to be interactive in order to enable the people to control and 'play' with the light.
- Modifiability; the platform needs to be modifiable in order to upgrade or extend the system if needed to make it future-proof.
- Modularity; the platform needs to be modular in order to fit the design of the installation to specific needs and to facilitate the maintenance of the system.
- Openness; the platform needs to be open in order to connect it to other systems and to enable other systems to connect with the lighting system.

These adaptive platforms also require new technological concepts. There is a need for a city-wide 'plug and play' platform with generic modules (e.g. in the area of sensing, data storage and analysis, identification etc.). This platform needs to be open, with standardised interfaces to prohibit 'vendor lock-in'. Such a platform will allow all kinds of parties (both profit and non-profit organisations, but also citizens and students) to develop applications that can be plugged into the system. This will allow a wide range of solutions to use the system and available open data: from professional lighting solutions to simple neighbourhood applications.

The last challenge in the new paradigm is dealing with open data. Providing open data is attractive to invite organisations, companies and designers to create innovative new services to join the platform. But it will also inevitably raise questions of privacy and security. Dealing with the ownership of the data is an important aspect, as well as also concepts like 'privacy by design' and 'usable privacy'.

As stated earlier, the role of municipalities is to safeguard public interest. But this is no easy task. What is in the interest of the public? How to be objectively assessed? How can the effects of political interests be avoided? Here too, a 2.0 view will need to be developed along the way.

Realising smart cities

Experience from implementation projects in public lighting in practice reveal the challenges with the paradigm shift towards continuous innovation of services for people. This transition is currently taking place, and opens up new opportunities for the co-creation of shared value through innovation. Public lighting and public lighting infrastructure can play a significant role as a stepping stone towards achieving the ambitions of cities in their transition towards smart cities.

The core of the paradigm shift lies in co-creation within the urban lighting ecosystem in identifying societal needs and jointly enabling the development of meaningful solutions. The technological development should aim for a platform in which all partial solutions can be integrated, and that is open to the development of the applications superimposed on it. The starting point should be the people and other stakeholders who benefit from its value. A 'designerly' approach facilitates citizens in participating as experts on their own quality of life. The main challenge is in the co-creation process: all partners will participate in the path of innovation, embracing the uncertainties in the outcome and jointly seeking opportunities that offer the best value for the most partners.

To achieve a successful transition to open innovation 2.0 in the realisation of smart cities, new organisation practices are needed within all organisations, as well as for the ecosystem itself. New regulatory frameworks that support innovation and co-creation are also needed. There is still a lot to learn about this process, and there are many more challenges to explore in practical projects. It is only in this way that a big step forward can be taken in the realisation of smart cities that will offer a high quality of life for their citizens.

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The projects referred to here have been carried out in collaboration with various partners. For more information, please contact the authors through: www.ili-lighthouse.nl or www.tue.nl/ili

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Creative Cities and the LERP-PEARL Transition Model

Abstract

This paper introduces three Unesco nominated creative cities to illustrate large scale city innovation. Since building a world-recognised creative city is a long process, transition management concepts were adopted. A two-stage transition model of 'LERP to PEARL' is then proposed. LERP — leader, execution, resources and partners are required to test run the vision in the initial triggering stage to increase awareness and attract the attention of the relevant parties. 'PEARL' — partners, execution, activation, resources and leadership of multiple constituents are required at the second self-organising stage for making the creative city sustainable. At the second stage, partners need to be enlarged, which enhances execution power, helps activate more participation and brings in a larger amount of resources than at the first stage. With more stakeholder involvement, multiple leaders will be nurtured and, hopefully, a self-organising system will be established to sustain the transformation.

Key words: *creative cities, regional innovation systems, networks in innovation, societal innovation, transition model*

Introduction

The motivation for this study comes from the increasing reports of successful city revitalisation projects that have transformed and integrated various systems for a sustainable society. The announcement of various rankings, such as creative cities (Cabrita and Cabrita, 2010[1]; Hospers, 2003[2]), innovation cities (2thinknow, 2011)[3], smart cities (Rodrigues and Tomé, 2011)[4] and liveable cities (Donald, 2001)[5] helped to disseminate the successful models of those awarded cities, leading to a wave of city rejuvenation worldwide. The United Nations Educational, Scientific and Cultural Organisation (Unesco) launched a 'Creative Cities Network' in 2004, facilitating international cooperation among cities for cultural diversity and sustainable urban development.

By studying three Unesco nominated creative cities, this paper presents a transition model that depicts the process and key success factors of their transformation. In the following sections, we first explain transition management; introduce the three cities; present our transition model supported by the three-city revitalisation measures; and lastly, finalise the paper with a conclusion.

Transition management

City rejuvenation is a long process; it needs the involvement of many players, supported by a variety of resources at different stages. Rotmans (2005) [6] explained that:

> 'Transition management is designed to encourage and stimulate societal innovation towards a sustainable society. This is based on the realisation that this cannot be done by force or in a top-down manner, but requires a subtle co-evolutionary approach, by means of a visionary process of agenda building, learning, instrumenting and experimenting.'

It is an attempt to tackle persistent problems by steering them in a more sustainable direction, through clever, subtle changes and adjustments at several levels concurrently. At the core of transition management is the challenge of orientating long-term changes in large socio-technical systems. Transitions are understood as processes of structural change in major societal sub-systems. They involve a shift in the dominant rules of the game, a transformation of established technologies and societal practices and a movement from one dynamic equilibrium to another (Meadowcroft, 2009) [7].

Rotmans (2005) [6] also described how such new ways of thinking or change in perspective should be further translated within various networks, organisations and institutions. A transition towards a sustainable society requires a different type of steering. That is, it is necessary to create room for innovation processes and to facilitate the circumstances and conditions in which these processes can strengthen each other, especially for a scaling up effect to take place. To achieve this goal, all relevant parties — the government, knowledge institutes, non-governmental organisations, companies and intermediaries — must combine their efforts to create the conditions that make the transition to a sustainable society possible. In other words, these actors have to take on new roles, acquire new competencies, develop new practices and work together in a new way during the transition process.

Above all, a transition towards a sustainable society requires a new knowledge infrastructure. Often, the current knowledge infrastructure is inadequate in tackling the issues raised. Thus, a new interdisciplinary and trans-disciplinary knowledge infrastructure is required for effective development, distribution and utilisation of the new knowledge to successfully implement system innovations.

Unesco Creative Cities Network

The rationale behind choosing 'city' as the level of analysis is because the formation of free global economy and the convenience of the Internet have blurred the boundary of national borders. As a result, cities are the uprising competitive units, leading to intensified competition at this particular level. In addition, half of the world population lives in cities (Rodrigues and Tomé, 2011[4]) and cities have been recognised as centres for the production of knowledge, culture, information and innovation (Navarro, Ruiz and Peña, 2012[8]). City Mayors (an international think tank for urban affairs) believes that metropolitan areas, rather than nation states, will shape the world's social, cultural, technological and economic agendas in this century (Thite, 2011[9]). In such context, cities all over the world devote a large amount of work encouraging and cultivating their collective knowledge to shape future competitiveness (Cabrita and Cabrita, 2010[1]). However, cities are also struggling with cooperation and competition for the ultimate goal of attracting talent, knowledge, capital for wealth creation and quality of life.

