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Open Innovation 2.0 — Yearbook 2014

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Foreword

Welcome to the Open Innovation 2.0 Yearbook 2014

I am really pleased to welcome you to the 2014 edition of the Open Innovation 2.0 Yearbook! Last May, as part of the Irish Presidency of the European Union, we were able to formally introduce Open Innovation 2.0 at the OI2 conference in Dublin Castle. The OI2 conference, which was formally opened by President Barroso, brought together government, business, academic leaders and indeed citizens to learn, network and work together for progress.

We learnt at the conference that the problems Europe faces are too difficult and large to be tackled in isolation and that a new approach is needed. Following a grounding in the principles of Open Innovation 2.0 as well as much sharing and learning, the conference attendees used the process of Open Innovation 2.0 itself to create the Dublin Innovation declaration. We also learnt from ordinary Dubliners, who attended our future cities showcase at the Lord Mayor's residence, of their extraordinary desire to participate in the innovation process.

The Dublin Innovation declaration consists of 10 recommendations for action to stimulate Innovation in Europe to get us all on a path to sustainable intelligent living. Indeed conference attendees voted on the final recommendations and each of these were overwhelmingly supported. Subsequently, briefings of the Dublin Declaration have been given to senior EU and Government officials and key elements of the declaration are being included in output of the Innovation High Level Panel which will report its finding under the Italian Presidency of the EU.

In this 2014 edition of our OI2 yearbook you will find fresh thinking as well as compelling evidence of the OI2 paradigm. We know Innovation itself is morphing at a very fast pace and we will endeavour to track and indeed help drive the changes so that an Innovation mind-set and culture becomes pervasive in Europe so that we can continue to drive improved quality of life, progress, sustainability and more in Europe and beyond. We know that culture is very important for sustaining innovation — you may have heard the expression that 'culture eats strategy' for breakfast, so no matter how good our innovation strategy and instruments are, unless we collectively are able to embrace Innovation as a way of life, the results we get from our efforts will be sub-optimal.

I wish you happy innovating.

Martin Curley,
Vice President & Director,
Intel Labs Europe, Intel. Corp.

Introduction

Uptake Open Innovation 2.0 in your projects

The Open Innovation 2.0 concept was endorsed at the Open Innovation 2.0 conference in May 2013 held in Dublin. We can firmly say that the paradigm change is real!

The yearbook Open Innovation 2.0, edition 2014, tries to highlight the trends and the impact of the new approach in action, involving all stakeholders into the common journey from invention to innovation.

Earlier editions of the yearbook as well as reports published in the OISPG series (all found from *bit.ly/OISPG_series*) brought together the open innovation's puzzle pieces for modern practice.

We still hear from many practitioners the very misleading statement 'but we have been doing open innovation for more than ten years now!'

That is, however, not true. There has been a growing culture of collaborative projects with commonly created results, IPR, and there have been normal projects which have had also strong subcontracting elements. Good examples of collaborative projects which shape actively the larger collaboration landscape are e.g. the projects under the past EU research frameworks which have led to the discovery that normal industrial and academic collaboration in Europe is cross-national. It has also led to extended collaboration between the research and academic institutions and the industry. Rules to share IP have been clear. So, is something new under the sun happening now?

Yes, definitely! Something new is being cooked! Often innovators still talk about the leaking funnels, clusters and also triple helix innovation where the stakeholders are academia, industry and public sector. Open Innovation 2.0 however brings us further, taking the full advantage of strong seamless interactivity across all stakeholders, including users, across the whole innovation ecosystems.

Important is not only the quadruple helix innovation but also the active search of entirely new connections and areas between clusters, again with the drive of creating entirely new innovations based on, but not limited to, the existing clusters. As clearly visible in the yearbooks new approaches create disruptiveness, and unanticipated opportunities. As the CEO of Supercell, Ilkka Paajanen tells us 'one never knows a priori which product will be a breakthrough'.

Against this background, it appears crucial for the public sector to catalyse a fluid, frictionless innovation space where all the stakeholders can share their ideas, prototype them and scale up the successes rapidly. And, of course all stakeholders should be able to build and contribute to the innovation ecosystems by bringing in their competencies, and also their hearts, with growing trust in genuinely experimenting, prototyping and making success together. The key is to bring all beautiful theories of the shared culture into practice. Sharing is the best guarantor for growing the pie for all stakeholders.

I believe this edition of the yearbook gives you stimulus and ideas on how you can uptake Open Innovation 2.0 in your projects. Hopefully we can also receive your feedback on how you did it, to share your experience in the future editions of the yearbook series.

I thank all contributors to this year's edition and wish you interesting journey into open innovation.

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Executive Summary

The 2014 edition of the Open Innovation 2.0 Yearbook highlights new trends in innovation, delves deeper behind the buzzwords and tries to give a good overview of what actually is going on.

This edition of the yearbook is divided in three sections in order to be better accessible and comprehensive. The first section is called **Open Innovation 2.0: The big picture,** and is based on the White Paper from the Open Innovation 2.0 Conference 2013, which was updated to correspond the current situation and trends. This paper together with the Dublin Innovation Declaration (bit.ly/OI2DublinDeclaration) is a sound basis for modern innovation understanding and actions.

The second section, named **The European setting,** illustrates the European perspectives on innovation from institutional and ecosystem standpoint. The special topics in this section are touching the aftermath of the financial crisis, and also youth engagement to innovation.

The third section is highlighting the best practises of open innovation in real world cases — **Open Innovation 2.0 in a real-world setting.** Here we talk about Open Ecosystems, Big Data, Youth Innovation, Smart Cities and two very special, but interesting, topics on Lawyers in Innovation as well as Drivers for Creativity Based on Humor!

In the article by **Curley and Salmelin** the concept of Open Innovation is elaborated to illustrate the main drivers for this new paradigm. The paper describes the drivers in some detail and interlinks them to a coherent innovation system. Examples are shown as well. The European research and innovation framework, the Horizon 2020, is taking up some of the recommendations following the paper, but let's see how this important shift is happening in actual project profiles.

The innovation paradigm is really changing from the closed one to the open, and furthermore to the Open Innovation 2.0.

In the article by **Pallot** et al the experimental design concept and process is introduced and elaborated, building on the context of Living Labs and open innovation. Real world settings, user experience and clear process to embed the feedback in the design process are shown in several practical cases, in logistics, well-being and green services context.

Sargsyan and Roos argue that hardwired revolution is just behind the corner. Open hardware development is emerging in tangible products and is very interesting from the investors' perspective, as it creates entirely new opportunities for configurable, user-centric 'things'. The article discusses also the new business model opportunities in light of a case study from the banking sector.

Carayannis further elaborates on the quadruple helix innovation model which encompasses the mash-up innovation and the multilevel policy approach. Interestingly he elaborates on the new drivers beyond the existing, and reflects on the more complex approach of quintuple helix innovation environments! It is extremely interesting to see the drivers needed for the transformation to the new, and how the various aspects are interrelated. The article sets a great real world context with its example about the transformations in innovation systems seen in the Nordic countries.

Von Gabain et al illustrate in their article the EIT and KIC scene from inside. KIC (Knowledge and Innovation Communities) create an interesting innovation ecosystem in the clusters, but also between them using a common methodology. The chapter deals with the implementation of an experimental innovation model of new innovation networks in Europe. These networks aim at catalyse innovation to become a value driver of entrepreneurial Europeans, including new ventures, products, services and processes.

Turkama and Schaffers elaborate in their article on the evolution of large-scale public-private research and innovation initiatives; and also how they create, and demand, innovation ecosystem thinking so that environments function properly. As example, they analyse the Future Internet PPP funded by the European Commission during the period 2011-2016. In this context the governance of open innovation ecosystems is discussed as well as the expected impacts of such large joint initiative. The text also proposes actions related to innovation sustainability.

In her article, **Lin** discusses the aftermath of the financial crisis in the light of the excellent work done on knowledge capital, structural intellectual capital and the effects on national competitiveness. Policy measures from different parts of the world are set in context of increasing intellectual capital.

In the article there are good references to a wider set of studies targeting the major OECD countries (Organisation for Economic Co-operation and Development) regarding intellectual capital and competitiveness. Results are just startling.

Carrol interlinks existing youth unemployment solutions with modern approach of using data (and especially big data) as driver for future growth. The new educational challenges together with the stated incentives can be very impactful when it comes to coping with the unemployment challenge. Open data and open platforms create a strong raw material basis for new enterprises and young people to create their own jobs.

Ramaswamy highlights in his paper the triple win: Wealth-Welfare-Wellbeing being created by open innovation ecosystems. Ubiquitous connectivity fosters new societal and co-creative value constellations which take us beyond the traditional boundaries. This new interaction model leads to a more inclusive society based on joint wins across all stakeholders. In the paper new value co-creation models are also discussed with examples, from the triple win perspective.

Rantakokko describes an interesting case from Oulu, Northern Finland, the Oulu Innovation Alliance, where we see in practise how the public, private and civic sector together with the academia are creating a genuine quadruple helix approach to develop public services and infrastructures, especially related to mobile and wireless technologies. The evolution from a successful inward-looking cluster to ecosystem-centric open approach has been remarkable. The numbers speak for themselves.

Levy and Rannou touch on innovation ecosystems in lifestyle communities in the Internet of Things (IoT) context. Quite an interesting example on wearables and citizen-generated data, including data management which provides additional value for the community, is discussed. Important boost for this sector to grow is the open plug-in platform for devices both from hardware and system level.

Chatterjee describes quite an interesting approach to entrepreneurship and growth. The OpenEYIF (Open European Youth Innovation Framework) sets a blueprint for an open innovation ecosystem for young entrepreneurs focusing on Open Innovation as process. This three-stage new ecosystem creation process is described with very concrete, measurable objectives and timeline. The roadmap includes presentation of new tools supporting entrepreneurship and interaction in the open space as well.

Van Ouden et al elaborate further on the case on innovative lighting which was presented in the last year's edition of the Yearbook. The vision is now progressing in reality, and the article describes the experiences and the visions now, one year after. It gives valuable insight on the success factors and bottlenecks when applying open innovation in practise. The diversity of devices and infrastructures to be integrated is stunning. Good lessons from this approach can be transferred to other sectors as well.

Marom and Wright describe in their article the importance of moving from theory to practise: from 'knowing' to 'doing'. Crowd-based assets are a new source of innovation and economic growth. Many organisations are aware of this, conceptually but the threshold to move into this in practise is quite cumbersome. Why? The article shows a good insight on how to do crowd(re)sourcing in practise and how to avoid the usual mistakes. The article shows also by several examples how crowdfunding and crowd sourcing has worked, and which are the pain points.

Do lawyers and innovation belong together? **Huuskonen** brings a fresh insight on the role of lawyers in innovation, as critical enablers to allow us to look beyond the current frameworks and being able to identify (and remove) the hinders for future innovative technology approaches and business models. Examples of implementing new technologies in virgin environments are also shown to highlight the importance of 'new' thinking in all professions.

As a good and inspiring end for the yearbook we have **Roos**' article! Innovation capability in organisations is the most important asset in the modern enterprises. How to maintain and preferably increase the innovation capability by acting differently, organising the enterprise differently and developing values and practises for creativity? How do we transform our organisations from data- to design-driven innovation? Or do we need to transform along other axis? Inspiration and creativity is related to the general ambience of a company. What Roos introduces in his paper is very important: Humor from employees stimulates readiness for change and is extremely important in the transformation processes of any organisation.

Culture and behaviour defines us. Are we ready for openness, sharing and building the future together?

Altogether an impressive collection of ideas, concepts, examples and huge amount of practical experience is again served in the present edition of the Open Innovation 2.0 Yearbook.

Enjoy reading!

CHAPTER I

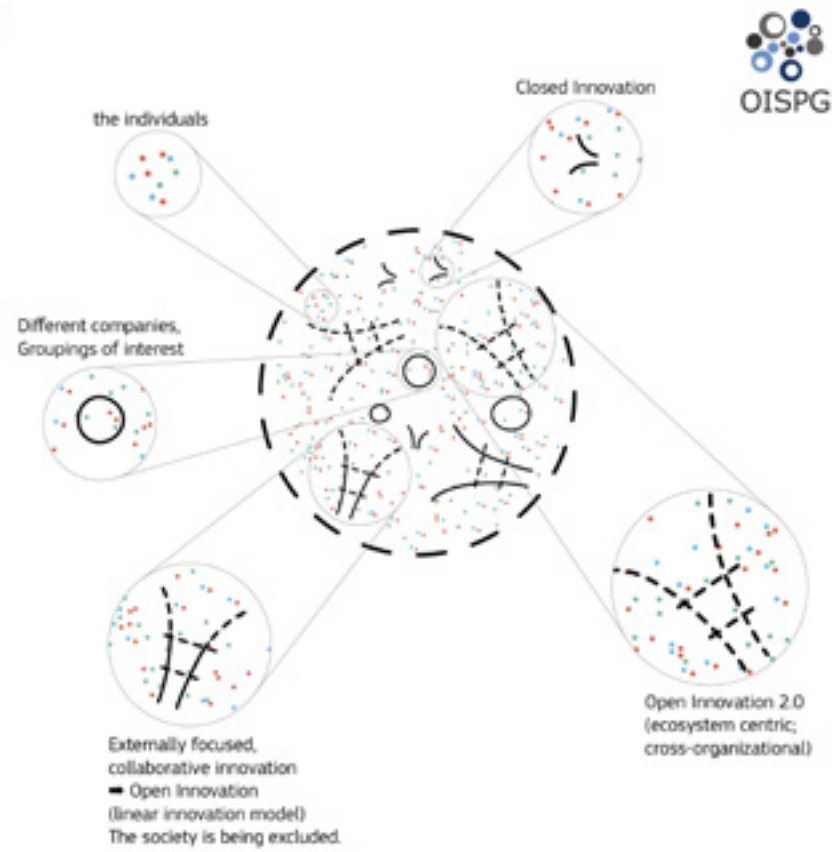
Open Innovation 2.0: The big picture

Open Innovation 2.0: A New Milieu*

Abstract

The challenges we face in Europe and beyond are too large to tackle in isolation and thus we need a new approach. Better solutions are needed globally in domains such as healthcare, transportation, climate change, youth unemployment, financial stability, prosperity, sustainability, and growth. These challenges provide a significant opportunity to create new shared value through innovation. Society's challenges may well reflect the transition to innovative solutions, and today's challenges are perhaps best seen as examples of Joseph Schumpeter's *creative destruction* model where the failure of old approaches fuels the motivation for change and shapes the future ([1]). The challenges also call attention to the *quadruple helix* model of innovation where civil society joins with business, academia, and government sectors to drive changes far beyond the scope of what any one organisation can do on their own. To do so will require us to redouble our drive to experiment. Our destination is a new model for innovation, Open Innovation 2.0.

Figure 1: Innovation Ecosystem



Source: EU Open Innovation Strategy and Policy Group, 2013

* The authors wish to thank OISPG vice-Chairman Dr Richard Straub for a thoughtful review of this paper.

Open Innovation 2.0

Innovation matters. According to the US Department of Commerce, technological innovation accounted for 75 % of GDP growth in the USA since the end of World War II ([2]). In parallel, innovation itself is changing faster than a speeding bullet and through our monitoring of innovation best practices, we observe a new paradigm emerging. The Open Innovation Strategy and Policy Group (OISPG) has published 10 substantive reports on different aspects of a new innovation paradigm and this informs us that something different is happening. We believe that the intersection of mega-trends such as digitisation, mass collaboration, and sustainability needs is creating a unique opportunity to enable an explosive increase in shared value due to innovation.

Open Innovation 2.0 (OI2) is a new paradigm based on principles of integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption. We believe that innovation can be a discipline practiced by many, rather than an art mastered by few.

The probability of break-away improvements increases as a function of diverse multidisciplinary experimentation, which is the essence of OI2. In today's complex world, experiments simply cannot be conducted in isolation. Collaborative research will accelerate the innovative process and improve the quality of its outcomes. While closed-world innovation will not disappear, it will be dwarfed by the efforts of teams that enable a wide spectrum of stakeholders to take on active roles.

The adoption of the new OI2 paradigm can be the catalyst that unleashes a virtual Cambrian explosion of innovation in Europe. Instead of gravitating to the lowest common denominator of its society, Europeans will deliver to the highest common multiple by leveraging all the talents and resources of European society. OI2 is all about an openness to innovation that does not resist change, but embraces it. OI2 requires a new mindset focused on teams, collaboration, and sharing. Only with this focus will it be possible to tear down the walls that form separate silos of civil, academic, business, and government innovation. Silos will be replaced with creative commons, shared societal capital, and the systematic harvesting of experimental results. Information technology will play a special role because IT can supply the necessary connectivity and enable social networking among innovators and the communities they serve.

There is much that needs to be done to properly establish OI2 in Europe. This is why policy-makers must make serious efforts to strengthen the framework supporting open innovation approaches. As one example, the work of the European Institute of Innovation and Technology (EIT) is a step in the right direction. There is significant opportunity for growth based on Europe's strong hubs and regions that garner high scores on measures of innovation, including competitiveness and other Information Communication Technology (ICT) maturity indices.

It is important to note that Europe is traditionally stronger in research output and weaker in innovation take-up (i.e., adoption). To improve adoption rates, the new EU Horizon 2020 programme stresses a more holistic perspective for Research, Development, and Innovation (RD&I) and this is another step in the right direction. This programme should encourage more Europeans to take measured risks and reap the benefits of new higher-expectation businesses.

Academic Perspectives on Innovation 2.0

Central to the success of OI2 is the concept of shared value and shared vision. Michael Porter and Mark Kramer ([3]) have espoused the idea of shared value where companies shift from optimising short-term financial performance to optimising both corporate performance and social conditions, that is, increasing the value shared by both the corporation and the society in which it is embedded. The thinking of Porter and Kramer has profound implications on how to attack the challenges that Europe is facing. OI2 is a paradigm that is also concerned with the creation of shared value, sustainable prosperity, and improvements in human well-being. Many people recognise that innovation is not just an imperative for economic and social progress. Rather, it is a composite of mindset, art, skill, and societal capability that underpins the survival and progress of the human species. Hence it is key that OI2 aims to enhance simultaneous value creation for civil, business, academia, and government markets.

MIT's Michael Schrage commented that 'Innovation is not innovators innovating, but customers adopting.' This statement perfectly characterises the shift in mindset that is a hallmark of OI2. In an interview about innovation, Schrage went on to say, 'The real story of American innovation is (about) the folks who adopted inventions and thereby transformed them from mere inventions to full-scale innovations' ([4]). Innovation happens when a customer becomes a co-creator of value, an active subject of the innovation process, and is not merely a passive object. In Schrage's terms, *invention + adoption = innovation*.

Industrial Perspective on Open Innovation 2.0

With advances in global information and communications technologies, the processes and practices

of innovation are evolving at an increasingly rapid pace. As shown in Figure 2, innovation as a discipline has moved from being something diffused by a brilliant researcher, through the era of open innovation, and now to an ecosystem-centric view of innovation, where the ecosystem is often the distinguishing unit of success, not individual companies or universities.

Industrial research is changing and instead of innovation being driven by a brilliant individual researcher, innovation success will be driven by teams of boundary spanners that possess multidisciplinary skills. In addition, methodologies, such as the Intel. Labs Joint Pathfinding process, create mechanisms that are able to span the so-called *valley of death* that lies between research and product adoption and thus enable much higher returns on research investments. Joint Pathfinding occurs where research laboratories and business groups share resources, risks, and decisions jointly. The eclectic team works together to build product roadmaps that identify the pathways from research to results.

Government Perspectives on Open Innovation 2.0

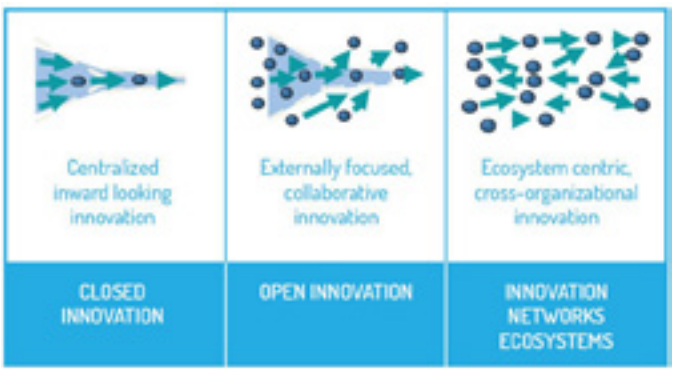
The political mindset about innovation is changing worldwide. In particular, a primary tenant of OI2, that successful innovation is accelerated when a wider spectrum of stakeholders participates, is heard more frequently from world leaders, as the following comments reveal.

- *In his 2013 State of the Union speech, US President Barack Obama said 'Innovation does not just change our lives, it is how we make a living.' When speaking at the opening of a newly expanded innovation facility in May of 2013, Obama added, 'We are seeing the pooling of research, of risk, and the potential for breakthroughs in manufacturing technology that only happen when we bring everyone together. No company alone would have the incentive to (make this investment) on its own, but together companies are willing to move forward' ([5]).*
- *The EU Commissioner for Research, Innovation, and Science, Máire Geoghegan-Quinn, has articulated the necessity of a continuum model for innovation. In a 2011 interview Geoghegan-Quinn said, 'To transform research into genuine innovation and to strengthen the whole chain from research to retail, a close working relationship with other Commissioners, with Member States, with research institutions, and with business will be necessary.'*
- *The UK Chancellor of the Exchequer, George Osborne, recently warned 'Innovation is not a sausage machine.' In a 2012 lecture to the UK Royal Society, he went on to say, 'You don't get (innovation) by a plan imposed by government and you can't measure it just by counting patents or even just spend on R & D. It is all about creative interactions between science and business. You get innovation when great universities, leading-edge science, world-class companies, and entrepreneurial start-ups come together.'*
- *The UK Shadow Minister for Science, Liam Byrne, said at the 2014 EU Innovation convention that 'Innovation is the Number 1 escape route from Austerity for Europe'.*

At last, in the Western economies, there is recognition that a long-term view is needed. As stated in the Obama Administration's Strategy for American Innovation, 'A short-term view of the economy masks under-investments in essential drivers of sustainable, broadly-shared growth. It promotes temporary fixes over lasting solutions. This is patently clear when looking at how education, infrastructure, healthcare, energy, and research — all pillars of lasting prosperity — were ignored during the last bubble' ([6]).

Political perspectives like these will help ensure that the right policy decisions are made to accelerate the creation of both business and societal

Figure 2: The Evolution of Innovation



Source: EU Open Innovation Strategy and Policy Group, 2013

value through innovation. The role of the public sector is to create the environments for OI2 where the mash-up of the needed components can happen in a frictionless environment. The public sector provides not only the framework but also brings in the fuel for the innovation processes, for example, by procuring innovative products and sharing RD & I risk. It is also important to create efficient political and legal environments to catalyse innovation and experimentation.

Open Innovation 2.0 in Detail

In the last decade, Henry Chesbrough ([7]) creatively conceptualised the idea of open innovation where ideas pass to and from different organisations for exploitation. Today, innovation success is characterised by how well innovation ecosystems assembled from a multitude of participants create novel products and services that are quickly adopted. Once again we want to stress the importance of the creativity beyond organisational boundaries as essential to creating valuable components for innovation from a societal (market) perspective due to new co-creation processes across all stakeholders.

The EU's Open Innovation Strategy and Policy Group (OISPG) unites industrial groups, academia, governments, and private individuals to support policies for open innovation at the European Commission. OISPG has published annual yearbooks that document and summarise current innovation practices in Europe. In past years we are witnessing a new level of open-ness with increased sophistication and complexity associated with innovation.

OI2 is the second significant paradigm shift in the recent history of thought about innovation ([8]). Everett Rogers ([9]) set the stage with his insights into the diffusion of innovation leading to adoption. Approximately forty years later, the paradigm shifted to Chesbrough's first-generation description of Open Innovation ([7]). And now, just ten years later, the paradigm is shifting again to Open Innovation 2.0. This is consistent with Kurzweil's (1999) law of accelerating returns, which predicts that paradigm shifts will occur more rapidly, especially in technology domains.

The OI2 Paradigm

For OISPG, the OI2 paradigm is an innovation model based on extensive networking and co-creative collaboration between all actors in society, spanning organisational boundaries well beyond normal licensing and collaboration schemes. With OI2, sharing and the co-generation of innovation options will enable a significant competitive advantage and will help achieve broader scale innovation benefits for larger numbers of stakeholders. In OI2 there is also a cultural shift away from resisting change and toward innovation and the creation of shared value. Telecommunication networks deployed in the service of increased social interaction are a key characteristic of the OI2 paradigm. When communication bandwidth increases, trust builds quickly among collaborators. According to Karl-Erik Sveiby, greater bandwidth and accelerated trust lead to the creation of more innovative options as more shared ideas are activated. As George Gilder (1993) observed when analysing the power of Robert Metcalfe's Ethernet design, the value of telecommunication networks grows as an exponential function of the number of intercommunicating nodes ([10]). Recent experiments such as the creation of wikis demonstrate how powerful communication networks can be when enabling large groups of individuals to collaborate.

A second core characteristic of the OI2 paradigm is the use of the quadruple helix model where government, industry, academia and civil participants work together to co-create the future and drive structural changes far beyond the scope of what any one organisation or person could do alone. This quadruple helix innovation approach is most successful when there is a shared vision and a shared value is created.

Open Innovation 2.0 by Example

In following chapters in this 2014 *OISPG Open Innovation Yearbook* we identify key examples of open innovation that help illuminate the new paradigm which leverage diverse concepts and practices including the principle of shared value, open innovation, co-creation, entrepreneurial experimentation, and triple/quadruple helix innovation. We believe that the effective collaboration of government, academia, industry and civil individuals working together can drive structural changes and improvements far beyond the scope of what any one entity can achieve on its own.

Our observations indicate that we are indeed witnessing a strategic inflection point in the practice and impact of innovation. OI2 is enabled by the collision of three mega trends digitisation, mass collaboration, and sustainability. Across the world, Moore's law is colliding with virtually every domain. Industries that have taken centuries to mature have been dramatically reshaped in less than a decade (e.g. music, books). Many more industries are ready for this *atoms-to-bits* transformation with energy distribution and the emergence of *smart* electrical grids as prime examples.

As OI2 evolves, its goal will be to help practitioners and academics achieve results that are more probable, predictable, and profitable. OI2 in real-world settings will increase the velocity and success rate of innovation due to its co-creative and experimental nature. While Niels Bohr cautioned, in good

humor, 'Prediction is difficult, especially about the future,' we can apply OI2 to increase the probability of making significantly better choices, thus creating profitable new markets as a consequence.

Open Innovation 2.0 Semantics

The three key words that define innovation are newness (or novelty), adoption, and value. An idea of course does not have to be completely new, just new to a user, organisation, focus area, or society. Indeed, many successful innovations are adaptions of existing ideas, products or services which are already adopted and successful in some other sphere. Innovation is also about value creation and, unless value is sustained, innovations will fall away. ISPIM founder Knut Holt (1978) said, 'Innovation is the fusion of a user need and a technological opportunity. Ultimately there is only successful innovation when a user, organisation and society perceives and receives value.' OI2 promotes the role of the user to be an active participant in the innovative process from the very beginning and to continue throughout the process ([11]).

Building on the *innovation value chain* concept as defined by Hansen and Birkinshaw ([12]), we can describe the process of innovation as going through three phases: idea generation, idea development, and the diffusion of developed concepts. (Recall that diffusion was Roger's term for the process leading to adoption.) Most innovations fail in the diffusion or adoption phase. A recent Doblin study found that the average success rates of innovation, that is, the proportion of all new and developed ideas that are adopted, is around 6 %. Paradoxically, most of the European funding supports are targeted at the idea generation and exploration phase whilst the hardest part of innovation is the adoption phase.

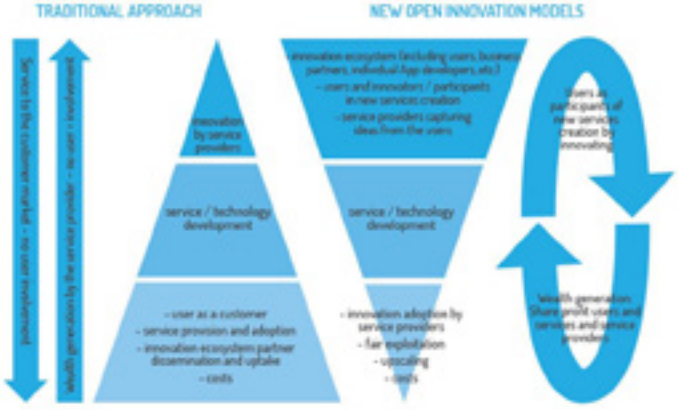
Of crucial importance in OI2 is the idea of full spectrum innovation and Doblin's taxonomy of 10 types of innovation is a powerful framework for describing this ([13]). Whilst much of innovation efforts are focused on inventing and improving product features or performance, Doblin's research showed that often the highest returns from innovation come from business model innovation, ecosystem orchestration, user experience innovation, and brand innovation.

User-driven innovation is a crucial part of the OI2 paradigm and is also a key lever for adoption because users co-create solutions that meet their needs. Jean Claude Burgelman from European Commission correctly identified that the user has moved from being an object of research in the innovation process, to being a contributor, and on to being a co-creator of the innovative outcome. The innovation process is being turned on its head and the OISPG report on the socio-economic impact of open service innovation has conceptualised this as the reverse innovation pyramid shown in Figure 3. Rather than innovation being something that is done for a user, the user co-participates in the innovation process as well as profiting from its outcome. Apple's App Store is a great contemporary example of reverse innovation.

But also companies like Lego are adopting this approach with the Lego Cuuso platform encouraging even children to submit designs for future products, for which they need to solicit significant online support from other children and if their designs are manufactured by Lego they share in the revenue.

Citizens now seem much more 'open to innovation'. Over 92 % of Dublin citizens who visited the 2013 OI2 futures showcase at the Dublin Lord Mayor's residence said they would like to see new technologies tested in the city and would like to be part of the experiment. The European Internet Foundation's seminal report on our Digital World in 2025 identified mass collaboration as the dominant mega

Figure 3: Reverse Innovation Pyramid



Source: Open Innovation Strategy and Policy Group, 2013

trend — imagine the power of collective European intelligence focussed on solving some of our major societal level issues.

The growth of the global app. economy is one such example where an industry that did not exist a decade ago is being fuelled by millions of individuals working as developers. In Europe alone, the EURAPP report estimates the revenues in the European App. economy were EUR 17.5 billion with contract development work being EUR 11.5 billion of this. By 2018 the European app. economy is projected to grow to EUR 63 billion with contract development work growing to EUR 46 billion.

The pivot of discussion has extended from crowdsourcing to also include crowd funding. Kickstarter, the most well-known crowd funding site, raises on average more than a $1 million a day for entrepreneurs. In its short history since its launch on April 29, 2009 has raised more than $1 billion from over 880 000 individuals who have contributed to more than 4 000 projects. Interestingly there is new research which shows that the success of funding on websites such as Kickstarter is well correlated to the amount of contacts one has on social media showing the importance of networking and the network effect.

Another key concept for creating successful innovations and accelerating their adoption, particularly for complex solutions, is a *design pattern*. A derivative of research in architecture and city planning ([14]), a design pattern is a generally reusable solution to a commonly reoccurring problem. As we moved towards an increasingly interconnected and complex world, the use of design patterns will significantly help accelerate both the creation and adoption of innovations. For example, innovation of healthcare delivery systems will likely take the form of a constellation of improvements (i.e., a design pattern) and not the adoption of a singular product or service.

Venkat Ramaswamy is a key evangelist of the idea of *co-creation* and central to his paradigm is the concept of *engagement platforms*. By co-creation, Ramaswamy means the design and development of innovative products and services where producers and consumers both participate. An engagement platform is the place where people and their environment join so that co-creation can begin. An engagement platform can be as concrete as a brick-and-mortar research facility, as abstract as a social networking site, or be an admixture of both. There must be a leader who is much like a theatrical producer. The leader's responsibilities are to select the right cast of co-creators, design the right settings and scenery, and orchestrate successful performances. The Knowledge and Innovation Communities (KICs) supported by the European Institute of Innovation and Technology are good examples of engagement platforms. The ICT KICs have developed a catalyst-carrier model to help accelerate traversing the path from *research to retail*.

The Living Labs was created in 2006 by the European Commission and the Finnish EU Presidency as an innovation ecosystem. Since founded as a modest start-up, the Living Labs has developed into a network of regional innovation ecosystems on all continents. Today the network comprises more than 300 sites. It is imperative for the Living Labs to create attractive innovation ecosystems following the quadruple helix innovation model (i.e., including the user), where the innovation trials and scale-up can happen more successfully due to strong engagement of the citizens in the regions. Living Labs can be seen as one example of the open innovation ecosystem development beyond traditional test beds that have usually been technology driven.

The landscape of industrial research is also changing. Following P&G's success with its Connect+Develop open innovation strategy (www.pgconnectdevelop.com), many companies are improving their innovation processes and systems. The Connect+Develop initiative, now 10 years old, broadcasts P&G's needs for innovation — open problems that the company wants to solve — to a global audience of innovators. Innovators are encouraged to propose solutions and participate in the development process. Over the decade P&G has developed over 2 000 partnerships and fielded a multitude of products the company calls *game changers*.

Frans Johansson ([15]) has written extensively about what he has branded the *DeMedici Effect,* where intersectional innovation (i.e., innovation that spans disciplines and cultures) generates high yield and breakthrough results. Innovation is often about creating novel intelligent combinations of existing solutions and emerging technologies to perform tasks better, faster, and cheaper or to enable previously impossible tasks to be performed. Often an idea that works in one sector can span a boundary and be successfully adapted to generate new value in another sector.

Through improved and more extensive networking, OI2 focuses on creating increased social capital, enabling broader boundary spanning and the creation of new activation triggers for innovation options.

Cultivating and orchestrating innovation ecosystems are important parts of OI2. It is increasingly clear to us that innovation ecosystems can be created and transformed by creating a shared vision

and reinforcing the vision with active social network management and orchestration. Russell et al describe innovation ecosystems as 'the interorganisational, political, economic, environmental, and technological systems of innovation through which a milieu conducive to business growth is catalysed, sustained and supported' ([16]). Again quoting George Obsorne, UK Chancellor, 'You get innovation when great universities, leading-edge science, world-class companies, and entrepreneurial start-ups come together. Where they cluster together you get some of the most exciting places on the planet. That is where you find the creative ferment which drives a modern dynamic economy'.

From OI2 perspective we need to go beyond the rather monolithic cluster thinking to multidisciplinary ecosystems, incorporating a unique asset that Europe has, the most advanced and demanding users of the ideation and innovation processes. In this case, users are academics, industrialists, members of government, and the citizens themselves.

In parallel, the importance of high-expectation entrepreneurs (HEEs) is ever increasing. High-expectation entrepreneurship occurs when disruptive technologies meet high ambition, creativity and hard work. HEE is especially important as according to a report from the Global Entrepreneurship Monitor, HEE's contribute about 80 % of all new jobs created. When HEE's attach themselves to fast moving ecosystems, accelerated performance and expansion of the ecosystem occur.

The European Union's introduction of the European Innovation Scoreboard ([17]) gives a way of measuring the relative performance year-over-year of national innovation ecosystems and identifying constraints areas where improvements need to be made to drive improved national performance. This is a critical tool for measurement and management of national innovation systems and should be broadly adopted.

The field of Open Innovation 2.0 is constantly evolving and in Appendix A we list 20 snapshots of this rapidly expanding discipline. There are, of course, other snapshots today and even more in the months and years to come. Open innovation will require a new type of accompanying research capable of observing brief learning cycles for new management practices and fast sharing of learnings across Europe.

European Research and Innovation Framework in light of Open Innovation 2.0

Horizon 2020 is the new research and innovation funding instrument of the European Commission. It is very interesting to observe how the programme is taking shape in practice (the first calls are closing at the time of writing this text) but for sure the new instruments are concretely indicating the new, more holistic approach on research and innovation, shown both in the new tools and the actual calls too.

In many project areas the project design should incorporate the users as co-creators of the solution and not only being active in the piloting and validation phase. Having the user-driven experimentation approach we ensure higher success rate but also the possibility to focus the development work in right direction for impact. Experimentation as described by the ISTAG is part of the EAR (Experimentation and Application Research) methodology very suitable in bringing research onto innovation, creating new markets.

What is of course open is how far the proposers are using the EAR methodology in the projects and how projects are designed for prototyping and innovation. There is a common learning process in here, shared by the Commission introducing new instruments and approaches as well the constituency responding.

Other new instruments to be applied in the current framework are, e.g., the Open and Disruptive Innovation Scheme where good ideas (novel, disruptive and when successful having European impact) are being funded in continuous calls for grants. The first phase is supporting early prototypes and feasibility studies to see whether the idea is worth developing further. Again, the intention is to harvest new ideas on broader basis than ever before, and thus reinforce the flow from research and ideation to new products and services.

Innovation vouchers can be powerful when transforming enterprises more digital which is essential when moving ahead with the digital agenda in Europe.

Public procurement is an important bridge between development and take-up. To make this work earlier in the innovation process the Commission is covering the risk in selected areas by precommercial procurement tools. These procurements taking some risk can be very transformative by nature when looking at future services of public interest becoming more user-centric.

Competitions have been proven to be successful mobilising very large communities to solve the problems published. Example of this is, e.g. the Ansari prize for commercial space travel. Commission has decided to bring this instrument into practise also in H2020 because then new innovation constituencies can be mobilised with full innovation potential.

Mapping these new activities with the '20 snapshots' of Open Innovation 2.0 we can see that the H2020 is moving to the right direction, supported by other actions focusing on web entrepreneurship, young innovators and interlinking policy actions with H2020 as well.

Conclusion

Open innovation 2.0 is not the panacea, but it adds an essential component to the traditional innovation approaches and it accelerates collective learning (i.e., as a tide lifts all boats) and value creation.

By harnessing these dimensions and by using the collective and collaborative potential of people in Europe and beyond, we can create a brighter more sustainable future. With the emergence of the Open Innovation 2.0 paradigm, there is a new opportunity for an entrepreneurial renaissance. To paraphrase Alan Kay, 'The best way to predict the future is to *innovate* it.' Let's go make it happen.

Open Innovation 2.0, the next winner!

Appendix

Twenty Snapshots of Open Innovation 2.0

David Teece, Professor of Global Business at the University of California, Berkeley, Haas School of Business, recently said that innovation is changing so rapidly that no study can aim to comprehensively describe it. In the spirit of his remarks, we present in appendix to this article, 20 snapshots, shown in Figure 4, on aspects of OI2 that describe its near-term trajectory.

Figure 4: Twenty Snapshots of Open Innovation 2.0

Source: Curley, M., Salmelin B. (2013). *Open Innovation 2.0: A New Paradigm*, EU Open Innovation Strategy and Policy Group (OISPG) White Paper, (Online), Available at bit.ly/OI2WhitePaper

Table 1: Opening up the Twenty Snapshots of Open Innovation 2.0

#1: Shared Value and Vision	Shared value is the value created at the intersection of corporate performance and society when big problems are solved. Shared value is best achieved in the context of a shared vision.
#2: Quadruple Helix Innovation	Industry, government, academia, and citizens work together to co-create and drive structural changes far beyond the scope of what organizations can do on their own. There is much deeper networking among all participants, including societal capital, creative commons, and communities.
#3: Innovation Ecosystem Orchestration and Management	Innovation has moved out of the lab and into an ecosystem that crosses organizational boundaries. Innovation networks are the driving force. An innovation network is an informal or formal grouping based on trust, shared resources, shared vision, and shared value. Ecosystems are most effective when they are explicitly orchestrated and managed.
#4: Innovation Co-creation and Engagement Platforms	Co-creation includes all stakeholders, including citizens, users, or customers, in the development of innovative solutions. An engagement platform provides the necessary environment, including people and resources, for co-creation.
#5: User Involvement, User Centricity, User Experience	The role of the user has changed from being a research object, to being a research contributor, and on to being a co-innovator. The locus of innovation has shifted from guessing about product and service features users may want to user experience design to guarantee that features are desirable.
#6: Openness to Innovation	Society's posture is attuned toward embracing innovation. At the heart of this openness is a culture that embraces the entirety of socially-transmitted behaviour, norms, patterns, etc.
#7: Focus on Adoption	Schrange: "Innovation is not innovators innovating, it is customers adopting." In OI2 there is purposeful effort focused on driving adoption of innovations.
#8: 21st Century Industrial Research	21st century industrial research is characterized by visioning, inventing, validating and venturing. Successful innovation initiatives will be led by teams of boundary spanners that possess multidisciplinary skills.
#9: Sustainable Intelligent Living	Beyond designing for user experience, OI2 defines innovation as co-creation of services and solutions which add value, improve resource efficiencies, and collectively create a trajectory towards sustainability.
#10: Simultaneous Technical and Societal Innovation	In OI2 there is simultaneous technical and societal innovation with changes affecting technologies, business cases, organizations, business processes, and all of society.
#11: Business Model Innovation	Business model innovation is about defining and designing new models for capturing business value. Osterwalder & Pigneur's (2010) business model canvas is a good tool for visualizing and prototyping business models and incorporates techniques such as visual thinking, design thinking, patterns, and platforms.
#12: Intersectional Innovation	Breakthrough insights occur at the intersection of fields, disciplines and cultures, according to Frans Johannson. His book, The Medici Effect, provides numerous examples. (2006) Current activities can be found at www.themedicigroup.com
#13: Full-Spectrum Innovation	Doblin's taxonomy, the 10 Types of Innovation, is a powerful framework for describing a full spectrum. Doblin's research showed that often the highest returns from innovation come from business model innovation, ecosystem orchestration, user experience innovation and brand innovation. (Keeley et al. 2013)
#14: Innovation Approaches Using Exponential Technologies and using Mixed Innovation Models	OI2 encourages the use of exponential technologies and an appropriate mix of disruptive, modular, incremental and architectural innovation approaches to maximize the impact of innovation. Key approaches include prototyping, experimentation, and living labs
#15: Servitization	Servitization is the delivery of a service component as an added value when providing products. This is an alternative to maximizing the adoption of products. The strategy generates sustainable revenues through annuities and helps optimize asset utilization and longevity.
#16: Network effects	In OI2 we focus on designing for network effects where new users, players or transactions reinforce existing activities. Network effects accelerate growth in the number of users and in value creation. Networking is a socioeconomic process where people interact and share information to recognize, create and act upon business opportunities.
#17: Management of Innovation as a Process or Capability	OI2 recommends explicitly setting up management systems for innovation and systematically improving innovation capability in individual organizations as well as across members of innovative ecosystems.
#18: High-Expectation Entrepreneurship	High-expectation entrepreneurship is the intersection of high ambition and disruptive technology to create growth businesses. High expectation entrepreneurs (HEE's) expect to employ 20 employees or more within five years and are a primary source of job creation.

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Open Innovation 2.0 — Fundamental Change in Innovation Processes*

Abstract

In this article I elaborate further on the changes we have seen in innovation processes and innovation environments when we moved from the traditional approaches to the Open Innovation 2.0 paradigm. Shortly speaking the dynamics, the processes, and the environments have all fundamentally changed.

It is important to see how these changes in the drivers for success have led to different policy approaches by all stakeholders. Also the roles and collaboration of stakeholders is very different from the past.

Introduction

The traditional innovation approach is based on linear innovation, where there are clear phases from the ideation leading through research, development and piloting to scaling up of results. Very often this approach is based on science-based excellence or focused on improvements of the existing products or processes. The renewal dynamics of these approaches are however limited.

Looking at the recent European developments it is evident that we need new innovations which lead to sustainable societal and economic development through new products and services, even in entirely new sectors at the crossroads of old disciplines. ICT is by its connectivity also changing the patterns of innovation: Innovation is increasingly based on co-creation processes across all stakeholders, including the end-users. Here we need to have a look at one of the most important assets in Europe for growth: the most advanced and demanding users — be it the user industries or citizens.

By actively involving the user communities in the innovation process as active subjects, not objects, we can create solutions for new markets and elaborate in a speedy and thriving manner the successful solutions and abandon the failing ones in early stage.

How do we then create the ecosystems for new approaches and even new industrial sectors?

Twenty Drivers for Open Innovation 2.0

In the white paper manifesting the Open Innovation 2.0 paradigm we highlighted 20 key elements as the transformative factors for the modern innovation approach.

The OI2 approach emphasises the importance of *Quadruple Helix* innovation where the private, public and research institutions collaborate seamlessly and in which from the very beginning the user(s) communities co-create the new products and services. This leads to win-win approaches as the

Figure 1: Twenty drivers for Open Innovation 2.0

Source: Curley, M., Salmelin B. (2013). Open Innovation 2.0: A New Paradigm, EU Open Innovation Strategy and Policy Group (OISPG) White Paper, (Online), Available at bit.ly/OI2WhitePaper

* This article is based on the 'Open Innovation 2.0 — a new paradigm' white paper by Martin Curley and Bror Salmelin. The paper was published in conjunction with the 2013 edition of the Open Innovation 2.0 conference in Dublin.

users get products and services they need, and the suppliers get scalable products and services. If this co-creativity and prototyping in real world settings would not take place there would be a real risk that the development work would lead to a win-lose setting between the existing players in the market, and no new markets would be created either.

Cross-disciplinary innovation together with prototyping and experimentation is bringing forward the required dynamics. Failing fast and getting directions to potentially successful solutions at early stage is essential. Traditional piloting or test bed approaches are not sufficiently scalable to verify the market potential of the inventions.

In this palette of 20 drivers for Open Innovation 2.0 (Figure 1) one needs to highlight both societal and technological innovation which enable business model (more generally value creation model) innovations. The areas of business model innovation together with the new markets emergence are clearly dimensions/realms in which, we Europeans, can do/perform much better.

How to achieve the fluidity and frictionless environments for multi stakeholder trials, including legal and policy elements is the key to root in the European mind-set. We need to speak about openness for innovation, innovation 2.0 culture, to complement the view.

New Types of Leadership, New Processes and New Approach to Ecosystems

The paradigm has changed. Figure 2 illustrates some aspects to concretise this change and illustrate its drivers. Of course these factors are interrelated in complex systemic manner and lead to the need of looking at successful innovation ecoSYSTEMS and innovation processes together.

Closed innovation reflects the traditional linear paradigm, often based on brilliant individuals or performing industrial labs. Open Innovation, as introduced by Henry Chesbrough, is a move towards collaborative innovation structures, where those ideas not used by oneself can be seen as tradable assets to those who might have need for specific technologies.

When we began to analyse the innovation processes and the success closer, we realised that one of the critical elements is the scalability of the work, which naturally results in increased success rate. But how to achieve this?

We need to break out from the traditional linear models; we need to dare to do more experimentation in real world settings as only then we learn very fast what is scalable, successful, as opposed to what is simply not worth going forward with. Traditionally we see pilots and validation in many projects, but ... often they come too late to have any influence of the project work itself. This triple helix approach which excludes end-users from the actual innovation process is by far too slow. Only by moving to the quadruple helix model where the innovation process happens 'out there' with real people in real environments we can speed up the successful results and kill the bad ones in time.

Another dominant element of the open innovation traditional cross-licensing process is the cluster thinking. Cluster operations reinforce well the competitiveness of sectors. However, the challenge is not only to stay competitive in the existing field, but also to find entirely new areas for value creation. We need to have interdisciplinary manner actions between the clusters in the open innovation ecosystems to strengthen cross-fertilisation. And, taking the users on board and integrating them into the innovation process from the very beginning will lead to the creation of new markets. If we target

Figure 2: The change and drivers of the innovation paradigm

Closed innovation	Open innovation	Open innovation 2.0
Dependency	Indepencency	Interdependency
Subcontracting	Cross-licensing	Cross-fertilization
Solo	Cluster	System
Linear	Linear, Leaking	Mash-up
Linear subcontracts	Triple Helix	Quadruple Helix
Planning	Validation, pilots	Experimentation
Control	Management	Orchestration
Win-Lose game	Win-Win game	Win more-Win Game
Box thinking	Out of the box	No boxes
Single entity	Single Discipline	Interdisciplinary
Value chain	Vallue network	Value constellation

only traditional clusters and traditional industries we easily end up with a win-lose game.