With the need for cultural recognition that affirms a city's identity in the increasingly competitive globalised world, Unesco launched the Creative Cities Network in October 2004. According to the Unesco website, its goal is to bring together public and private partners as well as civil societies to contribute towards the development of creative industries and generate new forms of international cooperation.

Creative industries are defined by Unesco as industries that combine the creation, production and commercialisation of contents which are intangible and cultural in nature, such as creative, artistic and cultural goods. These activities are promising in terms of growth and are vehicles for cultural identity and diversity. They also offer the potential for increased employment through the generation and use of intellectual property and represent around 2.6 % of the GDP of the European Union (The Greater Lyon, 2014[10]). Each Unesco-nominated creative city must be unique in its cultural profile in a chosen theme out of seven ([1]), and be able to cooperate with the creative and economic institutions in the society. Also, it must act as a model and partner with other cities and communities, both close by and around the world within and outside the Creative Cities Network -(Hartman, Gulliksson and Brannlund, 2010[11]).

We report three Unesco-nominated creative cities, namely Kanazawa in Japan, Lyon in France and Östersund in Sweden for their outstanding displays in crafts and folk art, media arts and gastronomy respectively. From the application document of each city and relevant literature, the characteristics of each city were analysed based on the conditions of transition management introduced earlier. In addition, the author had the pleasure of personally interviewing the female entrepreneur who initiated and drove the city government to apply for the Unesco City of Gastronomy in Östersund, Sweden.

Background of the Three Creative Cities*

Kanazawa (Japan), founded as a castle town in 1583, has had a peaceful existence ever since. Having avoided serious natural disasters and war-time destruction, various kinds of crafts have been developed and preserved along with the city's distinctive samurai culture and lifestyle. During the Edo Period (1603-1868), the Maeda Clan abandoned military confrontation with the Edo in favour of civil administration, promoting and popularising scholarship, craftwork and the arts. Prominent scholars and craft artists were invited to the city to teach such skills. During the Meiji Restoration (1868-1912), the population of Kanazawa rapidly declined from 130 000 to 80 000 and the city needed revitalisation. In the 1890s, the textile industry transformed the city; centred on silk exports, and the development of the textile machinery. In June 1995, Kanazawa Mayor Tamotsu Yamade proposed the Kanazawa World City Concept, which was accepted as a long-term plan in 1996. Its basic theme was to strengthen Kanazawa's pride through developing its uniqueness cultivated over 400 years as a city of peace and taking responsibility for its preservation of traditional Japanese crafts and arts. After 13 years of transformation, Kanazawa was awarded as a Unesco city of crafts and folk art in 2009.

In *Lyon (France)*, the Lumière Brothers invented cinematography and shot the first film in the history of the cinema in 1895. In the 19th century, Lyon witnessed important architectural developments with construction of the Opera House, the Court House, the stock exchange, the Tête d'Or Urban Park and the Fourvière Basilica. It leverages its geo-strategic position as the crossroads of Northern and Southern Europe and its faithful preservation of the old city. In the old city of 'The Roman', 'The Renaissance', 'The Silk' and 'The Architecture' districts, nothing has been destroyed (Trouxe, 2011[12]). As a result, Lyon was listed on the Unesco world heritage of humanity list in December 1998. In order not to be overshadowed by Paris, the Greater Lyon Authority has a policy of economic development dedicated to the creative industries. This policy aims to support and increase the

[1] The seven Creative Cities Network themes include literature, film, crafts and folk art, design, media arts, gastronomy and music.

visibility of sectors that have a large creative component (design, fashion, the moving image). It accelerated the process of innovation through creativity and cross fertilisation between the various sectors. Branding 'ONLYLYON' in January 2007 is another endeavour, attempting to position Lyon as a creative conurbation, networking all economic, academic and artistic players. These measures illustrate the city's desire to assert its difference, its values, its identity, its personality and its exclusivity. In 2008, Lyon was awarded as a Unesco city of media arts.

Östersund (Sweden), founded as a trading centre in 1786, had a population of about 45 000 in 2010 and is the only town in the region of Jämtland (about 126 000 inhabitants). Between 2000 and 2004 the region went through a turbulent structural change, several regiments were closed down in *Östersund* and the effect was a massive loss of jobs. This seeming economic disaster turned out to open opportunities for developments of new industries, the creation of new markets and the chance to build a new identity. The region's clean air and fresh water provide unique conditions for superb produce. In addition, the Östersund municipality has an attractive rural area with very good quality of life. Activities such as down-hill biking, running and cross country skiing are examples of other activities that attract tourists in every season. Continuous sporting events and various types of festivals, combined with gastronomy have become a co-branding that attracts visitors. With the joint efforts of entrepreneurs, city governments and food producers among others, this rural, sparsely populated region in Sweden is now appreciated for its gastronomic culture, based on locally produced food and traditional culinary. In 2010, *Östersund* region was named a Unesco city of gastronomy.

Transition management in Three Creative Cities

For a large-scale city innovation to take effect, transition management such as the one proposed by Rotmans (2005) [6] needs to be implemented. From the literature, we have extracted seven important elements for a successful societal innovation. They are: clear vision, involving multiple players, developing new competencies and new practices, installing new knowledge infrastructure, changing structures of societal sub-systems, co-evolving and scaling up.

The evolution of each city has shown the above-stated seven elements. Due to space limitation, we explain each key element using one city as an example. In general, each city pronounced its *vision* (such as the preservation of traditional crafts in Kanazawa), followed with matching policies and resources. During the city transformation process, there were *multiple players* that passionately joined the efforts for a large-scale system change. For example, to promote *Östersund* as a city of gastronomy based on organic food with traditional culinary, the entrepreneur 'Fia' used 80 % of organic food in her own restaurant and persuaded the chefs and owners of other restaurants to increase the percentage of their organic food, helping the organic farmers and artisan food producers become sustainable. To reduce the cost, Fia negotiated with several distributors to pick up organic food from different farms free of charge, on their way back sending necessities to those sparsely populated farms. During the transformation process, city government and politicians provided their support by allocating required resources. Food academies and food training centres were placed to nurture a new generation of Swedish food processors. Furthermore, gastronomes and cultural workers published their experience with the fine food, which helped the marketing and the scaling up of the food industry in the *Östersund* region.

In developing *new competencies and new practices*, artisans in Kanazawa were not only trained in traditional Japanese crafts and arts but were also sent to other countries to learn advanced techniques aiming to combine the traditional with contemporary arts in order to stimulate innovation. For *new knowledge infrastructure*, Lyon created the 'Imaginove' cluster to nurture synergies between the different image sectors (video games, cinema, audiovisual, animation and multimedia) to increase their engagement and facilitate the competitiveness of product design, production and distribution. These efforts result in the advancement of various technologies and are the backbone of its well-known Festival of Lights. For *changing the structure of societal sub-systems*, the multiple constituents' involvement in *Östersund*'s food industry explains the societal-level structural change of farming, food producing and distribution sub-systems. *Östersund* also provides a good example of *co-evolving*, as its food, culture, sports, festivals and tourism projects jointly created an arena for sustainable organic food production with a gastronomic profile for the region, as well as the growth of the above mentioned industries. For *scaling up*, the 2013 Festival of Lights in Lyon has attracted around 4 million visitors, 80 light projects, 8 million small candles sold in Greater Lyon, 400 000 programmes broadcast and more than 250 newspaper articles. In addition, the city hotels were full during the 4-day festival, three times the turnover for the city bars and restaurants compared to normal periods, with 47 public and private partners (Fête des lumières, 2013[13]).