Organisational changes and collaboration changes are also clearly moving towards this mash-up, mixed disciplines approach. Value chains with sub-contractors highlight the linearity in innovation processes together with control approach which is typical for the manufacturing and traditional industry era. When products integrate into services and get more complex, we have seen networking between suppliers to be established, e.g. in the automotive sector, where independent component manufacturers deliver to many brands simultaneously, based on their special competencies. In open innovation 2.0 we go even further into dynamic value constellations where the links are not a priori determined, but more task-driven. Competencies and resources are combined based on the tasks, not as earlier when the services were determined by organisational structures. In turn, this also means that the end users will be much more dominant in the innovation process for modern products and services, especially on their functional level.

The innovation process change affects also radically the management styles of successful companies. We have plenty of examples where an authoritarian control-type of management is replaced by strong leadership. However, we need to go into even further metaphors when we move to Open Innovation 2.0. The successful leadership will be mentoring, catalysing, inspiring: it will be orchestration of fluid resources to perform their best. And, what makes all interesting is that the orchestration conducts not only the known players, but also the audience to create fantastic joint experiences with the interaction internally and externally; like in a successful concert where the ambience and success is all about the interaction and not just the play, even professionally.

Open Innovation 2.0 is a new mind-set; it is *openness for innovation*. It is the courage to experiment and prototype. It is the courage to fail and scale. And, as a consequence, it builds up a growing spiral of performance built on success and motivation.

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An Experiential Design Process and Holistic Model of User Experience for Supporting User Co-creation

Abstract

This article introduces an eXperiential Design (XD) process and a holistic model of User eXperience (UX) that were recently created within an EU research project named ELLIOT (Experiential Living Labs for the Internet of Things). Both the XD process and holistic UX model were empirically experimented along six different use cases within six Living Labs (LL). All use cases appertain to the domain of the Internet of Things (IoT) based services. Results show that while users mostly perceive the different facets of UX independently, their belonging dimensions should be properly balanced for positively contributing to product/service adoption. The iterative and systematic nature of the XD process, relevance of existing UX elements and value co-creation with users appear to be key factors in reaching a higher rate of adoption of innovative IOT-based services. Finally, the resulting holistic UX model, XD process and use cases are briefly described assessed and discussed with a set of conclusions.

Introduction

Recently, Curley ([1]) argues that co-creation and sharing of innovation options constitute a significant competitive advantage with broader scale benefits that leverage and benefit all stakeholders. He also explains that the most prominent attribute of 'Open Innovation 2.0' is adoption in referring to Schrage ([2]) explanation about innovation. In fact, during an interview at ACM Ubiquity in December 2004, Michael Schrage was asked by Ubiquity staff: '*And so you see the customer as the main player in the achievement of innovations?* '

Schrage answered: '*I do and this is extraordinarily key. I want to see the biographies and the sociologies of the great customers and clients of innovation. Forget for a while about the Samuel Morses, Thomas Edisons, the Robert Fultons and James Watts of industrial revolution fame. Don't look to them to figure out what innovation is, because innovation is not what innovators do but what customers adopt.'*

Pia Erkinheimo-Mennander, Head of Innovation Crowdsourcing at Nokia, explains ([3]): *"innovation failure rates have reached as much as 86 percent,* ([4]) *primarily because of the lack of end-user adoption; and often innovation developers don't have specific knowledge of the user's preferences and requirements* ([5])*'.*

One could conclude that this is mainly due to the application of an out-dated traditional industrial design process. While this process focuses mainly on product conformance with needs and requirements specified by developers, it rarely involves users, except in some cases as observed subjects, and simply ignores users' potential contribution in the value co-creation.

In contrast, the eXperiential design (XD) process shifts the priority from designing product features towards co-creating value with users in order to ensure a higher rate of product/service adoption. This kind of user co-creation approach was recently introduced by Curley and Salmelin ([6]) as a crucial part of Open Innovation 2.0 paradigm: '*User-driven innovation is a crucial part of the OI2 paradigm and is also a key lever for adoption because users co-create solutions that meet their needs.'*

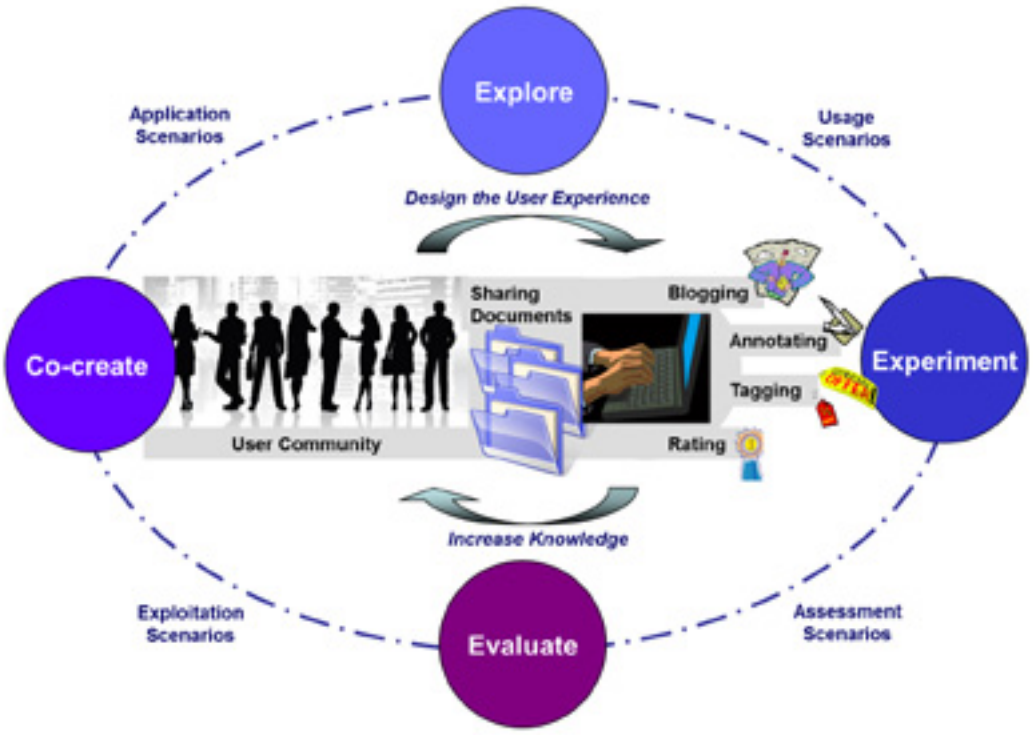
However, it requires all stakeholders, including users, to be engaged along the design process for co-creating, exploring, experimenting and evaluating product/service scenarios ([7, 8]). These four activities are intended to better support the identification of value expected by users (e.g. reliability, affordability, social interaction, empathy, fun) and supporting features that would convince a large community of users to adopt an innovative IOT-based product/service.

The XD process requires focusing on designing for value that is progressively validated by UX evaluation until it reaches a targeted score. Hence, exploring patterns of usage, capturing emerging people behaviour and evaluating the impact on service adoption become a corner stone in the design iterations and refinements. The intended goal is to raise the level of product/service adoption by a large community of users. This implies also to better understand the nature of repetitive or unique UX, consciously or unconsciously propagated by people, driving towards successful innovations.

Designing User Experience within Living Labs

William Mitchell, Professor at the MediaLab and School of Architecture and City Planning at MIT, argued that a Living Labs (LL) represents a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts. He identified several noticeable impacts and benefits, such as the integration of the users into the development process for ensuring highly reliable market evaluation; the reduction of technology and business risks, as well as decreasing investment needs for SME, micro-organisations and start-ups, since they can share resources without mobilising so much

Figure 1: Living Lab Iterative Design Process ([7, 8])



venture capital; and share access to a broader base of ideas, especially for large companies.

Since 2006, the LL approach was gradually applied within EU projects for involving all stakeholders, especially users and also policy-makers, at the earlier stage of R & D. A 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 ([2]). Curley and Salmelin ([6]) consider that: '*Living Labs create attractive innovation ecosystems following the quadruple helix innovation mode due to citizens' engagement in the regions. Living Labs can be seen as one example of the open innovation ecosystem development beyond traditional test beds that have usually been technology driven.*'

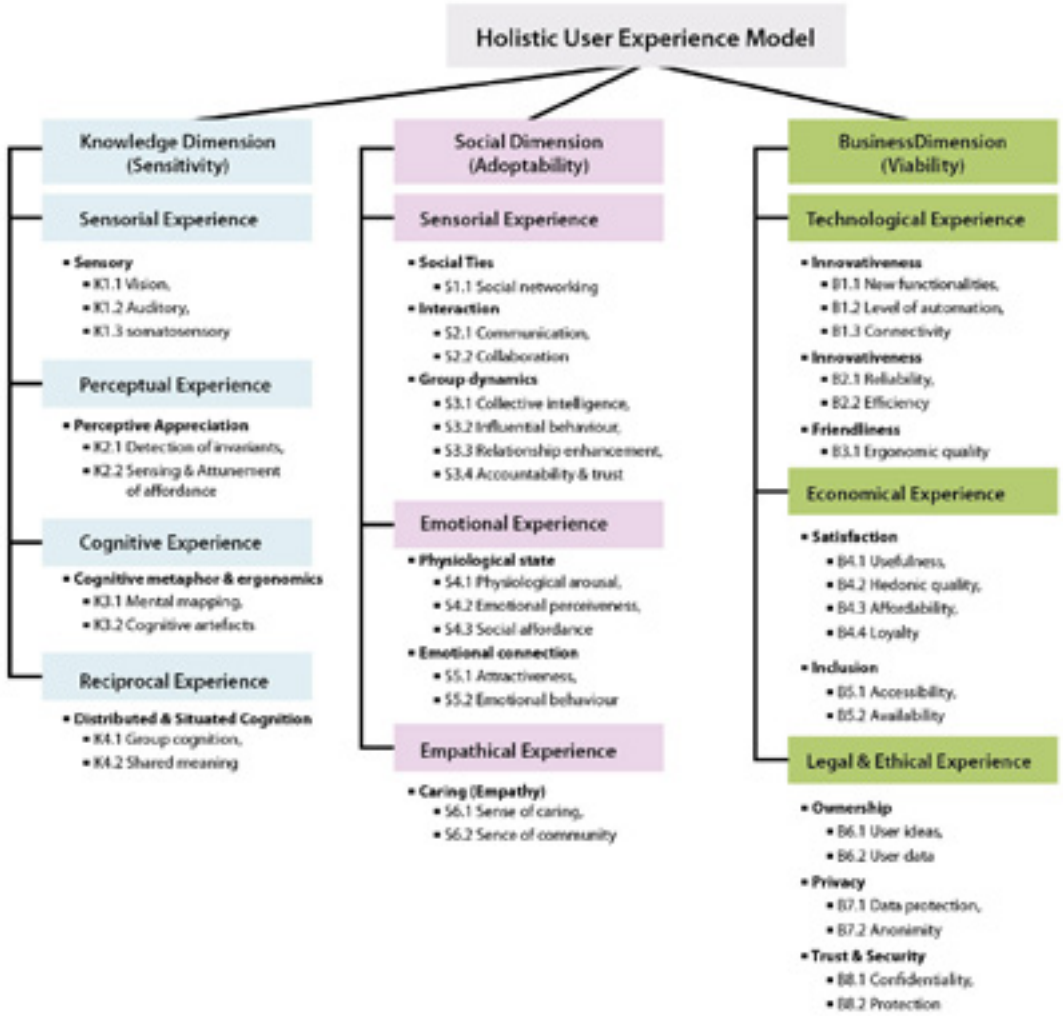
A LL combines the UX quality in co-creating, exploring and experimenting with users a product/service with the capacity to capture previous design experiences ([9]). It means that within LLs, UX covers the entire design process. A recent survey among ENoLL Livings Labs ([10]) reveals that User Co-creation and User Experience constitute the top two LL practices for engaging users in the R & D process.

A Holistic View of User Experience

There is a considerable amount of publications dedicated to UX. There are many definitions of UX that were previously discussed ([8, 11]) including the standardised one from ISO 9241-210: '*User Experience is a person's perceptions and responses that result from the use or anticipated use of a product, system or service*' ([12]). The ISO description presents UX as '*all users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after the use of product, system or service*'. It also mentions that the type of product/system/service, user profile and the context of use are factors that influence user experience.

A literature review and study on UX types, concepts, elements and their properties was carried out in order to create a holistic model ([8]). One of the goals was to get a global model that could be instantiated whatever is the use case domain. It has resulted in a holistic model composed of 10 experience types, 22 elements and about 80 properties. This resulting holistic model was then instantiated and experimented by each use case. The outcome of these experimentations lead to the refined version of the model (see Figure 2) that includes 10 experience types, 18 elements and 40 properties. Interestingly, our approach of deciphering the elements and properties of a holistic view of UX is intended to be more precise and rigorous for evaluating the overall level of user satisfaction. However, 27 properties were explored within the six experiments carried out in real situations. They provided a sound basis for the instantiation, refinement and validation of the holistic model. The instantiation mechanism consists in selecting the relevant experience types, elements and properties according to the needs of each specific application.

Figure 2: A Holistic View of User Experience



Three categories of experience types were identified ([8]), namely: Knowledge (sensorial, perceptual, cognitive and reciprocal aspects), Social (interpersonal, empathical and emotional aspects), and Business (technological, economical, legal and ethical aspects). The names given to all experience types are voluntarily based on convenience for practical simplicity and understanding rather than deep scientific foundation. Most of them appear to be quite intuitive. Nonetheless, the legal or ethical experience types look more surprising but interestingly making sense. In the literature, UX is not broken down into different types such as perceptual, interpersonal or technological experience, and appears more monolithic.

Indicators or metrics for the measurement or evaluation of each selected property of the different types of experience are not obvious to identify and often quite demanding. It is also worthwhile to practice the quantitative and qualitative methods that could be used for UX evaluation. These are, for example: ethnographic studies, bipolar surveys, log-data analysis, and data mining that allow identifying patterns of behaviour and usages. (see the latest version of the three description tables presenting the experience types, elements and properties of the holistic UX model ([13])).

The Living Lab Design Process

The previously described users' involvement has progressively evolved into engaging user communities in experience based design for co-creating value, exploring alternative scenarios, experimenting emerging solutions and evaluating the current level of UX ([8]). Authors claim that the iterative nature of the XD process allows repeating this design cycle until the highest level of user satisfaction is attained for inducing an appropriate rate of technology adoption. One could compare Mitchell's 'sensing' stage to the co-creation and exploration activities of the XD process while the 'prototyping' stage would partly correspond to the XD exploration and experimentation activities. Then, 'validating' could be correlated to the evaluation stage and finally, refining represents the following iteration of the Experiential Design process until a satisfying UX is reached for inducing a successful innovation through product/service adoption by a large community of users.

The main goal of the LL iterative XD process (see Figure 3) consists in supporting the co-creation of value with users in order to result in the most appropriate UX while sharing knowledge and crystallising the collective work of the LL stakeholders. Hence, new concepts, artefacts and solutions emerge from the knowledge acquired through accumulated experiences. It is not only targeted to evaluate the UX with collected data during the experimentation but also to anticipate it during the co-creation and exploration of value propositions that are intended to enhance the UX. The social dynamics of the LL approach is intended to ensure a wide and rapid spread of innovative solutions (viral adoption phenomenon) through the socio-emotional intelligence mechanism (Goleman, 2006). The experimentation and evaluation of the scenarios and artefacts are driven by users within a real life context through social, economical, educational, technological and societal perspectives.

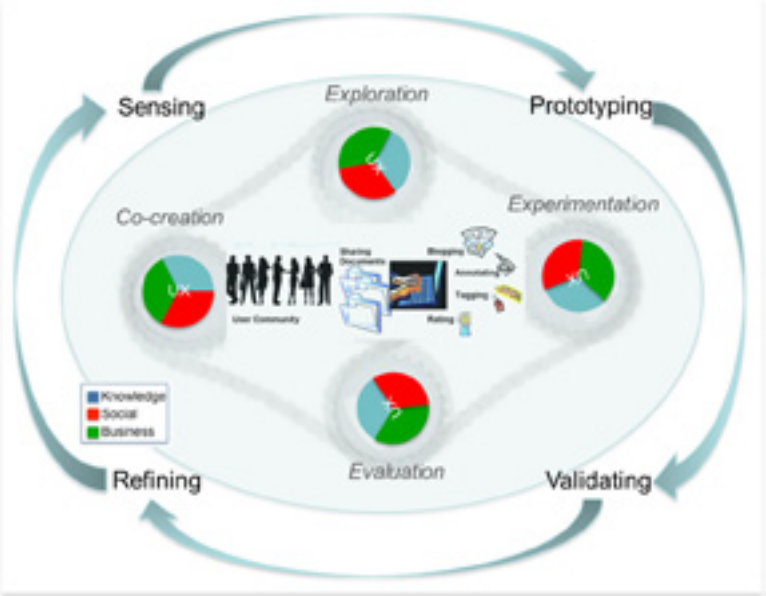
In contrast with the FormIT design process ([14, 15]) and its three cycles, namely: Concept Design, Prototype Design and Final Solution Design (recently replaced by Innovation Design), the number of iteration in the XD process is not pre-defined but rather occurring until the evaluation of UX satisfies all project stakeholders. Furthermore, the XD process concurrently occurs at different granularities, such as the scenario level, the concept level and the service level. Users can easily contribute to the co-creation of innovative scenarios and services including the identification of potential business models as they are expected to consume the resulting services. However, recruited users should fit with the usage context. For example, the IoT based Green Services use case was launched with the innovative idea of getting real-time air quality that leads to multiple usage scenarios involving different categories of users, such as: sport practitioners (e.g. joggers), asthmatic or allergenic people.

The Experiential Design Process

According to Pallot and colleagues ([16]), the XD process is an iterative process (see Figure 3 and 4) that links together the four activities to be carried out whatever is the innovative scenario to be designed. It consists to: co-create ideas of new concepts, artefacts and/or innovative scenarios as sessions of collective creativity involving all concerned stakeholders and especially users; explore alternative scenarios in setting the scene through the use of different immersive techniques within a live environment; experiment alternative scenarios in prototyping concrete application/services through the use of a technological platform within a real-life environment; evaluate alternative scenarios on the basis of metrics for measuring both the Quality of Service and the Quality of Experience that would allow assessing the degree of adoption by user communities.

All these above described activities form an iteration cycle while feeding and increasing the level of maturity and knowledge within a specific research and innovation area as well as application domain. After each iteration cycle and according to the outcome of the evaluation then the process could continue in reconsidering the values to be co-created or in exploring other technology alternatives and refining the design. It means that more use cases feed the process, the deeper the maturity and the greater the digested experiential knowledge.

Figure 3: The Iterative Nature of the Experiential Design Process



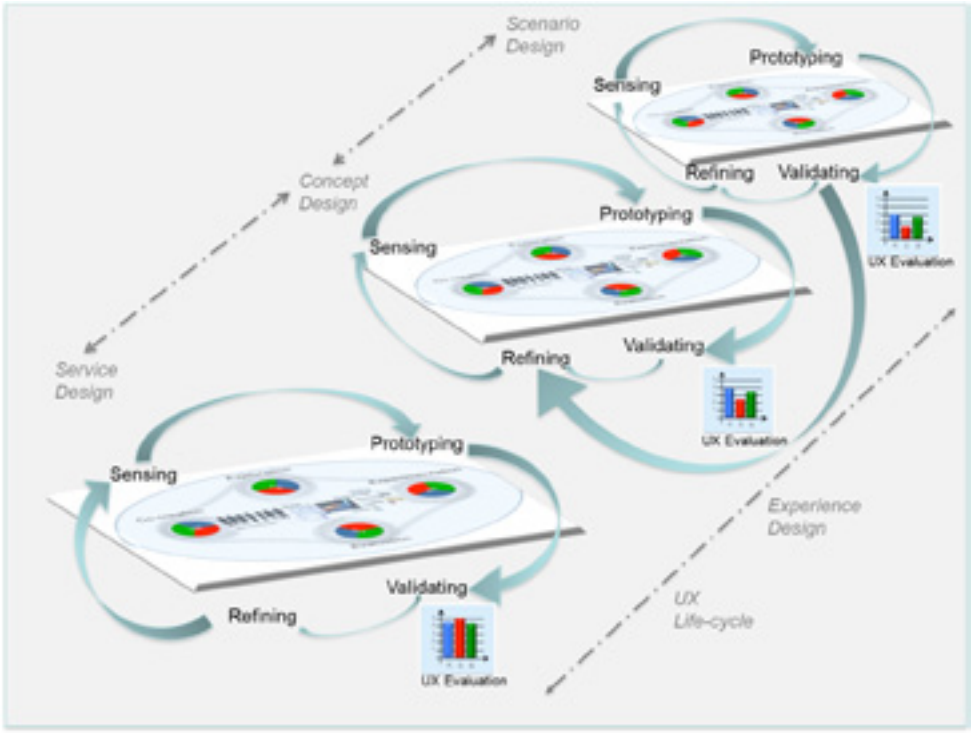
The XD process is correlated to Mitchell's Living Lab user-centric process composed of research methodologies for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts. In our view, 'Sensing' leads to consider simultaneously the context, users, the existing and emerging technologies (e.g. sensors, actuators) for co-creating and exploring innovative scenarios. 'Prototyping' means to concretise alternatives that allow experimenting them with users in real life situations. 'Validating' is the outcome of the evaluation of the experiments' results. Finally 'Refining' leads to the identification and discussion with all stakeholders of potential refinements in order to prepare the next iteration until it reaches the proper level of user adoption.

The main goal of the iterative XD process is to support the design for value that is continuously evaluated through the UX life cycle ([17]). Hence, new concepts, artefacts and solutions emerge from the resulting increase of knowledge acquired through accumulated iterations. It is not only targeted to evaluate the UX but also to co-create and explore value propositions that are intended to contribute to the increase of user adoption of innovative products/services. XD is the practice of designing with a focus placed on the Quality of Service (QoS) and Quality of Experience (QoE). It has no emphasis placed on deliberately increasing the number of features that are not required or validated by users. While a product/service influences UX through its form-features-aesthetic and usefulness as well as usability, users often react on the basis of prior experiences and perceive this product/service value through sensorial, perceptual, emotional and empathical feelings. In this context, empathy means the ability to project oneself into a scenario that cares for others. Users may also empathise with the people supporting the product/service and with other users when they get a chance to interact together.

Considering the UX life cycle ([17]), on the one hand, the focus is on 'Anticipated UX' with a group of people (e.g. lead users) imagining specific interactions with simulated artefacts. On the other hand, the focus is rather on cumulative experience formed through series of usage episodes. Different types of value have to be considered, such as sensorial value brought by touch user interface or perceptual value through the aesthetic aspects. It could be also about social or empathical value through people connections and interactions, economical value with a low-cost or luxury business model or technological value with a low or high-tech solution.

The XD concurrent cycles (see Figure 4) illustrate the different design loops to be carried out for co-creating value whatever is the innovative scenario to be explored. First of all, the scenario design loop confronts technology push and application pull. Secondly, the concept design loop turns artefacts into a viable technology platform. Thirdly, the service design loop enables the prototyping of the complete

Figure 4: Concurrent Cycles of the Experiential Design



service system as a network of different experiences and infinite possible re-combinations. Empathic design is also at the heart of service creation and part of the XD. It takes care of the complete UX Lifecycle. Raijmakers, van Dick and Gough ([18]) argue that designers and service innovators need to empathise with users and service providers to understand what value the service can bring, what problems the service could solve and what people interactions the service should facilitate.

Scenario design could be compared to playing a 'what-if' creative game with plausible alternatives combining social, technical, economical, environmental, educational, political and aesthetic trends that are key driving forces. It could also include a foresight study, for example in view of solving societal issues (e.g. smart city services) but merely requires immersive techniques/technologies for engaging all stakeholders, especially users, in the environment of augmented creativity. There is a strong analogy with 'scenario thinking' ([19]) or 'scenario planning' or even 'strategic thinking' as earlier expressed by Schoemaker ([20]).

Concept design consists in turning ideas into artefacts through visual representation of alternative designs. This technique is often applied in the creative industries such as film and animation industry, especially popular for science fiction and fantasy due to the massive use of digital technology. It is used also in the fashion and advertising industries or even in the domain of architectural design as well as in the automotive industry, especially for designing concept cars. Concept Design is related to 'creative thinking' or more broadly speaking 'creativity' techniques ([21]).

At the end of each design loop there is a 'go-nogo' decision, according to the result of the UX evaluation that is used as a transition point in making sure that the average score of the different types of UX are properly balanced. For example: from the scenario design towards the concept design or from the concept design towards the service design. In fact, the product design disappears as it is embedded within the concept design and design of the entire service system as explored in the design of the innovative scenario like when the Apple's iPod was just designed as a user friendly artefact for consuming iTunes online music.

Use Cases

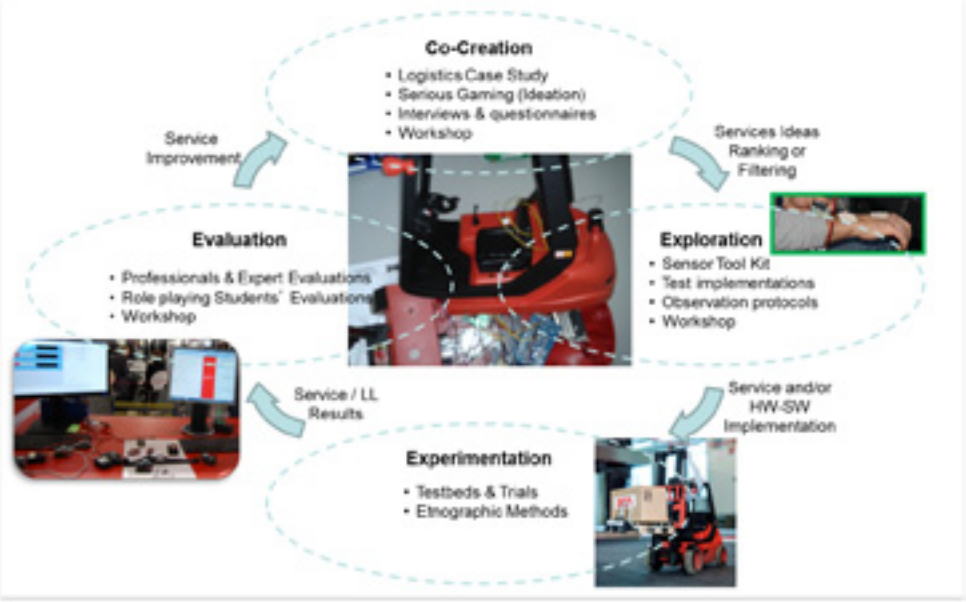
All use cases belong to the domain of the Internet of Things (IoT) based services, namely: Logistic Services (LS), Wellbeing Services (WS), Green Services (GS), Retail Services (RS), Environmental Services (ES) and Healthcare Services (HS).

The logistics Use Case

The logistics use-case, set up within the BIBA and LogDynamics Living Lab (LL) environment, follows an iterative improvement approach in the domain of intra-logistics. From discussion with experts, a specific focus on intra-logistics processes has been derived for ELLIOT. Intra-logistics deal with the logistics processes between companies (e.g. warehouse logistics, material logistics/production supply; etc.).

The main goal of the use-case is to create a service that identifies risk situations along an intra-logistics process chain and encourages stakeholders to freely explore alternatives for increasing safety and

Figure 5: The Logistic Use Case



security for operators and goods; by increase safety and security, intra-logistics processes will thus be improved.

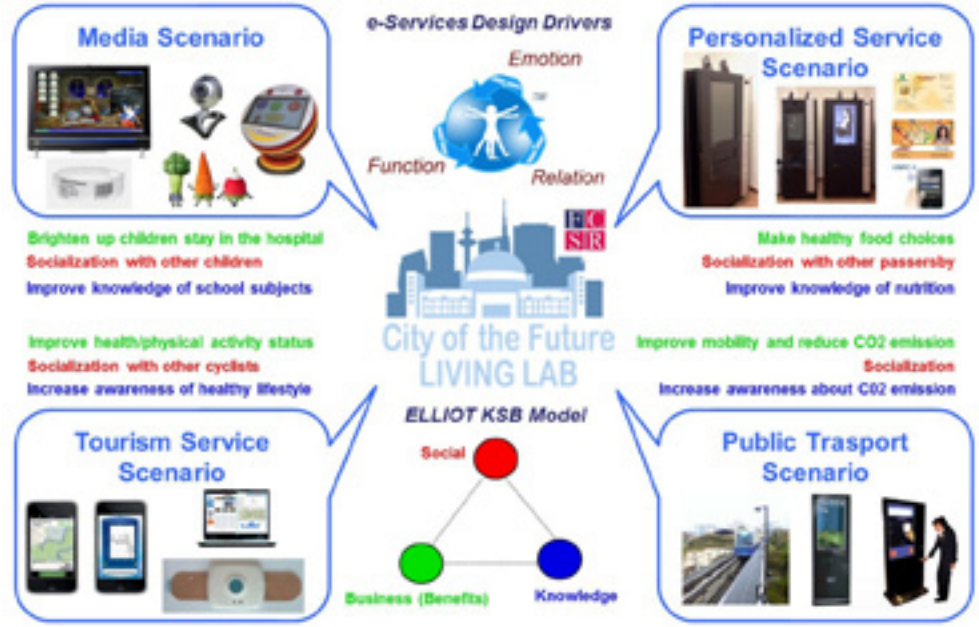
The Wellbeing Services Use Case

The City of the Future Living Lab is involved in the ELLIOT Project within several use case scenarios (23). Each scenario has a unique set of goals and expected benefits. The 'Media Scenario' is intended to provide a simple service to make children's hospitalisation at the paediatric department more tolerable; this is done by way of leisure activities and motivational support during the hospitalisation period through an interactive totem able to provide applications including meal ordering, leisure services and gaming to hospitalised children. The application use has been monitored through various types of data logs, making it possible to collect data on frequency of attendance and quality of usage. The activity in the Media scenario experimentation phase consisted of the investigation of the outcomes gained from the co-creation stage and the subsequent development into prototypes and mock-ups for validation. In continuous exploration of the Living Lab process of the scenarios, the issues and considerations emerging from the experimentation stage were discussed regarding the way data was collected, as well as the technical solutions proposed to address these. Thanks to the implementation of a serious game for the co-creation stage (Gaggiots), it has been possible to apply serious gaming in a new co-creation stage of this scenario, with interesting output coming directly from new users involved in the game.

The Tourism Service Scenario aims to promote physical activity as a well-being tool for health, rehabilitation, leisure and tourism practices. This is made possible by providing a service based on a wearable monitoring device, a smart-phone app. and a web portal. This service is evaluated involving volunteer participants into a minimum 3-day usage experience where they wear the monitoring device and use the related smartphone application and web portal. In this way they are able to monitor their body performance indicators during daily activities. At the end of the experience, a questionnaire based on different aspects was given to each participant to explore the scenario from the consumer point of view.

Personalised Service and Public Transport Scenarios were set up in a temporary store where data were collected and analysed together. This temporary store in the commercial area of the San Raffaele Hospital, was able to: dispense beverages and food; help user to become more aware regarding nutritional behaviours (i.e. showing nutrient data and healthy diets); provide mobility information regarding the hospital private automatic metro line and the public transportation system of Milan. To achieve these objectives, two innovative vending machines and one coffee vending machine were made available to the public; they have been attended by various types of users, such as patients, occasional visitors, returning visitors, clinicians, employees and others. Users are involved in an indirect way here: UX model analyses have been carried out based on data acquired from vending machine (such as products or bounce rate).

Figure 6: The Wellbeing Use Case



The Green Services Use Case

The Green Services Use case managed by Inria for ICT Usage Lab in Nice aimed at co-creating green IoT-based services with a set of stakeholders on air quality and noise measurement via citizen sensing. During the XD process involving 50 active users, a platform called *MyGreenServices* has been co-designed with respect of data privacy, offering various green services such as the visualization of environmental data collected by citizen, the alert services via mail or SMS, the ability to download data, the gamified forum for sharing ideas and best practices in terms of eco-responsible behaviours. Each participant can access to more details of his sensed data. In addition to the equipped city car, two types of citizen air sensors were provided during the two 16-days experiments: mobile ones and fixed ones for balconies.

In accordance with the overall objective of *MyGreenServices*, the UX measurement focused on the change of behaviour (in a wide sense), the ease of use and diffusion aspects (as being a tool provided to the citizen). Indeed, UX elements chosen to describe the user experience cover mainly: knowledge elements for the experiential learning aspects (specifically the "cognitive" elements); Social elements for the usage of the IoT system as a persuasive and dissemination tool (specifically the "reciprocal" elements); Business elements for the new technological functionality and ease of use (22). After the two experiments, 66 % of users declared a change of perception in the awareness against air quality and 44 % of users declared a modification in their activities during the experiment. More experiments are required to validate statically such a tendency in terms of behaviour change.

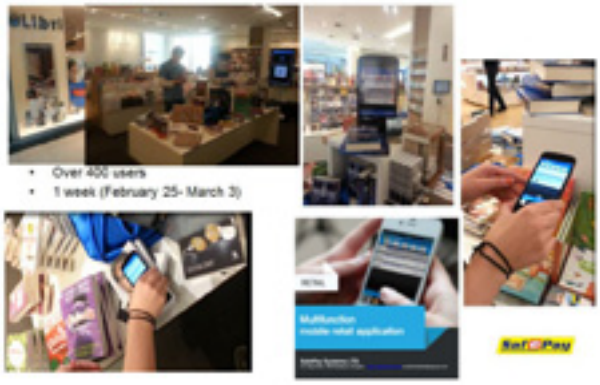
Figure 7: The Green Services Use Case

The Retail Services Use Case

The retail use case was organised in one of the largest bookstores of Budapest. A dedicated area was used for the pilot where all the books were tagged with RFID smart labels and the customers who volunteered to be participants could use NFC phones — even their own one if they had any — to collect price and other information from the books and use the other services provided by the smart shopping experience. Over 400 persons participated in the one-week long pilot. Our hostesses assisted participants as the mobile shopping solution may have been too challenging at first sight for many of them without our help.

The pilot was using IoT technologies in combination with mobile communication. Mobile handsets were used, and local proximity communication — NFC — was combined with remote mobile channels, to identify products and retrieve relevant information from back office servers. NFC — both its reader-writer function and its card emulation capability — was also used for smart couponing services as well.

Figure 8: The Retail Services Use Case



The Environmental Services Use Case

The Environmental services use case focuses on an application of ambient intelligence methods and IoT-based technologies, namely the Smart Home approaches and devices, into an office environment. This use case is based on LL co-design and user experience monitoring for finding a proper balance between the work environment settings, individual comfort of office employees, work efficiency, and reduction of energy consumed by an office during regular work hours. In accordance with these high-level objectives, pilot application was designed by INT and the developed Smart Office prototype was deployed to the testing office room located in premises of RWE IT Slovakia, an application partner for the Environmental services use case.

The pilot was implemented and installed in the testing office room. The office room of the administration department, occupied by 8 regular office employees, was equipped by sensors for monitoring the energy consumption (Plugwise Circle), indoor/outdoor temperature, humidity, and light intensity (Plugwise Sense and Switch components, Arduino Uno board with TMP 102 and BH1750FVI sensors), and presence/occupancy (Passive Infra Red motion sensors SE-10, RFID Card Reader of MFRC500 and related components, together with RFID Tags-Cards). The air condition-controlling device, built upon the RTD-NET Daikin interface, was introduced for monitoring and remote control of the air conditioning installed in the office room. The Control Unit, which hosts services interfacing the installed sensors and devices, is built on the Arduino platform and an embedded computer that remotely communicates with the Smart Office application server, which runs local LinkSmart middleware and the NoSQL system database.

Figure 9: The Environmental Services Use Case

The Healthcare Services Use Case

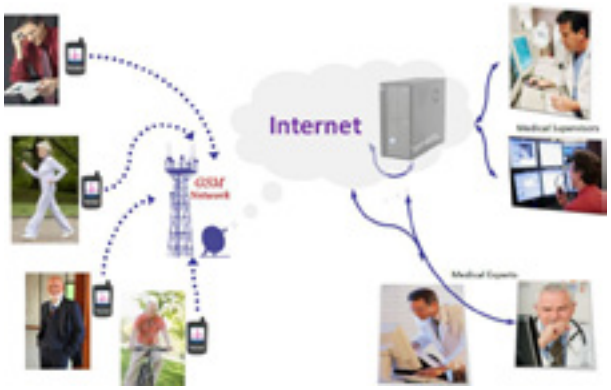
The CardioVascular Diseases (CVDs) are globally number one among those causing death: more people die annually from CVDs than from any other disease. In 2008, an estimated 17.3 million people died from CVDs. That represents 30 % of all global deaths. Each year 9.4 million deaths or 16.5 % of all deaths can be attributed to the high blood pressure. This includes 51 % of deaths due to strokes and 45 % of deaths due to coronary heart diseases.

The problem for prevention against CVDs is a hot topic nowadays. During the day everyone has diversity of activities and emotions, which can influence the heart itself and the entire cardiovascular system. Its continuous monitoring could prevent the negative events. If the patient is linked to an observing medical centre, as it is schematically depicted in Figure 5.13, the centre and the respective medical expert can react when critical events appear.

These were the main considerations, which gave the impetus for development of the Bulgarian Smart Health Cardio Belt (SHCB). The technology for monitoring the cardiovascular system is not new one. The cardiac 'Holster' sensor exists since early 1960s. But it worked offline, the patient data were

collected in it and Medical Doctor had access to them after certain amount of time. The first Bulgarian prototype (TEMEO) of the cardio belt monitored online 24 hours per day was developed three years ago by Security Solutions Institute. This prototype became the basis for further development of the SHSB system. The SHCB pilot had been selected after thorough analyses considering the public needs not only in Bulgaria but also in Europe wide, the level of the necessary development and the possible impact of the product for overcoming the current gaps and lacks of the existing prototype.

Figure 10: The Healthcare Services Use Case



Instantiation of the Holistic UX Model

The Experiential Design process includes the instantiation of the holistic UX model that is based on the specificities of the selected scenario and foreseen application to be designed. The instantiation process consists in selecting the necessary experience types, model elements and properties for being able to evaluate the user experience corresponding to the value to be validated (see Figure 11).

The selection of experience types depends on the values to be co-created with users and that could be evaluated through the measurement of the UX elements and properties during the anticipated, momentary, episodic and cumulative user experience ([17]). The more UX properties selected, the more demanding the UX evaluation.

The instantiation of the holistic UX model within the six use cases has leaded to the validation of 27 model properties (see Table 1). For each of them it has been necessary to identify and select relevant indicators, methods and techniques for collecting necessary data and for analysing these data in their specific context. It also means that there is an amount of 13 properties that remain to be validated. Right from the beginning of the project, it already appeared impossible to have a single common UX model that could work for any use case. This has enforced the idea to create a holistic UX model that could be re-used by any use case in selecting the most appropriate UX facets and properties according to its specificities. This selection process is named 'instantiation of the holistic UX model'.

However, the main benefit remains the possibility to simply re-use for each model property already defined indicators, metrics, measurement techniques and tools as well as analysis techniques and tools that were previously applied in other use cases. The only condition is that these previous use cases have to be based on the same holistic UX

Figure 11: Instantiation of the Holistic UX Model

model and properties. In fact, not only they validate the model properties but they also enrich them through the generated knowledge that could be shared among use cases.

Table 1: The 27 UX Model Properties Selected by the 6 Use-Cases

Elements of the UX model			Use Cases						Total
Types	Refs	Properties	GS	ES	WS	LS	RS	HS	ALL
Knowledge	K2.2	Sensing of affordances	1	1		1	1		4
	K3.1	Internal representation	1	1					1
	K3.2	Cognitive Artefacts	1		1	1	1		4
	K4.1	Group Cognition			1			1	2
Social	S1.1	Social networking	1		1		1		3
	S2.1	Communication	1		1		1	1	4
	S2.2	Collaboration			1			1	2
	S3.1	Collective Intelligence		1					1
	S3.4	Accountability & Trust						1	1
	S5.1	Attractiveness	1	1	1	1	1		5
	S5.2	Emotional Behaviour						1	1
	S6.1	Caring						1	1
	S6.2	Sense of Community		1					1
Business	B1.1	New functionalities (IoT)			1			1	2
	B1.2	Automation Level (IoT)		1	1	1	1	1	5
	B1.3	Connectivity (IoT)						1	1
	B2.1	Reliability (IoT)	1	1			1	1	4
	B2.3	Efficiency (IoT)						1	1
	B3.1	Ergonomic Quality	1	1	1	1		1	5
	B4.1	Usefulness	1		1			1	3
	B4.2	Hedonic quality	1		1				2
	B4.3	Affordability					1	1	2
	B4.4	Productivity					1		1
	B5.1	Accessibility				1		1	2
	B5.2	Availability				1		1	2
	B6.1	User ideas	1					1	2
	B7.1	Data Protection	1					1	2
		TOTAL	12	8	11	7	9	18	65

As shown in the Table 1, each use case has selected a specific set of UX model properties according to its needs. Among the six use cases, the most common UX properties are 'attractiveness', 'automation level' and 'ergonomic quality' that were respectively selected by five of them.

Evaluation of the Holistic UX Model

A survey, which consisted to have the six use cases rating the usefulness of the holistic UX Model, was carried out before the end of the project. Each assessment aspect has a scale value ranging from 1 (very low) up to 5 (very high). The following four bar graphs (see Figure 12.1 up to 12.4) show the resulting value for each assessment aspect as rated by the six use cases. While the degree of coverage of the holistic model appears quite complete and comprehensible, its complexity in terms of structure and simplicity to instantiate was rated less positively.

In short, it appears that a specific training on how to apply the holistic UX model to different use cases would be mandatory, especially for people that are novice with UX studies. The good point is the coverage of the model that was rated as being high. However, it should be noticed that the current three dimensions are quite arbitrary. One could wonder why there is no 'educational' dimension in the current model, as quite often it constitutes a specific value for users when software applications bring new knowledge to people. There could be other dimensions like a 'societal' dimension inn order to assess, from UX point of view, whether an application is inclusive (e.g. elderly people) or contribute to save energy.

While the novelty of the holistic KSB UX model is rated quite positively, the demanding side for instantiating the model to specific use cases appears rather negatively. Experimenters found the model more theoretical than grounded from practice. Nonetheless, a significant part of the model is based on previous work like for example on hedonic or ergonomic quality.

The level of reliability was felt quite positive. The vocabulary used for describing the model properties appears positively not too scientific. While the use cases rated the properties as rather adapted for the identification of potential metrics (though still quite demanding), they were, for most of them, interested by the model as they found it quite captivating for the discovery of UX facets and properties as well as bringing value for properly and efficiently contributing to the experiential design.

Finally, the use cases rated the difficulty to learn the model as average and strongly recommended to elaborate a User's Guide on how to instantiate and apply the holistic UX Model to different business sectors and application types (e.g. mobile, distributed). It also appears that, except for one use case, the model is sufficiently attractive for re-using it in other use cases or for recommending it to colleagues having to deal with UX studies. Regarding the level of support that bring the model to people that are novices in the area of UX, the use cases found the model not enough self-supportive through its description. It confirms the idea that a User's Guide on how to apply the holistic UX Model through illustrated examples would be a must.

Overall, both the Experiential Design process and UX model have facilitated, on the one hand, the engagement of users for co-creating value, and on the other hand, the UX evaluation and monitoring of the balanced score of the UX dimensions. The six use cases have reported iterative design refinements that have successfully increased the user acceptance/adoption rate.