Proposed transition model — from LERP to PEARL

City transformation is a long process and is much more complicated than a private company's organisational change. It requires vision, good leadership, multiple players' commitment, tangible resources, effective execution and a self-organising system. Generally, it goes through at least two stages — the initial triggering stage and the self-organising stage. Without the self-organisation of interdependent sub-systems, the transformation would not be sustainable. Therefore, we propose a two-stage 'LERP to PEARL' transition model as shown in *Figure 1* for a large-scale city transformation.

Figure 1:

LERP' — leader, execution, resources, and partners are the crucial elements in the initial triggering stage. Literally, 'lerp' is a special kind of honey produced by a type of Australian insect. It is a nutrient that facilitates growth, symbolising the fact that nurturing environments are very important at the initial stage of city transformation. 'PEARL' — partners, execution, activation, resources and leadership of multiple constituents is required at the second, self-organising, stage for making the creative city sustainable. Literally, 'pearl' is precious and desirable jewellery that catches people's eyes. Applied to city transformation, once the initial transformation is successful, it has to become desirable and attract relevant parties' attention to involve more partners. Thus, enlarged partners enable effective execution at relevant sub-systems. Then, proper activation for more participation can solicit required resources and commitment. With active participation of enlarged partners, supported by effective execution, proper activation and larger amount of resources, it is more likely that self-initiated leadership of relevant sub-systems can be established for self-organising a sustainable system. The final goal is that each sub-system can initiate and manage its own sustainable eco-system, at the same time harmonise with other sub-systems for building and maintaining a self-organising holistic system. *Table 1* briefly presents the key elements of LERP and PEARL model. The concept is further illustrated by real events of the three creative cities in *Table 2* for LERP and *Table 3* for PEARL.

In what follows, we use *Östersund* to illustrate the key elements of LERP, Kanazawa the *PEARL elements and Lyon the full model. In the* initial triggering LERP stage, Ms. Fia Gulliksson is the most distinctive *leader* who drove for the transformation of the city and the food industries in *Östersund* region (Jamtland). Her initial *execution* was to practice what she preached by using 80 % organic food in her own restaurant and persuaded other restaurants to increase the percentage of organic and artisan food. The initial *resources* she acquired include the support of the Östersund municipality for a small budget that she used to interview unique food producers and shoot films for the 'Gastronomy' magazine in preparing for the Unesco creative city application. As a result, she has been able to solicit joint efforts from some partners, such as farmers, artisan food producers, chefs and cultural workers.

As mentioned earlier, the self-organising (PEARL) stage will be illustrated by the events in Kanazawa. Various *partners* including businessmen, city government, associations, artists, art colleges, universities, training centres and philanthropists all became active partners in Kanazawa city's efforts in preserving traditional Japanese crafts and folk art. Its multi-constituent *execution* resulted in the city artisans mastering in 22 kinds of traditional crafts. Because the city successfully pushed the roots of traditional crafts into the lives of Kanazawa citizens, they were *activated* and developed with high levels of culture appreciation. As a result, the local market has a good share of the arts Kanazawa produced, without totally relying on exports. In addition, with such appreciation and the urge for passing traditional crafts and folk arts to the younger generation, Kanazawa Children's Arts and Crafts School was opened in 2008. With the pride of preserving traditional Japanese crafts and art, more and more *resources* were made available in the city. For example, Kanazawa established the fund for traditional techniques and arts training. A foundation for children's arts and crafts school was also set up. In addition, the city supports study abroad for the acquisition of knowledge and technology related to craftwork. Philanthropic organisations also donated money for this endeavour. To sustain such vision, initiation of different organisations has been observed in Kanazawa. For example, Kanazawa Drama Network was formed by the artists themselves in the Citizens' Art Village to have a national tour of locally created dramas. New applications of the craft technology have been implemented to new products and new designs, thus new styles of silk dyeing, textiles and craftwork were invented leading to the announcement of the Kanazawa Fashion Industry City Declaration in June 2004 (Unesco, 2009[14]). Furthermore, new performances were staged, including collaborations between contemporary music and the style of traditional Noh drama. This type of organic connection between professions in the region not only provides a synergistic effect, but has also led to the emergence of *multiple leaders* in new field, a diversification of the industry structure, and even the stability of the region's economy (Unesco, 2009[14]). In other words, citizens as well as the city government join together in their efforts to make Kanazawa a better known creative city. Thus, an inter-dependent subsystems change has forged a self-organising total system that adds value to the city.

The LERP-PEARL two-stage model can be further explained with the case of Lyon. The Greater Lyon Authority took the lead in planning for its city development (leader). With the goal of attracting worldwide attention, the city has a policy to 'develop its creative industries, taking the advantage of its cinematography invented by the Lumière Brothers'**.** After setting this clear vision, universities and research institutes were provided with resources to advance the relevant technologies (execution and resources). This initial move has attracted image artists, high-tech researchers and cultural workers to the city (partners). Gradually, the clustering effect took place. Therefore, it is not a totally top-down system.

As the second-largest University City in France, Lyon has sufficient supply of talent in the creative industries. With the overall living quality improvement, more and more talent chooses to stay in the city. In the second stage of the transformation, event planners, fashion designers, video game players, festival project managers and so on contributed their expertise to the same goal (enlarged partners). Each profession as a sub-system initiates its own activities, at the same time inter-connected with others such as Institut Lumiere with event planners (effective execution). To help activate the creative industries, the Greater Lyon Authority did one more thing — creating the 'Imaginove' cluster to facilitate synergies between the different image sectors, such as video games, cinema, audiovisual, animation and multimedia (activation). With increasing partners and technology advancement, more and more resources were poured into Lyon. For example, the European ICT Network set up The World Digital Solidarity Agency in Lyon (European ICT, 2014[15]) to capitalise on its technical support for raising awareness and overcoming the lack of information concerning the effective use of ICT for energy saving (more resources). The above transformation process has strengthened relevant sub-systems in media arts. With their inter-dependence, multiple leaders are also evident. For example, the well-known Festival of Lights needs support from image, fashion, design, animation and multimedia. Apparently, the media arts industry in Lyon has become self-organising in that businessmen and other stakeholders all join their efforts to sustain Lyon as a city of media arts for everybody's benefit.

In other words, during the process, the starting leader needs to nurture multiple leaders, the execution power needs to be enhanced in the second stage, the initial resources gathered by the starting leader needs to be expanded to multi-sources or self-generation, and the vision needs to be activated to involve more participation, so that a self-initiated collective leadership can be achieved for constructing a self-organising system.

Three cities, each with a different profile. The population of Östersund city is less than 50 000 and the region is only 126 000. Therefore, it is easier for Ms. Fia Gulliksson to be a distinctive driver in

building a city of gastronomy. Kanazawa has about 450 000 citizens, a proper size to instil with Japanese spirit and call for the preservation of traditional crafts and arts. The arousal of national pride with the two stages development has successfully transformed the city. Lyon city has about half million and the Greater Lyon area about 1.5 million people and is more densely populated. That is, city development needs to be more diversified to meet different people's needs. Therefore, Lyon is also known for its biotechnologies, architecture, textile and gastronomy in addition to media arts. However, the two-stage transition model can still be observed during the process of its transformation to a Unesco city of media arts.

Table 1: Illustrations of the "LERP to PEARL" transition model

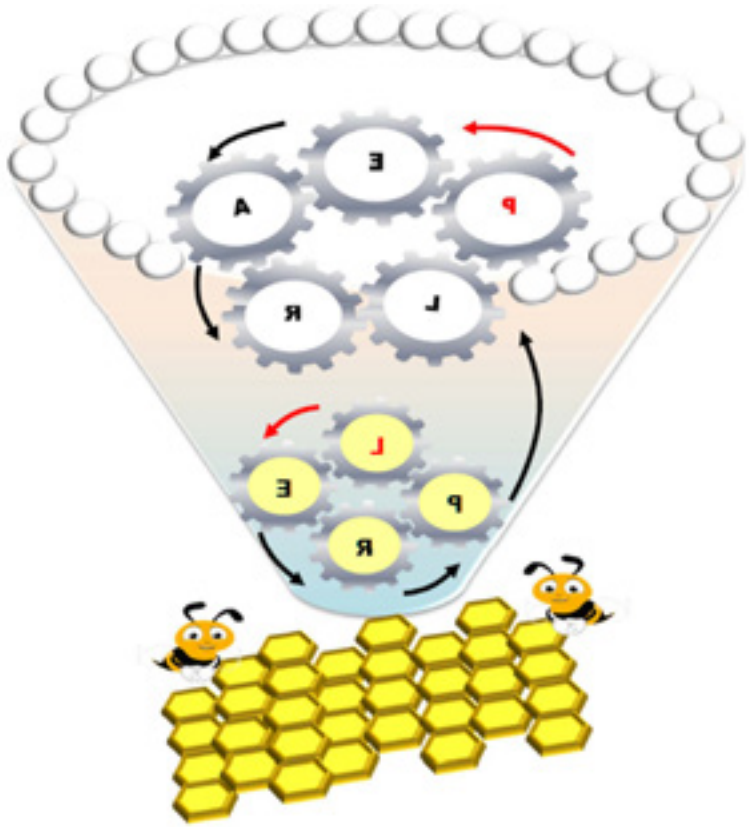
	LERP - Triggering stage		**PEARL - Self-organizing stage**
Leader	Starting leadership is required to get things moving	Partners	The enlarged and motivated partners become the advocates for the vision
Execution	Starting leader needs to have strong execution capability to step forward	Execution	The partners are the major force for effective execution, either individually or collaboratively
Resources	Starting leader acquires initial key resources to attract partners	Activation	Activation is required to solicit more participation and critical resources
Partners	Partners commit to the vision and join the efforts	Resources	Mass amount of resources are assembled from various sources or the sub-systems can self-generate required resources
		Leadership	Collective leadership is achieved

Table 2: Sample events of triggering stage (LERP) in three creative cities

Triggering stage	**Kanazawa – crafts and folk art**	**Lyon – media arts**	**Ostersund - gastronomy**
Leader	Mayor Yamade promoted the "World City" concept in 1995	Greater Lyon Authority committed to making Lyon a place of innovation, wealth and job creation.	Ms. Fia Gullikssson (a chef and restaurant owner) saw the benefits of developing Ostersund as a city of gastronomy
Execution	In 1996, the Kanazawa Institute of Traditional Crafts was set up	Supporting local SMEs, universities and research centers to achieve fields of excellence through offering high-quality business support services	Fia's restaurant used 80% organic food. She also persuaded other restaurants to increase the percentage of organic food to support those food producers.
Resources	Kanazawa provided subsidies to artists in silk dyeing, ceramics, and lacquerware to develop new products and to expand to new markets.	Lyon Program for an Information Society (PLSI) was created in 2001 to help improve public access to internet, electronic administration, digital education and economic development.	Fia asked the mayor for some resources to promote the "city of gastronomy" idea to the farmers and artisan food producers and to prepare for the UNESCO creative city application.
Partners (initial)	Craftsmen, artisans, Kanazawa College of Art and Kanazawa Institute of Technology	Technological researchers, academia and artists, and multimedia content providers	The mayor assigned Mr. Dag Hartman as the UNESCO Project Coordinator and Mr. Tore Brannlund as the Managing Director to provide Fia with necessary support.

Table 3: Sample events of self-organizing stage (PEARL) in three creative cities

Self-organizing stage	Kanazawa	Lyon	Ostersund
"Partners (enlarged)"	"Business men City government Associations Artists Art colleges Training centers Philanthropies"	"City government Event planners and entrepreneurs R&D centers Software developer Game designers Fashion designers Image sector Animation sector Audio-video sector"	"Entrepreneurs Chefs and restaurants owners Farmers Artisan food producers Distributors Food academy Politicians Event and tourism entrepreneurs Gastronomes Cultural workers"
Execution (effective and large scale)	Kanazawa artisans mastered 22 kinds of traditional crafts. They also explored new ways of preserving and developing its traditional industries.	To support image related companies, the Imaginove was set up in 2005. It aims to provide technological R&D, sales, international exposure and employment. With the synergy, the execution capability of each player is enhanced.	Each partner applies “city of gastronomy” concept in his/her realm of work. For example, the tourist brochures introduce gastronomy in the Ostersund region.
Activation	Successfully pushed the roots of traditional crafts into the lives of Kanazawa citizens. Consequently, they developed with high a level of culture appreciation. In addition, Kanazawa’s artisan spirit encourages continuous innovations not only of traditional crafts but also of new industries, creating high-value products in various fields, such as combining traditional with contemporary arts.	The Imaginove develops cross fertilization and synergies between the different image sectors (video games, cinema, audio-visual, animation and multimedia) to increase the competitiveness of product design, production and distribution. As a result, there are around 17,000 people in the creative industries in Lyon Urban Area, second after Paris. For deeper influence, branding “ONLYLYON” was launched in 2007 to position Lyon as a creative conurbation.	Through involving in the city transformation, the whole city has been activated to join the efforts. For example, the politicians approved relevant budget. The music festivals, the sport events and the tourism industry all work together and help promote gastronomy.
Resources	Kanazawa City has established the Fund for Training in Traditional Techniques and Arts. Its Children's Arts and Crafts School was opened in 2008 and a Foundation was founded to support this school. The City of Kanazawa also supports study abroad for the acquisition of advanced knowledge and technology related to craftwork. In addition, the City's budget for craftwork continues to increase.	Host international competitions for relevant companies in Greater Lyon to reach their full potential in terms of innovation. Offering a range of innovative, coherent and efficient services to Greater Lyon residents to enhance digital applications. In addition, the Lyon urban area offers world-class training and research potential in a variety of sectors. Such infrastructure has attracted World Digital Solidarity Agency (DSA) to base in Lyon.	Resources from multiple sources (partners) were provided. For example, to reduce the cost of organic food, the distributors provide free transportation. Eldrimner, the Swedish National Centre for Small-scale Artisan Food Processing, is situated at the outskirt of Ostersund. Close to the city center, Midsweden University has over 7000 students doing research in environmental sciences, tourism, sports and event technology.
"Leaders/Leadership (multiple)"	"-Artists organized their own Drama Network to have a national tour of locally created dramas -Crafts and folk art education has been extended to children by various institutes -The City supports overseas shows and private exhibitions to help young craftsmen and artisans -Kanazawa Life and Fashion Industry is The new application from The craftwork technology"	Media arts have become part of Lyon’s city life. As a result, economic stakeholders, local authorities or public utilities, artists and designers all contribute to the development of these tools and methods on a daily basis. Many public events that celebrate media arts in the city are becoming more and more famous.	There are about 500 companies and 2300 employees within the creative industry in the Ostersund region. A couple of hundred of project nomads and free cultural workers also participate in different projects. The younger generation is rediscovering the heritage of Swedish traditional culinary in Ostersund.