Figure 12.1: Resulting Score for the Model Completeness and Simplicity

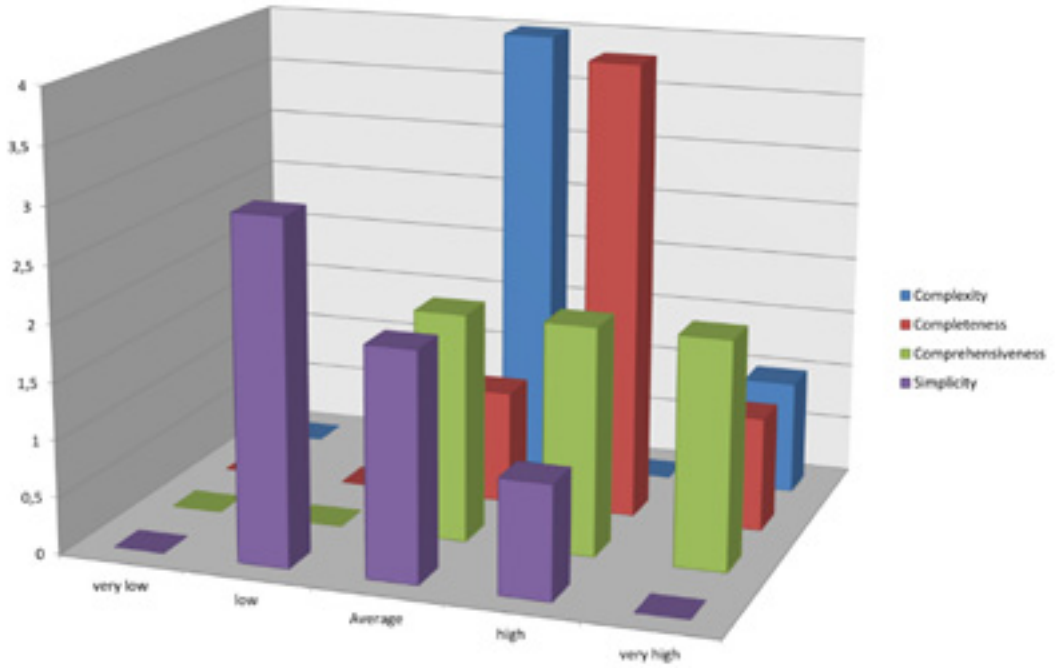


Figure 12.2: Resulting Score for the Model Novelty and Reliability

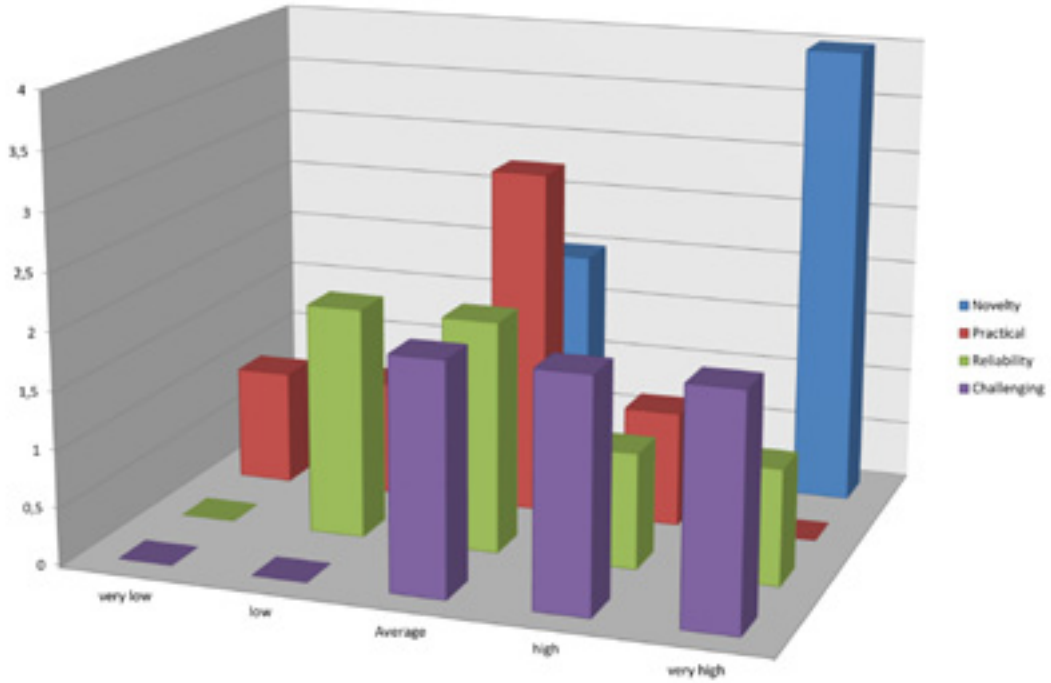


Figure 12.3: Resulting Score for the Model Accessibility and Measurability

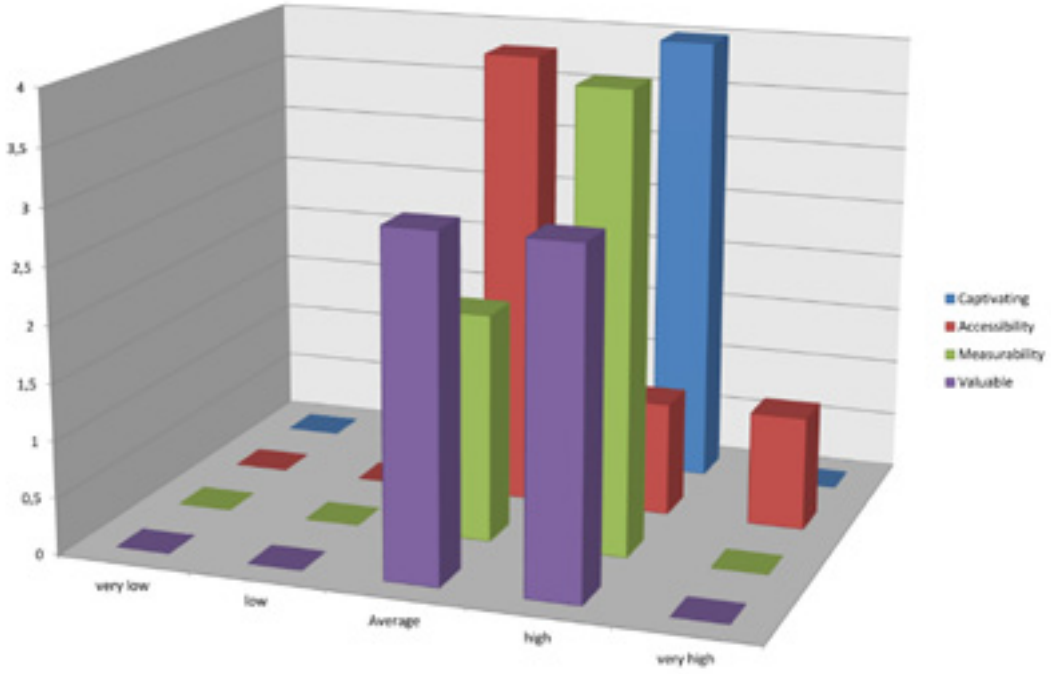
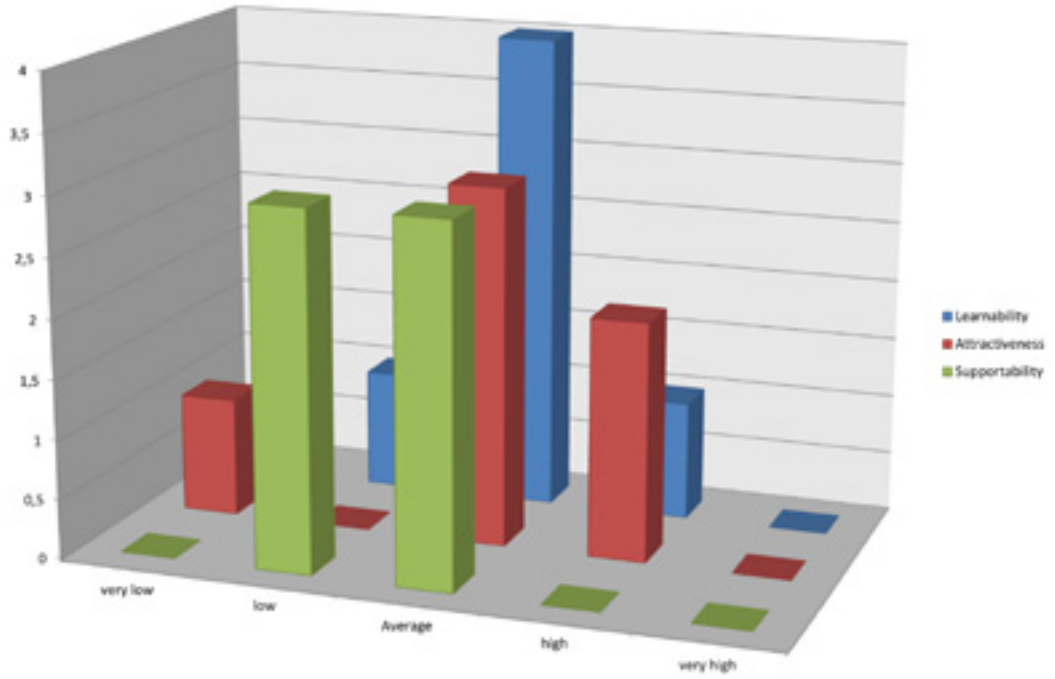


Figure 12.4: Resulting Score for the Model Learnability and Attractiveness



Conclusion

The proposed Experiential Design process and holistic UX model have shown during the use cases' experiments that they induce a combination of top-down and bottom-up approaches. Top-down because the holistic UX model guides project stakeholders in foreseeing the types of value and corresponding user experience they would like to design in their IoT related product/service. Bottom-up because the selection of the most appropriate model elements and properties for each experience type, which they have to evaluate, depend on the identification of potential indicators/metrics; hence, they have to start thinking at the earlier stage about the necessary metrics and related data that they have to collect and analyse for the UX evaluation. Several experiments demonstrated that the iterative nature of the Experiential Design process and systematic UX design/evaluation have leaded to adequate successive refinements. Overall, it has significantly increased the user acceptance and consequently the potential user adoption of the innovative IOT-based services.

It also worth taking into account that considering more UX properties means to have more metrics to identify for the evaluation. Existing papers highlight this difficulty in either focusing on a very narrow UX evaluation. For example: in considering solely generated emotion or describing a broad UX evaluation through hedonic quality and ergonomic quality. The use cases of the ELLIOT project have also reported this difficulty to identify proper metrics after the selection of UX properties. It reveals that there is a tendency to rather start from the possible metrics and look for correlated UX elements and properties. It illustrated a bottom-up approach for reconciliation with the UX model linked to values to be designed rather than using a top-down approach starting from model elements.

The use cases experiments have also revealed that the holistic nature and completeness of the UX model avoided the risk of overlooking some UX types, elements and properties, which are playing an important role for adoption. From an Academic perspective, the XD process and holistic UX model bring a form of learning by doing. Students discover by practice the way to drive user co-creation and the impact of different experience types, elements and properties on the user acceptance and potential adoption.

From an industrial perspective, the XD process and holistic UX model provide a reliable systematic exploratory co-creation with a quick UX assessment driving towards a higher rate of user adoption. This is especially true within innovative domains such as IoT-based products and services where the competition relies on the combination of creating new knowledge while shortening the time-to-market. The six use cases have confirmed that UX life cycle ([17]) has a profound impact on the organisation of the experiments and collection/analysis of data whether it is about anticipated, momentary, episodic or even cumulative use.

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The Next Financial Revolution is Hardwired

Introduction

The use of mobile phones is growing at a tremendous pace, and therefore in contrast with our economic growth in western countries. It seems to occur that our smart phones are literally becoming the key not only to our virtual world, but also to our physical world.

The barriers of entry into the financial business have been battered down, making it easier than ever to enter the profession.

As of the beginning in 2014, there are close to a 1 000 start-ups in the fin tech scene.

If the downside of the battered-down barriers to entry is less pay and lower status, the potential upside is that a flood of new innovative entrants into the field could portend a financial renaissance. This article is about the opportunity for (open) hardware development in the financial industry inspired by open innovation 2.0 and consumer needs.

Trends

Technology is not only for the laboratories and white coats anymore. Technology is cool. Check out www.kickstarter.com, a great example of open, collaborative and participative crowdfunding platform, and you will be amazed by the amount of novel emerging technologies. These technologies are there because of Open Innovation 2.0 which is all about co-creation and sharing results. Emerging technology is opening doors, finding cures, raising hopes of a better, more connected future. We have seen this in many markets already, like the gaming and the healthcare market. The speed with which people adopt and adapt to new tools is both dizzying and gratifying, human ingenuity at its best. 3D printing is entering our living space, and all kinds of labs including the Fab Labs, as open design and hardware labs, are giving us access to tools for developing hardware.

Some of these trends get accelerated by countries like India or Kenya, where whole generations leapfrog to new hyper connected devices. At the most recent Mobile World Congress ([1]), the big trend was wearable technology with new product introductions from companies like Sony and Samsung into this market. Most of these technologies are using Intel's brand-spanking-new 'Edison' microchip, the company's smallest computer. The fact that this chip is so small means it can be integrated directly into other devices. It boasts Intel's extremely low-power Quark processor, Bluetooth, and Wi-Fi connectivity to communicate with other devices. Essentially, technology should make our lives easier. Wearable technology falls into a long tradition of innovating through the lenses of a customer and we have seen these new hardware tools popping up due to several reasons. Even software developers, like XL Team in Romania, start to hire electronic designers to prepare for the wearable revolution ([2]).

One aspect is whenever a massive change occurs in technology or in the interfaces offered to people: you can then expect to find a flurry of innovation. Changes in interface suddenly let all sorts of behaviours becoming easier. Subsequently, when the effort required to accomplish an action decreases, usage tends to explode ([2]).

Mobile and the Financial Industry

Mobile telecommunications have revolutionised the world already, and promise to play an important role in the consumer of tomorrow. In line with the 'anything, everywhere' attitudes of tomorrow's consumption trends, smartphones have become more accessible, faster, and more efficient. They are quite literally the pocket gateway to the digital/Internet world, and people are flocking to them by the minute.

If Internet 1.0 was static websites and Internet 2.0 was all about the first social sites designed for interaction, Internet 3.0 is now about the mobile platforms and apps that are driving more and more online traffic and more customised user experiences. As noted above, there will be a huge increase of mobile-only Internet users in the next few years, leading to whole new ways of web usage that demand marketers' attention.

Lesson? Go mobile or go home. The consumer of the future carries the power of consumption and choice in its pocket.

Knowing that mobile phones will be very important in the coming years, we want to expand our thinking by looking at the opportunities that the phone as tool can provide, looking beyond the software and inside technology and enter the world of hardware.

We have seen high adoption rates of banking apps, and the most world known example of mobile money M-Pesa has inspired more initiatives to foster banking facilities among poor and unbanked population. In 2009 Gartner spoke out that Mobile Money would be the number one mobile application to be in 2012. We haven't reached that point yet, but the momentum is rising very quickly.

One of the first disruptive hardware tools built might be Square ([2]). Jack Dorsey, the creator of Twitter, was the first to develop a mobile device for banking activities, launched in May 2010. Square allows users in the United States and Canada to accept credit cards through their iPhone and Android phones, either by swiping the card on the Square device or by manually entering the details on the phone.

Developing a Business Model

As the current margin for financial institutes is decaying, a new possible business model is very important. Might the entry into hardware be a good move for financial institutions?

Selling hardware is totally different from a service offering. The costs of revenue is high in any device manufacturing segment because fixed costs, works-in-progress and overhead are very high, compared to software. Often, regular hardware and peripherals are being sold at rock-bottom prices. This is the case in the printing industry. The high mark-up items are the software, accessories and ink. It's the same model used by the auto and telecom industries.

Companies like Apple have to sell their, new or upgraded, products again and again within a year or two. For the software industry, micro-transactions for updates are more common and are much more frequent. And there is a good margin behind it, often close to 90 percent, like with Microsoft.

So where does this lead to the financial industry? Not entering the market? Leaving it to parties like SumUp, Paypal and Square? This might not be advisable. As we have seen at the recent technology developments, *hardware is the new software*. Hardware is a good way to create connectivity with the client.

We see a potential huge market that might be beneficial as well: security is becoming a large concern for the consumer. While users are great lovers of integrated devices, the security issues enhance the need of combining devices to ensure fighting cybercrime. One way to avoid the need of two electronic devices to ensure security is checking from the payment device itself that is actually using it. This means being able to recognise some significant properties of the human being, such as fingerprints, iris, DNA, but also writing properties (how is it written, speed), speaking properties (tone of voice, etc.). Some of the existing peripherals could already be used for that matter, others still have to be built.

Executive Interview

According to Malcolm Harden CEA, Vice-President CGI Federal, Chairman CGI Global Technology Council, identification devices for consumers could be very disruptive. From the two mobile phone world leaders, the iPhone5S and Samsung S5 phone have fingerprint recognition. However, US people are very skeptical about giving out their fingerprints. Who will own that data and who can you trust? On the US market, there is a great bias in National ID card, and if a smart chip would be taken as an ID, it would be a huge shift.

A game changer is for Mr Harden something that has a major impact in the consumer market as widespread, like the copy machine, and 3D printing doesn't seem to match to this requirement.

He expects the healthcare sector to be influenced majorly by the hardware revolution. Geographically, Central and South America, due to its uncapped economic potential, has a tremendous potential, also in the long term. Emerging countries have huge potential to change the economic model. When looking at history or industrial revolution, the game changers in some cases were processes like the assembly line, but they were also devices involved. Interaction with hardware has a huge potential to change the entire business model of the economic region: having a hit with the right device could create a new wave.

Wearable computing is a game changer, because it represents the hands free technology. In the next 20 years we will tend to have hands free technologies. Using those technologies, we can be more focused on the task rather than on the tool.

Case study

In 2009, Philips Design and ABN AMRO Dialogues Incubator launched a first financial wearable concept car. The tool, Rationalizer was used to enhance the psychological knowledge of a customer. Rationalizer was based on several assumptions:

- People do not trust advisers anymore;
- New technological ways to measure stress and emotions;
- Wearable technology will not only be in clothes, but as jewellery in the future;
- Stress is more and more abundant in everyday's life. If a person is stressed, decision-making deteriorates;
- Thanks to the Internet, more and more interactions are online and financially driven (eBay, poker, trading).

Rationalizer brought ratio into financial decision-making. Rationalizer measured the arousal level through a bracelet and visualised the results with light and color, revealing the state the owner is in and help him preventing taking overheated decisions.

Figure 1: Rationalizer: emotion awareness for online investors (Phillips and ABN AMRO 2009) ([5])

In the coming years, this kind of devices can be expected to be integrated into peripherals or even brought into the smart phone. Because of its processing capacity and the visual renderness, smart phones provide an even greater experience.

It is worthy to note that one of the authors of this paper, Mr Jaspar Roos, is the co-founder of the concept of Rationalizer while he was working at ABN AMRO Dialogues Incubator. In 2010, Dialogues Incubator halted the further development of this accessory. Philips still uses this prototype for further studies. For more information, check out: www.mirrorofemotions.com.

Market Success Factors

The new paradigm of Open Innovation 2.0 will certainly enter the scene in the creation of this market space. Principles of integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption will apply. As this market emerges, we have defined several market success factors to become a successful player in the financial wearables market.

Unserved user segments: Credibility will only be generated by rich understanding and connection with the client user base and consumer needs. This has happened with Square, as a tool for taxi drivers and other SME's that could not connect to the regular banking payment systems due to costs and work environment. As the market further matures, companies need to have more focused customer targets and value propositions. This connects well to the Quadruple Helix thinking, in which citizens become an addition to the mix of government, industry and academia.

One click play: Devices need to be simple and intuitive to use, likely only one or a limited purpose. This has happened with the debit card identifier, most European banks offer. It just has to work and be hassle-free. If used as an accessory on the phone fashionability and unobtrusiveness become relevant as well. Fashionability will matter more in consumer wearables.

Seamless platform experience: Most banks have invested heavily in web based platforms. The accessories should be seamlessly connected to their and other banking web platforms. This will make more sense to the customers, who will experience this as an extension of the integrated system of a financial institution. It serves another purpose as well: the extension of many big data projects to get more out of the datasets governed by financials. Building an increasingly rich data set with new sensors and measurements will provide enhanced intelligence, customer insights and accuracy. The user base will create more meaningful data and provide rich community sharing that will only further bolster user loyalty and trust. Financial institutions can accelerate this growth trajectory by building strategic partnerships with accessory and device companies. This will also be great source of opportunity to scale and broaden the marketing with lower costs of investments.

Conclusion

'Don't go where the puck is.
Go where it is heading to.'

Wayne Gretzky

Smart phones are ubiquitous devices, and they seem to integrate more and more sensors and compounds to grow in capacities. Integrating a wallet into a smart phone needs a high level of security to protect from cybercrime. This means that the right identification of the holder has to be made, something that will get easier with time. Still, a smartphone has to be kept simple for consumers to avoid wrong usage leading to intrusion from a cybercriminals. In terms of pucks, we see a future for tools specifically designed to enhance the qualities of a mobile phone.

We expect the hardware device to be the next wave in the financial industry. Especially with the NFC chip and other new to come biometrical sensors, showing up in phones the coming years, we might experience a financial renaissance. And all of those complex, new to the world devices will likely be created by consortia who embrace the principles of Open Innovation 2.0 with a focus of user/consumer needs.

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The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and beyond

Abstract

Smart, sustainable and inclusive growth is the key goal of several EU initiatives, strategies and programmes in the short, medium and long term and at the regional, national and pan-European levels.

In this paper, we attempt to explore, explain and enact the conceptual as well as practical linkages between theory, policy and practice related to the ingredients of such growth based on regional innovation smart specialisation strategies and viewed via the 'multi-focal lens' of the Quadruple and Quintuple Innovation Helixes (also Quadruple/Quintuple Helix or QH) perspective.

Setting the Policy Concept

The financial crisis that announced itself to the world with the demise of Lehman Brothers on September 15, 2008 and then morphed into a social, political and economic challenge to the world and in particular to the European Union and its core institutions and principles, exposed essential problems and unsustainable developments in many European countries. It also made clear just how inter-dependent and inter-linked the EU's economies are. Greater economic policy coordination ([1]) across the EU will help Member States to address these problems and boost growth and job creation in the future. The Europe 2020 Strategy ([2]) is a comprehensive economic policy agenda focusing on three priorities: smart, sustainable, and inclusive growth. This new EU strategy is about delivering growth that is (a) *smart*, through more effective investments in education, research and innovation; (b) *sustainable*, thanks to a decisive move towards a low-carbon economy; and (c) *inclusive*, with a strong emphasis on job creation and poverty reduction. Based on these three mutually reinforcing priorities, European Member States (and regions) are encouraged to identify their own assets and R&I strengths so that they could then focus their efforts on a limited number of justified priorities. By focusing on these three priorities, the European Union is planning to move decisively beyond the crisis and to create conditions required for a more competitive economy. Such an approach aims to help Member States and their regions to deliver higher levels of employment, productivity, and social cohesion in a manner that would be globally competitive and thus not only environmentally but also financially and socially sustainable.

EU Cohesion Policy ([3]) has to date contributed to improving economic, social, and environmental conditions within the European Union, as indicated by a number of evaluations carried out by the European Commission. However, the same *ex post* evaluations concluded that focusing on a few key priorities (especially in the more developed regions) could be more effective (European Commission 2010). Such concentration of resources will allow Member States and regions to build up a critical mass and make a tangible impact. The *Fifth Report on Economic, Social and Territorial Cohesion* prepared by the European Commission (2010) suggested the EU regions and Member States to start with programmes identifying a limited number of policy priorities (*concentration*).

Any such priorities should also be developed with a clear understanding as to how these will be achieved and how their achievement would contribute to the economic, social, and territorial development of the EU regions and Member States. In line with this understanding and the overall EU 2020 strategy, the European Commission recognised the importance of the Smart Specialisation Strategies (S3) principle. The principle of smart specialisation requires each region to build on its own strengths and to manage a priority-setting process in the context of national and regional innovation strategies ([4]).

This principle was initially outlined by the Expert Group 'Knowledge for Growth' in 2008. The point of departure for the Knowledge for Growth Expert Group was the innovation system research and theory applied at the level of regional systems of innovation (RIS). Following the earlier RIS tradition, RIS3 (research and innovation strategies for smart specialisation) calls for the design and implementation of research and innovation strategies and has been placed at the core of the new European cohesion policy as the main driver for the achievement of the Europe 2020 strategy objectives from a regional perspective. In order to facilitate the participation of small European nation states, the acronym RIS has been further extended to refer to both national and regional systems of innovation. Moreover, and within the RIS3 context, one could envision both regional and sectoral innovation systems as constituting elements of a regional innovation ecosystem.

The S3 concept is now recognised by the EU policymakers as an important logical step to reaching the Europe 2020 goals set by the European Union in the field of research and innovation. Moreover, the European Commission introduced ([5]) Smart Specialisation as a pre-condition (ex-ante conditionality ([6])) for using the European Regional Development Fund

(ERDF ([7])) in the new funding period (2014–2020). As a result, national and regional authorities across the European Union are required to prepare their research and innovation strategies for smart specialisation (RIS3), so that the Structural Funds are used more efficiently with the aim of increasing synergies between different EU, national and regional policies, as well as public and private investments.

While some regions are quickly advancing with the development of an original research and innovation smart specialisation strategy (RIS3), other regions are finding it more difficult to focus on clear priorities or tend to reproduce other regions' strategies without necessarily finding an optimal fit between conditions in the regions in question and the replicated RIS3. In June 2011, the European Commission launched the Smart Specialisation Platform (S3 Platform) to support its regions and Member States. This new EU facility is there to help European regions (and Member States) to define their research and innovation (R&I) strategies based on the S3 principle.

The concept recommends that each Member State and region focus its efforts and resources on a limited number of ambitious yet realistic priorities (*niches*) where it would be able to develop excellence and compete in the global economy in a sustainable (financially as well as environmentally and socially) manner following the smart, sustainable and inclusive growth priority. The S3 principle further requires uniting national and regional stakeholders and resources around an excellence-driven vision of their future. These vital changes are then expected to allow Member States and regions to strengthen their innovation systems, maximise knowledge flows, absorption and utilisation as well as spread the benefits of innovation throughout the entire national/regional economy via market, network and knowledge spill-over effects locally and regionally.

The Concept of Multi-helix Systems

As a preamble to discussing the Quadruple Innovation Helix (QH) framework that extends the Triple Helix concept, we will re-visit some key operational tenets of the Triple Helix system, namely, a set of components as well as relationships and functions (attributes), as follows:

COMPONENTS: The institutional spheres of University, Industry and Government, as an expansion from the dyad of industry and government as primary institutions of the industrial society, to a triad of primary institutions specific to a knowledge–based society and economy. Here, it is important to differentiate between the actors encompassed by the three institutional spheres:

- **research and development (R & D)** performers located in universities (academic research groups), industry and government (R & D units or departments in firms and public research organisations), as well as performers of the R & D functional equivalent in the arts, which generates artistic and cultural activities created similarly to scientific R & D, but with their own distinct discovery, validation and dissemination processes. This category of R & D performers can be found in university, which is a universal knowledge-producing and disseminating institution that encompasses both the arts and the sciences and occasionally integrates and cross-fertilises these apparently divergent modalities in interdisciplinary units. Examples of such interdisciplinary units include the MIT Media Lab or the Newcastle Culture Lab, the late Andy Warhol's Factory and the Kitchen Performance Space in New York City, as well as IBM's Watson Research Centre, Stanford's Centre for Integrated Systems and similar R & D organisations. R & D performers can also be found in the government sphere (e.g. government-funded organisations, etc.).
- **non-R & D actors**, such as those intervening in the context of design, production, marketing, sales, technology adoption, incremental change, combining existing knowledge in new ways, interaction with users, acquisition of patents and licenses, etc.
- **hybrid institutions** synthesising elements of academia, industry and government institutional design and/or support, which can be both R & D and non-R & D performers, e.g. interdisciplinary research centres, industry-university research consortia, translational research institutes, technology transfer offices in universities, firms and government research labs; business support institutions (science parks, business/technology incubators); financial support institutions for new technology-based firms (public and private venture capital firms, angel networks, seed capital funds, etc.).

RELATIONSHIPS: Here we distinguish between two main types of relationships as the social evolutionary mechanisms inducing change in Triple Helix systems:

- **collaboration and conflict moderation** (including provision of R & D and consultancy services, competence-building, formation of new markets or consolidation of existing ones, creating and changing organisations and/or institutions, networking, technology transfer or acquisition of goods and services through market or non-market interactions, incubation activities, financing, negotiation, etc.). The enhanced

potential for coalition-building and conflict moderation are benefits inherent in the formal properties of triadic relationships, and are often lacking in dyadic relationships, which are more subject to collapse into oppositional modes (Simmel, (1922) 1955.)

- **substitution**: Such relationships arise when, in addition to fulfilling their traditional functions, each institutional sphere may also 'take the role of the other' (Etzkowitz, 2008) by filling gaps that emerge when another sphere is weak, or unable or unwilling to enact its traditional role. Examples include a declining industry failing to infuse itself with new technology to seek a path to renewal, or government agencies taking up, in addition to their traditional function of regulation and control (e.g. specification of contract formats as the basis for market operations, or providing for public security and safety at the local and national levels), the provision of public venture capital — a traditional task for the industrial sphere. Similarly, universities, in addition to their teaching and research activities, increasingly engage in technology transfer and firm formation, providing support and even funding to encourage entrepreneurial ventures, thus enacting some of the traditional role of industry. Industry takes the role of the university in developing training and research, often at the same high level as universities. Moreover, a trend towards internal substitution within spheres was observed (Ranga et al. 2008). For example, in situations where a local university is only marginally involved in entrepreneurial activities and links with industry, especially small firms, vocational training institutions may take the lead in such interactions, as they provide a more practical, hands-on, shorter-term oriented education, which is better suited to meet the knowledge needs of the small, non-R & D firms than the programmes of the local university. Similarly, in the absence of R & D- and technology-intensive companies that are usually involved in Triple Helix partnerships, professional associations or chambers of commerce representing the interests of the local business community take the lead in fostering partnerships with academia and government. Such substitutive relationships of institutions taking non-traditional roles are a major potential source of 'innovation in innovation' (Etzkowitz, 2003), reflecting the expansion of innovation from an internal process within and among firms to an activity that often occurs within and among the other Triple Helix institutional spheres.

From Triple to Quadruple Helix

Francis Fukuyama's 'The End of History' was proven both right and wrong in that what we witnessed in the 1989–1991 period was the end of an era of static and even rigid geo-political, economic, strategic and technological (geo-PEST) configurations and alliances (communism vs. capitalism) and the beginning of the era of the Internet and more open societies and economies (varieties of capitalism).

Over the last twenty years however, globalisation has evolved and morphed into glo*C*alization with the nature, dynamics, scale and scope of learning and innovation as significant locally as it is impactful globally and at the same time people are seriously discussing a new emerging dichotomy — not any more communism vs. capitalism but state vs. democratic capitalism.

This new emerging divide represents both a challenge and an opportunity. While very different in nature, both models present a unique chance to better understand the principles of knowledge economy and society learning in various institutional and socioeconomic environments. They also allow implementing more effectively innovation policies and practices and improving the mechanisms of public engagement and deliberation. Given the fluidity and the speed of change in most (social, economic, political and technological) contexts, understanding these principles is critical to developing the capacity for higher order learning at the macro-, meso- and micro-levels and embedding such learning within an operational framework of technological and economic progress that integrates and engages all sectors of the economy and society. Such a model is seen as the key for future sustainable growth and prosperity.

Policy initiatives such as S3 allow regional and national policymakers to focus on a number of core processes in the knowledge economy and society, and provide evidence that further facilitates innovation in a range of trans-disciplinary areas. The RIS3 focuses primarily on a need to revitalise regional policies, thus promoting the formation of regional systems of innovation and these systems need to be conceptualised and implemented with a top-down view (integrating and differentiating across government, university and industry sectors and localities per the quote below — Leydesdorff, 2012) complemented and enhanced by a bottom-up set of insights coming from the civil society as discussed earlier. This is indeed the operationalisation of the Quadruple Innovation Helix concept in the context of RIS3.

Quote from Leydesdorff 2012:

'These systems tend to remain in a state of constant transition as each actor also develops their own activity. Therefore, a trade-off can be generated between integration and differentiation. Furthermore, new systems can be explored in terms of potential synergies and possibly formed. As the various bilateral translations function, a Triple Helix overlay can also be expected to develop into a system of meaning exchanges among differently coded expectations'.

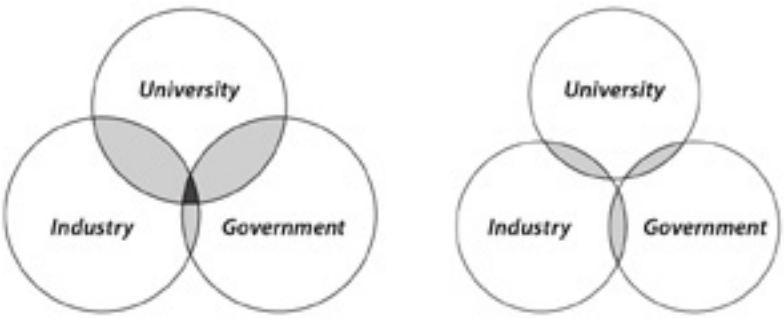
Engaging a wide range of actors has long been fundamental to Cohesion Policy since these different actors have skills and knowledge that is potentially able to support both planning and implementation (European Commission 2010). *The Fifth Report on Economic, Social and Territorial Cohesion* prepared by the European Commission (2010) has further advocated the importance of engaging fully relevant local and regional stakeholders, social partners, and civil society in both policy dialogue and implementation of policies. With this in mind, the European Commission called policymakers across the EU to maintain the dialogue between public and private entities (including socio-economic partners and non-governmental organisations), and other involved actors.

Such partnerships can make policy programmes more inclusive by allowing partners to develop a strategic '*regional viewpoint*'. The ex post evaluation ([8]) of 2000–2006 found that the application of the partnership principle was generally recognised as the added value of Cohesion Policy, especially in the context of local development measures ([9]). The same evaluation study indicated the increased use of partnerships in the EU15 ([10]) in the period from 2000 to 2006 with a significant improvement in the involvement of local and regional bodies, businesses, social partners and other organisations (European Commission 2010). The report offered some examples (in Spain and France) where a system of co-responsibility (between regional and national governments) had been introduced and which had allowed regions to take on more responsibility over the strategy design, monitoring, reporting, and managing, which increased their skills and capacity in these respects (*ibid*). These lessons have been closely examined during the preparation of legislative proposals ([11]) for the future EU Cohesion Policy 2014–2020.

In line with these proposals, the European Commission promotes the role of RIS3 which are multi-annual research and innovation strategies defining a policy mix and budgetary framework. Researchers and practitioners generally agree about the importance of building research and innovation strategies based on the involvement of local and regional bodies, businesses, social partners and other organisations. The so-called Triple Helix (TH) model is a formalised concept behind such interactive systems ([12]).

The Triple Helix concept has also been used as an operational strategy for regional development and to further the knowledge-based economy ([13]). The established Triple Helix model is a strong environment of parallel relationships between (national or regional) authorities, the wider business community (industry), and academia (including other research-focused institutions). This approach places more emphasis on the role of each one of these categories of actors in the innovation process: a stronger involvement of universities, engagement of (multi-level) authorities in formulating policies, industry and businesses in developing and marketing products, and the development of new technologies by academia ([14]). Triple Helix is a dynamic model, and as shown in Figure X, it alternates between a number of bilateral and trilateral coordination spheres ([15]) (see Figure 1).

Figure 1: A Triple Helix configuration with negative and positive overlap among the three subsystems (adapted from Leydesdorff, 2012)



In recent years, policymakers started experimenting with adding further categories of actors to the original Triple Helix model. One such model is known as the Quadruple Innovation Helix or Quadruple Helix (QH). Having analysed the Quadruple Helix concept, Arnkil et al (2010) conclude that the concept is still far from being well-established in innovation research and policy ([16]). Furthermore, the same authors find that some existing versions of the QH model are slightly modified versions of the classical Triple Helix concept. However, there are different views as to what this fourth group consists of; in other words, its membership can range from intermediate innovation enablers to different users of innovations.

Quadruple Helix models place a stronger focus on cooperation in innovation, and in particular the dynamically intertwined processes of *co-opetition, co-evolution and co-specialisation* within and across regional and sectoral innovation ecosystems ([17]) that could serve as the foundation for diverse smart specialisation strategies (and introduce a move towards systemic and user-centric innovation structures). One such version of the Quadruple Helix concept was recently endorsed by the European Commission in its 'RIS3 Guide'. The Guide outlines a set of general principles as to how S3 strategies should be developed at the regional level (European Commission 2012). The Guide recognises the significance of and the need for the Quadruple Helix approach by proposing to add a fourth group (civil society as innovation users) to a classical Triple Helix model ([18]), see Figure 2.

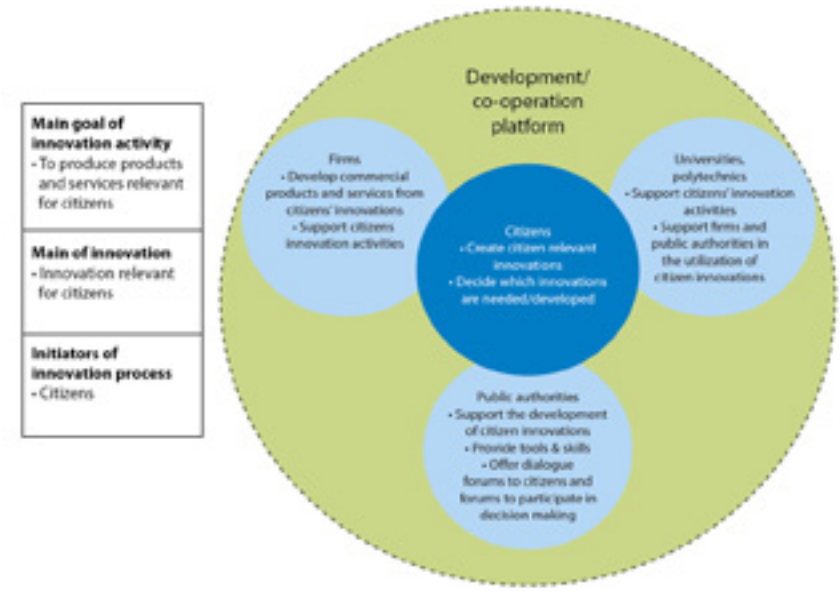
This Quadruple Helix model puts innovation users at its heart, and encourages the development of innovations that are pertinent for users (civil society). Users or citizens here own and drive the innovation processes. Arnkil and colleagues (2010) maintain that the degree of user involvement could be defined as inclusive of the 'design by users' ([19]). In line with this perspective, new innovative products, services and solutions are developed with the involvement of users in their role as lead users, co-developers and co-creators ([20]).

Not only citizens would be involved in the actual development work, they would also have the power to propose new types of innovations, which then connect users with their stakeholders across industry, academia, or government ([21]). In turn, the role of actors in the other three helices would be supporting citizens in such innovation activities (e.g. to provide tools, information, development forums and skills needed by users in their innovation activities). Furthermore, industrial players and public sector stakeholders would then be able to exploit the innovations developed by citizens.

This user-centred approach requires a further development of collective management and implementation of the RIS3 process as critical conditions for achieving successful governance of regional and innovation strategies. These strategies should not only target S&T (science and technology) innovation but also foster innovation in non S&T fields (i.e. social, public sector and service innovation). It should also ensure a more effective and complementary use of EU investments in the regions and help channel private capital into regional smart specialisation niches.

The RIS3 approach also maintains that through application of horizontal forms of multi-level

Figure 2: The User-centred QH model (adapted from Arnkil, Järvensivu et al. 2010)



governance, the smart specialisation approach is helping regions to upgrade their research and innovation strategies based on a number of key principles including the implementation of multi-level governance and the Quadruple Helix (QH) approach. The authors of the Guide suggest that by applying the QH approach (in the RIS3 context) regional policymakers are more likely to enable a place-based entrepreneurial process of discovery, which would then generate intensive experimentation and discoveries. Such direct addition of users in the innovation process is a necessary organisational counterpart of an open and user-centred innovation policy as it allows for a greater focus on understanding underlying consumer needs (European Commission 2012).

The Quadruple Helix as an Architectural Innovation Blueprint to support RIS3

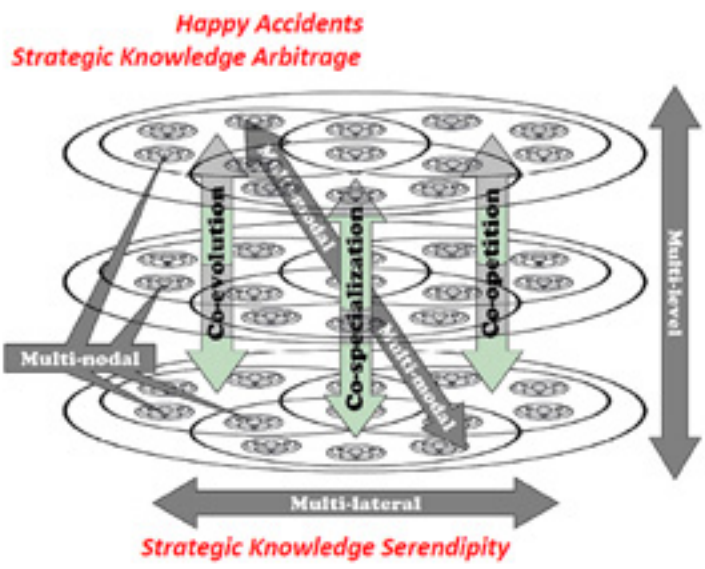
The RIS3-focused policymaking can help develop regional environments that support and utilise user-centred innovation activities with the aim of securing better conditions to commercialise R & D efforts ([11]) across European regions. Such a Quadruple Helix approach to innovation would allow for a wider range of innovations, adding to those based on technology or science. On the other hand, the user-centred Quadruple Helix would require substantial flexibility, reworked adapted processes, learning/teaching new skills, and a possible shift of power between different players (European Commission 2012).

The Quadruple Helix concept promoted by the Smart Specialisation Platform brings together four sectoral perspectives with a focus on the institutional, regional, and operational functionalities and complementarities of these sectors in the context of the knowledge economy. The overall RIS3 context provides an appropriate operationalisation framework for embedding the concept in both policy and practice.

The Quadruple Helix concept thus can serve as an architectural innovation blueprint that engages simultaneously (in a dynamically balanced top-down and bottom-up approach) four sectoral perspectives (from the top-down angle government, university, industry and the bottom-up angle civil society). The inter-sectoral and intra-sectoral as well as the inter-regional and intra-regional knowledge and learning interfaces that are embedded in the Quadruple Helix architectural blueprint determine its efficacy and sustainability. A combination of these four perspectives aims for the conceptualisation, contextualisation, design, implementation, and evolution of (smart, sustainable, and inclusive) growth-driving entrepreneurship and innovation ecosystems (as well as clusters, networks and other agglomerations) at the regional level ([23]).

Civil society as the fourth pillar of the Quadruple Helix blueprint represents bottom-up actions and views of the civil society. However, to benefit from these, policymakers should ensure mechanisms such as crowd-sourcing and crowd-funding capabilities in instruments, and initiatives included in their regional RIS3 strategies. Embedding these elements may allow for faster, broader, cheaper, and more resilient learning, learning-to-learn and learning-to-learn-how-to-learn dynamics ([24]). In addition, the social networking capabilities enacted via the fourth pillar would enhance the likelihood and impact of knowledge serendipity and knowledge arbitrage events ('happy accidents') ([25]). These 'happy accidents' would then act as triggers, catalysts and accelerators of exploration and exploitation dynamics) that could substantially empower any Quadruple Helix RIS3 strategy ([26]) (see Figure 3).

Figure 3:



Moreover, this approach putting the emphasis on pro-active, targeted and learning-maximising interfaces and knowledge exchanges across all four pillars (government, university, industry and civil society) as well as across sectors and regions would make for more resilient — namely smart, sustainable and inclusive — growth. It would also endow the underlying policies, practices and initiatives with the capacity to adapt faster and even self-organise and self-optimise in the face of known-unknowns and also unknown-unknowns eventualities and beyond-the-horizon disruptions.

Therefore, the objective of the Quadruple Helix approach would be to further empower and connect eco-systemic value creators. These are innovation users who can also be innovation co-creators such as entrepreneurs, inventors, artists and other value generators — that may through this approach be better enabled to reveal latent and emerging needs, challenges as well as opportunities. This is not to say that entrepreneurs or other value creators and innovation agents are only found in civil society but indeed they could complement and reinforce similarly minded individuals in the government, university and industry (entrepreneurs of the mind across the Quadruple Helix continuum).

Multilevel Governance

Successful research and innovation strategies cannot be effectively formulated and implemented without putting in place a functioning multi-level governance structure.

Moreover, there are several ways that public authorities can support and assist Quadruple Helix (QH) actors in meeting the challenges intrinsic in implementing the QH innovation models. Examples of these roles are as follows:

- Enabler, e.g. sponsor and provider of infrastructure;
- Decision maker, e.g. maker of regional/local QH innovation policies (e.g. guidelines, financial incentives, R & D&I programmes supporting user-oriented innovation);
- Supporter, e.g. to support the development of QH partners (e.g. firms, universities, users), the systematic collection and utilisation of user information and the knowledge and capability development related to QH, to promote the empowerment of citizens and to assist citizens in their innovation activities;
- Utiliser, e.g. to utilise the user-oriented development services provided by QH innovation environments by themselves (as part of the development of public services);
- Developer, e.g. to utilise user-oriented development methods in the internal development work public sector;
- Marketer, e.g. to raise awareness of user-oriented innovation models and practices among citizens, businesses and public sector;
- Quality controller, e.g. to support the development of 'quality checks' or standards for QH type of activities and for other co-creation environments and to assess the quality of QH type of activities by means of these standards.

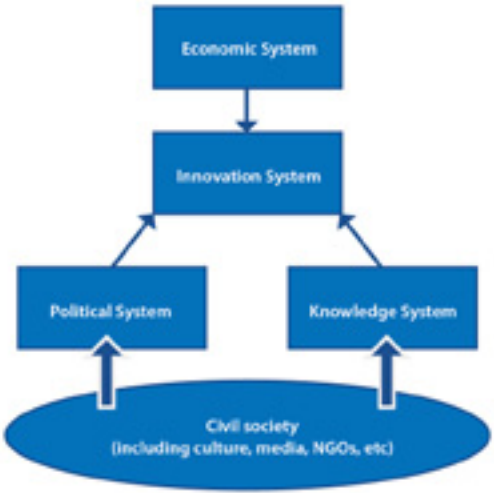
Systems theory is usable when trying to understand in what way the knowledge and innovation systems interacts with the political and economic systems for the purpose of regional development. Carayannis and Campbell (2006:9-11) describe the self-rationale of these systems ([27]):

1. ***The self-rationale of the political system***: The political system should assume responsibility for the performance of a society. Policymaking, legislation, steering, coordination and communication are the tools available for influencing the dynamics of a society and economy. The political system aim at stimulating and coordinating the performances of the other societal systems.
2. ***The self-rationale of the economic system***: The economic system aim at achieving wealth. In doing this, the economic system can assess how to avoid for example inequality or negative environmental impacts.
3. ***The self-rationale of the knowledge system***: The knowledge system creates and distributes knowledge. The knowledge system can potentially influence the other societal systems by supporting and enhancing their performance, since all societal systems become increasingly knowledge dependent.

The political and the knowledge systems are similar in the manner that they both aim at improving the performance of society. The political system does this through the governance of society, while the knowledge system realizes it by producing knowledge. The innovation system can be considered as 'subsystem of the aggregated knowledge system' ([28]). The political system is able to influence the economic system directly through economic policy, but in many cases, the political system can do this even more efficiently through innovation policy. Thus, the innovation system constitutes an important interface where the political, economic, and knowledge systems meets and interact.

In accordance with the concept of Mode 3 and Quadruple Helix described below, the inclusion of different actors — the creators, users and appliers of knowledge and technology — ideally initiate a creative and substantiated knowledge production process. Parallel to this, the political system has developed similar characteristics of inclusion, with governance networks and citizen juries enabling more informed decisions. Both systems are therefore contributing with experiences of the regional context. Since both the political and the knowledge system increasingly operate in an inclusive fashion, the innovation system represents a unifying point, a platform for the aforementioned informed debate and creativity (see Figure 4).

Figure 4: Societal systems interact through the innovation system for regional development



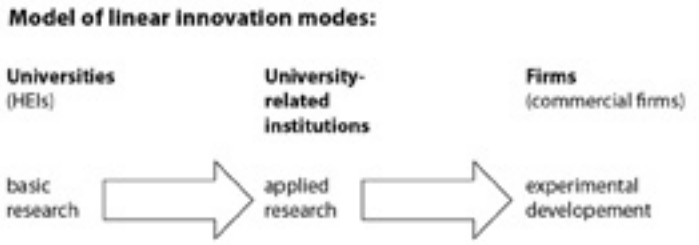
Innovation is consequently important not only for the economic performance of a region, but for the development of a region over-all. The case study of the technology centre of KETEK, active in a peripheral non-university region, can be considered as positioned at the centre of the innovation system in the region, and is subsequently a key player in the regional development. When considering Smart Specialisation and the influence of the peer review this platform offers, the operating pattern and interaction between these systems is thus highly interesting. I will in the following give a theoretical description of the knowledge/innovation system and the political system, followed by an analysis of how these systems operate in a practical case. As mentioned, the economic system, that is, business and firms, act in accordance with a rationale of profit, and is therefore not interesting to elaborate on further in this context.

Mode 3 and Quadruple Helix

The concepts of the Mode 3 Knowledge Production System and the Quadruple Helix Innovation System were initiated by Carayannis and Campbell (2006; 2009; 2012) and can be considered to represent an evolution of Mode 1, Mode 2 and the Triple Helix ([29]).

The theory of Mode 1 and Mode 2 for scientific knowledge production was developed by Gibbons et al. (1994) with the aim of distinguishing a new kind of scientific knowledge production, which had been emerging since the mid-20th century. The traditional knowledge production, Mode 1, refers to knowledge production in a university setting, i.e. academic, investigator-initiated and discipline-based knowledge production. The model is linear in the sense that knowledge is transferred step by step, from basic research conducted in universities to the application at firms as experimental development (see Figure 5).

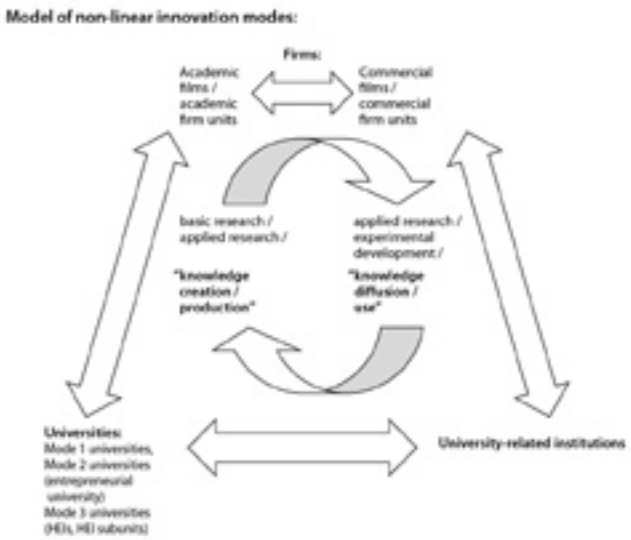
Figure 5: Mode 1 Linear Innovation Modes. Figure from Carayannis and Campbell (2012:25)



Mode 2, on the other hand, is non-linear, characterised by knowledge produced in the context of 'application', 'trans-disciplinarity', 'heterogeneity and organisational diversity', 'social accountability and reflexivity' and 'quality control' (Gibbons et al. 1994: 3-8; 167). According to this concept, it is important to tie universities and industry, science and technology closer together. The producers and users of knowledge are connected during the whole process of knowledge creation (see Figure 6).

A Mode 3 university or higher education sector operates simultaneously in accordance with both the principles of Mode 1 and Mode 2 (30). In short, Mode 3 implies a glocal knowledge production system, including denser connections between actors on the regional or local level, as well as extensive connections to global innovation networks. As in Mode 2, Mode 3 emphasises parallel processes, where basic, applied and experimental research are carried out simultaneously. This is thought to provide competitive advantage, when basic research is directly tied to market application and the time horizon for the R & D cycle is shortened, at the same time as feed-back is given on current research (Campbell and Güttel. 2005:167). 'Academic firm' and 'entrepreneurial university' are denotations demonstrating how firms and universities adopt characteristics of each other, which is significant of the Mode 3 system (Campbell and Güttel. 2005:168). One major obstacle in research cooperation between academia and business has been to overcome the cultural gap and the need for a high degree of trust, and these kinds of integrated organisations are thought to be able to more easily overcome these problems and thereby more straightforwardly engage in collaboration (Campbell and Güttel. 2005:167). Looking from the firm's point of view, its ability to recognize, assimilate and exploit knowledge is often crucial for its survival in the long run. One way of doing this is to recruit personnel from universities, or to encourage personnel mobility between firms and universities (Campbell and Güttel. 2005:168). Mode 3 also allows for the co-evolution of different knowledge paradigms. According to Kuhn (1962), a single paradigm has only a limited ability to explaining a specific phenomenon, while the coexistence and co-evolution of knowledge paradigms allow for paradigms and theories to interact and learn from each other ([31]).