Conclusion

Developing into a creative city, innovation city or liveable city has attracted the attention of city governments worldwide as cities are becoming the competitive unit rather than nations. Since building a world-recognised creative city requires a long process, benchmarking successful cities ensures an effective way to revitalise a city with unique or hidden features. This article depicts three Unesco creative cities, namely Kanazawa in Japan, Lyon in France and Östersund in Sweden for the categories of crafts and folk art, media arts and gastronomy. For successful city transformations, we have observed a two-stage 'LERP to PEARL' transition model that requires visionary leaders, strong execution power, critical resources and the involvement of key partners in the first triggering stage. In the second self-organising stage, enlarged and committed partners enhance the execution power, which activates general public thus brings in mass amount of resources, and then multiple leaders initiate their own eco-system and harmonise with other sub-systems for a sustainable total system.

In responding to Rotmans' (2005) comment that, 'Sustainable development is an intrinsically normative, subjective and ambiguous concept and is therefore difficult to operationalise', the proposed two-stage 'LERP to PEARL' transition model tries to uncover the critical operations for cities that need rejuvenation on a scale.

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Open Innovation 2.0 in Future Cities

Introduction

Looking back to when the Smart City idea became popular, we see some commonalities and some differences in the interpretation and the understanding of what a Smart City is. We often consider Smart Cities based on rankings: the Smart City as a reality. However, a Smart City is not a reality, but an urban development strategy, partly technology driven and partly driven by community participation with a strong future vision. On the other hand, a Smart City is about how citizens are shaping the city, and how citizens are empowered to contribute to urban development. To this end, a Smart City is an urban innovation ecosystem, an accelerator and an agent of change. A Smart City uses digital technologies to enhance performance and wellbeing, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens.

Figure 1: A services and technology-driven future city [1]

Sometimes we refer to Smart Cities as Future Cities, looking into the horizon and making our choices for the future by effectively integrating the physical, digital and human systems in order to build an environment that will deliver a sustainable, prosperous and inclusive life for its ecosystem participants (citizens, businesses and government).

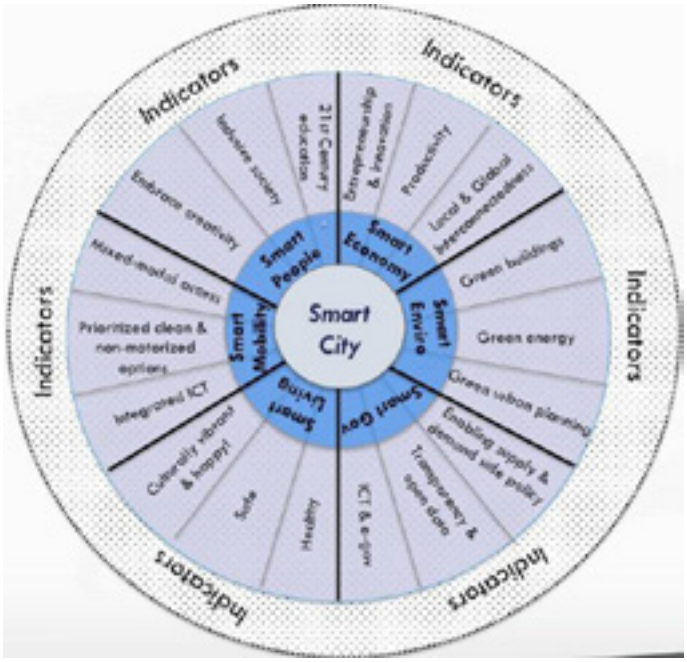
The role of open innovation 2.0 in future cities

The Future City is an urban 'innovation ecosystem'. The role of each stakeholder engaged in this ecosystem is crucial. Each participant in this ecosystem can be a change agent. The Open Innovation paradigm, or as we call it Open Innovation 2.0 [2] in Future Cities is about the extensive collaboration among the city government, research/academia, citizens and the businesses (quadruple helix). It is also about sharing ideas, results, intellectual creativity and co-creation among all involved in the ecosystem. The efficient interaction and collaboration among the open innovation ecosystems participants should happen in order to secure the maximum economic and social impact for all the stakeholders involved. Collaborative skills, shares ideas, values and processes, open data need to be in place to make the collaboration efficient, and generate wealth for smart and future cities.

Smart city models

Different models are offered for understanding and planning Smart Cities. An interesting model, called the Smart City Wheel, is offered by an urban strategist B. Cohen, which is co-created as a result of a collaborative inspirational work among academia, research, business and citizens and it is illustrated in the diagram below, published in CoExist [3].

Figure 2: Smart city wheel [3]



Most cities can agree that there is real value in having a smart economy, smart environmental practices, smart governance, smart living, smart mobility and smart people. In the chart above, by walking through the smart city wheel, one can notice that a smart city strategy can be developed and implemented in three main steps: develop a vision empowered by citizen engagement; set baselines and targets, indicators and go lean. Is it simple to apply this model?

Indeed, most cities agree on the collaboration of the ecosystem participants to make the city smarter. However, how complex is it? The Smart City can also be interpreted as a system of a system of another system... (and of even more systems by just continuing the line of thinking). Looking into the puzzle model below, Smart City Wheel model may not always be easy to apply.

Figure 3: A smart city as a system of a system

This model is a selection of different available models on the web and offers a new model or a newly co-created model. The model is a compound, but it truly shows the dynamic nature and complexity of Smart Cities.

Citizens engagement

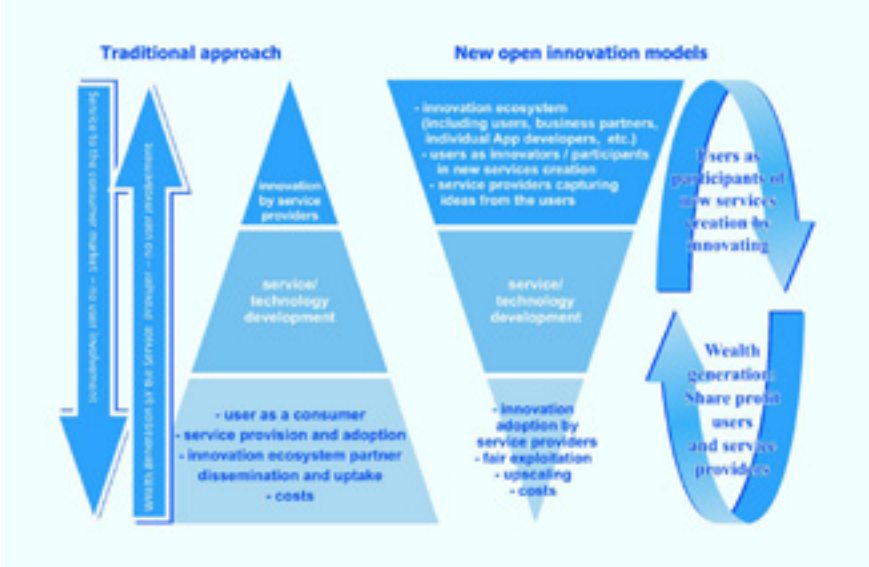
A smart city should be able to respond faster to city and global challenges than a city with a simple transactional relationship with its citizens.

In the recent past, considerable attention has been drawn to Smart Cities and even to the Future Cities topic and engaging citizens. A considerable number of studies offer methods for smart cities and

collaboration among citizens with the aim to have societal impact.

An Open Innovation model was offered by the OSI consortium led by the author of this paper, G. Sargsyan, called the 'Reverse Innovation Pyramid' [4] where the users/citizens are part of the shared profit, values and wellbeing.

Figure 4: Reversed innovation pyramid [4]



Will this model be the way towards an effective citizens' engagement in the Open Innovation 2.0 process, by leveraging societal capital as a vital factor for maximum impact?

It is clear, indeed, that the ecosystem is becoming more complex due to the evolution of different factors that have influence on each participant in this ecosystem. I see this model as a strong backbone for the creation of a new, refreshed model considering the dynamic changes on different factors of future cities. Analysis of the new ecosystem and creation of new methods are needed. An important aspect will be the citizens' engagement and how to make it efficiently empowered by societal values for ICT-intensive user-driven services.

Experimentation of models in different cities

In order to move from theory into practice and create a functional open innovation ecosystem in Future Cities, the offered new methods should be experimented. There are interesting smart models offered in Open Innovation for the effective collaboration and engagement of citizens. One of those models is presented in the 'Citizens Engagement' section of this paper.

The experimentation of different types of cities (size, geography, climate, culture, etc.) will be valuable and it will allow a better understanding of the Future City challenges and implementation strategies. It will also be very useful in terms of scaling up these experiments into a common truly effective and valuable European smart cities ecosystem. Sometimes small-scale experimentation can be essential for designing functional open innovation ecosystems for future smart cities.

Market role and value of smart cities

In the context of Smart Cities, key 'smart' sectors include transport, energy, healthcare, water and waste. Interest in smart cities is motivated by major challenges, including climate change, economic restructuring, the move to online retail and entertainment, ageing populations and pressures on public finances [5]. The European Union (EU) has made constant efforts to come up with a strategy for achieving 'smart' urban growth for its metropolitan city-regions[6][5]. Arup estimates that the global market for smart urban services will be USD 400 billion per annum by 2020. Notably, 'smart' cities include Chicago, Boston, Barcelona and Stockholm.

According to Frost & Sullivan, Smart Energy is the fastest growing market segment in Smart Cities. The market for Smart Energy is expected to make up 24 % of the total global smart city market in 2025, growing at a CAGR of 28.7 % from 2012 to 2025. Globally, the smart-city market is expected to reach USD 1.56 trillion by 2020. The growth is driven by a large-scale adoption of smart grids and intelligent energy solutions. The research expects

that over 26 global cities will become smart cities by 2025. Europe and North America will hold more than 50 % share of them [7].

What would be the role of OI2.0 in this fast growing market? The market is an essential part of the OI2.0 ecosystem and if the collaboration is effective, all the other ecosystem participants will benefit too. The model of OI2.0 can be a stimulator to help this happen in a more efficient way.

Big data in future cities

Another 'hot topic' nowadays is 'big data'. How can the use of big data create Future Cities? Cities are immersed in huge amounts of data, which come from everywhere: buildings, phones, utilities, trains, etc. ICT allows us to collect and analyse all this information in static or real time. Using business intelligence, information management and advanced analytics solutions, big data can allow us to easily understand every level of city administration, users/citizen behaviour and market implications. When cities give the right information to the right people at the right time, they make better decisions and they can measure the ongoing impact of their decisions.

Ideally a future city needs to use both top-down and bottom-up approaches simultaneously. The top-down approach means that governments or city administrations create platforms to collect and analyse data, then make decisions. The city administration also decides which data is available publicly and which is not.

As for the bottom-up approach, it means that citizens create and/or use apps to upload information and make it public for others. However, the government cannot control data flows. Therefore, the golden middle needs to be found. A solution can be that the government creates open platforms where the data is publicly available and citizens can constantly update it. Getting citizens involved in the process of improving cities is crucial as eventually without the citizens there is no city.

Future thoughts

Smart Cities are the backbone of Future Cities. The role of OI2.0 can be essential in Future Cities. Ideally OI2.0 brings all the participants of the innovation ecosystem into balance; combining social and economic values using enablers, such as ICT. Technology is an enabler among a series of other enablers and the ultimate objective of this process is that the shared values and shared economies will result in full happiness for all parties involved. Getting citizens involved in planning and implementing in Future Cities is crucial.

The future of smart cities lays in the effective open innovation ecosystem and collaboration with citizens will contribute to societal capital.

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Innovation Dilemmas of the Future

Introduction

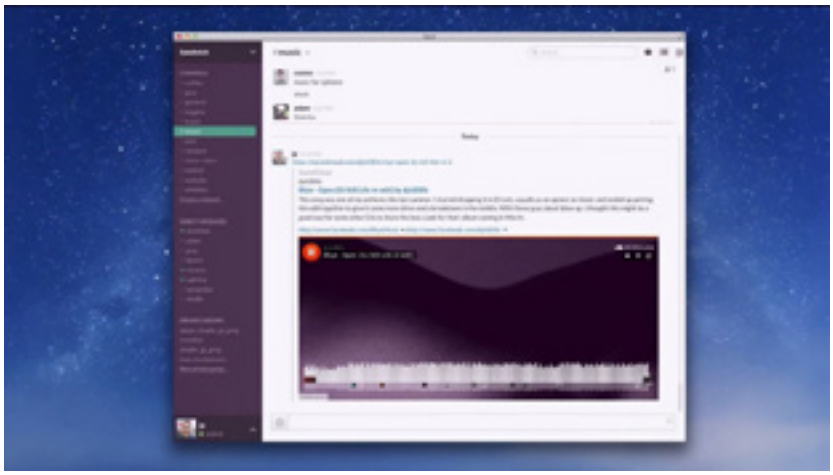
Every now and then we look back to understand what the world thought of new innovations. We see some unexpected failures, which no one had expected, including ourselves. Think of Google Glass [1]. Where are the hordes of people walking around with this sophisticated pair of glasses on their nose? They are nowhere to be found, as the device found a strongly negative reaction from the audience. From the point of view of Open Innovation new paradigms, or as we call it Open Innovation 2.0 (OI2.0) [2], this was not expected either. Consumers fear that their privacy will be violated. Is this a key issue to consider for OI2.0 implications? What does this mean for the year or even the decade ahead? Forget for a moment the calibrated success stories of smart watches or the life-prolonging wonder drug C60 that shook the medical world, but look at the innovation dilemmas that are coming our way. There is great uncertainty mostly for OI2.0.

A dilemma is more interesting than a prediction because it means that we are at a crossroads and it is difficult to make a choice. The dilemmas covered are in the field of innovation management, OI2.0 inspirations, sharing values, economics and use of technology.

Innovation by start-ups or corporations?