Figure 6: Mode 3 Non-Linear Innovation Modes. Figure from Carayannis and Campbell (2012:25)



Mode 3 permit both 'top-down government, university and industry policies and bottom-up civil society and grass roots initiatives', which together will provide a 'tighter and more robust coupling of vision with reality' ([32]). The ambition with this concept is to push for 'a sustainable development perspective that brings together innovation, entrepreneurship and democracy' ([33]). Mode 3 will, in other words, encourage the democratisation of innovation, through an inclusive setup. 'People, culture and technology meet and interact to catalyse creativity, trigger invention, and accelerate innovation across scientific and technological disciplines' ([34]). This is where the demand for evolving the concept of Triple Helix to Quadruple Helix steps in. In addition to university, industry and government, Quadruple Helix also adds civil society and a 'media-based and culture-based public' as a helix in the innovation system ([35]). Civil society and the public are users and appliers of knowledge and are thereby thought to contribute with a region-specific context and experiences. Accordingly, Quadruple Helix implies a broader understanding of knowledge production, involving culture, arts, media, values and lifestyle. These factors, also including the manner in which media construct public reality, are expected to influence the creative environment in a specific region and, in turn, the innovation system ([36]). 'Creative Knowledge Environments' (Hemlin et al. 2004) and 'creative class' (Florida 2004) are relevant concepts in this context. In the view of Carayannis and Campbell, the fourth Helix highlights a demand for innovation policy to 'present' itself to the public through media, to seek legitimation and justification. This is important, because 'the sustainable backing and reinforcing of knowledge and innovation in the glocal knowledge economy and society requires a substantive supporting of the development and evolution of innovation cultures'' ([37]).

Enacting and evaluating Quadruple Helix setups: examples in excellence from the Nordic countries

Typology/Taxonomy of a number of regions and related good practices and then a specific case-in-point of Ostrobothnia and linkages to the questionnaire

Many successful regional economies seem to have one important thing in common — they put innovation at the heart of their regions' economic sustainability and growth. In attempt to counteract the impact of the current crisis, regional policymakers need to ensure that their policies foster innovation and facilitate the innovation diffusion from the very start. See for instance the case of Finland and the Nordic region at large as outlined in excerpt from a recent Economist report (Economist, 2013):

In 2010 a group of students at Aalto University, just outside Helsinki, embarked on the most constructive piece of student activism in the history of the genre. They had been converted to the power of entrepreneurialism during a visit to the Massachusetts Institute of Technology. When they got home they organised a 'summer of start-ups' to spread the word that Finland's future lay with new companies, not old giants. The summer of start-ups turned into a season of innovation.

***The Start-Up Sauna** — a business accelerator that is still run by young enthusiasts but now funded by government, business and academia — occupies a dilapidated warehouse next to the university. It offers a wide range of services: working space, coaching for budding entrepreneurs, study trips to Silicon Valley and plenty of networking opportunities (including in the Sauna's many saunas).*

The Sauna-masters have an understanding of entrepreneurship in advance of their years. They recognise that there is more to innovation than high tech: the Sauna also has design and knitting factories. They understand the importance of bridging the gap between engineering and design. They realise that promoting entrepreneurship is a matter of changing culture as much as providing money. They look to Russia and the Baltic states as well as to Boston and San Francisco.

No more Nokias

The student revolution was part of a wider reconsideration of the proper relationship between government and business. This had started in 2008, when the Finnish government shook up the universities (and created Aalto) in an attempt to spur innovation. But it was speeded up by Nokia's problems. Finland had become dangerously dependent on this one company: in 2000 Nokia accounted for 4 % of the country's GDP. The government wanted to make the

mobile-phone giant's decline as painless as possible and ensure that Finland would never again become so dependent on a single company.

The Finns created an innovation and technology agency, Tekes, with an annual budget of EUR 600m and a staff of 360. They also established a venture-capital fund, Finnvera, to find early-stage companies and help them get established. The centrepiece of their innovation system is a collection of business accelerators, partly funded by the government and partly by private enterprise, that operate in every significant area of business and provide potential high-growth companies with advice and support from experienced businesspeople and angel investors.

As a result, Finland has become much more market-, and entrepreneur-friendly. It has produced an impressive number of start-ups, including 300 founded by former Nokia employees. Microtask outsources office work. Zen Robotics specialises in automating recycling. Valkee makes a device that lifts wintry dark moods by shooting bright light into the ear canal. The country has also acquired the paraphernalia of a tech cluster, such as a celebratory blog (Arctic Start-up) and a valley-related name (Arctic Valley). The fashionable argument now is that Nokia's decline is 'the best thing that ever happened to this country'.

The new Finland is particularly proud of its booming video-games industry, including successful companies such as Rovio Entertainment, the maker of Angry Birds and a leading supporter of the Start-Up Sauna, and Supercell, the maker of Clash of Clans. Supercell's employees are what you would expect: men with beards and ponytails who take time out from their computer screens to show off their collections of action figures.

Ilkaa Paananen, Supercell's CEO, points out that Finland has spent years preparing for its current success. Helsinki started to host a festival for gamers in the early 1990s. Today the festival is so popular that the organisers have to rent the city's biggest ice-hockey stadium, with room for 13 000, and still turn people away. Kajak University offers courses in video games. Finns have a comparative advantage in the four things that make for great games — blood-soaked storylines (all those sagas), bold design, ace computer programming and what might be politely called 'autistic creativity'.

The arrival of the iPad and its apps allowed the Finnish industry to break out of its frozen ghetto. Mr Paananen says he now has the wherewithal to build the 'company of my dreams'. Screens on the wall display how Supercell is doing against its rivals in real time. The games-masters talk about IPOs and 'massive growth curves'. The company recently moved into new headquarters which, poignantly, used to be Nokia's R & D centre.

The mood reflected in the summer of start-ups can be found across the region: investors everywhere are looking for new opportunities and bright young things are running companies in converted warehouses. Hjalmar Winbladh, one of Sweden's leading entrepreneurs, says that the atmosphere has changed completely since he started out in business in the early 1990s. Back then people like him were oddities. Today fashionable young people worship successful tech entrepreneurs such as Niklas Zennström, the co-founder of Skype, and Daniel Ek and Martin Lorentzon, the co-founders of Spotify. Mr Winbladh says that his biggest problem is to attract young talent from other start-ups. They all shudder at the thought of spending their lives in big organisations.

Nordic governments recognise that they need to encourage more entrepreneurs if they are to provide their people with high-quality jobs, and that they can no longer rely on large companies to generate business ecosystems on their own. They are creating government agencies to promote start-ups. They are encouraging universities to commercialise their ideas and generate start-ups. They are telling their schools to sing the praises of entrepreneurship.

Many of the region's most interesting entrepreneurs operate at the low end of the tech spectrum, often to help parents deal with the practical problems of combining full-time work and family. Niklas Aronsson, co-founder of a company called Linas Matkasse, has applied IKEA's

do-it-yourself model to family dinners. He delivers bags containing all the ingredients needed for a meal, chopped up and ready to cook — a perfect solution for people who are short of time but prefer not to bring up their children on takeaway pizza.

Monica Lindstedt, founder of Hemfrid, is also in the business of selling time. She has turned her company into a house-cleaning giant, applying professional management to domestic cleaning and turning it into an employment perk. Hemfrid has persuaded the government to treat house-cleaning as a tax-deductible benefit, like a company car. It has also convinced companies that this is a great way to reward their employees and free them from domestic distraction. Hemfrid now has 10 000 regular customers and 1 326 employees, 70 % of them born abroad.

Nordic entrepreneurs are also reinventing retirement homes for baby-boomers. A Finnish private housing association, Asunto Oy Helsingin Loppukiri, has built a housing community in the suburbs of Helsinki that is dedicated to the idea of helping people help themselves. The residents took an active part in designing both the buildings' common areas (which include saunas and exercise rooms) and their individual flats. Most of them own shares in the company. It tries to offer a balance between independent living and community involvement. The members eat together once a week and tend a communal allotment whenever they feel like it.

Don't go

Despite all this entrepreneurial energy, the Nordic region still finds it hard to turn start-ups into enduring companies. There are too many examples of successful entrepreneurs who have upped sticks and gone elsewhere. These include not just members of the post-war generation such as Ingvar Kamprad, the founder of giant IKEA (who lives in Switzerland), and Hans Rausing, the founder of Tetra Pak, a huge packaging company (who went to live in England), but also members of the up-and-coming generation. Mr Zennström, along with many of the brightest Swedish investors and entrepreneurs in his age group, lives in London. Too many successful start-ups still choose to sell themselves to foreign (mainly American) multinationals rather than becoming local champions.

Despite all its entrepreneurial energy, the Nordic region still finds it hard to turn start-ups into enduring companies

Still, there is reason to hope that the entrepreneurial boom will also produce a new generation of global champions. The region's lifestyle entrepreneurs have a chance of becoming global moguls for the same reason that Mr Kamprad did: because they are riding the wave of demographic change. And the region's high-tech entrepreneurs have a chance of founding enduring companies because they are building up businesses as well as mastering technology.

One example is Rovio Entertainment, which struck gold with Angry Birds, a game that involves catapulting irascible avian at elaborate fortresses constructed by evil pigs. It was downloaded more than 600 million times in 2011. Having produced one big hit, most games companies would have started looking for the next one, but instead Rovio set about turning Angry Birds into a brand and extending its reach. It struck licensing agreements with a range of companies to make Angry Birds-branded products, from toys to chocolate to theme parks. It raised capital from outside investors such as Microsoft, which chipped in $42m. Rovio now has 500 employees in Finland and had a turnover of $100m in 2011. Michael Hed, the company's CEO, has a traditional corner office, but it is full of stuffed birds and pigs.

A number of attempts have been made by researchers and policymakers to evaluate different aspects of the Triple Helix model in the context of regional innovation systems and this can indeed be extended to cover the Quadruple Helix concept. Some authors focus on connectedness between different actors. One example is a recent exercise carried out by the Regional Council of Ostrobothnia that initiated a project where they developed a method for measuring Quadruple Helix connectedness and gaps. The results of this study would then be used as factual evidence for improving RIS multi-level governance.

The S3 Guide focuses on connectedness within the Quadruple Helix and taking this conceptual

perspective as a guideline for good regional governance, requires a coherent approach. In this regard, Smart Specialisation or S3 presents itself, not just as a continuation of what we have done already under the umbrella of regional systems of innovation (RIS), but rather as a way of questioning existing RIS practices and removing dysfunctional policy arrangements, which prevents growth and development.

Therefore, one of the objectives of this document is to develop a self-assessment and evaluation tool, which could be used by regional policymakers to measure their region's progress in adopting, adapting, and deploying the Quadruple Helix approach in their research and innovation strategies for smart specialisation (RIS3).

The *Fifth Report on Economic, Social and Territorial Cohesion* prepared by the European Commission (2010) also suggested improving monitoring and evaluation systems across the EU to track performance and to help fine-tune efforts as needed to guarantee that pre-defined objectives are attained in the most effective manner. This requires a clear strategic vision of what the programme aims to achieve and how success will be recognised and measured (proper target setting). Furthermore, it also requires a greater recourse to rigorous evaluation methods — both longitudinal and latitudinal (i.e. cross-sectoral, multi-level and across time and space) — for the evaluation and continuous improvement of the formulation and implementation of QH modalities and systems in the RIS3 context.

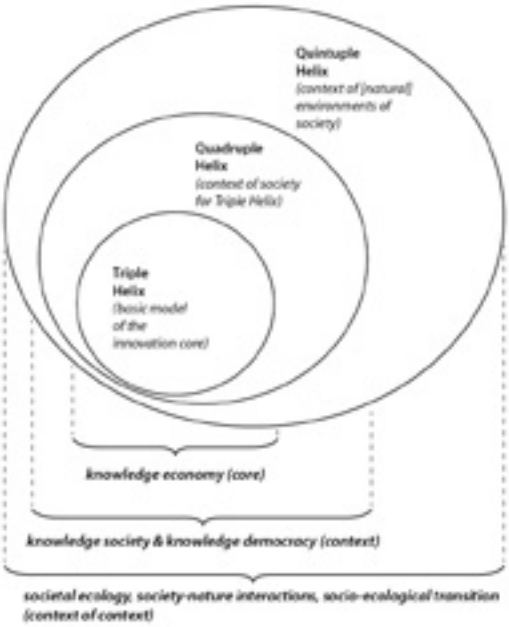
In conclusion: Quadruple Helix plus (QH+) for Smart, Sustainable and Inclusive (SSI) growth

In closing, the environment as a major — and perhaps the key (at least in the medium to long term) externality needs to be taken into account when formulating a RIS3 instrument based on the Quadruple Helix approach ([38]) — what we could call Quadruple Helix Plus (QH+). This would ensure focusing of policies and practices on a triple-bottom baseline (economic, social and environmental) driving the design and implementation of related initiatives, ecosystems, clusters and networks (see Figure 7).

Within the context of QH+, one could further consider a number of issues or questions that would guide the formulation and implementation of a regional smart, sustainable and inclusive growth strategy. In particular, the following S3-related topics are worthy of further attention:

- Which tool and analyses, quantitative and qualitative, could be used to provide the evidence needed for priority choices?
- How has the process of priority choices worked so far in regions/countries? Which are the main novelties of the RIS3 approach in this respect?
- Which are the mechanisms to have wide and effective involvement of stakeholders in priority selection?
- How can the S3 approach or similar, relevant or related approaches enable regional partnerships to take their Triple/Quadruple Helixes into Mode 3? Regional systems of innovation are characterised by lock-ins ([39]). Moving a Quadruple Helix

Figure 7: From Triple to Quadruple and Quintuple Innovation Helix Perspectives



into Mode 3 ([40]) requires sophisticated initiatives in path breaking and new path creation.

- In this respect, the S3 Guide refers to the theory of 'the process of Entrepreneurial Discovery' outlined by Foray ([41]). Other relevant S3 tools are 'peer review' and 'critical friendship'. What are the experiences with these tools? Are they adequate, or should they be developed further?
- To what extent does S3 open up for an extension of the Triple Helix into a Quadruple Helix (Q4) ([42]) taking the broader societal context (including the national system) of the regional system of innovation into consideration, as well as the Quintuple Helix, taking a new look at the limitations and possibilities of the natural environment and natural resources of the region?
- With reference to 'entrepreneurial discovery', to what extent does S3 enable the formation of new and unique regional strategies, based on re-combinations of knowledge assets embedded in the region?

- S3 is expected to set in motion a new dynamic in regional level partnerships and institutions set up to promote regional systems of innovation. According to Carayannis and Campbell (2012) ([43]), the concept of open innovation diplomacy (OID) ([44]) encompasses the concept and practice of bridging distance and other divides (cultural, socio-economic, technological, etc.) with focused and properly targeted initiatives to connect ideas and solutions with markets and investors ready to appreciate them and nurture them to their full potential. In this sense, OID qualifies as a new and novel strategy, policy-making, and governance approach in the context of the quadruple and quintuple innovation helices. A particular aspect of OID in the context of Quadruple Helix is co-existence, co-evolution, co-specialisation and co-optation of different paradigms of knowledge and innovation. With reference to this topic, these questions may be raised:
  - To what extent is the S3 or other relevant, related or similar approaches enable regional actors to do open innovation diplomacy (OID)?
  - What is the role of S3 or other relevant, related or similar approaches in discovering new ways of co-evolution and co-specialisation of university based scientific knowledge, following the STI mode of innovation, with industries usually applying practice-based knowledge following the DUI mode of innovation, as well as the modes of innovation and knowledge in the 'creative' industries based on art and design?
  - To what extent does S3 or other relevant, related or similar approaches open up for entrepreneurial (mode 3) university strategies, where universities take responsibility for the Quadruple Helix?
- Going GloCal — transnational and higher order learning (L3) ([45]) and metrics, measurement, management (M3) ([46]) for growth? The S3 – Europe 2020 strategy is intended to enable deeper integration of regional Triple / Quadruple Helixes into European and global systems of innovation.
  - Globalisation of universities, industries, and regional policy institutions, i.e. all three corners of the Triple Helix, through transnational learning.
  - Impacts of transnational learning on the locally based dynamics, structure and processes inside the Triple helix. For instance, what is the role of 'critical friends' and 'peer review' in the development of regional S3 strategies? The significance of transnational learning on the formation of new knowledge ecosystems.
  - The nature, dynamics, role and impact of higher order learning (in public and private sector as well as regional and sectoral contexts and the policy and practice implications for policy-makers, practitioners and civil society at large).

In a discussion of the role of the environment as a driver and delimiter of smart, sustainable and inclusive growth, Carayannis, Campbell and Barth (2010), outline the following ideas and concepts that may be of both conceptual and practical use regarding theory, policy and practice considerations for RIS3 ([47]):

- The challenge of sustainable development (under the aspect of global warming) proves that there are currently several crucial questions that need to be answered ([48]): So new political goals must be formulated, in reference with CO_2 emission limits, in the quest for a long-term sustainability. Furthermore, there is rising demand for 'new green' knowledge solutions and know how in order to utilise resources innovatively for society and the economy in an environmentally conscious manner. Moreover, our present way of life and lifestyle must be scrutinised under a sustainable impact assessment. Apart from environmental protection, it also demands the protection of biodiversity (see Barth 2011a; Bhaskar 2010; Le Monde diplomatique 2009, pp. 22-23, 72-73, 92-93; UNDP 2007). Global warming concerns us all as it takes place on a 'local' as well as 'global' level and implies ramifications for the 'gloCal knowledge economy and society' ([49]). It is clear that the challenge of global warming is accompanied with the challenge of sustainability (for the

world) in the 21st century ([50]). Therefore, there are nine areas, of which Carayannis and Kaloudis write about, that require 'sustained action', political and economic 'leadership' or 'empowerment' and 'intelligent use of technology' (Carayannis and Kaloudis 2010, p.2)

1.) 'Financial/Economic system' ([1]);
2.) 'Environmental challenges' ([2]);
3.) 'Feed and heal the world challenges' ([3]),
4.) 'Energy challenges' ([4]),
5.) 'Educational challenges' ([5]),
6.) 'Political democratic reform across the world' ([6]),
7.) 'Transformative government across the world' ([7]),
8.) 'Equity and Security across the world' ([8]),
9.) 'Technology, innovation and entrepreneurship as drivers of knowledge societies' ([9]).

([1]) The area of 'Financial and Economic system' refers to financial and economic aspects of the effects of climate change. The following question arises (among other things): How should the two systems effectively change or adapt with-each-other in order to reduce or exclude crises in consequence of climate change (see for example: Barbier 2009; Barth 2011a; Green New Deal Group 2008; Hufbauer et al. 2009; Meyer 2008; OECD 2010; Sen 2007)?

([2]) The area of 'Environmental challenges' has to do with causes and effects of climate change and which political and social measures should be taken to increase environmental conservation and sustainability (see, for example: IPCC 2007a, 2007b; Giddens 2009; Høyer 2010a; Müller and Niebert 2009; Stern 2009).

([3]) The area 'feed and heal the world challenges' emphasises new and solution-oriented approaches under the aspect of knowledge and care in the course of climate change (see Parker 2010; Höll 2006).

([4]) The area of 'energy challenges' highlights new green technologies and renewable energy, which lead to sustainable development (see also Barbier 2009; Green New Deal Group 2008; Høyer 2010b; UNEP 2008).

([5]) The area 'educational challenges' is based on a better education as a key for empowerment, equality of chances and new knowledge for sustainability and development (see, for example, OECD, 2009; O'Donnell, 2004; Sen, 2007; UNDP, 2010).

([6]) The area 'political democratic reform across the world' promotes democracy as being a local and global key for sustainable development. Here, also the themes of democratisation, freedom, equality, policy-making, gender, and political culture are relevant (see, furthermore, Barth 2011b; Biegelbauer 2007b; Campbell 2007; Campbell and Schaller 2002; Kreisky and Löffler 2010; Otzelberger 2011; Ulram 2006).

([7]) The area 'transformative government across the world' has to do with the political standing or rating of a nation-state. Examples here are the search for democracy, quality of democracy, types of political systems, etc. (see also Barth, 2010, 2011a, 2011b, 2011c; Campbell 2008; Campbell and Barth 2009; Campbell et al., 2010; Diamond and Morlino 2005; O'Donnell 2004; Rommetveit et al. 2010; Schumpeter 1976; Tilly 2007).

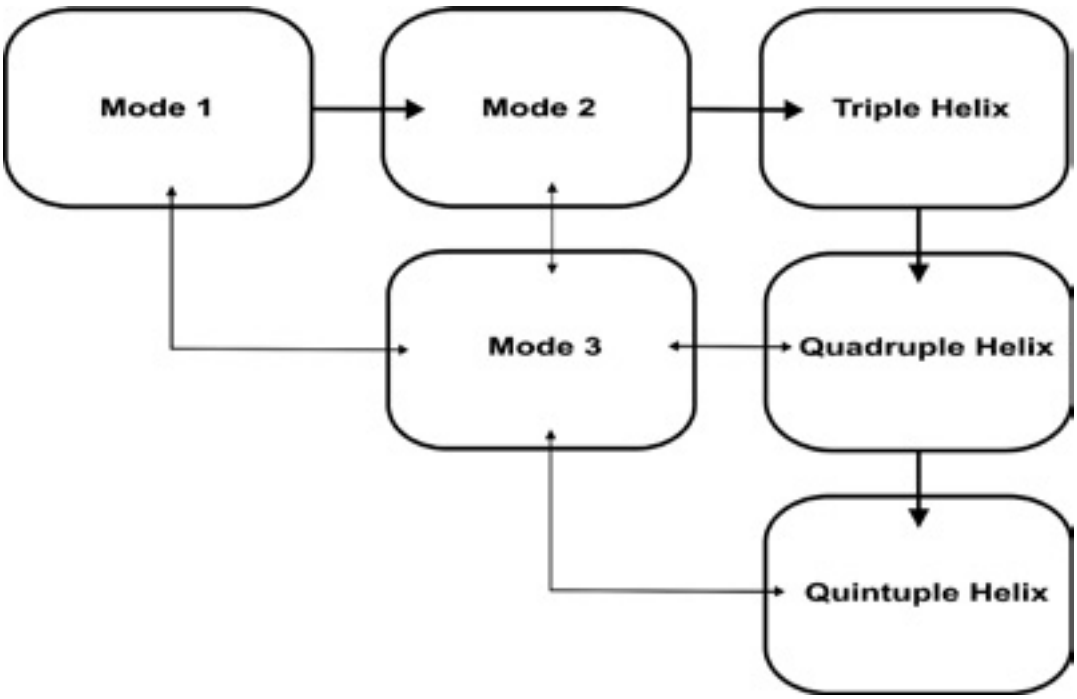
([8]) The area 'equity and security across the world' refers to equity and security as being basic prerequisites to foster and support sustainable development (see, for example: UNDP 2011; Barth 2011a).

([9]) The area of 'technology, innovation and entrepreneurship as drivers of knowledge societies' emphasises the fact that a sustainable development in knowledge societies can only be achieved when new knowledge is promoted and produced and when innovations (with a new entrepreneurship) are developed further (see here the idea and concept of the 'Academic Firm', Campbell and Güttel. 2005; see also and furthermore Bhaskar 2010; Biegelbauer 2007a; Campbell 2006; Carayannis and Campbell 2006, 2009, 2010, 2011; Dubina 2009; Dubina et al. 2012; Kuhlmann 2001; Lundvall 1992; Nowotny et al. 2003).

Let us consider now in greater detail the production of the resource of knowledge. Knowledge (for example, the advancement of green technology) can act as key to success for sustainable development. Essentially, it should be understood today that nation-states that concentrate on progress of society, a higher competitiveness of their economies or a better and sustainable quality of life, have to apply the resource of knowledge. In the transformation to a knowledge-based society, knowledge-based economy or knowledge-based democracy ([51]), also under the aspect of climate change, it is possible to generate new and usable knowledge in conjunction with sustainable development. The resource of knowledge, therefore, turns into the 'most fundamental resource' (Lundvall 1992, p. 1), with qualities of a 'knowledge nugget' ([52]). Knowledge, as a resource, is created through creative processes, combinations and productions in so-called Knowledge Models or Innovation Models and thus becomes available for society: 'We can also call this the creativity of knowledge creation' ([53]). We want to refer here specifically to six currently existing models of knowledge creation and innovation creativity (see also Figure 8 and ([54])):

- '**Mode 1**' (see Gibbons et al. 1994): Mode 1 'focuses on the traditional role of university research in an elderly 'linear model of innovation' understanding' and success in mode 1 'is defined as a quality or excellence that is approved by hierarchically established peers' ([54])
- '**Mode 2**' (see Gibbons et al. 1994): Mode 2 can be characterized by the following five principles: (1) 'knowledge produced in the context of application'; (2) 'transdisciplinarity'; (3) 'heterogeneity and organisational diversity'; (4) 'social accountability and reflexivity'; (5) and 'quality control' (Gibbons et al. 1994, pp. 3-4).
- '**Triple Helix**' ([55]): The 'Triple Helix overlay provides a model at the level of social structure for the explanation of Mode 2 as an historically emerging structure for the production of scientific knowledge, and its relation to Mode 1', and it is a 'model of 'trilateral networks and hybrid organisations' of 'university-industry-government relations' ([56]) (see Figure 8).
- '**Mode 3**' ([57]): 'The concept of Mode 3 is more inclined to emphasize the co-existence and co-evolution of different knowledge and innovation modes. Mode 3 even accentuates such a pluralism and diversity of knowledge and innovation modes as being necessary for advancing societies and economies. This pluralism supports processes of a mutual cross-learning from the different knowledge modes. Between Mode 1 and Mode 2

Figure 8: The Evolution of the Three Modes of Knowledge Creation (Carayannis and Campbell, 2009)



manifold creative arrangements and configurations are possible, linking together basic research and problem-solving' ([58]). Mode 3 'encourages interdisciplinary thinking and transdisciplinary application of interdisciplinary knowledge' as well as 'allows and emphasises the co-existence and co-evolution of different knowledge and innovation paradigms' ([59]).

- '**Quadruple Helix**' ([60]): The Quadruple Helix Model is based on the Triple Helix Model, adds as fourth helix the 'public', more specifically being defined as the 'media-based and culture-based public' and civil society. This 'fourth helix associates with 'media', 'creative industries', 'culture', 'values', 'life styles', 'art', and perhaps also the notion of the 'creative class' ([61]).
- '**Quintuple Helix**' ([62]): The Quintuple Helix Model is based on the Triple Helix Model and Quadruple Helix Model and adds as fifth helix the 'natural environment'. The Quintuple Helix is a 'five-helix model', 'where the environment or the natural environments represent the fifth helix' ([63]): 'The Quintuple Helix can be proposed as a framework for transdisciplinary (and interdisciplinary) analysis of sustainable development and social ecology' ([64]) (see also later our analysis in Section 3).

About these six briefly described models can be concluded that in a knowledge society (and knowledge democracy), at the national level, a network-style linkage of knowledge is being processed, and each model fulfills a specific contribution for the 'creation, diffusion and use of knowledge' ([65]). In reference to sustainable development, under the aspect of global warming, we should add: whether in the future a state (nation-state) is leading in world politics as well as in the world economy is also being determined by the social (societal) potential to balance new knowledge, know-how and innovation with nature. The basic innovation 'core model' of the Triple Helix focuses on the knowledge economy. Quadruple Helix already brings in the perspective of the knowledge society (and of knowledge democracy). From the point-of-view of the Quadruple Helix innovation model it is evident that there should be a co-evolution of the knowledge economy and of knowledge society (see also Dubina et al. 2012). The Quintuple Helix finally stresses the socio-ecological perspective of the natural environments of society. Social ecology focuses on the interaction, co-development and co-evolution of society and nature ([66]).

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([9]) http://ec.europa.eu/regional_policy/sources/docgener/evaluation/expost2006/urban_ii_en.htm

([10]) EU15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom

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Appendix

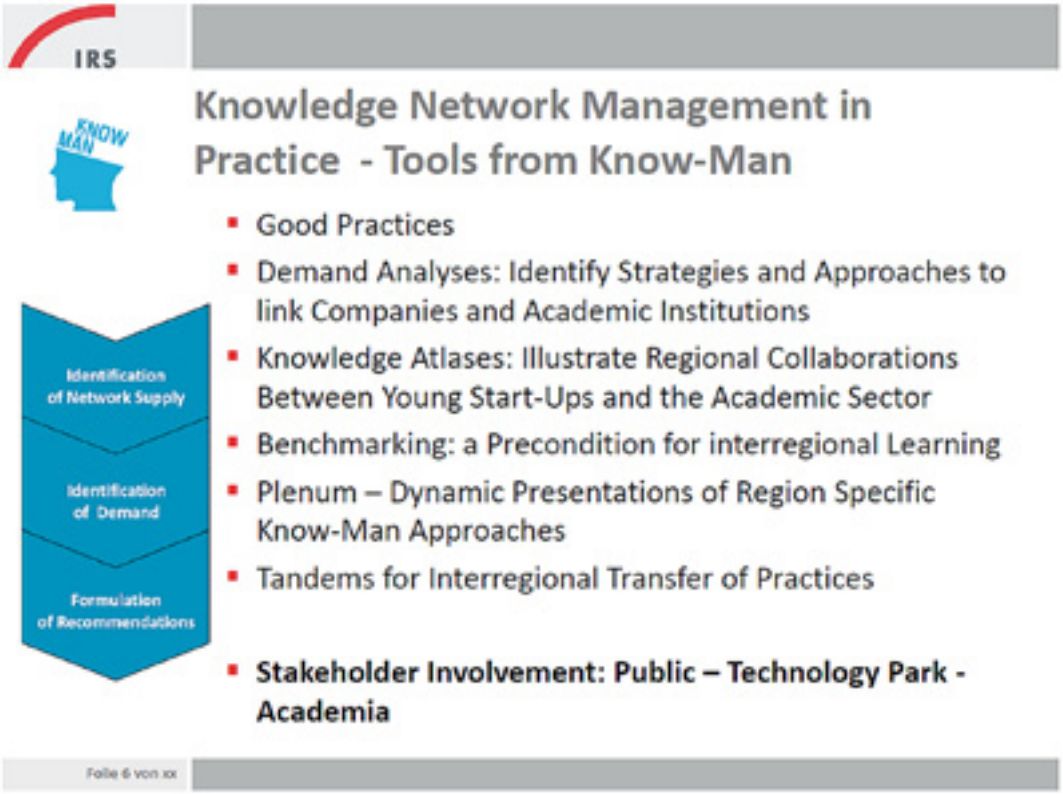
Good practices emerging from theory and practice

In this context, some key remaining challenges and opportunities for theory, policy and practice as well as foundations for establishing good practices from theory and practice:

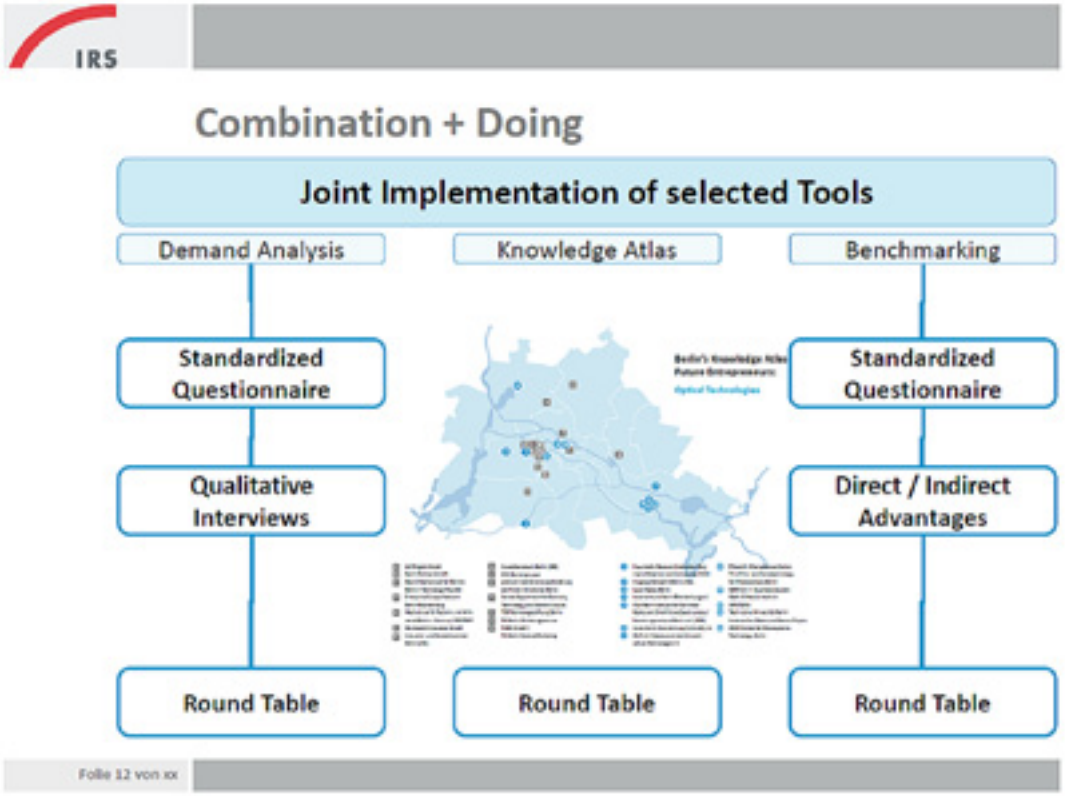
1. empirically based research on the on-going S3 experiment
2. theoretically or conceptually based analysis and discussion with relevance for S3 as well as
3. empirical studies of Quadruple Helix processes or strategies which may be seen as relevant to the future development of S3.

Examples of good practices emerging from the experience of diverse regions and projects, are outlined briefly below:

Appendix 1



Appendix 2



Other best practices may be found at:

- http://s3platform.jrc.ec.europa.eu/en/c/document_library/get_file?uuid=e50397e3-f2b1-4086-8608-7b86e69e8553
- http://wbc-inco.net/object/document/10299
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CHAPTER II

The European Setting

The EIT's Knowledge and Innovation Communities (KICs): towards European Innovation Factories

Abstract

Since the European Institute of Innovation and Technology's (EIT) set-up, the concept of the Knowledge Triangle was considered the basis for its future Knowledge and Innovation Communities (KICs) — a new model of accelerating growth and jobs creation. The Knowledge Triangle encompasses research, education and innovation itself and captures interactive exchanges and flows between the three areas. It has been acknowledged that Europe is strong in all three corners of the Knowledge Triangle, but that they often act in isolation. At the same time, it is recognised that there is a missing element in this Triangle that is linked to the underlying limited ability to better exploit knowledge assets in Europe. The present chapter deals with the implementation of an experimental model of new innovation networks in Europe. These were designed to catalyse innovation to become a value driver — value defined as a new generation of entrepreneurial Europeans, new ventures, new products, and new processes.

Introduction

Humankind is facing increasingly complex societal challenges. Examples are environmental destruction and pollution, climate changes, infectious diseases — still a key threat to human life, untreatable neurodegenerative and malignant diseases, overpopulation and dramatic demographic imbalances, restricted access to renewable energy — to name only a few of them. Innovation is generally considered as a key means to overcome these challenges, but do we understand its nature? One is astonished how many people, even in top decision-making positions, restrictively allude to discovery, invention and translation, when talking about innovation. It is not always understood that innovation only strikes if novel, and sometimes disruptive, services and products return to the people.

As a result, the public debate regarding the acceleration of innovation is often restricted to specific requests for example to increase budgets for academic research, to spend more money on education, to support programmes translating basic into applied research or to subsidise businesses with innovative potential. Correspondingly, the common understanding of the value chain is often limited to a pretty linear view: Higher education provides the human resources to conduct basic research, which is in turn translated to applied research leading to prototypes picked up by industry that markets the product to customers.

It is often believed that novel products 'just pop out' of laboratories. In reality there are enormous efforts of complex networks needed to secure smart investment, to provide interdisciplinary connection between academia, research institutes, businesses, local and national authorities, non-profit sector and — to a growing degree — of end users. Many people not involved in this process are often shocked to learn that the development of a single novel product may need a private investment that can reach a level of hundreds of EUR millions — as in the case of some pharmaceuticals, or that an old military technology deployed in a different setting may change the way how people communicate, work, and entertain — as in the case of the Internet ([1]).

Creativity, Invention and Innovation

Regarding innovation, both policy makers and business leaders often assume that it is driven by single geniuses: while there is no doubt that outstanding individuals, like Nils Bohr, Carl Benz and Alexander Fleming have made outstanding contributions leading to subsequent innovations, the detailed analysis of their stories often reveals that complex networks of individuals not seen in the background were key to bringing their inventions and discoveries to the customer.

Take, for example, Alexander Fleming. He did isolate the antibacterial product of mould by serendipity which he coined penicillin, but was not in charge of developing the antibacterial drug that entered clinical trials 14 years later at the beginning of the Second World War. While his invention was the first step of a long journey towards saving the life of millions of patients, he himself was not in contact with the medical and pharmaceutical team that transformed penicillin into a usable drug with acceptable side-effects and efficacy ([2]).

Whilst underpinning the role of people in innovation who are not on the front-page, it is also worthwhile to share another story, the one of Bertha Benz, with her maiden name Ringer, and her creative spirit, wit and courage who took innovation to people and markets. In 1871, she invested her dowry in the workshop producing gas-driven engines of her fiancé, Karl Benz, a university-educated civil engineer, talented developer of machines, who was however unable to sell his inventions and their usefulness to the people. His first patented automobile powered by a combustion engine, failed to find a customer.

In 1888, without telling her husband, Bertha drove the newly constructed vehicle the one-way distance of about 106 km, becoming the first person to ever drive an automobile over a real distance. Although the purpose of the trip was to visit her mother, Bertha Benz also had other motives: to prove to her husband and the customer that the automobile, they both heavily invested in, would become a success once it was shown to be useful. On the way, she solved numerous challenges. She had to find ligroin as fuel, available only at apothecary on her journey. A blacksmith helped her to repair the brakes and, in doing so, Bertha Benz invented brake lining. She also had to use one of her own stocking garters to insulate a wire. She left her hometown, Mannheim, around dawn and reached her mother's home in the city of Pforzheim sometime after sunset.

She recorded everything that had happened along the way and made important suggestions, such as the introduction of an additional gear for climbing hills and brake linings to improve brake-power. Most importantly, she demonstrated to the customer that her husband's invention is a useful innovation that has — for good or for bad — evolved into life changing high impact product ([3]).

From her story, one can learn that human ingeniousness and the usefulness of innovation are key to success; that one also has to bet money on innovation; that outsiders and people not at the top of the innovation hierarchy are pivotal; that learning and smart steps in innovation do not rely on official university education; that risk taking is a key step towards innovation; that building networks is instrumental, such as converting a blacksmith and pharmacist to supply chain providers; that communication between people of different skills and background gives rise to breakthroughs and last but certainly not least, that innovation has to include the customer.

The story of Bertha Benz discloses that more than a 100 years ago, Europe was inspired and highly populated by individuals who took their chances by setting up companies driven by innovation, which have and are still impacting our lives. Names such as Nobel, Reuther, Siemens, Citroen and von Behring are not fancy brand names of corporations, as one may believe, but remind us that European entrepreneurs have changed the world.

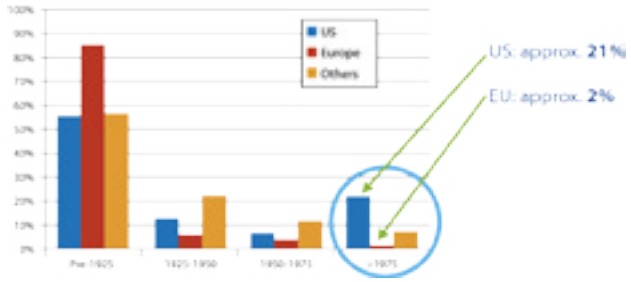
At the same time we are all aware that our 'old' continent has difficulties to keep up with the pace of global innovation and big time US names, like Gates, Boyer and Alafi, remind us that beacons of their class are a rarity in the European innovation landscape of today. This recognition is painful in light of the fact that Europe has enormous assets for the various 'players' needed in the innovation arena. There is a high degree of education at all levels, a solid academic and industrial research base, a resource of historical power houses in research & technology, still a sizable share of Nobel Prizes each year, an increasing number of research centres of excellence, an impressive landscape of competitive corporations and strong SMEs, a long tradition of product development and growing European interaction between national R & D players. Thus, we are left with the question: 'Why are these enormous resources not better utilized to keep Europe up in the top league of innovation?'

The EIT and a European Approach to making Innovation happen

In the Open Innovation Yearbook 2013, Stephane Distinguin points out that Europe needs a distinct model of innovation as compared to the Silicon Valley one to overcome its shortcomings ([4]). The authors of this article agree with this point of view. There is a long list of failures in trying to copy Silicon Valley. Europe's innovation model needs to be designed by building on its strengths, such as free flow of products and services, capital, talent and knowledge, and its existing tremendous innovation capacity. Furthermore, the authors of this article not only agree but have been involved in the design of such a model, tested it, calibrated and scaled it up.

One of the most daring experiments in the innovation policy arena was launched six year ago. Following the political agreement between the European Parliament and Council in March 2008, a group of 18 people appointed to the Governing Board of the European Institute of Innovation and Technology (EIT) met for the first time on 15 September 2008. Their task was to translate the legal texts setting-up the Institute into a strategy and a roadmap to develop an Institute successfully achieving its mission. The mission of the EIT is to create a new operational model of how innovation is managed and financed at a pan-European level and

Figure 1: The knowledge triangle that is research, education and innovation as well as technology, business, and customers with their needs and aspirations, need to be integrated by entrepreneurs who are able to create value.



Source: Veugelers, R. (2009), A Lifeline for Europe's Young Radical Innovators, Bruegel Policy Brief, Issue 2009/1 March 2009. Note: Figure based on a sample of 226 companies, obtained from matching firms in the FT Global 500 from 2007 with the 2007 EC-IPTS Top 1000 EU and non-EU R&D scoreboard companies. Leading innovators are thus defined both by their market capitalisation and R&D expenditures. The US has 80 companies in this sample, Europe 86 and other countries 60.

to deliver growth and jobs to the EU through this novel approach to innovation.

That 15 September was a remarkable date, also for another reason, probably more well-known reason. On the same day, the renowned investment bank, Lehman Brothers, went into bankruptcy. Meeting for the first time, the founding Governing Board led by its first Chairman, Martin Schuurmans, was only unified by the thought and prospect to find an opportunity in the crisis and the will to not implement 'more-of-the-same' regarding innovation policy in Europe.

The EIT Governing Board comprised a group of interesting and strong individuals from all over Europe, covering many aspects of competence that are relevant for innovation. Previous CEOs or Chief Executives from leading innovative corporations, co-founders of renowned high tech enterprises, presidents and vice-presidents of modern and first-class universities, representatives of well-backed-up private foundations supporting first class science and innovation and acknowledged academics studying intrinsic features that make societies innovative.

The broad collection of backgrounds and the mandate given to the Board warranted from the beginning the potential in the build-up stage of the EIT. Luckily, the legislators behind the EIT concept granted an unprecedented degree of creative freedom to the Board members to structure its future. On the other hand, Governing Board members also had to realise that the EIT only would have a future as a game-changer in Europe's complex innovation landscape, if tangible results could be demonstrated by 2012, when the process behind the EU budget allocation for the period of 2014 to 2020 was expected to start.

Facing this dilemma during autumn 2008, the Board speeded up to define the future EIT strategy, to set its long and medium term goals, to elect out of its group an executive committee and to implement the needed actions with the highly appreciated support of colleagues from the European Commission in Brussels. In less than 15 months after the 2008 inauguration, the Board was able to designate the first so-called Knowledge and Innovation Communities (KICs) throughout Europe to focus on sustainable energy, climate change mitigation and adaption, and the future information and communication society. The KICs and their impact on Europe's competitiveness are discussed below.

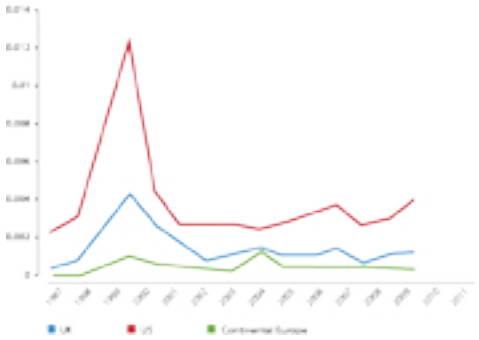
Before reaching this first milestone, the Board went through a number of passionate discussions to find and agree upon the 'business model' of the EIT. There were many ideas in the air on how to tailor the mission of the EIT. It was recognised that for innovation to happen, communication across disciplines is key. Based on the advice of Gottfried Schatz, the former president of the Swiss Research Council, that 'creative ideas are children of solitude, yet are rarely conceived in isolation' some Board members pointed out that the EIT should become a think tank fostering innovation throughout Europe and others — more business-minded — that scientists must be taught to manage whilst members with educational responsibilities underlined the necessity to change the mindset of students towards the somehow wider term of open innovation.

Martin Schuurmans reiterated his key message that innovation is best fostered in a multicultural, interdisciplinary and game-changing environment ([5]). Everybody felt there was a missing link and it was the group most anchored in the arena of entrepreneurship that threw this topic into the debate. The

knowledge triangle that is research, education and innovation as well as technology, business, and customers with their needs and aspirations, need to be integrated by entrepreneurs who are able to create value.

It was argued that the true weakness of Europe's innovation landscape is the age distribution of innovative companies. When compared to the USA, only 2 % of European companies set up during the last 25 years belong to the innovation sector, whilst every fifth US company founded in this period belongs to the innovation sector, often stemming out of universities ([6]). Only 0.0006 % of the GDP are placed into VC capital funds in continental Europe, while 0.004, i.e. six times as much, of the US GDP is funneled into VC funds investing into the future of the United States ([7]).

Figure 2: European VC investment continues to lag the US Share of GDP



Source: Marston L., Collins, L., Bravo-Biosca, A. Lane, H., (2013), Unchaining Investment. Barriers to US venture investment in UK Internet and digital businesses, Nesta Report, June 2013

Some of the questions raised in the debate were as follows: Could entrepreneurship be an integrative force for the Knowledge Triangle components? Could it act as a facilitator and accelerator of different kinds of flows across the Triangle? What could entrepreneurship mean in the specific context of the EIT and its KICs? For example, how would this concept materialise in a new funding model and trust-driven governance by the EIT towards its KICs? How would it create value for large industry through entrepreneurship, open innovation learning environments, or corporate venturing? What would be the right model for entrepreneurial education for engineers and scientists? How to shorten the time from labs to markets and society?

The concept of value creation brought a vivid discussion among Board members representing all the Knowledge Triangle. Some defined it as capital returns, others as social value, in terms of jobs and education, yet others, referred to the complex challenges at a regional or global scale. We talked about value in the context of the Knowledge Triangle which is different for diverse stakeholders collaborating in such an open innovation environment. We realised that it is yet different for a university professor who also would like to start a company but it will also be different for a publicly funded agency such as the EIT.

The discussion on value creation strengthened the role of entrepreneurship as the very process during which innovation is brought to markets and society. Most people think that if the company does not produce revenues and is not profitable for the long run, it does not create value. However, looking at biotech industry initiated out of the San Francisco area, we can learn that innovative companies can create value not necessarily built on revenues and profits. In the case of the biotech industry, approximately 90 % of these are so called virtual values. It means that there is no direct correlation between revenues, profits and company valuation. Even 80 or 90 percent of all biotech companies have no regular revenues, no profits, do not even have a product on the market but they still convey very important economic value as well as social value developing knowledge, educating employees and tackling public health challenges.

Not welcomed by all members and initially with some reluctance, the Board finally accepted and unanimously backed up the notion that focusing the innovation strategy of the EIT on entrepreneurship could be its unique selling proposition and the best chance to succeed with impact ([14]). We concluded that in the context of the EIT value should be defined both in economic and social terms. This recognized the complex reality of an open innovation environment in which all stakeholders have their own interests and goals and they all contribute to value creation.