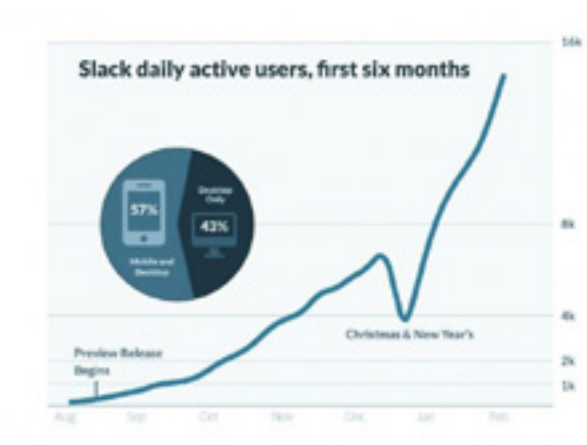
Startup Slack [3] has been in the news a lot lately. The company focuses on communication in teams that combines implementation of archiving, chat and instant documents.

Figure 1: Slack chat screenshot



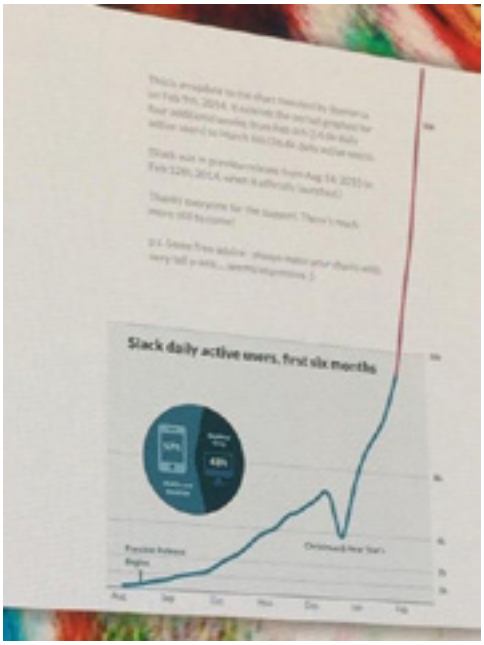
Let's say, Dropbox meets Google Apps, meets Yammer...;-) With an investment from Google Ventures and the world's famous venture capitalist Kleiner Perkins, the valuation of the company amounts to USD 1.12 billion. At that time there were only 268 000 users. That is a lot of money for a start-up launched just one year ago. This can be considered as grist for the mill of the gurus of Silicon Valley who say that start-ups are the only answer for innovation in the world. Such a valuation is a confirmation of their message.

Figure 2: Slack daily active users, first six months



*And as one can see, even faster growth in January 2015.

Figure 3: Slack growth in January 2015



Start-ups also attract interest because they are all the underdogs starting with a business model or technology that is quite different from the existing norm. Take for instance a subscription model, whilst the whole industry is still on sale of individual units.

A good example is the publishing industry. There has been no one in the industry to propose things to be done differently and to make a business model for this. Through initiatives such as the Correspondent, Medium and Blendle that sector has been awakened. Blendle offers the opportunity to pay only for the article you want to read. Correspondent is an ad-free medium that delivers the so-called long reads. People are joining the movement for quality journalism. On Medium, a social network developed in North America, one can find long reads and open speech publications. You could say Medium is the opposite of Facebook media stars like Buzzfeed [4]. All examples are in conflict with the business model of a traditional publisher.

So, start-ups seem to work well. After such a wave of disruption, think how many other sectors can follow the example of start-ups in the publishing world. Many executives in corporations have lost trust in their own marketing and IT departments that have been unable to realise digital innovation across companies. The common conclusion is that these departments are too much focused on legacy systems and models, not commercial and too cumbersome. Innovation must be fast and disruptive. Logically, then follows the idea to cast off and move to Silicon Valley to invest in technology start-ups. So instead of investing in their own people and capacities, attention is focused on initiatives outside of your own organisation. Go West! Step into the next Facebook! Use the co-creation model! Invite other experts from the sector to give you feedback on your innovative ideas!

But then again, is it wise for a company to take on anything that comes from the start-up scene?

Recently an interview was published with Ralph Hamers, the CEO of ING [5]. Like many bank managers, he puts the emphasis more and more on investing rather than self-innovating. In our belief system, this is too rosy a picture, mainly because of all the great company valuations of few leaders. Currently, there are so many start-ups out there, that we start feeling overwhelmed. Only in the financial world,

there are more than 3 000 initiatives that have reinvented the wheel. Crowdfunding, another good example of co-creation and sharing, payment options and money transfers back to your home country, in every part of the financial value chain there are at least 50 new parties to substitute the banks. With all these different disruptors, it has become more of an art to assess a start-up on the basis of their pitch and website.

Here is an example to demonstrate the issues of working with a start-up. Jaspar Roos (an author of this paper) was amazed by the customer growth rate of a competitive start-up. He called some of the clients who worked with the organisation, to ask why they were working with this start-up. Guess what? They had only agreed to participate in a free trial pilot, but suddenly their logo was there as one of the trusted clients for the start-ups. We have seen this happening a lot. In the battle for attention, many start-ups take the poetic freedom to overstate their customer base. The same as they do with technological superiority. And so messages of the potential hazards emerge. Chances are that as a big corporation you may become blinded if you are focused on start-ups alone and you do not talk to your own IT department. And the government sees this too; just think of the City of Amsterdam, Berlin or Barcelona who all want to be the new Silicon Valley of Europe. It sounds so easy. The moment you cannot solve your problems internally, find the solutions outside.

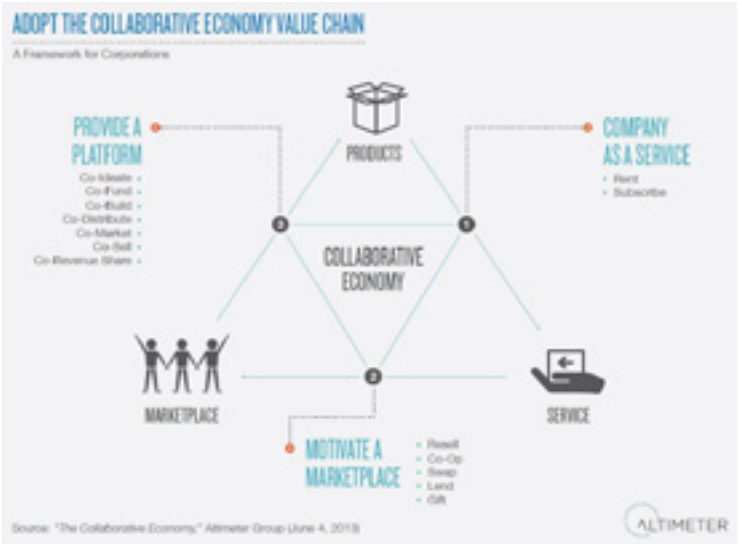
An alternative route may be that large companies start investing again in solving internal problems. Many good methods from the start-up scene like 'scrum' and 'lean' start-ups, which launch projects faster rather than testing in a laboratory are well known by managers. If they provide space for their employees to carry out their dreams within the organisation and start a dialogue that can stimulate the internal vision and business model, that produces an interesting mix.

A familiar example of a big business innovation is the world famous Tinder, a freemium dating app that is 'just' a part of the media company IAC that also owns the two largest paid dating websites in the world. Or take Watson, IBM [6], a truly breakthrough innovation of a large company that was the first to create a triple helix for different data techniques. In the pharmaceutical world, this means that a doctor using Watson to treat a symptom of a patient will always get the latest insights and can prescribe the best possible treatment. That is fundamentally different from searching on Google. These examples are relevant because corporate innovation is not dead. It often involves partnering with start-ups and other stakeholders, but not focusing on the innovation capacity from outside alone. The model of OI2.0 can be a stimulator to make this happen. Who dares to follow their example and join the internal discussion or as a manager to take the huge risk to not listen to Silicon Valley?

Sharing economy or trusted economy?

Last year, we read a lot about new business models. Parties like Airbnb [7] and Peerby[8] are new, sexy and idealistic. This also fits with the image of start-ups as sharing, peer-to-peer and collaborative consumption. It's all about the same thing: do well by turning to the unused capacity, that is, a bonus for you and good for the environment by avoiding all additional personal consumption.

Figure 4: Adopt the collaborative economy value chain, Collaborative Economy (Altimeter Group, 2013) [9]

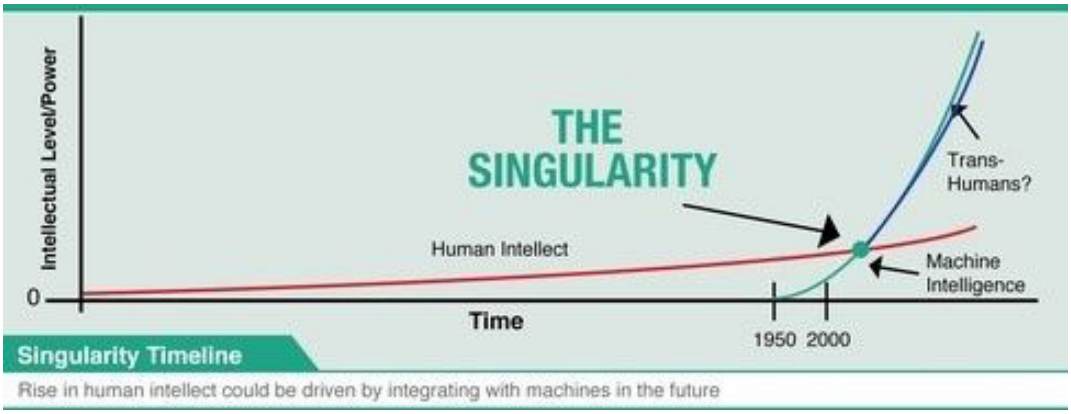


So, we were excited about the transport app Uber [10], a good example of Open Innovation, shared values and money. I use past tense because ideologically Uber is not such a good example any more. EUR 8 billion turnover in a year, 20 % of which lingers as revenue in the company and not among the drivers. That is not a small portion, but the dominant force in the market! The images we associate with it as good for the environment or sharing is not such, because we do not share our Uber cab. They are often professional drivers, who are also struggling to keep afloat due to the lack of employment by Uber. In the Netherlands, companies like TCA and Connexxion had already tried similar initiatives. Think Taxi Bavaria with one national phone number, bookings app TaxiID, TomTom Taxi or Cabster. These initiatives never really got off the ground. The competition is therefore limited. Uber understands marketing much better, but is not radically different or technologically more advanced. The shift to shared economy primarily means that the money goes to the few hundred men who are in a start-up. We have nothing against money or deserving what is earned, but we do not see them as idealistic or cute anymore. It is just hard business. If we still want to pursue that ideal of cooperation and have less waste, old models such as cooperative and credit unions are not as relevant. In the DNA of these organisations sit real idealistic principles.

Will the coming years be more about sharing and thereby hip and happening or about dull but familiar revival of cooperatives? Tech or no-tech? Let's try to add OI2.0 principles and see it can bridge the two. We believe that these principles can empower the sharing movement and create more products and services that can empower all instead of a few.

The previous two dilemmas were dealing with technology. Within that world there is a vanguard of supporters of singularity that has now become a movement for everyone who believes that technology is the answer to the world's problems. Isn't it? With the exponential growth of computing power and developments in genetics, nanotechnology and artificial intelligence, humanity will soon overcome biological limitations. The singularity momentum will be in 2028 [11], when the intelligence of a robot will go beyond that of humans.

Figure 5: The cross-over point of human and artificial intelligence, the Technological Singularity. Image by Futurebuff [11]



This moment has implications for almost all the important areas of our lives, such as the environment, education and health. This means an infinite decision speed and increased accumulation of knowledge by applying technology. At least, that's the technology church preaching to the choir.

On the other hand, you hear opposing views from, for example, by Elon Musk, founder of Tesla cars. He warns us of a world where super computers and robots decide what is good for humanity. Will we then end up in the world of 1984, are we robots or part of the 'Matrix'? How much technology is enough?

Technology will undoubtedly bring many benefits, but our needs for involvement, commitment and attention will not change. In its early days, the Internet was promoted as a time saver. We would have much more time for the things we love and care about. Reality bites unfortunately. Everywhere we go, we see people fixated on their screens. We are hooked and singularity smacks into me more drugs to sustain my addiction. Hope for the best.

We believe that technology has ensured that we can do things easier or faster, but there is just so much fuss and distraction that it might not be always for the best. Indeed, the truly priceless things in life are

not on the technology side. For professionals on the creation side of the production process the question arises if adding even more technology or connectivity will add value for customers? Even a tech guru who wants to have time to read, talk and actually live, he/she is being disconnected from these technologies. It seems like the time has arrived when being disconnected will become a luxurious status and will let people to actually live. Social aspects are so important to life that people start realising again after such a long attraction to technologies. We think that many opportunities lie in no-tech solutions, but as an innovator can you sell something that the rest do not even believe in?

Does OI2.0 have a role to play here? Ideally OI2.0 brings all the participants of the innovation ecosystem into balance; combining social and economic values using enablers, such as ICT. We think that technology is only an enabler among a series of other enablers and the ultimate objective of this process is the shared values and shared economies resulting full satisfaction/happiness for all the parties involved.

Our thoughts on the coming decade

The past ten years have been dominated by technological connectedness. Many can no longer imagine a world without all this wonderful technology. And we, the authors, use it every day and earn our money with it. However, we do not think this necessarily will remain so. This is what the dilemmas are all about. Looking ahead to the coming decade, we believe that people's desire to interact with more people with emotional wisdom rather than technology wisdom. Those are the people who inspire us. Social interaction has been ignored due to the technological advancement.

We see a new dichotomy: on one hand, there are those who can afford to be cut off from the world itself. Offline will be for the upper class. On the other hand, there is the working underclass that is addicted or obliged to stick to their devices like a rat in a wheel because of their bosses.

Technology becomes less relevant to us because it has become a commodity. Take for example all those programming classes at primary schools all over Europe. In fact, learning any language besides English is relevant for European harmonisation. However, a world full of technology will make something non-techie like social studies and creative education truly distinctive. It is impressive that the fathers of both authors of this paper both are still using simple Nokia mobile phones. It is quite curious that those phones still work, but also impressive because they actually get in contact and meet people without having to use technology. Here again, it is a great example of technology as an enabler for social interaction.

We expect a new wave of innovation in which humanity is paramount, in both large trusted companies and in a growing number of start-ups. This undoubtedly means that new business models will emerge. Being human also means limited scalability. Technology is scalable because of its zeros and ones, which can simultaneously have the same quality everywhere. Being human brings fluctuations in the quality, and also has localisation. If I'm with you I cannot be elsewhere. But this may not be bad. This is the same with something important such as love. And there is a lot of money in this market. Call us romantic or naive, but we expect that the future of innovation can be more human and also upscale as a technological wonderland.

Have a lot of innovation fun in the coming decade!

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