The EIT and its KICs — State of the art and First achievements

The EIT has defined itself as a high impact innovation investment institute. This novel entrepreneurial Institute is to seed trans-European ecosystems

where research, business and higher education come together on topics of societal challenges. These ecosystems are not single clusters but networks of clustered partners. Knowledge, talent and funding flows between them; thus building interconnected knowledge that breeds intra- and entrepreneurs. These strive, in the long term, to create trust from venture capital and other investors ([6]).

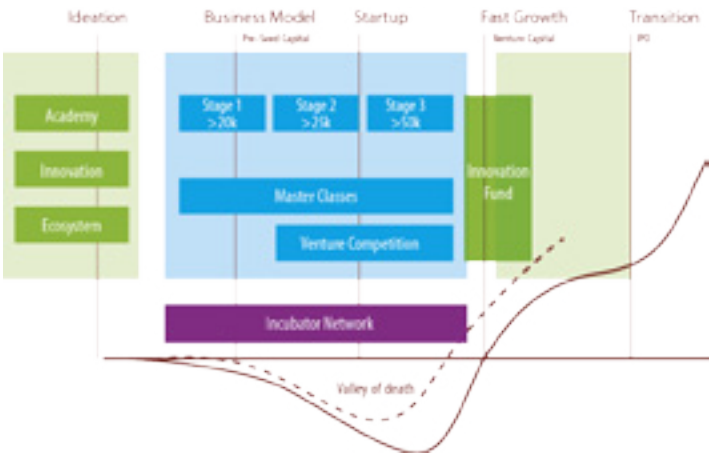
In 2009, only one year after its set-up, the EIT was on the verge of making its first footprint in the European innovation arena. The Institute launched a Call for Knowledge and Innovation Communities (KICs) ([8]). The KICs — a particular new type of innovation networks bringing research, higher education and business together — were to become the key operational arms of the EIT. The Call document was only nine pages long and stood in sharp contrast with typical European call documents and the language therein. Moreover, quite disturbing as some still advocate, the Call was not prescriptive and vague. Indeed this was the case: the Call was meant to be inspirational and empowering, to focus thinking on outcome and impact rather than inputs and available budget. There were just few conditions and few guidelines on what made a KIC — a KIC.

As a result of the Call, the Board selected three highly integrated partnerships: Climate-KIC in the area of climate change mitigation and adaptation, EIT ICT Labs operating within the theme of future information and communication society and KIC InnoEnergy focused on sustainable energy. Each of the KICs defines its own legal structure and governance model. They are each structured across Europe in five or six so-called co-location centres that are a physical location where people working in a KIC from all disciplines and cultures come together. Each KIC has a broad portfolio of activities integrating research, higher education, innovation, and instilling entrepreneurship in this process. Their goal is to educate generations of entrepreneurial Europeans, breed new high-growth companies, and deliver new products and processes. They experiment, innovate and learning-by-doing.

Climate-KIC drives innovation in a new, largely still non-consolidated sector. Private-public partnerships are often the right vehicle to develop and implement complex solutions to mitigate and to adapt to climate change. Regions and cities partner with universities and companies. The entrepreneurial small and early-stage companies try to integrate a fully-fledged value chain in this emerging and fragmented market. One of the first achievements of Climate-KIC were its education related offerings and in particular the Contextual Learning Journey, a summer 'crash course' in entrepreneurship. Climate-KIC offers EIT-labelled degrees, including PhD level. Interestingly, as the KIC's CEO, Mary Ritter, states, it has redefined the incentive system: if a student drops out of the programme to start a business, this is considered a success. The KIC already has made a wide impact. It has impressive students and alumni, who have formed an alumni association that has become an official KIC partner.

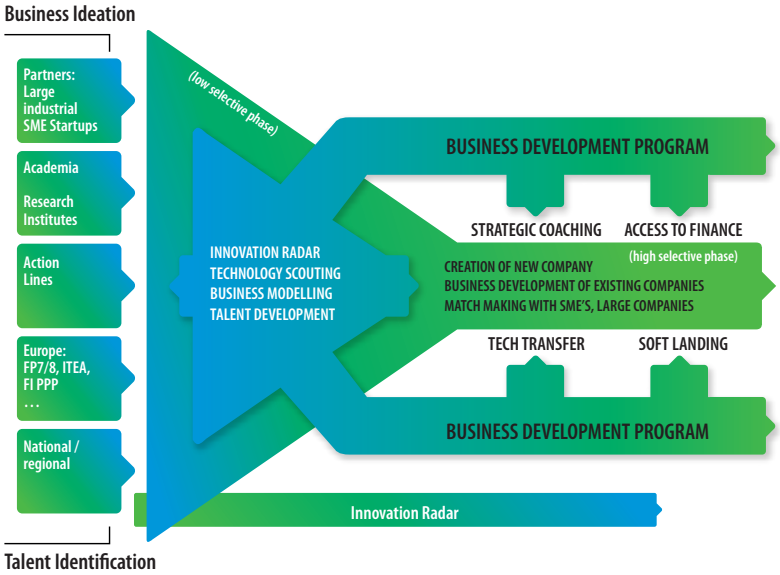
EIT ICT Labs innovates in the areas of future information and communication society. It has developed a 'catalyst-carrier model' that is based on the EIT funding as a catalyst for leveraging existing ICT capabilities and resources in Europe. Some business-related 'catalysts' activities foster innovation linked with entrepreneurial activities in the industrial setting. Industry partners are interested in joint projects because this open framework helps them come together in a neutral environment and better understand emerging trends in technology

Figure 3: Climate-KIC Business Incubation and Acceleration Model



Source: Climate-KIC

Figure 4: : EIT ICT Labs Entrepreneurial Talent and Venture Development Model

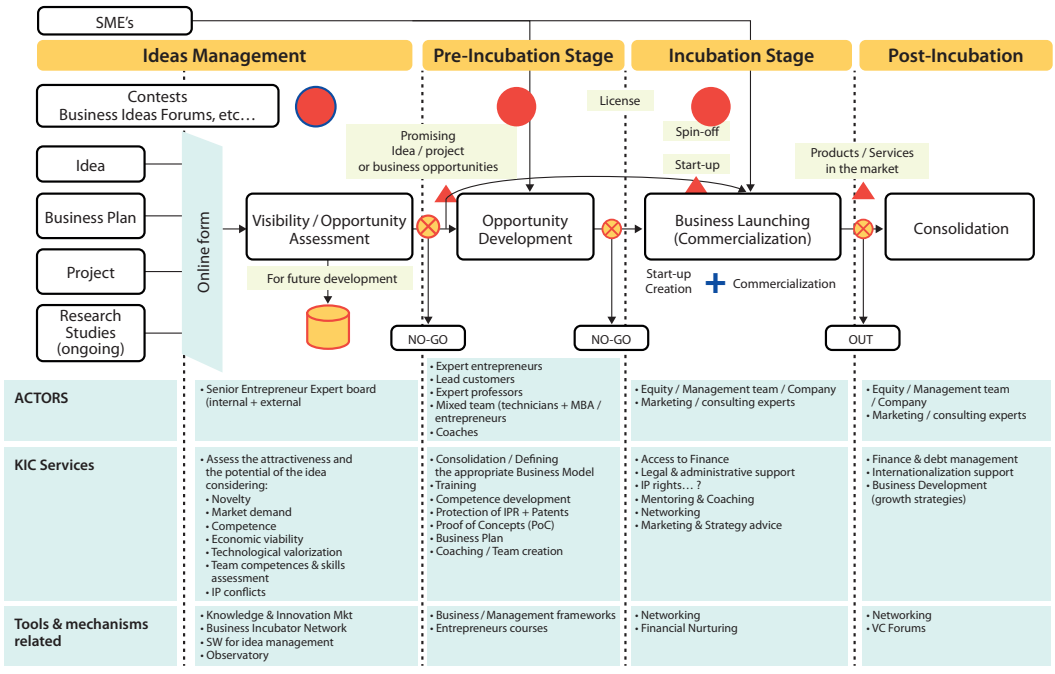


Source: EIT

development and market expectations. For example, their 'Innovation Radar' offers a platform of collaboration between companies, which often compete on the market — Siemens, Ericsson and Nokia. EIT ICT Labs leads a collaborative effort to work on industry standards. If they succeed in creating a common framework, they will leverage the single European market, as per the case of GSM technology. The KIC also supports entrepreneurs. It is working on a new finance facility with the European Investment Fund. It manages a number of business networking events and has an in-house soft-landing service allowing entrepreneurs to explore possibilities around the KIC's co-location nodes.

KIC InnoEnergy deals with sustainable energy. It is the only company among the KICs as the other two are associations. The KIC's shareholders agreed on a business model that will hopefully lead it to financial sustainability. The KIC expects to own a portfolio of shares in companies that enter its flagship initiative — the Innovation Highway™. The Highway

Figure 5: Examples from the KICs: KIC InnoEnergy Highway



is a pan-European incubation/acceleration network. It has six entry points physically located on the premises of KIC's co-location centres. KIC InnoEnergy houses the ventures for a limited period of time during which it provides coaching and helps with marketing and business development. It is a 'one stop shop' that supports start-ups through an integrated process from the earliest stages of incubation to post-revenue. The value proposition offered by the KIC is access to the first customer in return for equity.

All the KICs have been actively developing a portfolio of educational offerings, testing transnational incubation models and searching for innovation projects to accelerate their development process. They all proved successful and have attracted substantial private sector commitment, which is contrary to prevailing trends. They continuously extend the number of partners and in some cases establish new co-location centres. More importantly they attract the best entrepreneurial talent and a significant part of their students are non-Europeans. Actually the most important asset of the KICs, their real value are students. Europe needs young entrepreneurial engineers and scientists, able to collaborate in trans-disciplinary, international teams. We witness today the first EIT and KIC alumni, not only get a respected degree but also 'on the spot' get into business and start companies ([1]).

The KICs as a Tool to foster 'Open Innovation'

Open innovation in the KICs is really about getting all the players together in one arena both physically and virtually. The text of the first Call specified: 'KICs will be characterised by geographically distributed people who are brought together for significant periods to work in centres where individuals from different types of organisations and cultures (nationalities, industry, academia, research etc.) are co-located in significant parts of the innovation chain (co-location centres). This co-location of people will allow stakeholders to work together face-to-face and move forward effectively towards KIC goals. The co-location centres are expected to be the lead nodes amongst a much larger number of partners in the network. It is anticipated that KICs will typically involve four to six co-location centres or lead nodes. (...) Notwithstanding geographical co-location, all necessary means should be used to ensure a continuous linkage between all the partners in the KIC.' ([8]).

However, open innovation is case specific. In the ICT industry, patents, exclusivity, and IP protection are less important than in the energy sector. The simple reason for this is that in economic terms, the development cycle of a new product, service or treatment is in the case of the latter can last seven to ten years. It is a long investment and there needs to be at least some warranty to the investors. In the field of ICT the time from idea to market becomes ever shorter. If an improvement to a product takes one or two years, then taking the risk of free floating information is worthwhile since there is always competition and somebody may pick up an idea before it is formally protected. The KICs have individual policies for structuring open innovation partnerships and intellectual property management.

Climate-KIC has partners in five geographically distributed nodes: London, Paris, Eindhoven, Berlin and Zurich. Each co-location is responsible for interlinking with the local and regional existing structures and thus invigorates local innovation ecosystems. A parallel network is made of six Regional Implementation Centres or RICs in Poland, Hungary, the United Kingdom, Germany, Spain and Italy. RICs allow the KIC's network to extend beyond co-locations. Participating regions become test-beds for innovation. The RICs offer a programme 'Pioneers into Practice' that matches local entrepreneurs with internship opportunities within the KIC's network. They perform an important function as outreach arms of the KIC. For example, a RIC in Lower Silesia, Poland, is strongly supported by the municipality of Wroclaw. The EIT+, a company that is a joint venture between the city and the five largest multidisciplinary universities in its metropolitan area, has become a centre of competence in climate related technologies. It extends the Climate-KIC network to potential partners in the Czech Republic and other countries. Last year the RIC hosted the Climate-KIC Innovation Festival that attracted over 600 participants that came to Wroclaw for a couple of days to network, brainstorm, and build trust and relations — core assets in an open innovation environment.

EIT ICT Labs has extended to seven co-location centres located in Berlin, Eindhoven, Helsinki, London, Paris, Stockholm and Trento. The KIC executes projects across these nodes joining research, education and innovation in both academic and industrial settings. These trans-disciplinary projects foster open innovation practices along six action lines: Smart Spaces, Smart Energy Systems, Health Wellbeing, Digital Cities of the Future, Future Media and Content Delivery, Intelligent Mobility and Transportation Systems. The KICs educational programmes are a way of vertically and horizontally integrating the innovation ecosystems of its partners. Mobility of students and faculty across countries and between academia and business as well as the sharing of infrastructure and resources lead to the emergence of hotspots such as the Open Innovation space at Aalto University, where one of the KIC's nodes is housed.

KIC InnoEnergy has six co-location centres: in France, Germany, the Netherlands, Poland, Iberia,

Figure 6: Map of co-location centres

Source: EIT

and Sweden. Co-location centres are embedded into local innovation ecosystems. The CLC Iberia office is located within the UPC campus in Barcelona in the same building as the creativity departments of Intel and Gallina Blanca. Furthermore, the KIC's incubator is hosted by 'Creapolis', the ESADE Business School innovation centre in Sant Cugat. These are two physical co-locations but geographically, CLC Iberia partners are spread from Barcelona to Madrid and from northern Spain to Lisbon. The French node in the Alps Valleys is located in the Giant Innovation Campus of Grenoble, in a central location of the city, in the same building as the CEA. In this area there are many excellent research centres and universities ranked amongst the best in France. The co-location leverages pre-existing large investments to develop national industrial clusters such as Capenergies and Tenerrdis.

Sometimes, at the periphery of the innovation network, a person comes up with an idea that triggers a process that leads to a 'black swan event' ([9]). This is one of the reasons for which KICs develop a mechanism that permits the inclusion into their networks of partners from countries where there is no co-location. They need to have an outreach programme, not only in the sense of sharing practices as a public EU institution, but also for their own benefit, thus understanding that an open innovation environment needs to have an inroad for ideas from the peripheries.

To this end, the concept of competitive and collaborative funding brings interesting results. The former relates to a business-like assessment process of the KICs' strategic visions, operational capabilities and business plans. The latter was introduced in 2012 in order to stimulate development of a cross-KIC agenda. Ultimately, this means that a KIC's open innovation ecosystem will expand into the EIT innovation eco-system. Taking into account the very nature of the open innovation environment which is competition and collaboration, creative ways of finding synergies, to accelerate the flow of people, knowledge, and capital between the networks and to interlink them will exponentially enrich each and every player including those at the very peripheries.

Early Learning, Next Steps & Future Perspectives of the EIT and its KICs

As of 2014, the three existing KICs operate as network enterprises, with their co-location nodes becoming switching points in the European scheme of overlapping academic, industrial, venture capital and other networks. They are business-driven towards financial self-sustainability so that when in the long-term, the EIT funding stops, they will further expand having a sound value proposition based on a strategic vision and a viable business model. They are managed by CEOs, follow business plans and are governed by their respective Governing or Supervisory Boards. Ownership, accountability and personal risk taking are positioned at the centre of the innovation process ([10]).

In a nutshell, the EIT is to boost innovation processes from ideas to products, from labs to markets and from students to entrepreneurs in the areas of high societal need through the Knowledge and Innovation Communities. Joseph Schumpeter referred to an entrepreneur as a driver of economy who by combining assets (including technologies) in new ways creates new opportunities, new markets, new economic values and effectively new demand and supply curves. An entrepreneur, he claimed, succeeds by combining new or existing technologies, capital, equipment manufactured by other businesses and the eagerness of millions of consumers seeking to improves their lives ([11]).

The EIT is indeed about the new wave of entrepreneurial European innovators. The most promising entrepreneurs nurtured within the KICs' open innovation ecosystem are spotlighted in the process and recognised. We celebrate their success with special entrepreneurship awards. The winners of the 2012 and 2013 competitions were Christopher Williams (Naked Energy) and Dominik Peus (Antaco) from Climate-KIC; Rosa Vilarasau (Noem) and Lionel Chaverot (Enerstone) from KIC InnoEnergy; and Patrick Duessel and partners (Trifense) and David Tacconi (CoRehab) from EIT ICT Labs. In 2013, additional special recognition was given through a new category — the C.H.A.N.GE. Award dedicated to young entrepreneurs and change agents of the future. Out of many competing candidates the winners were Kate Hofman (GrowUp) from Climate-KIC, Dorottya Maksay (Homebuddy) from EIT ICT Labs, and Eduardo Appleyard (Solar Lighting for Africa) from KIC InnoEnergy. Their entrepreneurial successes are promising and they are on the right path, building a new European success story and in some instances, returning to European entrepreneurial roots.

If a policy measure manages to change the development trajectory of a country or a region by just a tiny bit in the short term, it makes a huge difference in the long-term. While it may be too early to judge to what extent the EIT and its KICs will become successful, its early achievements should not be underestimated. If we were to point out only one accomplishment of the first years of the EIT and the KICs, it would be that the EIT has managed to refocus European innovation processes on entrepreneurship and this has already brought and will bring far-fetching results in terms of growth, development of human and social capital, and quality jobs. There are early successes to cherish and there are also challenges to face ([12]).

A challenge still ahead is how to manage a large, complex, networked ecosystem like the KICs. A KIC needs a business plan that outlines its expected trajectory towards creating value for its stakeholders. Its stakeholders include the EIT but also industry and academia. The grants administered by the EIT are not to become another state subsidy but a seed investment and therefore the EIT as an 'investor' has to accept the logic of private sector to the extent possible for a European body. Hence the KICs are becoming innovation factories rather than yet another pan-European network. They are expected to have an ambition to become power houses, integrating research, companies, and foremost students into the forefront innovation processes of Europe.

Another issue is that KICs have to understand their business case and this is critical because unless they understand this, they will not be able to deliver value for their shareholders and stakeholders. Some KIC partners express a real concern on how to define the business model of a KIC. In most cases, they expect the KIC to educate a new type of engineers and scientists, integrate value chains and bring academia and industry to work closely together. Indeed, from a broad perspective, the real value a KIC can produce comes from its ability to integrate distributed capabilities to tackle complex challenges.

Another issue is how to distil top talent throughout Europe, bring these people to the KICs and help them take the lessons learned back to their home countries and institutions. The last 20 years of entrepreneurial history of the emerging markets of Central and Eastern Europe, have rolled out the amazing transformation of Poland, Hungary, the Baltic States and other countries in the region. The dynamics of transformation were fuelled by a generation of entrepreneurial people who grasped opportunities and took risks. They created business ventures but also democratic civil society institutions. This entrepreneurial talent should be integrated within the most advanced KICs to bring fresh blood, a different sort of thinking and a 'hungry' immigrant mentality that remains the critical driver of Silicon Valley's success ([13]). Some of them will stay, some will emigrate further, some will return to their home countries. In return, once in their home countries again, KIC alumni will enrich and stimulate local innovation ecosystems.

Over the last years, the EIT strategy and the KIC concept were presented and advocated to other European players in the field. This was done in order to place ownership, accountability and entrepreneurship into the centre of innovation, to overcome the silos mentality of the players within and between Member States and to catalyse the integration of the knowledge triangle. This is how the EIT embarked on its entrepreneurial path. We are learning by doing. We have the courage and imagination to take calculated risks, fail, learn from the mistakes and resiliently continue on the chosen path.

Unleashing individualism and entrepreneurial spirit in academia, in particular at technical universities, engineering, biomedical universities, causes faculties to reflect on how they treat people who are not streamlined and diverge from the typical scientific path. If professors would like to start companies rather than continue university careers, should the system punish them, or should they be given a chance to return to academia in 2 to 3 years' time. Whether they succeed in business or fail, they bring to students as well as to their research a real life experience, a critical perspective and personal creativity. Enriching their professional portfolio they create social value. One of the most important tasks for the EIT as a European Institute is to address factors in Europe that hinder innovation.

If the 'Old' Continent is to avoid a future anchored in its glorious past and solely becoming a top tourist destination, it needs to deal with the lack of people that dare to behave in an entrepreneurial manner. Like Andy Warhol attracted young artists from all around the world to his New York 'factory', in a similar fashion, KIC co-location centres will emerge as innovation powerhouses where entrepreneurial talent is given opportunities to flourish and to make a difference.

Post Scriptum

In Horizon 2020, the EIT is recognized for its achievements and awarded with an unprecedented increase of budget from EUR 308 million to EUR 2.7 billion equivalent to 3.5 % of the overall EU research and innovation budget for the period of 2014 to 2020. This budget will be invested to consolidate the three existing KICs and to launch five more over the next years. Altogether five more KICs will be established in such thematic areas as Innovation for healthy living and active ageing, Raw materials: sustainable exploration, extraction, processing, recycling and substitution, Food4Future — sustainable supply chain from resources to consumers, Added-value manufacturing, and Urban mobility. As a part of Horizon 2020, the EIT keeps its flexibility and experimental character whilst creating stronger synergies and complementarities with other EU programmes. This will hopefully lead to more of the EIT's good practices and processes being disseminated into the mainstream of the framework programmes at the EU and national levels. In such a case, the EIT has played and will continue to play an important role in transforming the innovation system across Europe.

Acknowledgements

The EIT and the KICs became reality due to a group of people who joined forces to make this experiment successful. In this regard, credit has to be given to the current and previous members of the EIT Governing Board, colleagues from the European Commission, DG Education and Culture in particular, the EIT Headquarters, and first and foremost to the first three Communities.

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Creating Ecosystems for Open Innovation in European Large-Scale Research and Innovation Initiatives

Abstract

This paper explores the evolution of large-scale public-private research and innovation initiatives towards innovation ecosystems and investigates conditions for strengthening such ecosystems. As an example we consider the Future Internet Public-Private Partnership programme which runs 2011–2016 and is based on developing a Future Internet service platform with wide application and exploitation opportunity. In examining this case we discuss the evolving characteristics of the FI-PPP ecosystem, as well as steering and governance mechanisms and the emerging programme impacts. Finally the paper presents some thoughts on conditions for sustainability and further evolution of the ecosystem.

Introduction

European Union investments in advancing the European Knowledge Economy and Single Digital Market development are by definition longitudinal and accumulative by nature. The European Commission continuously monitors and adjusts its instruments for addressing the identified grand challenges, and achieving the mutually set strategic goals for research and innovation through large scale initiatives like the Innovation Union strategy and the European Digital Agenda. The new Horizon 2020 framework programme for research and innovation will be a key instrument to implement these initiatives. Europe's Innovation Union strategy for 2020 emphasizes the investments not only in corporate R & D and science and technology driven research, but also on public-private collaboration and innovations to address major societal challenges. New approaches to instrumenting research and innovation are experimented with. A representative example of such approaches is the Public-Private-Partnership (PPP) for research, whereby various new structures are tested and validated before broader implementation. The new PPPs are explorative industry lead initiatives that simulate real market environments with public sector participation in a co-creation process.

Over the years, discussions evolved to shift the focus of the framework instruments towards multidisciplinary large-scale initiatives with closer collaboration and openness among the partners. Impact, open innovation principles, and sustainability after lifetime of the initiatives are becoming more and more important. In particular the public private partnerships that started in the 7th Framework Programme, including the Factories of the Future, Energy-Efficient Buildings, Green Cars, and more recently the Future Internet, demonstrate a potential evolution over time into open ecosystems of their own. Such ecosystems are characterised by complex relationships and interdependencies between ecosystem partners and by efficient and effective forms of self-organisation. This development calls for reflection on the type of governance, process management and orchestration instruments available aimed at steering the development towards expected impacts.

In this context we address the example of the Future Internet Public-Private Partnership (FI-PPP), whose aim is to enhance Europe's future competitiveness by accelerating the development and adoption of Future Internet technologies in Europe, thus advancing the European market for smart infrastructures and increasing the effectiveness of business processes ([1]). One of the interesting features of the FI-PPP programme is that it develops a European level common technology platform offering generic, reusable software components and services, thereby enabling developers across Europe and globally to build, prototype and test their own applications in a range of business and societal sectors, for example within smart city environments.

The term 'innovation ecosystem', although it has clear roots in innovation systems thinking, has emerged relatively recently, emphasising the dynamics and complexity of actor relations and their resources in the development and innovation process. From this perspective emphasis is not on control of the innovation process but on creating the right conditions for creativity, collaboration and sustainability. In relation to the FI-PPP context various issues of wider relevance arise, including the role of common technology platforms in two- or multi-sided markets, the emerging characteristics of the FI-PPP innovation ecosystem, and their implications in terms of open innovation, governance and sustainability.

The Future Internet Public Private Partnership

The Future Internet PPP Programme is a five-year, EUR 600 million, industry-led partnership among 150 leading European Future Internet actors. The forming decisions regarding the FI-PPP programme were made at the time of deep recession in Europe, and the programme was aimed at elevating the competitiveness of the European ICT industry in global competition. Other major drivers for the programme on political level were the European

Digital Single Market initiative, and broader, the Digital Agenda for Europe. The programme objectives emphasise a holistic approach to Internet business development, including the identification of opportunities for standardisation, policy contributions and emerging business opportunities from cross-industry collaboration.

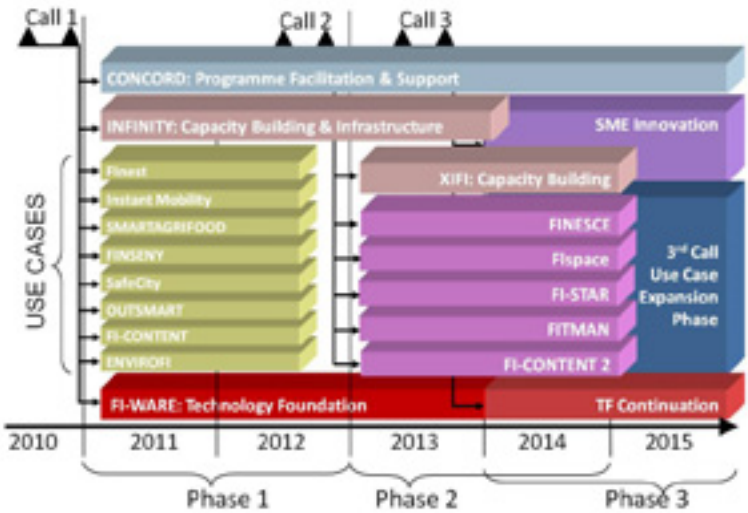
The experimental programme structure has been developed based on experiences from earlier framework programmes and PPPs, and advocates increased transparency, openness and collaboration among the parties. The main new characteristics are the contractual obligation to collaborate at the programme level, and the programme facilitation activity aimed at implementing the formal management structure. The collaboration is ensured by a special clause by the European Commission (Special Clause 41), which states that the programme beneficiaries are required to create and participate in boards and advisory structures together with representatives from complementary grant agreements. They should collectively address collaboration and synchronisation of activities, including issues such as management of outcomes, common approaches towards standardisation, SME involvement, links with regulatory and policy activities, and commonly shared dissemination and awareness raising activities. Another differentiating feature is the broad based engagement of third parties into the programme activities. This will take place during the third (last) phase of the programme in particular, as the programme then has matured to a stage where the developed technologies are mature, and supporting structures are established.

Figure 1 describes the programme structure and actors. The programme consists of three phases covering the period 2011–2016, starting with a phase of developing the architecture and technology platform (FI-WARE) as well as common software components called 'generic enablers' aiming for wide use across a range of sector applications, and capturing usage area requirements. The second phase is consolidating the platform, preparing for and conducting early trials and moving to usage. Finally the platform infrastructure is offered as a stable infrastructure for large-scale trials and as an enabler to SMEs for growth and job creation. Of critical importance is the engagement of developer communities and SMEs in order to push wider exploitation on the commercial market.

The FI-PPP platform concept aims to support stakeholder roles in the Future Internet value network, in particular technology providers, infrastructure providers, integrators, service providers, application developers and users. For a particular application environment, e.g. a smart city, application developers will be able to use FI-WARE technology to build Future Internet applications. A specific suite of tools will enable to operate a dedicated smart city platform. Based on these tools, a key facility is FI-Lab, which enables application developers, users' communities (e.g. cities) and other parties to jointly develop and experiment solutions, thus connecting to an environment of open innovation ([2]).

So far, the FI-PPP programme can be considered to have succeeded in its objective to engage the major stakeholders in Europe and attract interest among new stakeholder groups and communities. The current programme beneficiaries include all major European ICT companies, including Deutsche Telecom, Orange, Atos, Telefónica and Nokia Solutions and Networks, as well as actors from vertical application sectors, like Technicolor, BBC and Disney. Overall the share of industry partners exceeds

Figure 1: The FI-PPP Programme Architecture ([1])



60 %, which is significant in the EC programmes. Also the share of first time participants to Frame Programmes is impressive, as over 30 % of the partners participated in an EC programme for the first time. The FI-PPP, because it is established not within an organisation with existing interests but in an environment which fosters collaboration, in principle represents an excellent point of departure for disruptive innovation. However, the real impact and success of FI-PPP after its foreseen lifetime will be strongly determined by its capability to create an innovation ecosystem which stimulates ongoing collaborative innovation.

Innovation Ecosystems and Platforms for Open Innovation

We now turn to the issue how, in the context of large-scale public-private partnership programmes such as the FI-PPP, open innovation can be strengthened and how an innovation ecosystem can be created which is sustainable after programme finalisation. As regards the FI-PPP no final answers have been developed yet, and insights and experiences from elsewhere might be useful in upcoming discussions.

The innovation ecosystem concept is intuitively attractive as a model, however it has not been that clearly defined or systematically studied, and much remains unclear in relation to issues in situated contexts, in particular of building and expanding such ecosystems, arrangements for governance and decision-making, and conditions for successful evolution and sustainability. Usually evolving around a specific technology, the innovation ecosystem concept emphasises the dynamic interactions between a range of actors or entities, enabling the coupling of their resources for the purpose of technology development and innovation ([3]). These interactions foster feedback loops in terms of adoption of innovations and business creation, in turn driving next waves of development and innovation. In these contexts, value is co-created by the ecosystem members, through processes of both collaboration and competition, often enabled by provision of a platform which also facilitates the governance of the ecosystem through defining access conditions to resources and architectural information ([4]). A main characteristic of the ecosystem is to provide an environment for experimentation resulting into successes or failures through natural selection.

Some of these aspects have, to some extent, been integrated in the FI-PPP, such as the engagement of a variety of actors from different sectors and representing both demand and supply side, the creation of 'use case' projects piloting Future Internet technologies and their application in real-life settings, the possibility to extend collaborations among partners including new entrants through open calls, thus attracting SMEs in their role of developers, and the creation of an open lab environment. However the dynamic evolution and sustainability of this ecosystem is not guaranteed as FI-PPP's structure and funding base is to a high degree determined by the model of EC projects in the framework programmes for research and innovation. A future challenge will be to gradually integrate the fundamental characteristics of open innovation ecosystems into the FI-PPP in so far as this is feasible.

The fact that the FI-PPP ecosystem is built around a Future Internet technology and service platform brings interesting implications with it regarding ecosystem building, open innovation, and governance. During the last decade the concept of 'platforms', and 'platform strategy', has received a lot of attention. It has become clearer how technology platforms form the basis for bringing together complementary products and services in 'multi-sided markets' ([5, 6, 7]). Such multi-sided markets act as economic platforms as their participants gain the benefits of network effects. In this type of market, platform owners, service providers, content providers, application developers, end users such as smart cities collectively constitute a network of interdependent parties that establish network effects, thus enhancing the value of such platforms. As examples of single-firm oriented platforms (e.g. IBM, Nokia, Google, Facebook, Microsoft, Apple) show, the platform owner potentially gains substantial advantages in terms of value creation and market dominance. In this context, and aiming to exploit the potential network effects, different types of platform strategies are being used in terms of openness, compatibility, control ([8]). In this context, it appears that different options exist in establishing collaboration in terms of the two dimensions openness (open versus closed) and hierarchy (flat versus hierarchical), each with their own challenges and benefits ([9]). In relation to the prospects for FI-PPP we should bear in mind that the discussed technology platform strategies are related to individual players' strategy development, while FI-PPP is aiming at collaborative innovation and exploitation. For FI-PPP, given the resources it has brought together and the interests of its partners, it will be most relevant to observe whether the developments go in the direction of exploiting the FI-PPP as a structured business, or whether some form of collaborative innovation community can be developed providing the basis for the model of 'swarm creativity' ([10]), or possibly there is scope for hybrid models. These options represent a great challenge for the FI-PPP community to clarify its own future.

In this sense it is interesting to follow the discussion regarding future FI-PPP governance. Will an open,

flat model emerge as in open source communities, or will more closed, hierarchical forms prevail, or can we foresee hybrid forms? Most relevant to FI-PPP is how value creation is enabled by the technology and value architecture, including decisions regarding modularity, interface standardisation and connectivity ([11]). Such decisions will determine the openness of the future FI-PPP ecosystem, and will set the incentive framework for future innovation and business creation and ecosystem building. This raises a range of issues regarding future FI-PPP platform ownership, business model and governance. Given the desire to create open ecosystems that foster collaborative innovation and business creation one of the current challenges within FI-PPP is to design appropriate platform business and governance models.

Governance and Decision-making in Complex Systems

In designing future governance models for large-scale research and innovation programmes which are intended to transform them towards sustainable innovation ecosystems, it is useful to understand and learn from the characteristics and practices of decision-making structures and processes in contexts we already are familiar with. In general, decision-making and governance in complex organisational networks or ecosystems should not be organised according to conventional organisational control models. Ecosystems exhibit non-linearity characteristics making it difficult to predict the impacts of top-down decisions. This implies a considerable role for self-organisation and team flexibility, and rather on agreeing on a shared vision, on rules or principles and setting objectives, than on control ([12]). Organising research and innovation initiatives for 'swarm creativity' will require to adapt and open up the innovation initiatives for the outside world. This may imply, for example, to create roles within the programme that correspond with external market forces, such as industrial demand and venture capital, and to open up the ecosystem for developer communities based on free access to developed technologies and know-how. Probably we need to think more in terms of risk and rewards sharing than in conditions for access.

In this context we shortly discuss some of the identified governance challenges and experience based solutions for the FI-PPP as a case. Large-scale research and innovation initiatives can be considered as complex systems. Through better understanding of the structural characteristics of such systems (e.g. their sub-systems and their interrelation, the system dynamics, the interactions among a variety of partners with different interests, emergence properties such as trust, and the evolution of the systems) we may discover general principles to improve formal and lateral management processes for increased effectiveness and impact. Main topics of interest include the orchestration between the formal governance and informal culturally determined forms of 'heedful interrelating', emergence of trust and collaboration in self-organising co-creative processes, forming of a shared sense of purpose among the partners, learning capabilities as a success factor for innovation ecosystems, as well as best practices for organising such systems and principles for maximal impact and sustainability.

Given the inherent complexity of the research agendas and problem settings, large-scale innovation initiatives typically have multiple complementary and partly conflicting objectives. This leads to the development of different but interrelated sub-systems and work streams, involving parties specialised in various domain areas within the ecosystems. Such subsystems may include ecosystems and communities around architecture and technology development, applications and experimentation, business and societal impact creation, policy and regulatory conditions, and environmental concerns. Within such sub-systems the actors may have very different motivations to join the collaboration, and may also have different interpretations of the goals and objectives of the initiative as a whole and its parts. In order to effectively organise the operation of such complex systems, it is essential to identify the various sub-systems and their interactions and become aware of the various orientations and interests of the participating actors, whether they represent corporations, the public sector or research. For some actors the sub-systems may represent an activity of knowledge creation legitimated by knowledge logic, others approach the programmes through market development logic. The different sub-systems are likely to develop their discourses and informal rules for respectful interaction. Development of the rules depends on the structure and strength of the existing and emerging trust relationships among the partners, as well as the formal governance structure of the systems.

Major governance challenge for managing such ecosystems lie in creating sense-making mechanisms and shared vision and approach to the innovation ecosystem as a whole. In order to achieve this goal, it is important to understand and appreciate the root cause for potential resistance and restrictions by the participants to agree on governance structures, rules and procedures. The resistance often stems from the participating organisations' own strategic priorities and objectives for the participation, competition, conflicting cultures and norms, and various levels or risk bearing abilities. Typically in the ecosystems the parties are in different stages of development and maturity,

contributing to imbalance of knowledge and self-organisation with informal governance structures within the various groups, which can lead to the creation of core and marginal communities with various rules and levels of commitment within the ecosystems.

Experiences in FI-PPP Governance

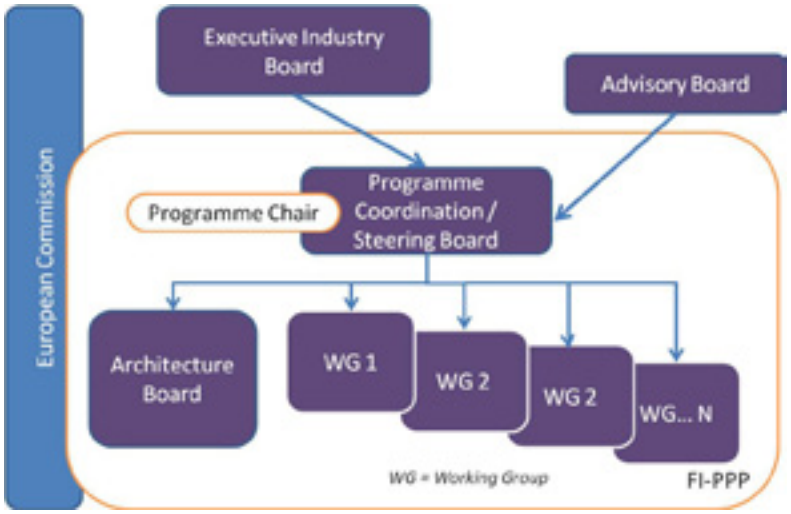
With the multiple diverse objectives and partners the FI-PPP partners' motivations and expectations towards the programme outcomes were understandable very different. For some of the beneficiaries the programme represented a technology development initiative, whereas some others perceived it as a political tool or a means to create new business opportunities for their company. Also differences have become clear between industry participants' and European Commission viewpoints regarding the public-private partnership, and possibly the concept of industry-led PPP. while the Commission is supposed to act as observer, is less effective, and, clearly, industry participants are requesting an active role of the Commission. While all agree on the importance of setting up a sustainable innovation ecosystem, the debate among industrial partners focuses on the degree of openness and the precise terms of conditions of providing access to technologies. With this inherent mismatch in the approaches, the articulation of programme positioning, value proposition and priority setting posed a great challenge. These challenges became apparent and critical only during the second phase of the programme, as the focus shifted from structural set-up and technical development towards commercialisation and expansion of the use case projects and preparing for sustainability.

The first activities in the beginning of the programme included agreement on the collaboration model and deliberations of the parties and governance bodies. The process was kicked off during the programme negotiation phase in February 2011, and lead by the Facilitation and Support Action CONCORD. Together with the European Commission, CONCORD came up with an overall governance model for the programme, which was then negotiated and finalised with the representatives of all FI-PPP projects (Figure 2). The collaboration model emphasised transparency and access to data for all parties. All projects were represented in all governance bodies, and had unlimited access to materials and decisions by all bodies and groups within the programme. Special emphasis was given for the implementation side, with requests for representatives from 'User' side from each project to the highest decision-making authority, the Steering Board.

Decisions regarding the governance model were reached without any major issues or delays. Achieving agreement on the Collaboration Agreement, however, proved very challenging. CONCORD, together with a task force of lawyers from all major stakeholders, drafted a contract and collected feedback from all participants in two rounds of iterations by structured template by email, and mass teleconferences in May 2011. The major topics were the use rights and licensing terms for the developed technologies, as well as third party representation of participants. After long negotiations the agreement was reached, and all parties signed the agreement.

During the first year of Phase 1, much effort was dedicated for institutionalising the management and collaboration structures and processes. The different boards developed their own routines for interactions and communications. Also the horizontal programme level working groups on

Figure 2: FI-PPP Programme governance architecture (situation by end of 2013) *



* In 2014 this governance structure of FI-PPP will substantially change, as the programme continues Phase 3 with strong emphasis on market exploitation.

dissemination, exploitation and business models, policy and regulation, and standardisation were established. Given this strong internal focus on establishing the FI-PPP programme and building up the internal collaboration, less effort was devoted to engagement of external parties. The main collaboration and events were organised within the European Future Internet community.

Moving on to Phase 2 with a new set of Use Case projects and several new partners, FI-PPP's emphasis shifted towards a more external focus with the use and exploitation of the developed technologies. This also implied a major paradigm change for the way the FI-PPP programme needed to be managed. More effort was needed for cross-board communications and sharing between the technical and other constituencies in order to develop the networks and ecosystems required for service delivery and business model development and validation. Emergent questions included also issues related to more detailed definitions of the access rights and sustainability of the developed technologies. More attention was allocated to dissemination and stakeholder engagement. This included establishing linkages to other related initiatives in technical and policy domains for leverage, as well as for reaching potential users, SMEs and developer communities.

Due to the restrictions caused by the Collaboration Agreement, there were no major changes to the programme governance model. One board was added reflecting the recommendations by the Programme Advisory Board and the ongoing quest for increased business impact, namely the Executive Industry Board. The role of this Board was to ensure the commitment of the major industrial stakeholders, and strengthen the business linkages and receive strategic advice on the commercial aspects of the programme. The programme was also appointed a Programme Chair, whose responsibility is to create alignment within and across the various programme governance bodies and to represent the FI-PPP programme among external stakeholders. This new role simplified the communications and representation of the FI-PPP programme towards the broader stakeholder audiences.

Programme and Project Level

The FI-PPP programme structure brought together a set of projects that together constituted the holistic programme whereby technology platforms are developed and validated with a variety of different Use Case projects. These projects had been selected based on the innovativeness and credibility of their plans to implement their Use Cases as a part of the programme, and contribute to the technology platform project. While the platform project (FIWARE), capacity building (INFINITY) and the facilitation action (CONCORD) were strongly horizontal with clear programme level focus, the eight Use Case projects in Phase 1 all had very distinct characteristics and identities. The cases varied in size, use domain, partnership, orientation towards technology vs. conceptuality, as well as geographical and market focus (B2B vs. B2C).

With this the projects also had very different actor networks and focuses. Synergies and interdependencies among a part of the projects were apparent, whereas for some others there was little common ground. The project focus during Phase 1 was pre-dominantly technical, on conceptualising the reference architectures and pilot requirements. Prototypes were built by some projects but not all. Programme level focus was lower due to priorities in project level management and impact creation in thematic networks. Programme level work was not allocated specific resources, and impact was not systematically monitored by the projects or The European Commission. Consequently the programme level work suffered from little attention and focus, which lead to slow decision-making regarding joint activities (joint working groups on various targeted impact areas in programme level).

This scheduling related challenge was amplified with the timing of the competitive call for Phase 2. Once the structures and nominations for the programme level joint working groups had been made, the preparations for the Phase 2 started in full swing. This placed the projects in a competitive situation, whereby sharing and collaboration across projects became restrained. After the results of the call were published, the projects had again different priorities depending on their acceptance to Phase 2, or rush to complete and wrap up the activities within the few coming months.

From the beginning of Phase 2, strong emphasis was given for the programme level activities and impact. The key enabler for this was the enforced requirements from The European Commission to allocate significant amount of resources for Programme level activity, and monitor the projects contribution on both impact categories. With the five Use Cases the Programme level work continued following the earlier defined formal structures and processes, but with new intensity and commitment to manage outcomes. Other major enablers for successful work include timing, non-competitive set-up and execution focus in the projects. The work of the horizontal groups is considered of more relevance as the projects tackle similar issues at the project level. Furthermore, the projects lack some of the competences and resources required in these execution areas, so the programme level support and collaboration is welcomed.

Programme Impact

During its first year of operation, the FI-PPP has partially achieved its targeted objectives. According to the external review ordered by the European Commission ([13]), the main areas for improvement were on industrial impact and articulation of vision and Key Performance Indicators for the programme. Challenges in these key tasks can be accounted for the slow emergence of informal governance structures and community building within the programme. In such a complex programme the decisions regarding the structure, decision-making and priority areas are made at the system level, shaped by reliance on bargaining process among participating organisations. The FI-PPP managed to negotiate these structures with the support of an external facilitator and involvement of the Commission fairly easily.

Further to the formal governance structure, the partners had to collectively develop their logic for action and integrative heeding mechanisms in order for the programme to become a living, evolving 'system of systems'. This process was time consuming and partly failed in the first phase of the programme. This could be accounted for the lack of face-to-face interactions among the partners, and the complexity of the system set-up. Some of the partners had little or no boundary objects and thus did not feel like partners in a same programme. Effectively this lead to inefficiencies and delays in decision-making and concretising actions related to articulated vision and expected impact. Table 1 presents some key observations of FI-PPP evolution over time.

Towards a Sustainable Ecosystem

Complexity in FI-PPP's environment and in the programme itself combined with a high level of ambition requires an ecosystems approach to the programme governance and facilitation, since the expected impact exceeds that possible for any of the single projects to achieve and since conventional organisation models are not appropriate. The FI-PPP programme at this point evolves naturally with the phases of the programme and the schedules of the partnering projects. Given the challenge to transform into an innovation ecosystem and

Table 1: Some observations of FI-PPP evolution 2011–2013

FI-PPP evolution	2011	2011	2013-2014
Evolution of FI-PPP's external environment	Setting up and institutionalising processes and sub-groups	Pressures to achieve results, competitive set up	Transition to Phase 2 and Phase 3
FI-PPP's coordination mechanisms (formal-hierarchical, networked, ecosystemic)	Standard programme management rules	Standard management rules at program and project level	Standard procedures
	Decentralised authority in projects	Governance based on roles, rules, debates	Cross-programme exchanges e.g. working groups
	Structured information and communication patterns	Relations management with key stakeholders	Increased networking with stakeholder communities
	Process based management		
FI-PPP as programme organization	Standard management rules and procedures	Governance based on roles, rules and debate	Programme management more networked
		Vision and mission discussions	Opening up for dialogue and collaboration within the wider ecosystem
		Top down KPI discussions (bureaucratic mode)	
		Governance model discussions	
FI-PPP as an innovation ecosystem	Operating as a group of loosely coupled projects	Organising within the FI-PPP	Gradually opening up for dialogue/collaboration within the wider ecosystem e.g. by open calls, collaborative agreements and networks
Developing (eco-)systemic learning capabilities	*Information-based*	*Based on debates:*	*Increasing emphasis on dialogue:*
	Limited to information distribution and formal communications	Limited to debates regarding effective governance	Cross-programme dialogues in working groups
			Dialogues including external parties and aiming towards open collaborative innovation
Main achievements	Agreements on the collaboration structures, management processes	Launch of the programme level working groups on various impact areas	Re-organising for Phase 2, implementing new governance bodies

exploiting potential network effects it has a great advantage being grounded in a technology platform and having established ICT-based instruments of communication and collaboration. However, the ambition to become a sustainable ecosystem after lifetime will require the programme organisation, priority setting procedures and decision-making processes and responsibilities to evolve in time and adapt to the changing environment. We propose an explicit transition process from the Phase 3 situation to a sustainability driven ecosystem environment. On the short term, this calls for pushing the openness of the current programme for external driving forces, and at the same time for enhancing the programme learning system through systematic monitoring and enhancing the ability to address unsolved issues and dilemmas as raised from within the programme as well as by the executive boards, programme reviews or the Advisory Boards. With an incremental process of cyclic improvements and learning the programme will be in a better position to evolve into a sustainable innovation ecosystem that remains alive after the programme is finished. Pre-requisites for this evolution include effective impact oriented management processes and structures, but equally important are the informal communication structures, collaboration mechanisms and the commitment of the participating organisations. Last but not least an effective public-private partnership requires reconsidering the roles of industry partners and the European Commission in the governance structure, including responsibilities regarding setting objectives, degree of openness and establishing cooperation and cohesion across various EC initiatives.

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Innovative Government Leaves Legacy after the Financial Crisis

Abstract

Australia and Chile were hit hard by the 2008 global financial crisis; however they were able to recover faster than other advanced countries partly due to their innovative stimulus measures. The Australian government was innovative in designing efficient stimulus disbursement through building school infrastructure and renovation for 9 500 schools, energy-efficient ceiling installation for over 2 million homes, and 135 000 training opportunities for the young unemployed. The rationale behind such design was to assist the low-skilled workers and to prepare better qualified labor force for the future all over the nation. Different from Australia's innovative investment on physical properties, the Chilean government's innovation centred on intangible process improvement, including transparent stimulus information sharing to facilitate consensus among different parties and efficient enactments of relevant laws for smooth implementation of stimulus plan. Although different, innovation of tangible or intangible stimulus measure has its respective effect on the fast recovery of Australia and Chile.

Introduction

The 2008 global financial crisis is considered by many economists to be the worst since the Great Depression of the 1930s. The initial US subprime mortgage problem that rapidly developed and spread into a global economic shock caught many national leaders by surprise. The spreading financial woes resulted in a number of financial institution failures, first in some advanced countries then in some developing ones. World political leaders, national ministers of finance and central bank directors coordinated their efforts to reduce fear, but the crisis continued and eventually led to a global currency crisis. During this period, economies worldwide slowed, credits tightened, international trade declined, and business and consumer confidence eroded with enormous and rapid job losses.

Financial crises have been a cyclical recurrence in rich and poor countries alike over the past couple of centuries. Each time, the pattern is similar: capital crunch, currency crash, high inflation, high unemployment, undulations in housing and equity prices, and government defaults on international and domestic debts ([1]). The source of the problem generally includes improper rules and policies, ineffective governance, failed surveillance systems, and implementation flaws. These problems are mainly intangible in nature. Our intangible national intellectual capital study revealed early warning signs of financial crisis for countries such as Greece, Iceland, and Ireland ([2]). It is our deep belief that national intellectual capital, albeit intangible, can provide valuable insights for searching a national benchmark as well as for future risk control.

This paper aims to report two innovative governments — Australia and Chile, which the author believes will leave legacies for their innovative measures in combating the 2008 global financial crisis. In addition to their relatively good governing systems before the crisis, their efficient and effective stimulus programmes during the financial turmoil provide some insights for bench learning in the future. The co-development of intangible national intellectual capital (NIC) and tangible GDP per capita (ppp) of these two countries are also explored.

Background Information

The sign of financial problem started to show in 2007 when the US subprime mortgage flaw surfaced, which eventually led to the Lehman Brothers trouble in September 2008. In late 2008, the global conditions were much worse than initially envisaged. When businesses ran short of capital, their daily operations were affected, including production stoppage and shedding off excessive manpower. When consumers could not get credit or lost their jobs, they refrained from spending money and purchasing goods. This cyclical problem affected the real economy thus developed into the deepest and most synchronised global crisis in the last eight decades. With the two largest import regions, the US and Europe, in deep financial troubles, global international trade drastically dropped, credit tightened, and direct foreign investments were swiftly withdrawn. As a result, a domino effect was triggered and global recession set in. In the increasingly interconnected world, no country was able to escape unscathed from this financial crisis. By estimation, from January to October 2008 world stock markets lost 40 % of their value ([11]). The reported two countries were not immune from this financial turmoil. From its peak in November 2007 to the lows in March 2009, the Australian market declined by 54 % ([12]). In 2009, Chile's economy contracted by 1.5 %, export volume dropped by nearly 20 %, and industrial production fell by 9.3 % during the first half of 2009 ([3, 4]).

The following two paragraphs briefly explain the pre-crisis condition of Australia and Chile for more specific backgrounds. In recent decades, Australia has transformed itself into an internationally competitive and advanced market economy with focuses on services, technologies, and high-value-added manufactured goods. However, its exports remain heavily on mining and agriculture.

The Australian economy grew for 17 consecutive years before the 2008 global financial crisis, mainly due to economic reforms adopted in the 1980s ([5]). Overall, the Australian economy entered the global financial crisis with a strong base. Gross domestic product (GDP) grew by 3.7 % in the 2007–2008 financial year (ending June 30) and the unemployment rate stood at 4.2 % ([6]). The government also had a substantial fiscal surplus for the stimulus measures introduced after the onset of the crisis.

Chile has a market-oriented economy characterised by high levels of foreign trade, a reputation for strong financial institutions and sound policies. The country has learned the lessons from its 1982 economic and banking collapse, which led to the enactment of a new General Banking Act in 1986 with low external financing dependence. Consequently, most of its external debt is long-term and held by non-financial companies ([3, 7]). In the last several decades, the Chilean financial system has developed remarkably and its banking industry was ranked 4th (out of 133 countries) in terms of soundness ([3]). Exports account for more than one-fourth of its GDP, with commodities making up about three-quarters of its total exports. Copper alone provides one-third of government revenue ([5]). During the early 1990s, the democratic government deepened its reform efforts and Chile became known as a role model for economic reform. As a result, Chile experienced 12 magnificent years from 1986 until 1997, when GDP grew more than 7 % per year, opening up the country to the rest of the world, creating jobs, and strengthening macroeconomic balances ([8]). However, impacted by the Asian financial crisis of 1998, Chile lived through 12 lean years afterwards. The rate of growth and employment both went down by half; growth has averaged 4 % per year since 1999 ([8]). Nevertheless, in 2007, its trade balance was US$23.6 billion with a surplus of US$7.2 billion (4.4 % of GDP). Financial assets rose from 50 % of its GDP during the 1980s to nearly 200 % in 2008 ([3]). Overall, the nation benefited from a substantial record of sound macroeconomic policy and low levels of public debt ([3]).

The Impact of 2008 Financial Crisis

Australia

Australia was hit hard by the 2008 global financial crisis due to its export-oriented economy. In the last quarter of 2008, businesses ran down their stocks by US$2.2 billion (A$3.4 billion) (in real terms), the largest fall on record. Consumer confidence plummeted along with consumption ([9]). In October 2008, the Reserve Bank of Australia Board cut interest rates by 100 basis points. The Australian Government also announced that it would guarantee all Australian bank deposits and, for a fee, the wholesale funding of Australia's banks. To mitigate the negative impact, the Australian government announced a US$7.1 billion (A$10.4 billion) stimulus package of around 1 % of its GDP at the end of 2008. The stimulus package was designed to rescue the housing and consumption (representing over 60 % of the Australian economy) and to be quick acting with significant cash bonuses paid to those in need within weeks of the announcement ([9]). In early December 2008, the Australian Government announced large-scale infrastructure projects amounting to US$3 billion (A$4.7 billion) to prepare for the possibility of a deeper and longer lasting global financial crisis than expected.

On February 3, 2009, the Australian Government announced its second stimulus package of US$27.2 billion (A$42 billion) titled the 'Nation Building and Jobs Plan,' designed to support up to 90 000 jobs in 2008-09 and 2009-10, and to boost economic growth by about 0.5 % and 0.75–1 % of its GDP in 2008–09 and 2009–10, respectively ([9, 10]). In planning for a fast impact, 70 % of the second stimulus package was comprised of infrastructure spending, focused on quick-starting mid-scale infrastructure.

In addition, the Australian Government quickly followed its second stimulus package with a jobs package aimed at young people. With the US$970 million (A$1.5 billion) package provided by the federal government, the states were required to guarantee a training place to all unemployed people aged 25 years and under. The government anticipated this package would provide up to 135 000 young Australians with higher qualifications and a more skilled workforce in preparation for the return of normal labor market demand. An additional US$14.2 billion (A$22 billion) budget for large-scale infrastructure was also announced, which helped the Australian government outline its medium-term fiscal strategy ([9]). Please also see Appendix 1 for the details of its stimulus packages.

Chile

With a relatively small market and far away from the centre of the world economic activities, Chile enhanced its longstanding commitment to trade liberalisation with the signing of 57 free trade agreements including the US, the European Union, the Common Market of the South America, China, India, South Korea, and Mexico ([9]). Exports accounted for 44 % of its GDP in 2008. Because of its high trade and capital market integration, the economy was severely affected by this financial crisis. As a result, its unemployment rate grew from 7.5 % in 2008 to 10.8 % during the second quarter of 2009 ([3]). Inflation rose from an average of 2.6 % in 2006 to 7.8 % in 2008, with a peak of 9.9 % in October 2008 ([3]).

Chilean stimulus package was planned based on four pillars, namely government spending and investment, expanding credit access for companies, support to largely low-income people, and employment protection and incentives for worker training ([3]). In addition to provide liquidity to the market, the government launched its major fiscal stimulus package of US$4 billion (2.8 % of its GDP and 14 % of planned current fiscal expenditures), with a mixture of fiscal spending and temporary tax reductions ([3]). The plan was also complemented by a national agreement on labor market assistance, job protection and job-training stimulus. Fiscal policy was at the core of the Chilean government response to the crisis, which had a mixture of new fiscal spending, mainly targeted at low-income households (US$1.1 billion), investment (US$1.7 billion), and tax cuts ([3]). In addition, a law was enacted on 28 May 2009 that provided tax reductions to companies retaining workers ([3]), under the tripartite agreement between government, workers' unions, and companies.

In the past, the Chilean government conducted a rule-based countercyclical fiscal policy, accumulating surpluses in sovereign wealth funds during periods of high copper prices and economic growth, allowing deficit spending only during periods of low copper prices and growth. As of September 2008, those sovereign wealth funds — kept mostly outside the country and separate from Central Bank reserves — amounted to more than US$20 billion ([5]). Chile used US$4 billion from this fund to finance the fiscal stimulus package to fend off the 2008 recession with great speed and efficiency ([13]).

Innovative Governments

During the financial crisis, most of the countries announced their stimulus packages either at the end of 2008 or in early 2009. Generally, decisions were made with relative haste. As a result, the effect of such swiftly designed stimulus relied heavily on government's wisdom in terms of the comprehensiveness of planning, the speed of implementation and follow through and most important of all, the coordination amongst different departments and local governments. Some countries were able to reach internal consensus and the money was disbursed efficiently, whereas some encountered political conflicts hampering the execution of the government stimulus support. An easy test was to see how fast the poor families received the government subsidies. Both Australia and Chile had stimulus programmes innovatively designed, which were reflected in their fast recovery from the crisis, despite being hit hard. How Australia and Chile launched and implemented their stimulus is described hereunder.

Australia

Australia came through the recession relatively fast, maintaining good levels of business investment and employment ([14]). According to the OECD, Australia's timely stimulus measures, with a strong focus on direct government investment, are amongst the most effective of all OECD fiscal packages in stimulating activity and supporting employment ([10]). Statistics show that with the stimulus, about 210 000 unemployed had jobs and around 60 % of these new jobs were fulltime ([9, 6]). Australia was one of the first advanced economies to recover from the financial crisis and to raise interest rates, with seven rate hikes between October 2009 and November 2010 ([5]).

In addition to substantial trades with China, its sound financial system and national governance contributed a lot to Australian resilience. Its one-off cash payments to low and middle income groups were rapidly disbursed (within weeks of the announcement), which had an almost immediate impact on consumption expenditure, retail sales and economic growth. With strong prudential and corporate reporting framework, Australia coped well with the financial turmoil, leading to a very low government debt of 22.31 % in 2010, compared to around 80 % in other European countries.

Australia's most innovative stimulus measure was its quick-starting mid-scale infrastructure, as no similar measures were reported in other countries. In planning for a fast impact, 70 % of Australian second stimulus package was comprised of infrastructure spending. The largest component of its infrastructure package was the school-based infrastructure upscaling, which not only enabled speedy construction but also maximised the impact of the stimulus across Australia.

To speed up construction, school lands were made immediately available for new buildings and schools chose from standard designs rather than developing their own designs, hence there was no planning delay ([9]). In addition, such packages were provided to almost every population area of Australia, since the economic weakness was expected to be geographically broad. Furthermore, school infrastructure projects have low import content, thus the domestic impact of this stimulus was maximised. After the completion of this project, over 9 500 schools in Australia either had a new multipurpose centre, library or assembly hall or they had substantially refurbished existing facilities.

Another Australian government's successful and innovative stimulus programme was the energy efficiency ceiling insulation policy. It was meant to provide support to less skilled labour, for it required

only a single day training to become proficient. As a result, this project provided free insulation for over 2 million homes as well as employment opportunities for predominantly less skilled workers. To speed up the process, the system was operated as households arranged installation from a registered installer and the installer then claimed the costs of installation (up to US$1 600) back from the Government. Furthermore, Australian states were required to guarantee a training place to all unemployed people aged 25 years and under to enhance up to 135 000 young Australians with higher qualifications for future labour market demand.

The first two programmes were by far the most efficient, widespread, and innovative in creating jobs for the seriously affected low skilled workers and at the same time improving educational infrastructure with long lasting effect. The required training place for the young unemployed was designed with long-term perspective. Although swiftly decided, Australian stimulus measures were very well-thought with efficiency and effectiveness. In addition to create almost 200 000 jobs, thousands of students were and will be benefited from the 9 500 schools that had new or upgraded facilities. Over 2 million homes had free energy efficiency ceiling insulation, which helped reduce the energy consumption. The policy of energy efficiency ceiling also provided an effective advertisement-free environmental education to the general public.

Australian government has included future growth planning in its stimulus policies (Treasurer, 2009), which have manifested its support for better education, determination for building an energy-efficient society, and arrangement for widely distributed job opportunities. These smart stimulus designs and efficient execution will leave legacy to the benefited schools, families, and the general public.

As a result, Australia avoided a recession, with only one quarterly decline in GDP, a 0.9 % drop in the fourth quarter of 2008. In general, Australia weathered the world recession better than almost all other advanced economies (Debelle, 2009; OECD, 2010). Its GDP started to grow in the first quarter of 2009 and consumer confidence rebounded swiftly (Kennedy, 2009). Its export volumes increased by 1.7 % in the fourth quarter of 2009 and the terms of trade rose by 2.9 %. The Australian economy grew by 1.2 % during 2009 — the best performance in the OECD ([5]). The outlook for private business investment improved, as business confidence rebounded and profitability recovered in 2010 ([6]).

From January to August 2012, resource investment in Australia has continued to expand rapidly. Work continued on very large projects, capital imports grew strongly, and some additional resource projects have commenced or gained approval (RBA, 2012). As of 2012, temporary stimulus measures have largely been phased out ([14]). Australia's GDP grew by 3.3 % in 2010. Unemployment fell to around 5 % in 2010. As a result of an improved economy, the government expected to return to budget surpluses as early as 2015 ([5]).

In addition to Australia's proven resilience during this financial crisis, Australia has demonstrated its ability to implement policies in an efficient and timely manner. For example, following the announcement of government stimulus in February 2009, the first set of projects was approved by April and construction was under way by June. Such swift support becomes a good model for coping with future external shock.

Chile

Chile did not have as unique a stimulus package as Australia. That is, the contents of its stimulus did not vary much from that of other countries. However, its innovativeness was manifested through the transparent stimulus information sharing and the disbursement process, which was partially based on Chile's past innovative governing systems.

During this financial crisis, Chilean monetary and fiscal authorities both reacted promptly and in a coordinated fashion. The central bank aggressively reduced its interest rate, from 8.25 % in January 2009 to 0.5 % in July of the same year, at the same time the government implemented a large fiscal stimulus package. The majority of the measures implemented were focused on low-income households and small to medium-sized companies, regardless of the economic sector to which they belonged ([3]).

The Chilean government has been extremely transparent in announcing its stimulus measures, their detailed justification, and cost. All relevant information, including press reports and documents detailing each proposal are available through the Finance Ministry's website. This transparency orientation has been strengthened by the stipulation of a national transparency law in June 2009. The law required every public service to provide public information on their activities and data records ([3]). In addition, government policies did not introduce distortions in specific economic sectors; rather, they have tended to be based on general principles rather than favoring specific industries or interest groups ([3]). One salient feature of the Chilean policy-making process is the rapid national consensus. Taking the 2009 stimulus plan as an example, 15 days after the plan was announced it was legally and unanimously approved by the National

Congress in the form of Law. Chilean Finance Minister acknowledged the support received from a number of economic analysts, but especially those from the political class ([3]). Another example is the policy of tax reductions to companies retaining workers. For the success of this policy, Chilean government sought the tripartite agreement between government, workers' unions, and companies.

Fast decision with relevant parties' consensus and transparent information sharing are the unique features of Chilean government during this financial crisis. Rare among the countries studied, Chilean critical issues discussed during the crisis were swiftly written into law for successful enforcement. For sure, such efficient action cannot be achieved over night. The Chilean government and central bank have invested in building solid reputations in past years. For example, the Chilean financial market is governed by high-skilled agencies and appropriate prudential rules. Banking supervision is under the charge of a public autonomous institution and another independent organisation is the main regulatory body supervising all activities and entities participating in the Chilean securities and insurance markets. Such mechanism enforces compliance with all laws and regulations governing the financial market, and has the power to impose sanctions ([3]). Pension fund investments are also ruled by risk criteria and are supervised by a third regulatory body ([3]). The soundness of the Chilean financial system has been identified as one of the country's major assets.

IMF predicted that Chile would have leading growth within its region after the crisis. Indeed, the Chilean economy started to show signs of a rebound in the fourth quarter of 2009, with GDP increasing more than 4 % in 2010. Chile's government received high marks from economists and its citizens for its countercyclical spending in 2009 (financed largely from saved copper revenues) to offset the effects of the global economic crisis ([16]).

Particularly, Chile achieved such growth despite the magnitude 8.8 earthquake that struck the nation on 27 February, 2010 with estimated total immediate losses close to 17 % of its GDP ([5, 16]). However by 2011, the economy had recovered from the effects of the earthquake, which caused only a temporary disruption in Chile's economic activity ([17]). Although Chile's economic rebound was partly owed to the fast recovery of China (its largest export market in 2010), it also prepared for an external shock far better than either Britain or the United States ([13]).

Chile has great prospects after the 2008 global financial crisis. Its financial system remained stable, and prudent regulations allowed banks to withstand the global financial turmoil with little disruption ([14]). The country has emerged from the recession and the economic dislocation caused by the February 2010 earthquake ([16]). Another great achievement for Chile is that the OECD invited Chile to become a full member in December 2009. After a two-year period of compliance with organisation mandates, in May 2010 Chile signed the OECD Convention, becoming the first South American country to join the OECD ([5]).

In summary, the Australian government was innovative in designing efficient stimulus disbursement through building school infrastructure and renovation for 9 500 schools, energy-efficient ceiling installation for over 2 million homes, and 135 000 training opportunities for the young unemployed. Different from Australia's innovative investment on physical properties, Chilean government's innovativeness was manifested through its intangible process improvement, including transparent stimulus information sharing to facilitate consensus among different parties, efficient enactment of relevant law for smooth implementation of stimulus plan. Although different, innovation of tangible or intangible stimulus measure has its respective effect on the fast recovery of Australia and Chile.

Future Challenges

Even though both Australia and Chile weathered the 2008 global financial crisis very well, potential future challenges cannot be ignored. This section uses four macroeconomic indicators to present issues for contemplation. They are the percentage of real GDP growth per capita, total general government debt percentage of GDP, unemployment rate of labour force, and consumer price inflation (CPI). In addition, tangible (GDP per capita ppp) and intangible (national intellectual capital, NIC) co-development also provide some clues for future national development.

Four Macroeconomic Indicators

Figure 1 and Figure 2 compare and contrast general economic situation before, during, and after the 2008 global financial crisis in Australia and Chile. Figure 1 shows that general government debt of Australia started to rise from 2008, even after the financial crisis which more than doubled its debt level before the financial crisis. Nevertheless, government debt under 30 % GDP is still much lower than that in most European countries of around 80 %. The other three indicators are relatively stable. Although Australian GDP growth did slide into the negative in 2009, it bounced back in 2010 and remained positive afterwards. Its unemployment rate was not affected by the crisis too much and remained around 5 % all through the reported eight years, which was rare among the advanced countries during this financial crisis. Its innovative

measures to place the low-skilled workers in building school infrastructure and energy-efficiency ceiling installation apparently took effect. CPI did fluctuate a little, yet it stabilised after 2009.

Figure 2 shows that Chilean GDP growth plummeted sharply in 2009, with its heavy export-dependent economy. However, it bounced fast in 2010 to over 4 % and continued its growth to almost 10 % in 2012, which reflects its strong recovery. Its CPI rose in 2008, however dropped sharply in 2009, and then gradually resumed to around 3 % in 2012 as before the crisis. Its unemployment rate rose in 2009, however gradually reduced to around 6 % as before the crisis. Government debt is the only indicator that kept on rising even after the financial crisis. Nevertheless, around 12 % government debt is very low, even lower than Australia.

Figure 1 and figure 2 indicate that the two countries are in a relatively good state. Their rising government debt is still very low comparing to other countries and does not pose an immediate threat. Australia managed to avoid sharp downturns even amid the crisis due to booming demand for its raw materials from industrialising Asia, especially China. However, China's recent economic slowdown and the end of its resources boom have resulted in Australia's resources industry shedding thousands of workers. Australian central bank has cut interest rates repeatedly to spur weaker sectors of the economy, such as retail and housing construction, by boosting consumer spending ([18]).

For Chile, its goal is to become the first Latin American country to overcome underdevelopment, defeat poverty, and achieve per capita income of the OECD average (US$26,000) by the end of this decade ([8]). According to report, the most important causes of poverty in Chile are the lack of equality in education, weakness in creating good jobs, and weaknesses in the family ([8]). Therefore, the government has pledged to undertake a huge educational reform — trying to fix a system that has not worked because it was caught up by all kinds of interest groups in the past ([8]). Furthermore, to reduce the reliance on copper exports, the Chilean government has made efforts to develop global services (off shoring) as a new source of exports ([3]). An Innovation Council is in charge of identifying and supporting new export clusters based on innovation to increase the proportion of domestically added value.

GDP-NIC Co-development

In the current knowledge economy, intangible asset plays an increasingly important role in national development. This section presents the co-development path of tangible GDP per capita (ppp) and intangible national intellectual capital (NIC) of Australia and Chile to shed some light for their future development.

Figure 1: GDP growth, government debt, unemployment rate, and CPI in Australia

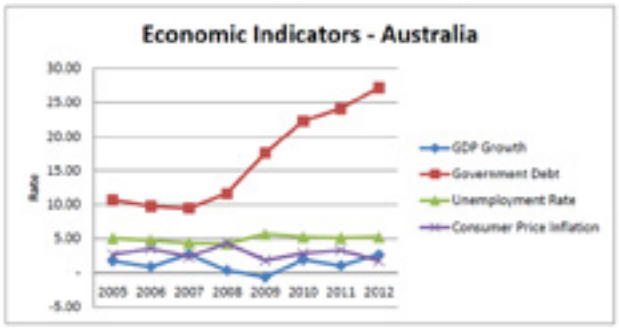


Figure 2: GDP growth, government debt, unemployment rate, and CPI in Chile

NIC is represented by national human capital (NHC), market capital (NMC), process capital (NPC), renewal capital (NRC), and financial capital ([19]). NIC is the sum of the above capitals. *National human capital* is the competencies of individuals in realising national goals, *market capital* represents a country's capabilities to meet the needs of its international clients, *process capital* comprises mainly a country's infrastructure, and *renewal capital* refers to a nation's capability for innovation that sustains a nation's competitive advantage ([19]). Figure 3 to Figure 7 show the co-development path of GDP-NIC, -NHC, -NMC, -NPC, and -NRC of Australia and Chile from 1995 to 2010. The figures also indicate the relative position of the two countries in a 59-country landscape, as each background bubble represents a country.

Figure 3 shows a background continuum from the bottom left to the upper right, indicating a relatively high correlation between NIC and GDP per capita (ppp). That is, the higher the NIC, the higher the GDP per capita (ppp) and vice versa. Although Australia's path is in the middle-upper part of the continuum, it does not have too much progress in NIC (horizontal progression) from 2000, despite its GDP per capita (ppp) (vertical progression) increases over the years.

Chile's NIC is progressing, except few years' backward development during the financial crisis. However, the pace of its GDP per capita (ppp) growth is slower than that of Australia. Chilean path is at the lower end of the continuum, indicating rooms for improvement.

Figure 4 is the co-development of GDP-NHC. The pattern is similar to that of Figure 3; however the gap between Australia and Chile narrows. Figure 5 of GDP-NMC does not show a continuum as Figure 3 and 4, meaning the correlation between NMC and GDP per capita (ppp) is not high. In other words, less developed countries with lower GDP may have better market capital than more advanced countries. For example, Chile has better market capital than Australia. Figure 6 is the co-development of GDP-NPC, the background continuum reappears. The pattern of this figure is similar to that of Figure 3 and 4. However, Australian process capital declines more than its NIC and human capital, comparing the status of 2010 with its respective peak. Figure 7 is the co-development of GDP-NRC. This figure shows the strength of Australia and the weakness of Chile. That is, Australia has an overall progress in renewal capital, despite some backward development, whereas Chile was stagnant in renewal capital over the long period from 1995 to 2010.

Figure 3 to Figure 7 present the co-development patterns of national tangible and intangible assets for Australia and Chile over 16 years (1995–2010). They provide points of thought for decision-makers to plan for national development.

Figure 3: Co-development of GDP per capita (ppp) and NIC for Australia and Chile

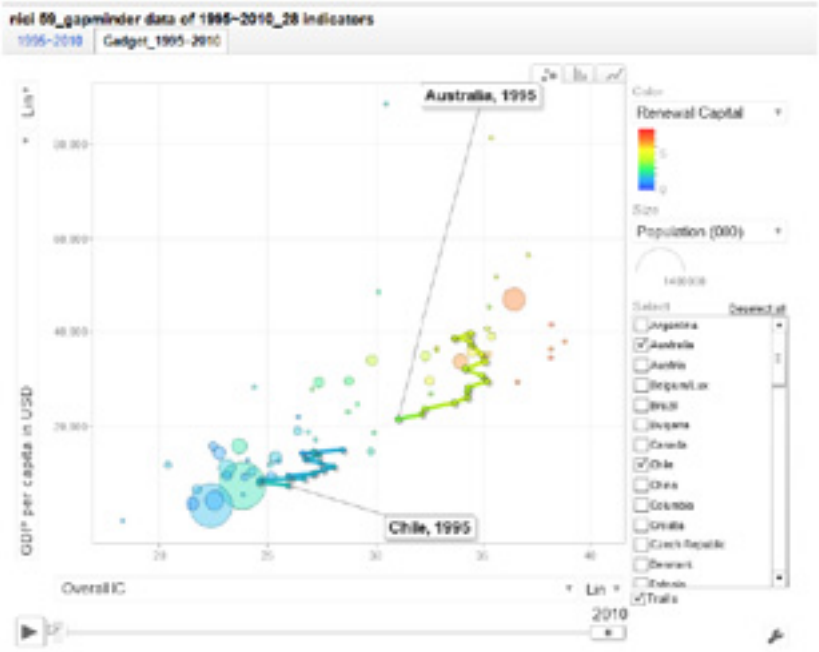


Figure 4: Co-development of GDP per capita (ppp) and NHC for Australia and Chile

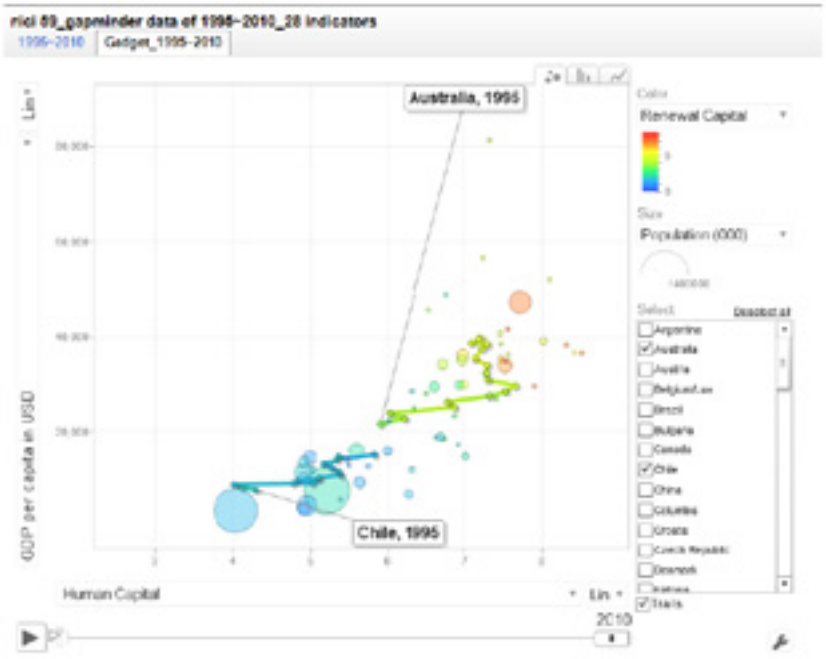


Figure 5: Co-development of GDP per capita (ppp) and NMC for Australia and Chile

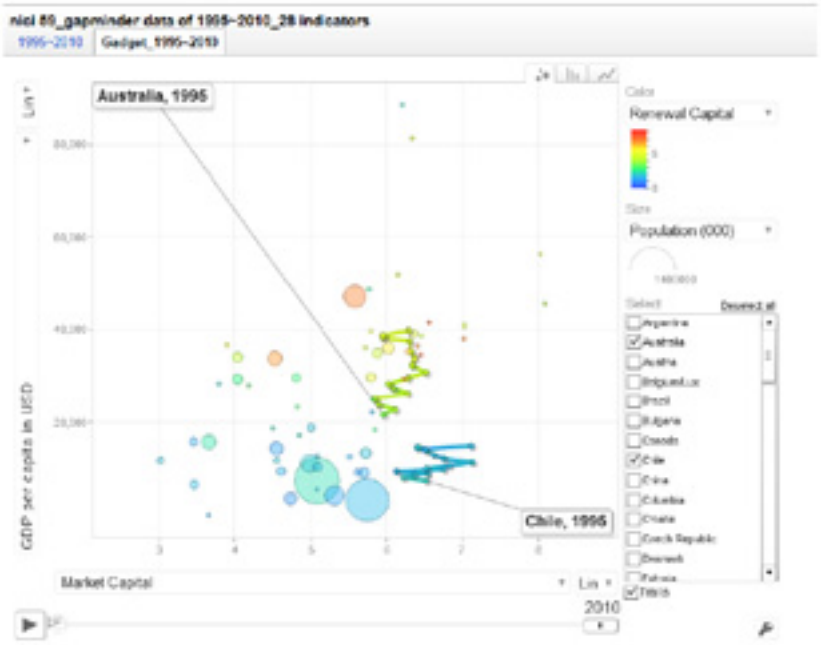


Figure 6: Co-development of GDP per capita (ppp) and NPC for Australia and Chile

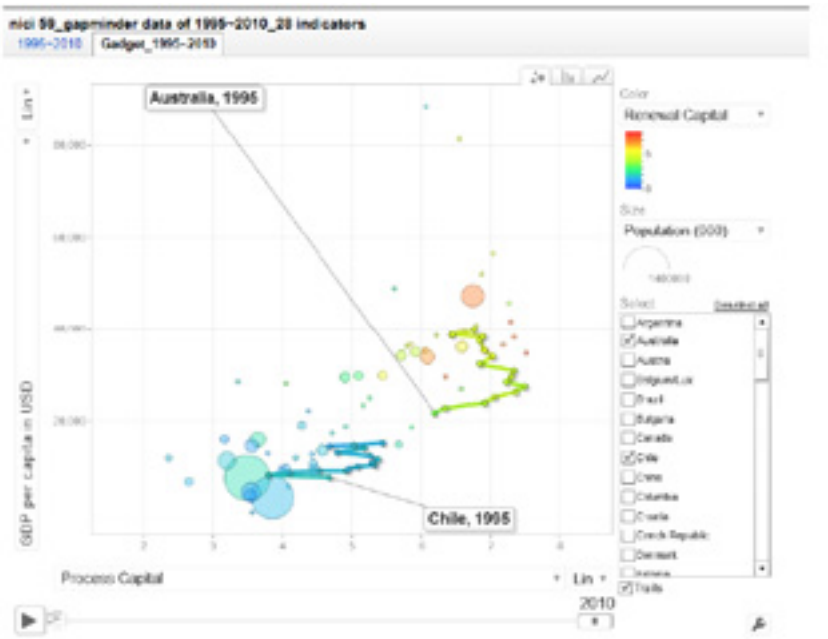
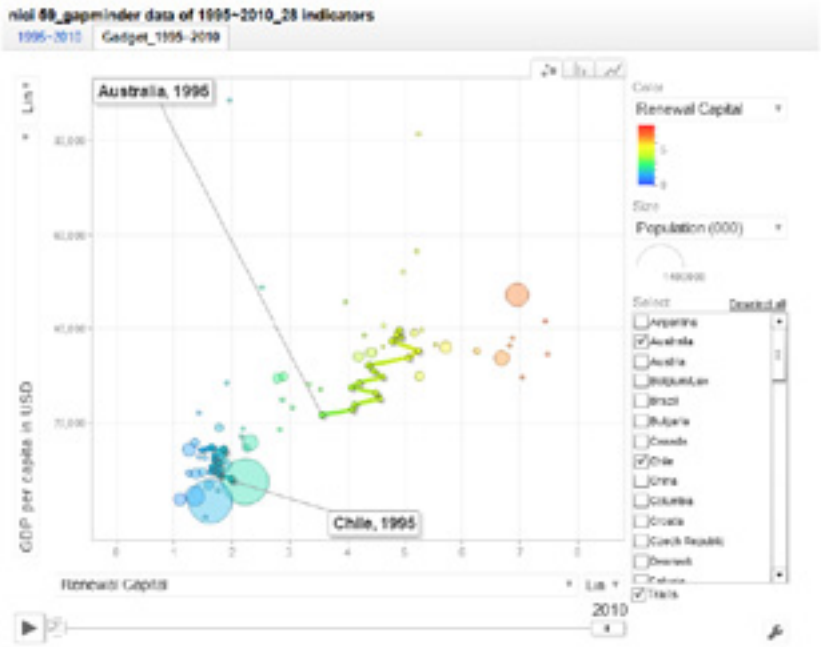


Figure 7: Co-development of GDP per capita (ppp) and NRC for Australia and Chile



Conclusion

History indicates that financial crisis is a recurrence for poor and rich countries alike. During the financial crisis, the economic contraction, rise in unemployment, and regulatory reforms can be viewed as the necessary restructuring costs for transitioning from the existing economy to an even more robust one. This paper reports two countries — Australia and Chile — which not only coped with the crisis well with fast recovery but also left legacies for people to remember and for other countries to benchmark.

Although the two innovative governments successfully implemented their respective stimulus measures, they must now sustain national development and well-being going forward. This paper also reveals some warning signs for the two governments. For example, the small scale zigzag developments of the Australian market capital (Figure 5) over the 16-year period indicate potential international trade problems. In fact, Australia recently encountered the decreasing demand from China and its resources industry has shed thousands of workers as a result. Australian

declining process capital in recent years (Figure 6) is another sign for attention.

For Chile, the 59-country background landscape of Figure 3 to Figure 7 clearly indicates that Chilean GDP per capita (ppp) and NIC co-development are at the lower part of the graphs. That is, there is still ample room for improvement tangibly and intangibly. In addition to the country's pledged educational reform to increase human capital and reduce poverty, special attention needs to be paid to its low renewal capital. Figure 7 shows that Chile remained stagnant in terms of renewal capital development (Figure 7) over 16 years. As renewal capability has been recognised as a key to national development and well-being, Chile needs to have higher degree of national renewal capital in order to achieve its goal of having per capita income of the OECD average (US$26,000) by the end of this decade.

In the past, national growth has mainly focused on tangible GDP growth. In an era of knowledge economy with keen global competition, the growing importance of intangible assets is a recognised trend. It is our hope that the reported two innovative governments during the financial crisis and their potential future threat may raise some topics for further contemplation.

Appendix

Stimulus package supported by the Australian and Chilean governments

Events	Australia	Chile
Financial rescue	- Cut interest rates by 100 basis points in October 2008. - Guaranteed all Australian bank deposits and the wholesale funding of Australia's banks (for a fee). - Depreciated Australian dollar in late 2008 as an effective automatic stabiliser.	- Aggressively expanded monetary policy and provided liquidity to the market in January 2009. - A mixture of new fiscal spending, targeted at low-income households (US$ 1.1 billion), investment (US$ 1.7 billion) and tax cuts. - Injected US$ 500 million in fresh capital into the state bank to provide credit to small and medium-sized companies.
Stimulus package (1)	Allocated US$ 7.1 billion (A$ 10.4 billion) stimulus package of around 1 % of its GDP in late 2008, including : - US$ 5.9 billion (A$ 8.7 billion) for four million pensioners and low-income families in the form of cash bonuses. -US$ 1 billion (A$ 1.5 billion) for housing construction. -US$ 128 million (A$ 187 million) for 56 000 new training places.	- Launched its major fiscal stimulus package of US$ 4 billion (2.8 % of its GDP and 14 % of planned current fiscal expenditures) in early January 2009. - Provided cash stipends of about $ 70 (Chilean Peso 40 000) for 1.7 million poor families that benefited more than 4 million people in May 2009. - More than 100 000 jobs were created.
Stimulus package (2)	US$ 27.2 billion (A$ 42 billion) for "Nation Building and Jobs Plan" to support up to 90 000 jobs and to boost economic growth by about 0.5 % and 0.75–1 % of its GDP in 2008–09 and 2009–10, including: - US$ 9.5 billion (A$ 14.7 billion) for school infrastructure. - US$ 4.3 billion (A$ 6.6 billion) on social and defense housing. - US$ 2.5 billion (A$ 3.9 billion) on energy efficiency measures (most of which will go to insulating the ceilings of existing homes). - US$ 576 million (A$ 890 million) on road, rail and small-scale community infrastructure projects. - Over US$ 7.8 billion (A$ 12 billion) for one-off transfer payments targeted at a variety of low- and middle-income groups, with about half the Australian population receiving payments. - US$ 1.7 billion (A$ 2.7 billion) for private business investment through a business investment tax break. - US$ 970 million (A$ 1.5 billion) to guarantee a training place for around 135 000 unemployed people aged 25 years and under.	- Advanced a pension reform to 2009, which benefited 950 000 retired people by increasing the amount of their basic retirement pensions. - By June 2009, 51.6 % of the fiscal budget and 58.4 % of the stimulus plan had already been implemented and the estimated cost of the tax elimination for 2009 was $ 628 million (0.4 % of GDP). - Granted workers to undertake training outside their own firms.
Infrastructure (Early December 2008)	Large-scale infrastructure projects amounting to US$ 3 billion (A$ 4.7 billion).	
Infrastructure (Early 2009)	An additional US$ 14.2 billion (A$ 22 billion) budget for large-scale infrastructure, which helped the Australian government outline its medium-term fiscal strategy.	

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Youth Unemployment & Innovation & Data Analysis*

Abstract

The economic downturn hit young people especially hard, limiting their opportunities to success. High unemployment, job insecurity, strong competition and a rapidly changing environment requires a new approach that ensures our youth competitiveness. More than ever, it is important to focus on the continued growth of students and teachers, integral education and especially in the development of their talent.

European young privileged situation has changed due to increased access to education and labour costs emerging countries:

Access to knowledge it is democratised now. Initiatives like *Massive Open Online Courses* (MOOC) make courses from prestigious universities around the world available for all. Therefore access to quality education no longer causes a difference. In other words since training is available to all; possession of a degree no longer distinguishes the individual.

Besides, young Europeans cannot compete on labour costs with less developed countries, while at the same time young from these countries become more and more skilled. All this requires refocus and reinvent education to return to our young the status of the best prepared for new and aggressive market environments. The culture of the 'entitlement' should finish and today's college students should be imbued of the idea of graduating from university as only the first step in the creation of their future.

Education has to emphasise actionlines like innovation, motivation and development of talent

Innovation, Motivation and Talent Development

We must focus on the development of personal talent and motivation to make possible an environment based on innovation. Motivation can be defined as an inner force that leads individuals to action. Motivation occurs naturally when people engage in what interests them.

'The motivational profile is intrinsic to human beings, we are all much brighter when we are motivated, but labour relations scheme, still based in the Industrial Revolution, prevents express that profile, and condemns us to situations of alienation, from

Figure 1:

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* *This article can be also set in the context of the Grand Coalition for Digital Jobs: ec.europa.eu/digital-agenda/en/grand-coalition-digital-job*

9 p.m. to 5 p.m. (in the best cases) and gray stocks usually much unproductive' ([1]).

In a work environment as competitive as described before, the only factor that can lead to success occurs when employees are engaged in what they like or think they are specially trained. 'It is likely that a person's "high" in self-efficacy would surpass less efficacious individuals in relation to factors such as promotions or career success or salary' ([2]).

Employees who are motivated at work are more likely to be **persistent, creative and productive**. They will also be much more permeable to learn new ways of working that involves changes in strategies of organisations.

It is precisely the combination of persistence, creativity, productivity and no resistance to change the enabling ingredients for innovation.

The development of motivation and talent required adjustments in all areas of life, but mainly in the workplace and education. At workplaces requires changes in the top management strategies, which should be more oriented to leadership and consensus of common goals with employees that the old model based on performance metrics in monetary terms. Changes introduced by the leaders require learning and adaptability by employees in order to be executed smoothly inside the organisation. We all know there is usually an innate resistance in humans and only motivation can help us to overcome the opposition. ([3])

Changes in classrooms are also required to leave room for innovation. According to Curtis W. Johnson expectations regarding education have changed and it has become in an industry also achievement-oriented, where those young people who wish have to prepare for the new economy that will dominate the world and 'hone the skills, capabilities, and attitudes that will help economy remain prosperous and competitive' ([4]).

Clearly the scheme where pupils sit for hours watching a teacher speaks no longer works. Most students are digital natives and they are accustomed to a completely interactive world where they can access knowledge through means other than a teacher lecturing. 'New classes' should be more students centric, enhancing the development of each student on topics that are of their interest, allowing them to perform real-world projects rather than passing exams, focusing on applied, modern technology, with classes and materials delivered on demand, encouraging collaboration and with Interdisciplinary approaches better than knowledge silos

We have a clear model of the changing role of education in the pioneer Aalto University in Europe, as an example of applying criteria of entrepreneurship, sharing and co-creation and innovation as a strategy ([5]).

Figure 2:

We are used to think of innovation as an intrinsic quality of human being: people are innovative or they are not. Now thanks to the work of innovation gurus we know that it is possible to develop a culture that supports, nurtures, and develops innovation in a systematic way.

How? Through talent development and application of the quadruple helix approach: government, academia, citizens and business.

Government
Creating policies to avoid penalising the failure of entrepreneurship and foster taking risks. It is known only a small percentage of all startups will succeed. It is essential not to penalise the entrepreneur and encourage him to take risks. Easy funding and tax breaks policies, among other activities to help start companies are very welcome.

Academic World
Universities can perform training tasks to enhance innovative aspects. Entrepreneurship and implementation of innovation may be less risk if rely on theories and systematic approaches.

On the other hand, the synergies generated through multidisciplinary studies and sharing the experiences of those who have already traveled the road are perfect ecosystem for a new generation focused innovation.

Not long ago, on a technological trip to Israel a few CIOs pondered there is a huge difference between the Israeli and Spanish universities (and surely this can be extrapolated to the great majority of European universities). It will be difficult to convince Israeli students to work in a company, their preference is to work on their own developing own ideas and projects. Surely there is a cultural factor, but ultimately culture is generated in universities.

Enterprises
Enterprises need closest approaches to innovation and change corporate culture to measure success with different formulas than the short-term 'Return of Inversion'. They also need to soak up new business models more in line with today's society. In this way:

- Services offered by the companies approach closer to the actual user demand.
- Virtual companies will be considered by their own and not like a reflection of physical businesses. In fact there are plenty of data-driven companies, companies whose raw material is information and whose boundaries are no longer geographic. Social network or crowdsourcing businesses reflect these new business models and a new philosophy where Internet is the natural environment in which business are conducted.

Citizens
The innovative thinking has to lead to more and better services demand. We have to be convinced that services can and must grow to meet our needs. We live in a highly competitive environment where we cannot compete in production of products. Europe is better positioned to compete in advanced services: there are many areas in our welfare society where we are ahead of many other countries like health, tourism, social policies, luxury products, care for the elderly, etc.

Data as Raw Material

Innovation models and paradigms exist to help in the process of reinventing. One of these models is the 'combination innovation model' consisting of the mixture of elements already existing in a way that had not previously been done before. What happens if we mix youth unemployment with one of the existing capacity in Europe such as the enormous quantity of information? USA took the lead in content access, indexing and search of information companies. Can we imagine a Europe that is leading in the analysis of the data?

We can prepare our students to be the leaders in extracting advantage of data analysis

Europe is a knowledge-intensive society but mostly is a data-intensive society. The data begin to be seen as a commodity very capable of generating wealth and under the new 'Big data' phenomenon lays an opportunity to create value and benefits for society, business and citizens.

According to an IDC study only 1 % of the world's data are analysed ([6]), while organisations are increasingly dependent on them ([7]) and experience indicates that when business decisions are based on analysis of data they are smarter, more precisely targeted and therefore can be translated into economic benefit.

However, the main drawback for data analysis at this time is the lack of trained people. Data analysis requires very comprehensive and multidisciplinary skills and consequently there is a clear opportunity for employment.

This opportunity is tailored to our society: we have the people, the data and the academic strength to provide analytical skills to fill the gap between offer and demand taking advantage of a new economic asset comparable to gold in words of the Word Economic Forum ([8]).

This opportunity also have to question us with a little bit of self-criticism and analyse reasons why we have not taken measures to anticipate demand and prepare our students to be the best in data analysis.

Social benefits of data analysis

In addition to the benefits in terms of employment intensive data analysis can also be beneficial to our society. These benefits can be summarised under four points ([8]).

Possibility to notice what is happening before the official indicators

For example, data from cell phones are particularly interesting because they are the only way people with fewer resources interact with technology. Analysing this data can help us to understand behaviour patterns of the excluded sectors of the population, and even help us to understand the spread of diseases ([9]).

Better understanding of real needs

Managing a high volume of information allows a more accurate picture of the real needs and furthermore allow us to build more user-centric solutions and improve access to services such as health, education etc. Otherwise the particularities are buried within the global population data.

The health sector continually strives to reconcile cost reduction to sustainable terms while must meet a growing demand for an aging society with great expectations in the care of older people is a good example of how can be based on analysis of these data to better understand patterns in the field of health and stop bad habits or remedy by preventive medicine.

More precise mapping of needs and services

McKinsey Global Institute says ([10]) that if US healthcare were to use big data creatively and effectively to drive efficiency and quality, the sector could create more than $300 billion in value every year. Two-thirds of that would be in the form of reducing US healthcare expenditure by about 8 %. In the developed economies of Europe, government administrators could save more than €100 billion ($149 billion) in operational efficiency improvements alone by using big data, not including using big data to reduce fraud and errors and boost the collection of tax revenue.

In Europe we are also piloting this idea through innovative projects as PALANTE: Leading and Managing Patient theirhealThcare through EHealth ([11]) which is a compound of 7 demonstration pilots based on the concept of secure and user friendly online access by citizens to their medical/health data. From the analysis of this data it will be possible to extract useful patterns of behaviour.

Ability to forecast demand and make the changes necessary supplies.

For instance more traditional sectors such as agriculture and manufacturing industry can benefit

Figure 3:

from data analysis to better matching between purchases, subsidies and production predicting and ensuring stock for instance.

Data Analysis: the job for data scientists.

First we should define what a data scientist is. One of the most complete definitions is from Jeffery Stanton, Syracuse University ([12]) who refers to the Science of Data as an 'emerging area of work related to the collection, preparation, analysis, visualisation, management and preservation of large amounts of information'. This definition gives a rough idea of the variety of knowledge that includes this new discipline:

- Computer skills as query languages, database design, mining and interactive data analysis, scripting or programming languages, expert systems and machine learning, etc.
- Knowledge based on mathematics like relational algebra and statistical but also predictive analysis and pattern matching, etc.
- Knowledge of data visualisation techniques, this being a very interesting field. One of the main problems in this area is how to translate the sea of data to information to the decision. The human eye is the main transmission channel and to be more effective techniques are developed to more effectively convey information.
- And of course knowledge of the business area in question. The data scientist is a specialist in handling the information and his purpose is to exploit the data to extract information.

The intensive exploration of bulk data has become a key to competitiveness and growth in Europe. It is required to place the workforce in an advantageous starting point providing them with the necessary analytical skills.

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CHAPTER III

Open Innovation 2.0 in a Real-World Setting

Wealth-Welfare-Wellbeing, Private-Public-Social Ecosystem Innovation, and Co-Creation of Value*

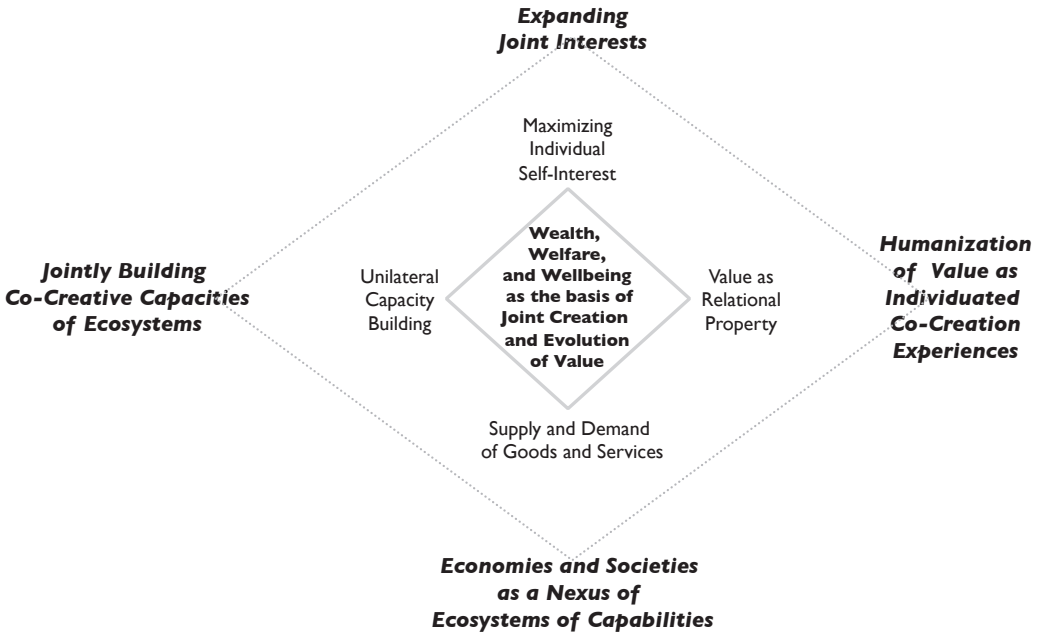
Introduction

The ubiquitous connectivity that many experience today, and that is within reach for millions of others, has fostered new social interactions, unleashing democratic and decentralised forces that take us beyond institutional boundaries. These forces continue to spawn new ways of engaging and collectively creating value. As we come to understand this new reality, we can see the contours of a more expansive and more inclusive co-creative economy and society, as shown in Figure 1 — one that is centred on *wealth-welfare-wellbeing as the basis of joint creation and evolution of value* among stakeholding individuals and enterprises ([1]).

Wealth-Welfare-Wellbeing as the Basis of Joint Creation and Evolution of Value

In the typical value creation process, enterprises and stakeholders had distinct roles. Stakeholders had a stake in value creation, but enterprises viewed stakeholders as being largely passive and docile recipients of value creation. Stakeholding individuals now expect to have a more active role, contributing through their differences in views of value and their agency in creating value. Individuals as stakeholders, whether inside the enterprise network or outside as part of the enterprise ecosystem, are integral to this differential process of jointly defining and creating value. A key point to

Figure 1: Contours of a Co-Creative Economy and Society



Source: Adapted from Venkat Ramaswamy and Kerimcan Ozcan, The Co-Creation Paradigm (2014)

* This article is based on the new book by Venkat Ramaswamy and Kerimcan Ozcan, *The Co-Creation Paradigm* (2004), Stanford University Press. Visit www.cocreationparadigm.com to learn more. The author is very grateful to Richard Straub for both his encouragement and insights.

be kept in mind, however, is that all stakeholding individuals as co-creators, who contribute to experience-based value creation, *exist equally, although they do not equally exist*. In other words, while the primacy of different stakeholders may vary depending on the particular framing of an economic system, stakeholders must be recognised as human beings in all their complexity, whose ideas about value can go beyond just narrow conceptions of 'left-brained self-interests,' as it were. As noted by Nobel Laureate Amartya Sen, 'Human beings are not merely means of production, but also the end of the exercise' ([2]). If the actual behaviour of human beings is affected by ethical considerations, then welfare-economic considerations must be allowed to have some impact on actual behaviour. And further, if wellbeing is considered to be the capability to achieve valuable human 'functionings,' then arguably *wealth-welfare-wellbeing* should be a basis of a joint creation and evolution of value.

The notion that individuals as stakeholders matter and must be conceptualised as being an integral part of the value creation process has gained hold in recent years. Stakeholders are increasingly seen as contributing intrinsically to value creation rather than as entities to be merely managed by an enterprise. Although advances have been made in going beyond the one-dimensional view of shareholder value (profit) maximisation and seeing management as beholden to shareholders, a '*homo economicus*' view of stakeholders still lingers. Stakeholder theory has evolved to a more human-oriented '*homo sapiens*' view. The enterprise is now seen as not just an economic but also a moral and human institution, where businesses are populated by and have consequences for human beings in all their complexity; this opens up the enterprise's purpose to a plurality of values and a social view of value as much as an economic one: 'businesses should be the best we can create together, rather than avoiding the worst' ([3]). This view opens up the possibility of additional value creation, rather than a zero-sum game, and of competition being emergent and value expanding, rather than being determined by industry structures and mere appropriation of value. But institution-centricity persists as opposed to seeing stakeholding individuals as their own active centres. Evolving further still, stakeholding individuals can themselves be seen as contributing 'value creation capital' with different kinds of contributions in an (innovation) ecosystem of value creation. Knowledge assumes special importance as a value creation contribution. In other words, the role of the stakeholder in value creation also changes from passive to active, affecting enterprises and being affected by them, opening up various kinds of causalities in the value creation process.

Co-Creation thinking evolves stakeholder capitalism even further with its individuated agency and experience-centric view of joint value creation, wherein agency presupposes and entails value(s), is co-creative, and is co-evolutionary ([1]). Agency is distributed in (organisations as) assemblage systems whose 'persons' include all human beings in an 'entrepreneurial' assemblage, in addition to artifacts, interfaces, and processes), whose strategic architecture of multiple, purposefully connected, platforms of engagements create outcomes of value together. Value creation is predicated on access to competence in the joint resource network (with stakeholders and enterprises still 'owning' particular key resources). So when an engagement platform–based offering entails multiple enterprises as part of the resource network supporting the offering, 'mutuality' considerations often apply, particularly in value creation instances where there is no common 'shared' value ground among resource-providing value-generating parties. The co-creation view accommodates shared, mutual, and even 'symbiotic' value creation (i.e., without 'reciprocity' necessarily).

At the heart of the co-creation-based view of economies and societies is the impulse for 'becoming'. Whether as customers, employees, managers, financiers, partners, or citizens in communities, every stakeholding individual can bring capital to the value creation process through their 'value creative capacities' and, in doing so, become a co-creator. As individuals' and enterprises' joint interests expand, they create value together through a multitude of channels and interactions. Co-creative enterprises intensify co-creators' acts of value creation in terms of wealth-welfare-wellbeing. As all enterprising entities and people attempt to change the way reality unfolds, interactions co-evolve through collective actions. Individuals' experience-based valuation of co-created outcomes, however, gauges their impact.

In contrast, we have traditionally had only limited conceptions of value creation — animated by the concepts of value as a relational property, supply-demand market mechanisms, individual self-interest, and unilateral building of capacities. As shown in Figure 1, co-creation thinking expands existing approaches to creating wealth-welfare-wellbeing in economy and society, by expanding our perspective on ecosystem innovation and value creation along each of the four dimensions, as elaborated in the rest of this article.

Humanisation of Value as Individuated Co-Creation Experiences

A traditional conception of an economic system encompasses organisations and institutions that

specify 'property relations' regulating production and distribution within a given society ([4]). Implicit in this view is the notion that value is a relational property. With the dawn of a co-creative age, enterprises must now see value creation as orchestrating platforms of engagements for intrinsic affects in and of themselves, beyond relational properties as such. Markets are a 'nexus of differences,' in which the single common element is expression, enaction, and embodiment of value as intrinsic affects through never-ending interactions and co-creation experiences ([1]). In short, individuated co-creation experiences are now the very basis of value creation in the economy and society as it is becoming, taking our conception of value *beyond the traditional goods and services based view to a more humanised view*.

Consider the field of telematics — the provision of mobile information and services to automobile drivers and passengers. As an example, take OnStar, which was launched by General Motors (GM) as a way of providing safety and emergency services to their customers. Over time, OnStar has evolved as GM has learned more about the broader interests and needs of its more than 6 million customers as stakeholders in experience-based value creation. Instead of merely asking, 'How can we use information technology to make driving safer and more secure?' OnStar now asks, 'What do customers desire to experience through their cars? How can information technology improve the driving experience, whether during a long commute, a cross-country drive, or a round of neighborhood chores?' As the answers to these questions expand, OnStar is creating a new space within which customers can enjoy personalised co-creation experiences that make driving more entertaining, informative, convenient, and fun ([1]).

Telematics is about providing connectivity to consumers in their vehicles, which demands wireless connections via satellite and telecommunication networks to common monitoring stations. OnStar's current capabilities are very impressive. But it's easy to imagine additional experiences that are well within OnStar's technological capabilities and that may already be available. Suppose I live in Pikes Peak, Colorado. The telematics service can communicate weather, traffic, or emergency alerts to me. Now, suppose I don't like the suggested route in its entirety. I may possess some specific knowledge that the system does not have, or I may want to alter the route to include certain points of interest. How can I interact with the system to co-create a route that is best for me? The telematics systems must also adapt and evolve with me, the consumer, and learn about my preferences and offer new services as appropriate. When my telematics system discerns (from my past information requests) that I am interested in the performance of certain stocks or enjoy the music of certain artists or root for a specific sports teams, it can automatically offer me share prices, information on concert tours, and the latest game highlights. But it also must allow me to personalise, define, and shape what it has given me so I can configure my desired experiences in the context of a particular moment in time. This requires ongoing dialogue with individuals, and transparent, accessible, and reflexive configuration of personalised experiences ([1]).

OnStar can thus be seen as a *platform of engagements embedded in a network of individuated co-creation experiences*, enabled by technological capabilities entailing wireless telephony, satellite communication, vehicle integration systems, and internal sensors, as well as the technologies needed to integrate the vehicle diagnostics into public networks, call centre operations, and external services such as 911 emergency networks. The hardware and software requirements and the quality levels needed to deploy OnStar safely as a vehicle-based application are quite impressive, illustrating how technologies, creatively combined, can become enablers of valuable human experiences.

Now consider a few extensions of OnStar as an engagement platform. Since the Chevrolet Volt electric vehicle was launched in late 2010, drivers have been able to manage the charging of the vehicle, including the ability to charge during off-peak hours, through the OnStar RemoteLink mobile app. Suppose I am interested in knowing if I can reach my destination on a single charge. The RemoteLink app. cannot only answer this, but it can plot a route with recommended charging stations and even download it to the vehicle. The same RemoteLink app. can also start a vehicle and its charging remotely, identify where it is parked, and even pay for the electric charging at accepting charge stations. Further, by linking the vehicle with smart power utility grids, the customer can direct the power utility to control when it charges, depending on the rates at different times of the day, when the power generated is coming from renewable energy sources. The win for a utility company, as stakeholding partner, is minimising power spikes and maximising grid efficiency.

GM has gone a step further by opening up the applications programming interface of its automotive cloud platform that enables OnStar-based services to developers. To illustrate its potential, consider a peer-to-peer car sharing service, RelayRides — a partner with GM — through which vehicle owners can rent out their idle cars and control the rates and the availability of the car. Through the OnStar

applications programming interface, RelayRides allows renters to use remote features with their smartphones, such as unlocking vehicles remotely to access the reserved car. Thus, the owner need not meet the renter to pick up or drop off keys. Or consider medical equipment technicians as care providers for senior citizen patients in their homes. Using an OnStar-enabled application, medical equipment companies could verify whether technicians visited the homes. They could also generate new sources of value by linking with other network partners so patients could directly interact with support services, and technicians could respond more rapidly and schedule their visits to accommodate patient requests in real time.

Thus, the capabilities for individuated co-creation experiences through platforms of engagements require the efforts of *nodal enterprises* that can connect together a variety of services, partners, and collaborative communities as part of the enterprising network. The enhanced competence base of such a network becomes an integral part of an individuated co-creation experience. Nodal enterprises like GM OnStar recognise the need for collaborative innovation across the private-public-social sectors and the engagement of citizens at large in building more inclusive 'quadruple helix' innovation ecosystems for open innovation ([5]). Such innovation ecosystems must both expand joint interests and be jointly designed by stakeholding individuals and enterprises to enable and connect with the co-creation experiences of individuals, as discussed next.

Expanding Joint Interests

From the time of Plato, philosophers have observed the plight of the human condition in 'reconciling self-interest with the moral urge of doing well for others'. In embracing co-creation thinking, we co-create with others not only because we want them to do well, so we, relationally speaking, will do well, too, but also because our notion of self goes beyond our own finite, embodied existence to encompass linguistic, intellectual, and communal capacities that are shared by the multitude and without which we would not even be able to function in society. We co-create in order to continuously multiply the ecosystem of capabilities that reside in the social, business, civic, and natural communities of which we are already members. People may not necessarily go beyond their self-interest if left to their own devices, unless joint interest is itself recognised to be in the self-interest of the individual. Co-creation does just that: it mandates that we do even better for ourselves by doing well for others, too. In other words, a co-creation-based view of economy and society is about expanding collective self-interests for you and me, and me and you, in 'win more — win more' fashion.

How can we see more of our joint interests to foster this approach? The notion of enterprises in the private sector leading initiatives for the greater good has become familiar thanks to the spread of corporate responsibility practices. Private sector enterprises are creating shared value together with the public and social sectors, and likewise, social (and ecologically oriented) enterprises are benefiting from working with the private sector ([6]), ([7]). The public sector can also have far more economic and social impact through partnerships with the social and private sectors. Regardless of who originates or orchestrates the underlying platforms of engagements, everyone can benefit, provided it is inclusive in practice, and expands joint interests by enabling and connecting with citizens actual lived co-creation experiences.

Consider the public sector example of UIDAI (Unique Identification Authority of India), which, though still finding its way, highlights both the opportunities for generating 'win more — win more' co-created outcomes and the potential pitfalls of less considered inclusivity in connecting with human value. Established in January 2009, in liaison with the Planning Commission and backed by the Prime Minister's Office of the Government of India, UIDAI was conceived as a public-private organisation with a chairman from India's IT private sector, a director general from the government, and almost 400 officers and subordinates staff*. As noted by UIDAI, 'A crucial factor that determines an individual's wellbeing in a country is whether their identity is recognised in the eyes of the government. Weak identity limits the power of the country's residents when it comes to claiming basic political and economic rights' ([8]). While the Indian government has made efforts in the past to provide clear personal identification documents to its residents, it has not managed to resolve issues related to the 'uniqueness' of identification within its national systems. Several different identification systems had been created for different purposes, with cards including voter identification cards, ration cards, driver's licences, and income tax cards. Absent a nationally accepted, verified identity number that both residents and agencies could use with ease and confidence, individuals underwent a full cycle of identity verification every time they tried to access a new public or private sector benefit or service — increasing overall economic costs of identification and causing extreme inconvenience to individuals.

The plethora of different identities for different institutions and different states in India has been a significant hurdle for the more than 30 million

* See also Ross School of Business Multidisciplinary Action Report on UIDAI #12-300.

poor migrant workers who are denied services and benefits when they move. With high levels of corruption, ghost and duplicate identities in various systems have been common, with more than a half of all Indians paying bribes or engaging in influence peddling to facilitate the completion of tasks requested of public offices. Due to identity issues, the government loses about $24 billion per year due to welfare schemes alone. The ability for an individual to easily obtain and maintain fraudulent identities also contributes significantly to the existence and growth of untaxed money in India, estimated at $1 trillion (equivalent to 60 % of India's GDP in 2010). Moreover, according to UNICEF, only about 40 % of children younger than five are registered at birth. This lack of identification becomes a significant barrier for underprivileged residents who cannot access benefits and subsidies from government welfare programmes. Thus, immense benefits could be derived from a mechanism that uniquely identified a person and did so instantly, securely, and accurately.

The UIDAI's purview was limited to the issuance of a 12-digit Unique Identification number (UID) branded as *Aaadhaar* (meaning 'foundation' in Hindi), which is linked to a person's demographic and biometric information. The UID infrastructure collects only basic Know your Resident (KYR) information (name, date of birth, gender, and address) for each individual and a photograph together with their biometrics (fingerprinting of all fingers and scans of both irises) during registration. The Aadhaar number itself is randomly generated and does not reveal any personal information about the individual. Moreover, the UID guarantees only a person's identity, not rights, benefits, or entitlements. While enrolling for Aadhaar is optional as such, the central government of India budgeted approximately $380 million to fund UIDAI, and enrollment commenced August 2010, with a goal of enrolling 600 million people by 2014. As of this writing, over 200 million Indian residents have registered with registrars in the 35 states and union territories that enroll residents, and over 180 million Aadhaar numbers have been issued, making it already the largest and most advanced biometric database in the world.

At a fundamental infrastructure level, UIDAI Aadhaar illustrates how the public sector can potentially enable and foster the building of capability ecosystems for all enterprises in the economic and social system, whether private, social, or public. This foundation is both technological and social. On the technical side, it provides a universal identity infrastructure over which private, social, and other public sector enterprises can build services and applications that benefit residents across India. Enterprises that become part of the UID applications ecosystem get an authentication service via UIDAI confirming almost immediately the identity of any individual through an advanced technology infrastructure that checks incoming UIDs and biometric information against its database. On the social side, it represents a new dawn of equal opportunity for each individual. (Aadhaar's logo is a sun in red and yellow with a fingerprint traced across its centre that communicates just this.)

The UIDAI Aadhaar initiative is not without resistance from within the government and external critics and opponents. Aadhaar's potential to eliminate duplicate or 'ghost' beneficiaries threatens rent seekers across the existing system who will no longer be able to exploit the system to their advantage. Although Aadhaar will act only as an enabler of services and systems, it does eliminate redundant systems and processes that duplicate work across government states and departments, sparking resistance from those who feel it will take over the function of existing personnel. Further, some existing government systems are not up to date and will need to be overhauled to enable the effective application of Aadhaar. For example, in some states, existing databases of the Public Distribution System, the Indian food security system, exist only in the form of offline document files. These files must be converted into an online database before they can be linked to Aadhaar. There is resistance to this change from some quarters.

The concept of Aadhaar as an electronic cardless identity has also spawned concerns about data privacy, viability, intent, and risks of the initiative. Some have argued that most of the poor get deprived of what they need because of corruption and not lack of identity. Leakages, it is argued, stem more from officials taking bribes and charging more for the transport of goods (e.g., grains). Others have called into question the huge amount of money being spent in the name of the poor and without any legal and constitutional sanction for it as yet. Although UIDAI has repeatedly emphasised its avowedly pro-poor mission, there has been backlash from civil society activists and leaders who work with the poor.

The scale of the Aadhaar initiative demands a deeper level of engagement with its myriad stakeholders for it to be successful in the longer term. Although it was set up with a public-private organisational structure, the lack of inclusivity of social sector stakeholders from the start appears to have contributed to social discontents. Public initiatives are as much a social as a technical challenge. While policy-makers need to focus on technical implementation, costs, and delivery issues,

concerted efforts are necessary to include social sector stakeholders in order to nurture public trust. Traditional communications efforts to educate the public of the benefits of the initiative are not sufficient anymore in an age where the influences of conventional and social media can take on a life of their own. Citizens need to be actively engaged in a dialogue about the initiative to ensure that concerns about functionality, security, storage, and privacy are addressed. This requires a focus on transparency from the citizen's perspective. It is crucial to connect with human experiences of openness and accountability and to establish dialogic engagement platforms to nurture public trust. This is not easy by any means, but without due diligence and purposeful design around co-creation principles (creative, intentional, integrative, and transformative engagement design) public trust can dissipate easily ([1]).

For instance, one of the strengths of the UID system is that it is based on both an open technology architecture and an open applications programming interface that allow any service provider to participate in the Aadhaar ecosystem by developing an application that utilises Aadhaar as an authentication method. UIDAI could build an applications design engagement platform that fosters co-creation of key applications. Doing so, however, requires co-designing the engagement design of this platform together with stakeholders both in the communities in which applications are designed and in the communities in which the applications will be used. In addition to the applications developers, service providers, and served customers, there are other key stakeholders such as public/private sector banks, non-banking finance corporations, microfinance institutions, National Payments Corporation of India (enables interoperability between banks), Reserve Bank of India (the banking regulator creating the regulatory environment promoting financial inclusion), and state governments and departments that enact policies and create systems and processes to deepen financial inclusion. UIDAI, as a nodal entity, faces the challenge of leveraging the capabilities of these stakeholders to support the strategic architecture of multiple engagement platforms in the financial inclusion application ecosystem. These engagement platforms will have to bring together the various stakeholders to engage in multifaceted dialogue aimed at generating new ideas in the ecosystem; discussing benefits, costs, and risks; and fostering active discussions and experience sharing and consensus building among stakeholders, all to enable significant co-creation of expanded value in the ecosystem. Further, continuous stakeholder engagement with the various users of applications service platforms would allow the ecosystem to evolve based on feedback from stakeholder experience domains, to minimise conflicts, and to lead the design of platforms toward more transformative engagement and actualisation of unique value all around.

Jointly Building Co-Creative Capacities of Innovation Ecosystems

Jointly building co-creative capacities of innovation ecosystems necessarily entails a convergent engagement of private, public, and social sector enterprises. Continuing with the UIDAI example, consider the real-life applications UIDAI is piloting as part of Aadhaar's application ecosystem. Consider, specifically, the goal of financial inclusion, which seeks to give people the ability to control their money, enabling them to gain access to basic financial savings, affordable credit, remittance services, and insurance and investment products. (Only about half of Indian households have a bank account.) The economically disadvantaged pay a poverty premium, as it were, because they have no means to store the cash they earn and because they are unable to apply for bank accounts due to a lack of identification. Furthermore, in rural areas, people often have to spend hours, and sometimes an entire day, travelling to the nearest banking facility and end up spending a significant portion of the money they had hoped to save for the journey.

Now consider an Aadhaar-enabled Payments System as a means for achieving the goal of financial inclusion. This is a prepaid system that includes a Business Correspondent (BC) operating a micro-ATM device and a process that enables cash transactions for the customer. The micro-ATM device is essentially a fingerprint authentication device that communicates with the UIDAI and the banks through a payment switch to access the bank accounts of the resident and the BC. The BC starts by depositing a predetermined amount, currently around $200, in the bank that owns the micro-ATM device. This amount or 'prepaid' balance changes with every transaction that the correspondent conducts for a resident. When a resident makes a withdrawal from his account, the correspondent pays the resident cash. This amount is credited to the correspondent's account and withdrawn from the resident's account. The opposite happens in the case of a deposit where the resident gives a cash deposit to the correspondent. The first step of the process is authentication of the resident done through the UIDAI's authentication application. Once the resident is authenticated, the Aadhaar-linked bank account is accessed, and the account balance is announced in the local language through a speaker interface in the ATM device. Similarly, the withdrawal or deposit amounts, both pre- and post- withdrawal/deposit balances, are announced through the speaker, ensuring complete

transparency and helping to mitigate any attempt by the correspondent to skim income from the resident's withdrawal. Although this is only in the early stages, the platform capabilities have to evolve as a function of experience-based engagement to connect with the social milieu in which the platform is embedded. For instance, the current design makes the details of the transaction clear to mitigate leakage, but it also raises the security risk of large withdrawals, notwithstanding privacy concerns. This is an instance where open ideation of the design challenge can generate new potential solutions.

As the UIDAI example suggests, innovation ecosystem infrastructures can turbocharge co-creative capacities. In the broadest sense, infrastructure is everything in the built environment that is distinct from natural environments. The foundational primacy of physical infrastructure affords it a rather unique status. For instance, a city's bridges, roads, and water system are not described simply as important physical artifacts but as investments in the city building process. The history of successful infrastructure investment is less about the direct impact of technology and more about the interaction between technology and society. The returns on investments are measured in terms of a society's economy, health, and social wellbeing. Infrastructure is thus a critical determinant of co-creative capacities of an ecosystem of capabilities.

With over 50 % of the world's population now living in cities and this figure projected to grow to more than 70 % by 2050, the need for adaptive and responsive infrastructure is paramount to the capacity, prosperity, livability, and sustainability of our future connected cities. The building of smart infrastructures allows cities to intelligently utilise technology to adapt to their environment, and it plays a central role in the competitiveness of cities and their capacity to grow and support sustainable living. ([9]), ([10]). Airports, like cities, also require a common open operating system that allows for the sharing of data between artifacts and presenting that data as information in the right way and on the right devices to benefit and engage citizens ([11]). Infrastructure networks, in addition to blending the social and technical, also operate to continually transform the natural into the cultural ([12]). Urban infrastructures cannot be reduced to a set of technical objects, but instead need to be seen as complex assemblages that link human, nonhuman, and natural agencies across territories and communities. In the past, we have rarely defined sites in a way that would permit joint exploration of organisational or network architecture ([13]). The emerging alternative position operates from the premise that the real power lies within the relationships among multiple distributed sites that are both collectively and individually adjustable. Further, the dynamic achievement of a functioning energy, communications, water, or transport network requires constant effort to maintain the functioning system. Despite occasional veneers of permanence, closure, and stability, infrastructure architectures are always precarious achievements. The links between nodes do not last by themselves. They need co-creative management systems, which is yet another reason for building co-creative capacities jointly.

Thanks to the world wide web, social media, and advances in mobile and interactive communications and information technologies, networked individuals around the globe are no longer passive and docile recipients of dispensed instructions and development assistance. They are active participants and collaborators in the value creation process and co-creators of solutions with a wide range of private, public, and social sector enterprises. On their part, enterprises are learning how to engage external and internal stakeholders and to harness their personal, peer-to-peer, and collective knowledge, creativity, and expertise for the purpose of engendering development together. Development, as Nobel laureate Amartya Sen has argued, is about capabilities to engage with freedom's processes and opportunities ([2]). This requires understanding the direct relevance of human capabilities to people's wellbeing and freedom and its role in influencing social change and economic production. Capacity development has typically prioritised problems, 'deficits', and strategies at the local level, since training for, measuring, and tracking capacity development tend to be manageable at that level. A perspective that privileges the local, however, comes with the risk of ignoring the diversity of the community itself, as well as opportunities to leverage ideas and solutions from communities outside the local. Note that community capacity is rooted in the meshwork of human capital, social capital, and organisational resources that is resident within and outside of that community, which can be leveraged to develop solutions to collective issues and thereby maintain and enhance the wellbeing of that community ([14]). Community capacity can be tapped by various forms of social agency, ranging from individuals through organisations to civic networks, to obtain desirable community conditions and improve sustainability of community capacity itself.

Co-creation thinking can expand value creation in economy and society by seeing it as *a nexus of* private, public, and social ecosystems of capabilities, with heterogeneous modes of human experience-based value creation that go beyond mere modes of 'production' of goods and services and 'relations of production.' Further, expanding joint interests, especially by jointly building co-creative ecosystem

capacities, provides for a far more productive basis for reframing human agency and markets, and economic growth and social enrichment in the future, as discussed next.

Economies and Societies as a Nexus of Ecosystems of Capabilities

Viewing markets as a nexus of differences implies viewing economies and societies as a nexus of ecosystems of capabilities centred on productive and meaningful human experiences, through platforms of engagements of all stakeholding individuals in economy and society as a whole. Consider the case of Rio Grande do Sul, one of Brazil's richest states, which nearly went bankrupt in 2005, as public investment reached its lowest level in 35 years. Since 1970, one government after another had failed to implement the necessary state reforms to reduce public debt. By 2004, 32 % of tax revenues were tied to the pension burden and 13 % to the increasing public debt. In the early 1990s, Brazilian commodity export-oriented states like Rio Grande do Sul suffered not only from the negative impact of the overvalued national currency but also from a severe decline in agricultural production due to recurring droughts. It became increasingly clear that no single entity could solve the state's major structural problems.

In late 2005, the Brazilian National Confederation of Industry (NCI), a powerful pan-business group, proposed a draft agenda to begin dialogue on setting goals for Brazil's sustainable development. The focus was on a joint interest engagement model that would result in a co-created strategic agenda. Several state governments and administrative departments warmed up to the concept, especially the state of Rio Grande do Sul. In 2006, leading entrepreneurs then rallied civic leaders to propose a comprehensive programme for the economic and social recovery of the state. The industrial state federation, FIERGS; three trade associations, FDCL, Fecomercio, and Federasul; and FARSUL, the entrepreneurs' association got together to begin deliberations on organising civil society and reversing the state's economic situation. Far from playing a passive role in building public policies, these economic agents decided to propose a deep process for social and economic recovery. Political articulation began in various social and economic spheres. In order to drive legitimate change, the initiative was dubbed 'Strategic Agenda 2020,' so as to engage not only members of the 'sponsoring' entrepreneurial organisations but rather the whole system, including representatives from trade unions, NGOs, government, political leaders, and educators. (For example, fully 30 to 40 % of the identified programmes in the NCI agenda draft were being undertaken by private entities and NGOs.).

For starters, a live engagement platform was conceived for engaging different stakeholders, building political consensus, and co-coordinating lobbying activities. The goal of this platform was to co-create a democratic means of developing another common engagement platform that could be incorporated into the government programmes of elected officials. Naturally, this called for a process of consensus building and democratic goal setting by a coalition of diverse stakeholders collectively representing the interests of the public. It was coordinated and facilitated by volunteers, economists, politicians, and external experts led by Symnetics, a consulting organisation, over multiple phases. In the first phase, about 950 people came together, representing all social segments — from community, union, and association representatives to business and academic leaders, NGO personnel, and government officials. Dubbed 'The Future Vision of Rio Grande do Sul 2020 (the Rio Grande that we want)', it was a landmark achievement in terms of social mobilisation and engagement through live meetings and workshops enabled by a 'Future Search' process.

The next phase was to co-design a strategic agenda entailing long-range goals, objectives, targets, and actions (initiatives) for current and future generations and to keep government focused on strategic priorities. It was important to bring a long-term perspective on economic and social programmes, while reducing the likelihood of discontinuity from one administration to the next. For instance, considering that a return on education and infrastructure programmes can take 10 years or more, the strategic governance agenda — by enduring successive administrations — can help maintain the commitment to initiatives and ensure that a 15-year plan of action is actually accomplished. The agenda had to identify a societal vision and a corresponding set of long-term objectives, targets, and actions in a framework that could either be created within government or outside of it by a coalition of stakeholders. In fact, in October 2006, the strategic agenda was presented to the two state government candidates, who promised in front of over 1 000 people and the media to implement its targets.

This brings us to the third phase of system wide implementation and performance management. While on one level, there have been roadshows and communication efforts and campaigns all over the state, on another level, there have been public discussions with newly elected government officials and reviews of initiatives and their collective progress across the board. A website (www.agenda2020.org.br) was created with an online public forum and open access to every presentation or discussion topic from the agenda to democratise the governance process moving forward. In effect, it was hoped that the

agenda would become a 'public observatory' for governance and performance management, where every public and economic entity would align its agenda with broader, strategic ones. This would also foster collective public debate and dialogue, with periodic 'feedback on the feedback' via updated newsletters and blogs as part of an ongoing conversation and continuous recalibration of the national agenda.

The Strategic Agenda focuses on 12 topics: Education, Health, Security, Citizenship, Agribusiness, Regional Development, Public Management, Logistic Infrastructure, Innovation and Technology, Environment, Energy Infrastructure, and Sanitation through 31 main projects and many others spread throughout the state. This large agenda and its proposals have produced smaller, more focused movements and entities that tackled state challenges with a local approach. These independent projects show how the Agenda2020's principles have gone beyond the original initiative itself, engendering a co-creative atmosphere and spirit around Rio Grande do Sul.

Co-Creative Transformation of Innovation Ecosystems

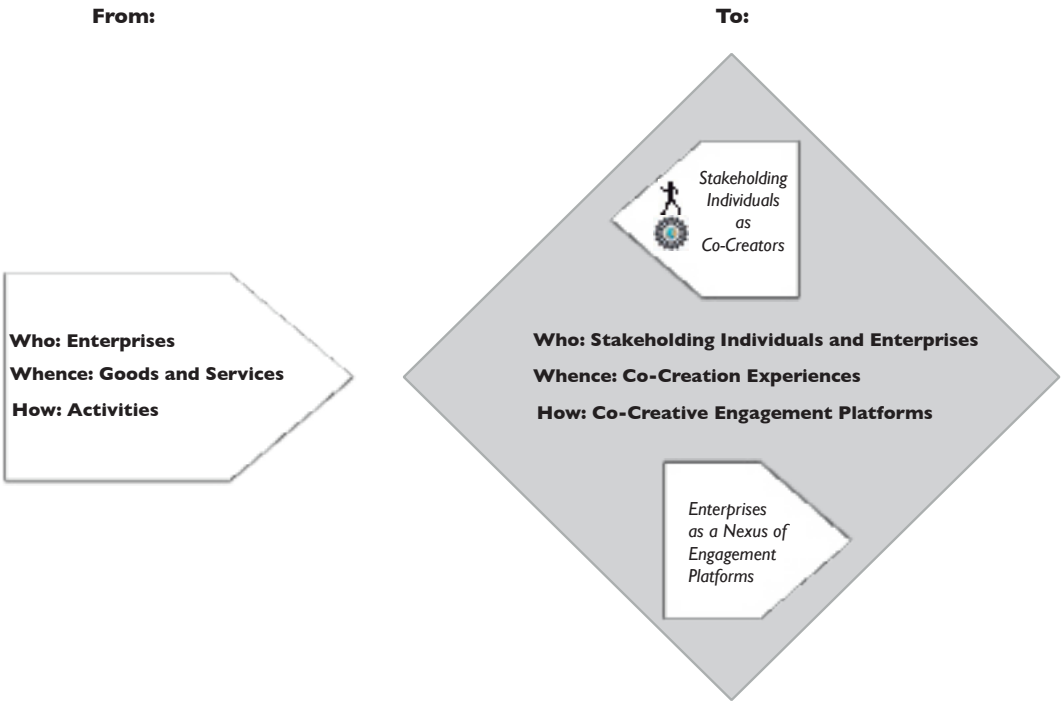
The co-creative transformation of innovation ecosystems toward wealth-welfare-wellbeing as a basis of joint value creation and evolution of value, as we have discussed, is predicated on the co-creative transformation of each participating nodal enterprise in the ecosystem, whether private, public or social, as shown in Figure 2.

This transformation entails joint creation and evolution of value with stakeholding individuals, intensified and enacted through platforms of engagements, actualised and embodied in domains of experiences, and virtualised and emergent from ecosystems of capabilities — see ([1]) for more details on co-creative enterprise transformation.

Briefly, co-creative enterprise transformation can be broken down into the following components:

1. Jointly creating and evolving value with stakeholding individuals;
2. Purposefully designing platforms of engagements;
3. Affording a variety of novel, personalised interaction environments;
4. Meshing together ecosystems of capabilities;
5. Augmenting creative capacities of enterprise architectures and management systems;
6. Enabling and supporting individuated value creation, personally and in the social, business, civic, and natural communities in which individuals function;
7. Connecting with the quality of actual experiences of engagements through the platform and of the outcomes of value that result;
8. Using rapid experiential learning, insights, and knowledge to co-evolve human stakeholder experiences of value;
9. Building new strategic capital for enterprises; and
10. Expanding wealth-welfare-wellbeing.

Figure 2: Co-Creative Enterprise Transformation



Source: Adapted from Venkat Ramaswamy and Kerimcan Ozcan, The Co-Creation Paradigm (2014)

The late Nobel Laureate Ronald Coase, who at age 101 (in 2012) witnessed more structural changes in economy than most of us, called for reconnecting 'Man and Economy', thus: 'It's time to re-establish the connection between economics and the ordinary business of life .... Knowledge will come only if economics can be reoriented to the study of man as he is and the economic system as it actually exists' ([15]).

Co-creation thinking bridges 'human experience and economy' as it were, providing a way to put back human experiences into the economy in central fashion, and beyond to 'individuated co-creation experiences in society at large' through the convergence of private, public, and social sector innovation ecosystems on wealth-welfare-wellbeing and co-creation of human value.

Enterprises must fundamentally stop thinking of individuals as passive and docile recipients of their offerings but must instead engage individuals as active co-creators of value. All entities that affect or are affected by the actions and outcomes of a value creation process can be co-creators. In other words, the more inclusive the engagement of stakeholders in the act of creating value (through engagement platforms), the better the results. Value is subjective and not only varies from individual to individual, but also within individuals in the context of their experiences in space and time. The meaning of value is thus a function of human experiences, and products and services are a means to this human experience-based embodiment of value. By definition, individuals are an integral part of creating experience-based value, and their creativity is relevant to the outcomes of experience-based value. Engagement platforms are both offerings and the means to create those offerings. Individuals must be engaged as stakeholders in value creation on the same level as enterprises. Convergence of value creation based on individuals' experiences in economy and society necessitates that all enterprises, whether private, public, or social sector, must engage people both individually and collectively. Private, public, and social enterprises must build innovation ecosystems of capabilities centred on the wealth-welfare-wellbeing of all individuals.

Building such innovation ecosystems requires going beyond 'doing well by doing good' to 'we do even better for ourselves by doing well for others'. By creating more value with others, the 'win more — win more' nature of value co-creation simultaneously generates enhanced wealth-welfare-wellbeing.

Co-creative public, private, and social innovation ecosystems have the potential to balance the invisible hand of free markets with the visible hand of governments and civil society, together with stakeholder expectations of more responsible, responsive, and effective enterprises, and coevolving better states of governance, infrastructure, development, and sustainability. Ultimately, co-creative innovation ecosystems have the power to transform our reality of the world. It is a 'way of becoming' toward a world full of transformative possibilities. Are we ready to co-create the change we want to experience personally and collectively in the world?

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Oulu Innovation Alliance — an Open Innovation Ecosystem

Introduction

Innovation dynamics has increased, leading to new requirements for the successful and sustainable innovation ecosystems ([1]). The evolution of innovation has been from closed, inward-looking innovation to collaborative innovation and further to the ecosystem centric, cross-organisational innovation (Figure 1). Ecosystem centric innovation puts focus on close collaboration in between all the innovation players.

City of Oulu with its innovation actors is a forerunner in open Innovation; the open Innovation approach is behind city's success as a 'European Silicon Valley'. Oulu's approach where innovation is a discipline practiced by many — being more than a sum of ecosystem parts — is very much in line with Open Innovation 2.0 (OI2) describing the new innovation paradigm based on principles of integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption (Figure 2). This ecosystem approach has been emphasised i.a. in the report of the independent expert group concerning European Innovation Partnerships (EIPs) as a Tool for Systemic Change ([2]).

Figure 1: The evolution of innovation ([1])

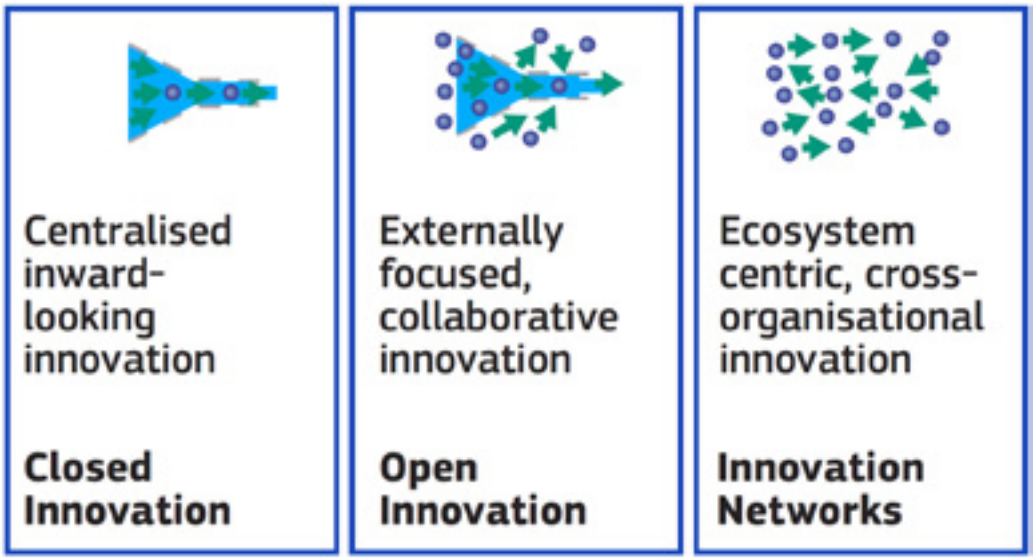
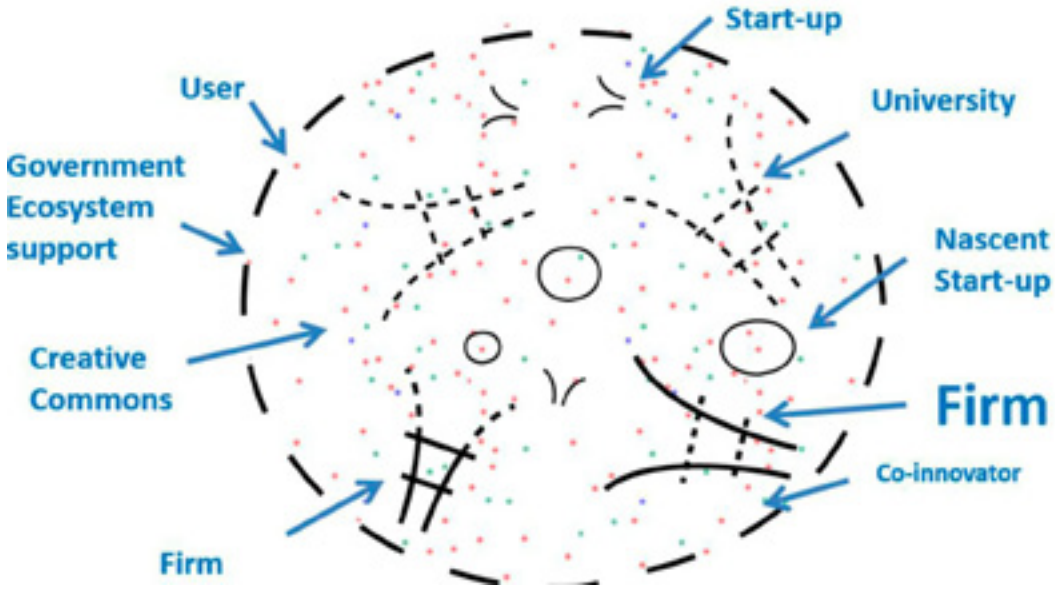


Figure 2: Open Innovation 2.0 (OI2) approach to innovation ecosystem ([3])



City of Oulu is also a good example of an innovation ecosystem with cross-organisational focus. The city, which is also regarded as the Capital of Northern Scandinavia, is located in Northern Finland (Figure 3). This article presents the Oulu open innovation and Public-Private-People-Partnership approach.

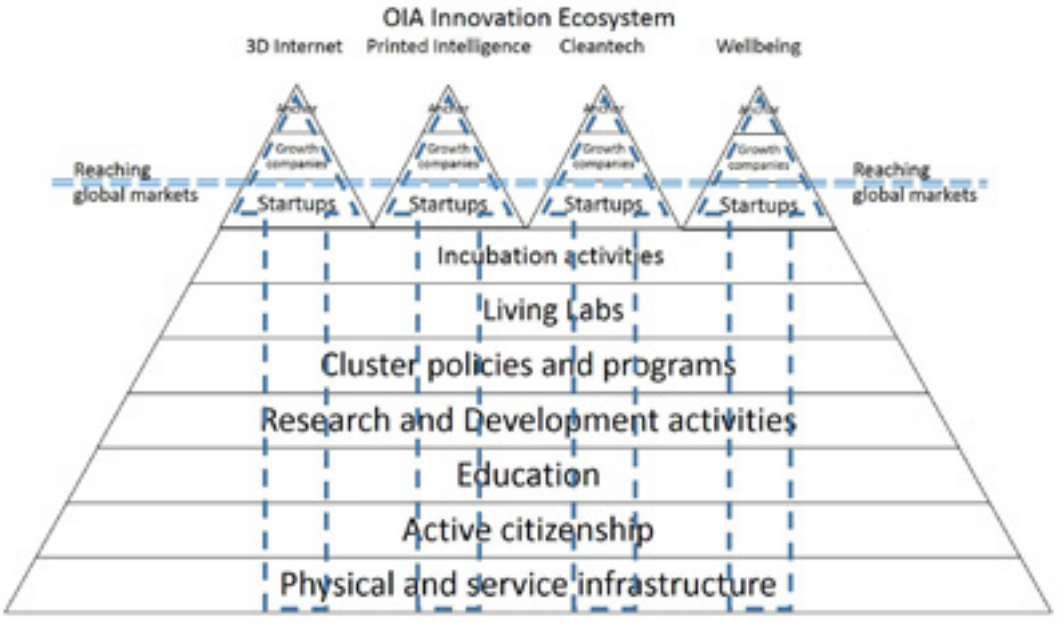
Basis for the Oulu Innovation Alliance

The basis for transformation of the Oulu region from a stagnant industrial region of the early 1980's to one of the leading high-technology centres in the world from 1990's onwards is based on a series of innovations co-created by the local industry, academia and the City of Oulu ([4]). These innovations include a number of 'global firsts' such as first NMT network (1981), first GSM base station and GSM phone call (1991), as well as the first contactless fare collection system in public transportation (1992). These innovations, and way of working together, have created the foundation for the economic success and subsequent well-being in the Oulu community.

To go beyond the success achieved with help of ICT City of Oulu formed the strategic Oulu Innovation Alliance (OIA) with the University of Oulu, Oulu University of Applied Sciences, VTT Technical Research Centre of Finland and Technopolis Plc. in 2009 ([5]). The purpose of the alliance is to perpetuate Oulu's long tradition of cooperation between education and research institutes, companies and the public sector that established the Oulu region's high-technology success. The ultimate goal of the OIA is to maintain Oulu's position as an internationally renowned centre for innovation. To achieve this goal

Figure 3: Location of Oulu

Figure 4: Oulu Innovation Alliance Ecosystem



the founding partners have committed themselves to focus on agreed innovation areas, to invest in infrastructures and to create and develop mechanisms for joint use.

The innovation areas were selected based on international benchmarking/foresight study combining globally potential sectors and sectors where Oulu has global level excellence. The selected innovation sectors were cleantech, future Internet, printed intelligence and wellbeing technologies. All of these sectors were recognised not only as a global growth sectors but also as an areas where Oulu can offer excellence and an ecosystem for the development and exploitation of new innovations.

Oulu Innovation Alliance Structure

Oulu Innovation Alliance has a multi-headed Innovation ecosystem structure, which aims to support the potential sectors' innovation activities as a multidisciplinary collaboration network, covering the whole value chain (Figure 4). The ecosystem covers all parts of innovation support mechanisms all the way from common infrastructures to the international business. At the same time, as recognised in the benchmarking study, the arrow heads from strong sectors will reach the global markets, benefitting the whole ecosystem. The multi-headed structure works also across sectorial boundaries, linking the best excellence to create new innovations and to achieve best results, following the principles of smart specialisation ([6]).

'The arrows' consists of innovation centres in respective sectors; all the operative work of OIA takes place in the centres that focus on different fields of expertise, while the ownership and coordination lies in the hands of the partner organisations (Figure 5).These research and innovation centres — Center for Internet Excellence (www.cie.fi), Printocent (www.printocent.net), Center for Energy and Environment (www.cee.fi), Centre for Health Technologies (cht.oulu.fi), as well as the business centre Martti Ahtisaari Institute (www.maigbe.fi) link the parts of the ecosystem theme wise putting emphasis on local open ecosystem and seamless collaboration.

OIA structure is based on open innovation approach; instead of talking about PPP (Public-Private-Partnership) the approach includes one more P. Public-Private-People-Partnership — PPPP involves an essential part of open innovation ecosystem — the users — to the system (Figure 6). Involving the real people to the innovation process at the earliest possible phase is one of the secret weapons of the Oulu Innovation Alliance. People in Oulu are active and eager to get to know and be involved in the creation of new innovations; these early-adopters form a group which can be used by companies, public bodies or researchers to get real feedback to their needs, be it new application, service or research question.

OIA Organisational Structure

To guarantee smooth collaboration OIA structure consists of common decision-making structure, with board consisting of directors of respective organisations (Figure 7). Second level is the working group consisting of more practical level presentation to exchange information in between the OIA organisations. The third level is the group of Innovation Centre directors where the practical collaboration is discussed. The everyday collaboration level is in innovation centres and OIA owner organisations staff where the practical work is done.

Example of Oulu Innovation Alliance Innovation Centres and Open Innovation — Center for Internet Excellence (CIE)

The mission of CIE is to actively drive co-creation of next generation Internet technologies,

Figure 5: Oulu Innovation Alliance Innovation Centres and Owners

Figure 6: Oulu Innovation Alliance Open Innovation Structure — PPPP

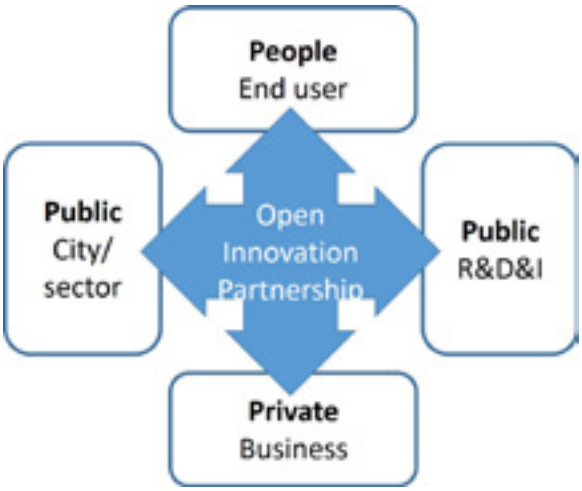


Figure 7: Oulu Innovation Alliance Organisational Structure

appliances and services ([7]). CIE aims to capture and create Internet-driven growth opportunities and value by combining cutting-edge research innovations with agile new business creation processes. Focus is in new technology of Future Internet which is closely linked with user-driven innovations and open innovation processes. The role of CIE is to build collaboration with OIA partners as well as other local and international partners, and find such spearhead programmes and projects, which will elevate the level of research and innovations.

CIE has strong focus on open innovation. Related to this, CIE is using and promoting the use and development of open-source platforms. In the field of 3D Internet the platform is called realXtend ([8]). The development of realXtend was started in 2006 and it is now spread globally as an open-source choice for virtual worlds. CIE with its collaborators is now involved in European Future Internet project FI-WARE to further develop the platform, and to make it as a standard for 3D Internet.

In addition to the platform development CIE is aiming its activities to find sectors where 3D Internet would provide maximum value added. In this context there are projects which are related for example to teaching/learning and tourism.

Living Lab Activities in Oulu

One part of CIE open innovation and end-user perspective consists of its Living Lab activities; CIE has been developing Oulu's Living Lab activities under

the brand OULLabs (Oulu Urban Living Labs) ([9]). OULLabs provides ideation, development and testing services for companies and organisations on one-stop shop principle.

OULLabs consists of a unique set of test environments, such as

- PATIO forum — Online forum for collecting user's opinion — at the moment the forum has more than 700 users from all age groups from 18 to 85 ([10])
- panOULU — Network of Public Wireless Internet access covering broadly the Oulu city area with 30 000 users/month of the hotspot network ([11])
- UBI hotspot — Network of interactive public displays for collecting citizen's opinion with 30 000 users/month
- 3D Virtual Laboratory — Visualising e.g. urban plans and involving users in the development
- TTKaakkuri — Product testing platform in the real healthcare environment
- Converging Networks Laboratory — Wireless network testing

From the city perspective the user's involvement provides excellent possibility to develop the services with the real users of the services; and not just for the users of the services. In this context OULLabs has been used to test the services before actually launching them for good. The user's involvement has also been used in the procurement processes; Living Lab services have been used as part of the procurement process to test service options from different bidders. The people who are supposed to use the equipment/services under procurement process have been able to test all the possibilities and give their comments. These comments have then been taking into account when selecting the winner of the procurement process.

City of Oulu has also opened its databases in the open innovation spirit to be used for example for product development purposes ([12]). Related to the 3D Internet there is also an open-source virtual environment under development — Oulu 3D model — which can be used as a platform for development environment and access point for new services.

One example of the city's activities in the field of open innovation and user involvement is the development of a new district, Hiukkavaara, by using it as a Living Lab environment where people and businesses are taken along already from the very beginning of the planning process. Besides the end-user perspective for the regional planning from very beginning, this means also big opportunities to develop new energy effective, ecological and innovative solutions, which can also be turned into successful business. All the OIA players participate in this innovation process, following the multidisciplinary nature of the innovation alliance work.

Open Innovation and Turning Ideas into Business

Oulu is well known for its efficiency to turn research into business ([13]). The innovation ecosystem based business development which uses research and people as a basis for new innovations is open innovation at its purest form. For example, an essential part of Nokia's success was built on this approach and close collaboration. The research-innovation-business process makes it possible for researchers

Figure 8: Oulu Innovation Alliance Research-Innovation-Business Process

and business developers to get instant feedback from users — be it a single user or a company considering the possibilities of setting up new businesses — at the earliest possible point (Figure 8). At the same time researchers gets feedback to their work from users of research results what to study next.

Essential resource for supporting the business development is the end-user community, consisting of Real People — not just students — who are willing and ready to give their contribution to the innovation process. With help of end-user testing company can test their product/prototype/idea with real users at any phase of the innovation process. Besides testing wit end-users/people, tests can be done with potential existing businesses which could exploit potential new products or research outcomes as part of their processes.

Oulu Innovation Alliance — a piece of Global Innovation Ecosystem

Oulu has already a history as a successful open innovation ecosystem, especially in the field of ICT. The Oulu's innovation engine is like the DNA in the body, being part of its each cell ([14]). It is based on the long tradition of cooperation between education and research institutes, companies, public sector as well as enthusiastic and innovative individuals. This Smart City-focused innovation ecosystem means that the entire system serves the common goal i.e. making the city a better place to live in and to make the global growth oriented business to grow in the city ([15]). Oulu Innovation Alliance — OIA — is the tool to further develop this approach, to make it work in all the strong sectors of Oulu.

The OIA collaboration is playing an important role to intensify and broaden Oulu's international networks, making it even more successful and attractive. The international approach to innovation, as well as Oulu's excellence in the field of interactive 3D Internet will lead to establishment of a close and interactive international network of innovation ecosystems.

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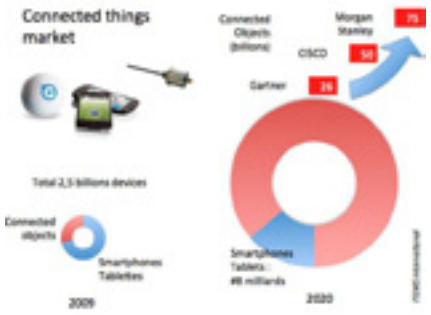
Smart Fabric to Big Data: from One Innovation to Two Promising Businesses

Introduction

The Internet of Things is now a reality. After many years of works and debates, the world of connected objects faces a tremendous increase in innovations and market products.

Figure 1:



The retail market including RFID Tags and the associated supply chain was considered the most promising 2008. Understanding of this market is different today given the increase in the number connected objects in our day-to-day life. The last CES in Las Vegas was a clear illustration of this trend ([1]).

Among the connected objects, the ones that were dedicated to the Quantified Self market were probably the most present and the most innovative.

Among them, Cityzen Sciences presented the Smart Sensing technology, which received the 'Inclusive Innovation' award. It was selected by Forbes as one of the 'Five Most Disruptive Innovations at the CES 2014' ([2]).

Background of the story

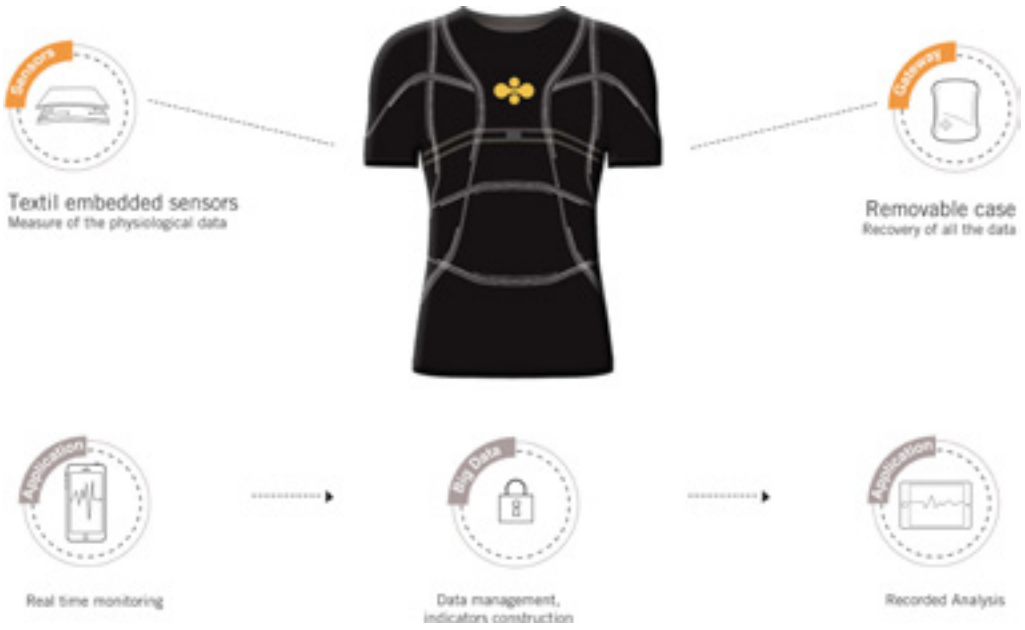
Jean-Luc Errant has a strong background in the use of digital technologies in health. However, the health market is very complex for a new entrant. You never know who your client is: the patient, the doctor, social security, the hospital ... There are many stakeholders to put sit around the table and it can take time and resources. So, he preferred to think about the benefit of future technologies for sport and wellness users.

When leaving the house nowadays, you always take three things with you: your keys, your mobile phone, and your clothes. Many of us are prone to forgetfulness and sometimes forget our keys, phone, or both ... but never our clothes. This simple idea is key: the future challenge for Cityzen would be to introduce sensors within the fabric of clothes with the objective that the users will be able to forget the presence of all these technological components.

Jean-Luc Errant is a sportsman. He has many connections among players and clubs in particular in Rugby, Basketball ... After different meetings he concluded that his vision was right. He decided to devote his time, his energy and his money to this challenge.

With a small team working with Jean-Luc Errant, we setup a project including strategy, technological

Figure 2:



rifts options and choices, design of services to users, partners, business plans. After first contacts with OSEO that was the French public fund devoted to finance Innovation, we decided to change the scale of the project. Jean-Luc gathered companies coming from different sectors and different cultures:

- Éolane ([3]) which is a successful French electronic company. Éolane has more than 3 500 employees around the world. They are able to design and manufacture electronic components, devices or systems. They can manufacture from a limited number of units to many hundreds of thousands of units according to their clients' needs. That is a successful wedding of industry and service in electronics,
- Payen ([4]), a firm specialised in innovative fabric based between Lyon and Marseille. Payen operates worldwide and provides advanced fabrics to major brands and professional sectors (cars, industry ...),
- Telecom Bretagne ([5]) (Mines Telecom Institute group), which has a famous expertise in Sensors and usages. Prof Gilles Coppin, Director of Labsticc ([6]), played a key role in the technical ripening stage of the project.

Connections were developed in parallel with first leagues clubs: Stade Toulousain for Rugby, AS Saint-Etienne for football, Villeurbanne (ASVEL) and Aix-en-Provence (PABA) for basketball. On the technical side, Cityzen Data developed relationships with CEA LETI in Grenoble.

A consortium was finally set up to apply for public funds from OSEO (which is now BPI France) with the name of Smart Sensing. It includes an industrial partner to test the technology: Cyclelab. The overall budget of the project is 17.7 millions. The project was backed by CapDigital ([7]) (ICT Cluster Paris and Ile de France Region) and succeed to get a public fund allocated by OSEO/BPI of 7.2 millions.

Beyond its award in Las Vegas, Cityzen Sciences has now developed partnerships in Europe, China and Japan. Cityzen Sciences is now part of a European Project financed in the framework of ITEA, Careware ([8]).

The Market

The terms 'fitness' and 'exercise' mainly referred to physically active groups such as athletes and body builders. Therefore exercise equipment or sports nutrition products were addressing these communities. But with growing focus of overall wellbeing among the general population, sports and wellness products have started to address sportsman amateurs and more globally the whole population. The new communities that are increasingly becoming an area of interest for various sports companies include weekend fitness or sports enthusiasts and people who are interested in maintaining keeping themselves fit With growing demand from users, sports and wellness products are now available in mainstream mass market outlets such as supermarkets and convenience stores.

Worldwide individual and team sports and fitness activities are expected to provide a significant boost to sales of sports and fitness clothing in the coming years. 'Within the developing regions, the trend towards westernisation is fast catching up and together with rising income levels, there is considerable demand for using sportswear for sports as well as casual purposes. Continuously evolving and heading in diverse directions, the sports apparel market has found new themes — versatility, growing fashion consciousness, increase in sports participation, particularly among women, emphasis on product performance and comfort, focus on healthy life styles — that are propelling its steady growth. The US, the largest sporting goods market worldwide, continues to set global standards in the industry' ([9]).

This market could represent $180 billion in 2018 according to PRnewswire. The Cityzen Sciences estimation is that the wearable technologies could address 10 % of this market. This evaluation matches with figures published by market research companies like Juniper (Smart 'Wearable Devices to be worth $19 billion by 2018') ([10]).

At the same time, modern life style, passive office work and a fast-food culture has caused the increase of health issues such as overweight, stress and sleeping problems. Sensors technologies measuring heart rate, temperature, physical movement, pain, sleeping status provide accepted and valuable services to users. By the end of the decade, the worldwide mobile health market is expected to grow to $49 billion, according to a new study by Grand View Research ([11]).

There are two ways to address these two markets:

- by proposing additional devices, and
- by including the technologies in other objects or devices.

Many additional devices already exist. They propose to monitor some daily life parameters are driven in part by sport: for activity monitoring with form factor such as wrist watch; or USB key you may have in your pocket or attached to your clothing (ex: fitbit one www.fitbit.com/fr/one), other devices are designed to be closer to the skin, and attached to the skin such as a patch, but still having a rigid body for electronics and battery. Usually

the parameters monitored are ECG, temperature and activity. Finally some sensors are integrated directly in the textile, mainly electrodes for heart rhythm monitoring (ex: Adidas) but electrode contact with skin remains difficult and gel is needed. Unfortunately, there are still a lot of challenges and issues that need to be resolved for wearable systems to become more applicable to real-life situations and also to become accepted by patients and other users as a reliable, multifunctional, easy-to-use, and minimally obtrusive technology that can increase their quality of living.

Cityzen Sciences makes the bet that the successful story will come from the clothes that we usually wear.

The Critical Value of Data Management

Cityzen Sciences understood early on that the value of technology and services would come from data analytics such as:

- How to combine data from different sources?
- How to consider the historical profile of each user?

Finally, Jean-Luc Errant and myself decided to launch a company dedicated to addressing these key issues focused on the Smart Fabric market with Cityzen Sciences, as well as other markets. We were fortunate to meet Mathias Herberts who has a solid background in data management and analytics.

Today the result is a robust and high-level performance platform and tools that are composed of 5 blocks:

- a storage framework based on 'geo time series'. Time series are going to become the new key paradigm for data originating from sensors. Traditional databases are not adapted to this market in spite of claims to the contrary. Cityzen Data has developed a very innovative solution for managing data and geolocation in the same series:
- a set of advanced functions and a language to clean, manipulate and analyse data; to detect patterns or weak signals.
- visualisation tools,
- a library of APIs.

Today Cityzen Data is in negotiation with several major groups including some that already have a platform to manage Data. Cityzen Data does not address vertical markets. It just provides an advanced technology to manage data to any players that want to use data analytics across all business sectors.

Towards European Partnership

Cityzen Sciences has established high level partnerships with major groups in Europe who consider that the technology developed by Cityzen data is more advanced than other tech providers. Some initiatives should be announced in the next few months in Europe and China.

Finally, with the help of BPI France, we have succeeded in launching two promising companies by setting up one innovative project. We have now to prove that customers will make them a reality. This is a challenge which Cityzen Sciences and Cityzen Data are excited to face.

Horizon 2020 is now coming with its priorities and its series of calls. It could give us new opportunities to develop new innovations that could strengthen our position on the market. However, it is not easy for a start-up to apply for a European Project. You have to decide to spend time to prepare a project when you have so many other things to do and so many potential opportunities on the market in Europe, Asia and the US, including offers to purchase both companies.

Cityzen Sciences is part of the Careware Project founded by ITEA. This project addresses similar and complementary objectives with Cityzen Sciences. Beyond this collaboration, European collaboration raises the key question: Are we ready to share a part of our Smart fabric technology in a European Project? Or would it be too risky to work with other companies that are bigger than us?

For Cityzen Data, the point is to balance our time with our trust on the evaluation process. Our geo time series technology does not address the final usage of Big Data but the way we manage the data itself. It is not necessarily the most sexy even we consider that the key factor of success after discussion with potential clients.

In both case, we are probably a good example of the kind of technology that Europe should support regarding international competition in these sectors and the potential of the markets in question. Even with our objective to develop the company from our French base including strong convictions about the future of Europe, we still have to find out new relevant opportunities.

Appendix

Cityzen Sciences in European Careware Project (ITEA3)

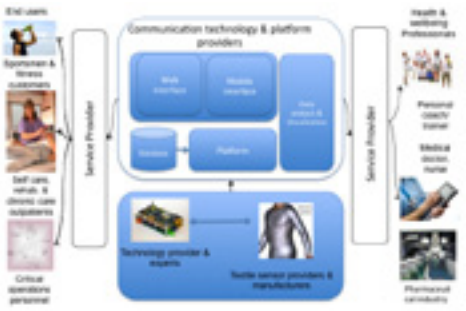
There is considerable potential for digital service development & innovation in the existing and emerging wearable sensor technologies that is not utilised at the European level because innovation development in this field requires sensor companies, electronic textile ([12]) experts, platform providers and service application developers working together in the business ecosystem (as described in Figure 1). The goal of the business ecosystem of CareWare project is to provide unobtrusive wearable sensor based digital services to support home care, professional care and operational care in health and sport domains.

The innovation of CareWare project is to result 1) improve sensor technologies, 2) versatile sensors and actuators integrated in electronic textiles 3) platform, architecture, big data analysis and visualisation solutions for novel sport and health solutions, 4) produce a variety of validated digital services/proof of concepts for personal health and wellbeing, 5) Business models & ecosystem for the digital service creation in health domain.

The novel CareWare ecosystem will provide new solutions for digital service innovation bridging the gap between electronic textile technologies, advanced sensor technologies and application platforms and therefore to allow the generation of unobtrusive digital services for monitoring and advancing personal health and wellbeing. For the healthcare system and society CareWare will result more treatment options, and solutions for lifestyle monitoring to support a healthier society. More sensitive and timely monitoring of chronic conditions to reduce overall healthcare costs and contribution to affordable, sustainable healthcare integrated into people's life. The benefits of the CareWare project for the different actors are summarised as follows:

Careware partners ranking according their weight in the project: VTT (FIN), PUMA (DEU), NXP (BEL), Philips (NLD), Cityzen Sciences (FRA), Eolane (FRA), Medixine Oy (FIN), SpaceNet (DEU), Esperity (BEL), AUDIMAS (LTU), Reden (NLD), Roessingh (NLD), Fraunhofer Gesellschaft (DEU), Visiotex (DEU), Lithuanian Sports University (LTU), Softkinetic Sensor (BEL), Actimage (LUX), Santech (FRA), Televic (BEL), Institut Mines Télécom (FRA), Traxmeet (FIN), Beddit.com-Finsor (FIN), HeiaHeia.com (FIN), Omegawave (FIN), Kauno technologijos universitetas (LTU), Optitecha (LTU), TNO Holst Centre (NLD), TITV Greiz (DEU), Elasta Ind (BEL), Centexbel (BEL), SIRRIS (BEL), Suntrica (FIN)

Figure 3:



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The Open European Youth Innovation Framework (OpenEYIF™)

Abstract

The European Young Innovators Forum (EYIF), Europe's leading foundation dedicated to promoting youth innovation, in this paper outlines the blueprint for an Open European Youth Innovation Framework (OpenEYIF™) that aims to create a Sustainable Youth Innovation Ecosystem in Europe using Open Innovation.

EYIF's OpenEYIF™, using Open Innovation methodologies, aims to tap the creativity of European youth and the institutional, academic, financial, industrial and market actors who can support them, creating an European youth innovation ecosystem that enables new European young innovators to build and transform their ideas and early-stage projects into innovative products and services in areas of vital socioeconomic importance for the future of the European project, such as Big & Open Data, Smart Cities, Space enabled Services and Digital Social Innovation.

Background, Concept and Objectives

EYIF's OpenEYIF™ leverages Open Innovation processes and mechanisms, aiming to create a sustainable Youth Innovation Ecosystem for Europe that, in-line with EYIF's vision, mission and purpose, forges a bottom-up movement of youth innovators across Europe, enabling the next generation of Europe's best new ideas and projects to reach the market.

EYIF, drawing on its expertise, experience and track record of helping European young innovators with early-stage ideas to take develop those ideas into concrete projects, products and services makes the following essential observation about the core idea that is the basis for the OpenEYIF™ concept:

In order to ensure seed-type activities generating actual take-up of innovative services and applications, it is not enough simply to open calls for participation in an Open Innovation value chain, rather it is necessary to provide a complimentary essential Open infrastructure of training, support and embedding in an Open Innovation environment for those selected through such calls, to build a sustainable longer-term ecosystem.

The guiding principle of EYIF approach, embodied in the OpenEYIF™ concept, is therefore to combine robust open-call lifecycles for participation of new constituencies of young innovators in Open Innovation value chain with full-lifecycle support for the grantees through training, incubation and post-incubation in actual innovation ecosystems.

EYIF's OpenEYIF™, is a three-stage integrated framework targeting the new constituencies of young innovators i.e. between 18 and 30 years, who though technically aware have not yet developed real-world projects in areas of vital socio-economic importance to Europe, such as Big & Open Data, Smart Cities, Space enabled Services and Digital Social Innovation.

The best ideas and early-stage projects will be awarded seed grants (below EUR100 000) and crucially, participation in an incubation programme hosted by one of a European network of business incubators and their ecosystems, offering new opportunities and creating new, positive and marketable opportunities for the new young innovators.

The Goals of the OpenEYIF™ are:

- To bring to the marketplace innovative, commercially viable applications that will contribute to the development of the areas of vital socio-economic importance for the future of Europe, such as Big & Open Data, Smart Cities, Space enabled Services and Digital Social Innovation
- using a three-stage integrated framework approach based on Open Innovation mechanisms targeting new constituencies of young innovators i.e. between 18 and 30 years,
- that will mitigate the risks of failure and increase the chances of technological and business success and thus ensure a sustainable longer-term innovation ecosystem.

Methodology and Process

The framework is structured around three main pillars that work together, holistically supported by a cross-stage communication and dissemination process:

- A European network of business incubators and their ecosystems qualified to host early-stage, pre-seed start-ups, offering a choice of geographic location and specialisation.
- A structured incubation programme consisting of technology training and technical support, entrepreneurial education, workshops, seminars, individual mentoring by experts, organised networking, and support for business planning and development.
- Full commercialisation support for grantees who successfully graduate from the programme with a marketable application, including access to international markets and to finance.

The three stages of OpenEYIF™
*(*the stages are running over two-year duration)*

Stage 1: Engage and Mobilise new innovators who have

- good ideas targeted at specific user communities, that would bring new innovative assets to the Open Innovation value chain,
- determination and willingness to work with open technologies to build innovative and technologically challenging projects and products, in a wide range of usage areas
- tech awareness, particularly ICT awareness, and
- concrete goals to create real-world projects, product and services that can evolve into seed-type activities generating actual take-up of products, services and applications

will be engaged and mobilised through a distributed pan-European communication campaign at the target communities, to apply to the OpenEYIF™ open calls for ideas and participation.

Stage 2: Build & Try (ideas are selected and turned into assets using Open Innovation mechanisms):

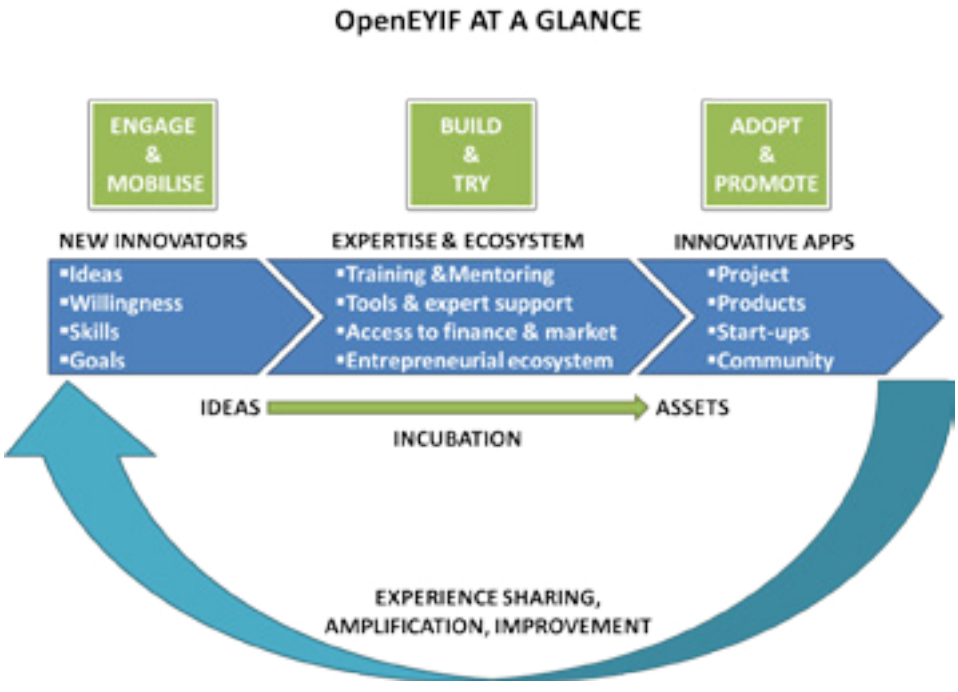
- robust open calls for ideas and participation to target, identify and select high-quality ideas,
- incubation of selected grantees in a public-private funded non-profit business incubator network across Europe as well as virtual incubation and embedding in the innovation ecosystems these incubators are a part of
- provision of training, mentoring and experts support on necessary technologies, tools, business and entrepreneurial skills to build their ideas using platforms and technologies and create projects and products that can be tried and improved iteratively,
- provision of access to finance and markets through carefully calibrated local/regional/European innovation ecosystem with leading experts and practitioners on market access, risk finance.

Stage 3: Adopt & Promote projects, products, start-ups

- will continue to receive post-incubation support on the technology, business and entrepreneurial aspects,
- will have the results i.e. the assets they created disseminated to the local/regional/European ecosystem of the network as well the ecosystems they are a part of and the specific user communities that they target,
- continue to be part of the local/regional/European innovation ecosystem they were embedded in to ensure a sustainable longer-term environment for the assets they created

The actions taken during Stage 3 will ensure that within these ecosystems the successful new developers will share their experience and amplify the call to action for young innovators. Equally, the feedback they will generate will lead to improvements in the way the OpenEYIF™ is implemented

Figure 1: The three Stage of the OpenEYIF™



and also the quality of ideas generated from the new batch of innovators for subsequent calls.

Cross-Stage Communication and Dissemination

The Framework foresees a 360 degree integrated approach for communication of the open call for ideas and participation as well as the dissemination of results, which will engage and mobilise different pan European communities, i.e. the Young Innovators Community, Tech and Open Data Communities, the Open Innovation, Open Source and ICT Infrastructure Community and the Start-up Ecosystems in different networks around Europe to submit their innovative ideas within the subsequent Open Calls.

At the exit of the incubation programmes the grantees will share their experience with the communities they had emerged from, contributing to the amplification of their experiences and leading to the engagement of more and high quality applicants during the second phase of the Open. Furthermore this will contribute to the adoption (exploitation) of their outcomes by their respective communities and across Europe.

Tools and Mechanisms

Robust Open Calls

The OpenEYIF™ proposes recruitment of European young innovators through a series of open calls for proposals, reaching the target groups (identified below) through multiple channels, both direct and indirect, online and offline:

- Online: The OpenEYIF™ implementation project website and websites of the incubators and their ecosystem actors, social media networks, blogs, specialised discussion forums, technology news sites and through targeted advertising (e.g. Facebook and Google ads);
- Public platforms: relevant European Commission Portals, National and Regional Government sites;
- Indirect: communicating through the respective networks of OpenEYIF™ implementers, such as EYIF's Regional Innovation Hubs;
- In person: by EYIF's Youth Innovation Ambassadors and Regional Innovation Champions;
- Media: public relations and ad campaigns in national and international media;
- Open Innovation Community: joint promotion with other Open Innovation projects and communities;

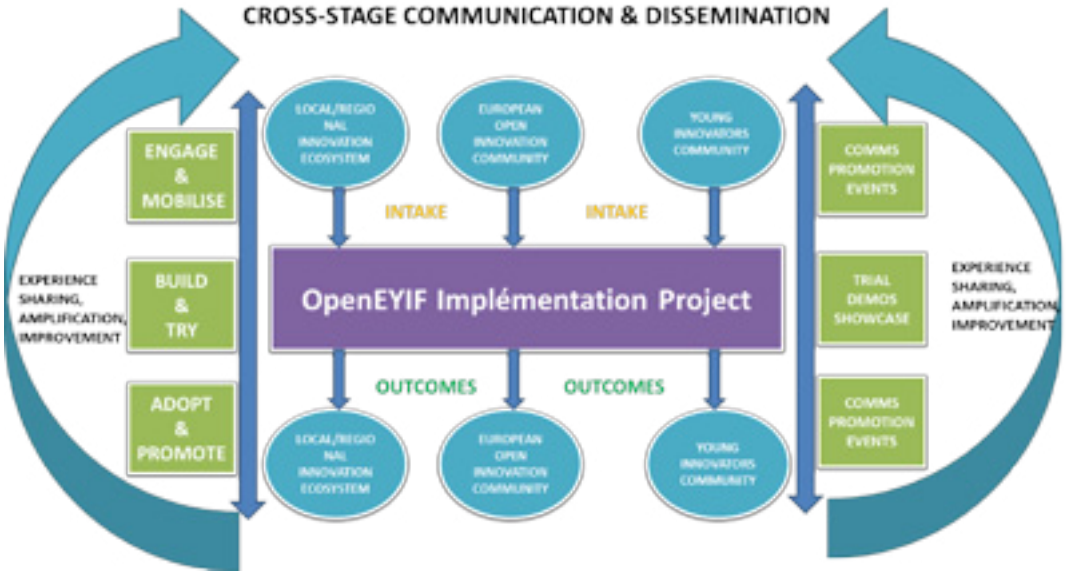
Promotional events & activities (hosted locally by participating incubators and ecosystems as well as road shows and external events: conferences, exhibitions, hackathons, etc.).

Open Incubation for Success

EYIF OpenEYIF™'s approach of providing full incubation for the awarded grantees mitigates the risk of their potential failure and the subsequent loss of risk capital. This approach is unique in comparison to other Open Innovation mechanisms in that it proactively mitigates risks instead of reactively managing risk of failure post-facto, when in fact it is often too late to take meaningful action. This approach significantly affects the Open Innovation success curve.

Open EYIF foresees a three-month residency programme in a network of fully-equipped business incubators, with technical training and support,

Figure 2: The Cross-Stage Communication and Dissemination of the OpenEYIF



entrepreneurial training, workshops, seminars, business networking, and one-on-one mentoring by experts. Grantees who successfully graduate from the programme with a marketable application will receive support for access to finance (accelerator, business angel and venture capital investment) and access to international markets.

The Incubator network's dual missions will be:

- To facilitate and accelerate the development of the early-stage pre-seed ventures, by enabling young Europeans to technically skill-up and validate their innovative idea, as well as acquire basic entrepreneurial skills and an European market perspective, and secure the capacity, resources, and funding in order to become viable entrepreneurial companies;
- To serve as a demonstrator of youth innovation that will showcase compelling success stories and role models, thereby inspiring young Europeans to take the risk to innovate, and inducing policy-makers and business leaders to share the risk by actively supporting youth innovation

The network of business incubators across Europe will provide the grantees their choice of geographic location and specialisation. The programme offered by the incubators will consist of several topics like Needs Filtering and Business Plans, Brainstorming and Prototyping, Business Models and Finance, Concept Development & Implementation, how to build a robust business plan around the developed prototype, Intellectual Property and Regulatory Affairs, Reimbursement Strategy, Sales, Marketing, Pitching and Business Sustainability.

Post-Incubation Support

Post Incubation Support will consist of assisting successfully incubated grantees after the incubation period for a six-month period (three months of intense support and three months of support based on request). The grantees will continue to receive tech support while the entrepreneurship ecosystem they will become part of will support them with access to finance (introduction to VCs, business angels, crowdfunding platforms, potential corporate sponsors/partners), markets, policy & decision-makers, business leaders & mentors and local ecosystem support.

Impact and Benefits

The OpenEYIF™'s three-stage integrated framework approach implemented through a communication campaign and robust open call mechanism, followed by a comprehensive incubation programme including a crucial post-incubation period, followed by a longer-term embedding of the selected developers and their successfully implemented high-quality applications will deliver new innovative assets targeted at specific user communities. In doing so, it will enhance the impact of the Open Innovation Value Chain in areas of vital socioeconomic importance to Europe, such as Big & Open Data, Smart Cities, Space enabled Services and Digital Social Innovation. The OpenEYIF™ foresees a cross-border, European approach that brings together strong actors from all parts of the ecosystem, irrespective of where they are in Europe to deliver this impact.

The key benefits of the OpenEYIF™ approach for Open Innovation in Europe is that it:

- creates awareness of the potential of the Open Innovation value chains in local/regional/European ecosystem that are currently not a part of Open Innovation Ecosystems,
- promotes and creates an adoption path for Open Innovation value chains amongst a new constituency of new constituencies of young innovators i.e. between 16 and 30 years, who are then likely to use it for future projects and products development ensuring wider awareness,
- ensures the selection of ensures a wider adoption of the Open Innovation value chains through both the dissemination of the results of these innovators which are successful implementations of high-quality ideas, as well as the personal advocating of their successful Open Innovation experience providing a sustainable longer-term environment for Open Innovation in Europe.

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Service Design Based on Smart Urban Lighting

Abstract

The lighting industry is in transition from a hardware only industry to a full solution and services industry. With the growing availability of all kinds of data on the one hand, and flexible lighting systems (with sensors and controls) on the other there are many opportunities for new business with services in lighting. It also creates opportunities for new professions, such as in the design of lighting services and in the development of software applications for smart solutions: professions that are new and require different skills than the traditional ones in the hardware related industry.

Introduction

Last year, in the Open Innovation Yearbook 2013, we presented the case of participative innovation in smart urban lighting, with a vision on the future of urban lighting and its transition towards a focus to improve quality of life in cities. In the past months various projects have been initiated to make this vision a reality. All of these projects build on the enabling technologies that led-lighting and ICT solutions provide and seek for meaningful services. In these projects various public and private organisations collaborate to explore new venues. A reflection on these projects shows that new skills are required compared to the traditional professions in the public lighting domain. We will first explain the context of smart urban lighting, and then we will show practical examples of two cases, before reflecting on the consequences for jobs in this field.

Innovative Lighting Solutions

Public Lighting and Public Lighting Infrastructure can play a significant role in achieving ambitions of cities in making the city an attractive place to live. Technological developments include an upgrade of the public lighting infrastructure and system by connecting to ICT solutions. This enables cities to offer a wide range of intelligent and integrated services benefitting society and individual citizens and bringing cities closer to the ambition of becoming smart cities. This integrated lighting- and ICT solution can best be explained by describing 4 levels of the system (see also Figure 1):

- **Infrastructure**
  The level of the infrastructure can be seen as the 'road' that enables all 'traffic'. Traditionally for public lighting this meant the underground wiring for power. Nowadays it also includes Internet connectivity as well as wireless solutions. In the coming years, the infrastructure will become a dense network to enable the connection of all kinds of devices and communicate all kinds of data.
- **Devices**
  The number of devices is growing rapidly. Traditionally, devices in public lighting contain public lighting luminaires and traffic lights. This is gradually expanding with other types of sensors and actuators, either with low bandwidth, such as timers, light intensity sensors, microphones, movement sensors, fine-dust sensors or high bandwidth for example camera's, interactive displays, touch screens, and smart phones. Many devices collect or use data and are therefore connected (the Internet of things).
- **ICT**
  On the ICT level the connection is made with data and software applications. The data that is collected through different devices contains e.g. time, people counting or proximity measurements, weather information, movements, energy consumption, camera data, etc. Mashups and data analytics will lead to insight in emerging patterns or correlations that can be used for various software applications.
- **Services**
  At this level meaningful services are developed that provide value for the relevant stakeholders. In urban lighting there are often different stakeholders that use the area, with different needs and wishes. The ultimate goal of urban lighting solutions is to create value for societal stakeholders by creating a healthy and liveable city. Smart lighting can offer valuable services for different stakeholders using the ICT based lighting platform.

In this four level model, technology is considered an enabler. Technological developments create new opportunities for applications. These applications become meaningful when they address relevant societal needs.

In the coming years innovation will take place at all four levels. Businesses will drive technology developments, securing intellectual property and providing hardware to the market. This hardware will become mainstream, easier to produce in low-cost countries and will create little jobs in Western Europe. However, in the field of meaningful applications designed to address societal needs there are more opportunities for new jobs, especially in the domain of developing new services with lighting. The type of jobs is shifting from hardware related jobs towards the design of lighting services as well is to the development of software applications for smart lighting solutions: jobs that are new and require different skills than the traditional jobs in the hardware related industry.

Figure 1: Levels in the system architecture of intelligent lighting solutions

The development of meaningful applications requires a changing attitude interconnecting the different levels:

1. Open platforms, open data and open knowledge make new connections possible. By linking data and integrating various perspectives new solutions for societal needs emerge. Data analytics becomes an important element to identify emerging patterns and spot new opportunities. It also enables to determine the impact of solutions. The technical challenge lies in the selection of the required devices to efficiently and effectively collect data and integrate all data into a total system.
2. Innovation driven by societal needs requires the active involvement of all stakeholders to find solutions that cater for their different needs. Stakeholders turn from objects to active participants, being involved in all stages, including very early ideation and prototyping. The active involvement of stakeholders is also needed to develop new revenue models that enable the continuous innovation and further development of the services. Municipalities may be able to provide basic infrastructures in public lighting, but due to budget restrictions it is not realistic to expect that all investments will be done from the public domain. By understanding the potential value of innovations for the different stakeholders, also opportunities for co-investment arise.

A Changing Business Environment

Meaningful applications in public lighting are based on societal needs and use the enabling technology in lighting and ICT to provide solutions that address the needs of the stakeholders. Different areas in cities have different stakeholders with different needs. The solutions will need tailoring to the specific situation. For example, an entertainment district in a city has different stakeholders with different needs than a residential area or an area around a school. For each project it is therefore important to start with an inventory of the specific stakeholders of the area and their needs. Based on these needs a creative process starts to define a proposition for an urban lighting solution. With intelligent lighting solutions it is often possible to address different needs with one technical platform as long as the platform is able to offer this flexibility. To illustrate this process we give the example of two projects that are currently in development.

Increasing the Hospitality in a Public Square

One of the projects the TU/e Intelligent Lighting Institute is involved in is the Amsterdam Smart Lighting project. In this project a smart lighting solution is being developed for Hoekenrodeplein, a square in Amsterdam. This project is a collaboration between the city of Amsterdam, Philips Lighting, Cisco Systems, Alliander and the Intelligent Lighting Institute. All partners invest in this pilot with the ambition to create a showcase for smart lighting solutions. Hoekenrodeplein is situated in the surrounding areas of the Amsterdam ArenA where frequent soccer matches and various events take place; the Heineken Music Hall and Ziggo Dome, both hosting large scale music events; the Arena Boulevard, with various shops; the Bijlmer ArenA train station; and Reigersbos, a residential area. So although it is very close to lively areas, the square itself is mainly used by commuters just passing it on the way to their destinations. In the redevelopment of the area an investigation was made of the main stakeholders in the area and their needs. These needs were defined as:

- **Sustainability**
  The city of Amsterdam has the ambition to reduce energy consumption and lower the carbon footprint and therefore would like to use led-based solutions. Furthermore the idea is

to only provide light when needed, and dim the lighting when possible. This is also preferred to reduce the level of light pollution.

- **Safety**
  The reputation of the area is not as good as the city would like. Improvement of the safety is needed for crime prevention and will improve the image of the area. Lighting is seen as a good way to support this need. Furthermore, a specific element in this area is the need for crowd management solutions when events are taking place and large numbers of people visit the area. Smart lighting solutions might also help to manage these crowds.
- **Hospitality**
  Various stakeholders wish to improve the hospitality of the area to attract people and to make them stay in the square for leisure activities. This will also increase the social safety and social cohesion in the area. Smart lighting solutions would potentially have an impact on the hospitality.

Because of these needs, propositions were developed for a smart lighting solution with the ambition to cater for as many needs as possible. The proposed solution is an adaptive lighting solution that creates an attractive atmosphere in any circumstance. It adapts to the use of the square: commuting or leisure. The solution exists of a set of dimmable led lights that reduce energy consumption. The system uses people counting sensors to be able to dim the lights when there is nobody around, but that also gear up when light is needed. Because the square is quite large it also makes use of the fact that the same light level might not be needed everywhere at the same time: by lighting up areas of the square where people are present, a pleasant atmosphere can be provided when it is not so busy, thus create an inviting atmosphere that attracts more people to stay and stay longer. When it becomes busier more lights are turned on, creating a larger area that is attractive to spend time. Furthermore, to increase safety when it is very busy, the system can be geared up to calamity lighting, enabling surveillance and emergency officials to keep an eye on the crowd or provide help when needed. A side effect might be that when these high light levels are applied, some people will find the place less attractive and will leave. Once the amount of people is down to a certain level, the lighting will change again to create a cosier atmosphere.

Technically, the system needed to create these light-on-demand settings involves just lights, people count sensors and an application to design and trigger lighting scenarios. When looking further in the needs identified by the stakeholders, an opportunity was found in using the same technical system to increase a 'virtual stage'. Dedicated spot lights can create a stage for (music) performers and local talents. People can book airtime on the stage through an app. or portal. The performance can be recorded or streamed to the web by the video camera that is normally used for people. This virtual stage can be promoted in connection to events in the area and might make the square more attractive to visit and create a prolonged stay of people before or after events in e.g. the ArenA, Heineken Music Hall or Ziggo Dome. It is even possible to charge a fee for the booking of the virtual stage, thereby creating a revenue model to earn back the investments for the development of the app. and for new investments in the smart lighting system and related apps in the area.

This case shows that the technical system enables the creation of various services for different stakeholder needs. The challenge lies not so much in the technology (although a good system integration of various existing building blocks can still be a challenge in itself), but more in the development of meaningful services that make sense in this specific area. The type of people needed to perform such projects is not the traditional lighting designers that are used to make a lighting plan based on uniform distribution of a sufficient lighting level. In this case the challenge is to creatively design services using the available technology and integrate the different needs into one solution. Furthermore, more dynamic lighting scenarios need to be designed, that address issues as atmosphere creation and changing the behaviour of people (in this case to invite them to stay in the square they otherwise only pass by). This will not be just a one-time design, but regular new lighting scenarios are needed to keep the square attractive over longer time for returning visitors. The hardware infrastructure allows for such flexibility.

Increasing Safety in an Entertainment District

The city of Eindhoven is currently implementing its vision and roadmap for urban lighting. This involves the set-up of various living labs in the city to explore the opportunities of innovative lighting solutions to increase the quality of life in the city. One of the living labs is related to the project Stratumseind 2.0. Stratumseind is the entertainment area in Eindhoven, a street of approximately 400 metres long with around 50 pubs, attracting over 20 000 young people every weekend. As in many entertainment districts, incidents happen. Moreover, the businesses in the area are suffering from reduced turnover. This was the reason to start collaboration between the entrepreneurs, breweries, property owners, police and city council and set up the living lab to explore

the possibilities to structurally improve and increase the economic and social activities on Stratumseind. The main needs identified in this case are:

- **Safety**
  The ambition is to reduce the amount of incidents. Stratumseind is also a very well-known area for specific events such as the celebration of national holidays and victories of the Eindhoven soccer team PSV. At times it can be really busy, and crowd management becomes an issue.
- **Liveability**
  Improving the liveability for the neighbouring residents. Some residents are living directly above the pubs and others live in adjacent streets and experience the area as being very noisy at times.
- **Attractiveness**
  The area is well visited in the weekends, but mostly late at night. There is a need to extend the liveliness for a longer time by attracting more people during daytime and early evening.

One of the propositions being explored at Stratumseind is the ability to influence mood and stress levels of the visitors of the street. For this purpose a research project 'De-Escalate' was defined that got awarded with a national subsidy in the Netherlands. Partners from various organisations also invest in the project, including the municipality of Eindhoven, Polyground, the Dutch Institute for Technology Security and Safety, the association CrimiNee, Philips Lighting, ViNotion and the TU/e Intelligent Lighting Institute.

The idea is to install a lighting system that enables different atmospheres through dynamic lighting scenes. The existing public lighting will be replaced by led, where not only warm white and cool white light, but also red, blue and green leds are integrated in a fixture. The led's can be controlled individually, allowing the creation of a very wide range of colours and intensity levels, as well as dynamic patterns. In this way different scenarios can be created that respond to triggers in the street and aim to diffuse escalating behaviour. For this system to work it is important to establish whether there is a risk for escalating behaviour.

In the living lab a 'base camp' has been opened recently where data from various sources is collected and combined to determine the real time level of the risk of escalation. OpenRemote provides an open platform that integrates different devices and provides a user interface for the control of the lights. The data that is collected contains a number of real time measurements such as: 3D sound measurements to identify noise levels and the direction of the noise, social media watching to identify how Stratumseind is being mentioned, and counting people entering and leaving the area to establish the bustle. Other data is collected with a delay, such as: police reports on incidents, determination of origin and counting of mobile devices to establish where groups of people come from, litres of beverages consumed by collecting data from the breweries or amount of waste thrown in the street measured by the cleaning service. Correlating the data on the incidents to specific parameters is done to predict when there is a higher risk for escalation. Historical data from past incidents is now used to find such correlations. Based on the determined risk level, lighting scenarios are activated. For this purpose different lighting scenarios will be designed that aim to diffuse the escalation and in the living lab their effectiveness will be researched.

Also in this case the technological infrastructure provides opportunities to address also other needs. An example here is that when the 3D sound sensors were installed, it suddenly appeared that during the weekend there was no block of 3 hours that the residents in the area could sleep well. After the closing of the pubs, late in the night, it was quiet for a while, but very early in the morning the cleaning cars caused high noise levels again, followed by the ringing of the bells of the nearby church. By changing the time of the cleaning to coincide with the church bells, the liveability of the area was significantly improved. Another example is the use of the lighting system not just to diffuse escalation, but also to create a more attractive atmosphere in the early evening to invite people to come earlier or attract other people at different times of the evening.

The challenge in this case lies much more in the integration of all the information collected by the sensors and other systems. The analysis of data of different nature and combining patterns to create new insights is a key element in this case. This requires new skills for data scientists. With these insights lighting scenarios can be designed and tested on their impact on the mood and behaviour of people.

New Professions

Looking at the two cases presented above we can see a shift in the type of skills required from the more hardware related to new ones that focus more on the ICT and services part. We would especially want to highlight two professions that are new in the domain of urban lighting: the data scientist and the dynamic lighting service designer.

Data Scientists

Data scientists know how to gather data with the Internet of Things. They know what combination of

sensors and data gathering is required to obtain relevant data and how to register the data. They also know to apply the various models, theories and tools to add and extract value from sets of the gathered heterogeneous data. They turn data into information. What is also relevant in the context of smart urban lighting is to use this information to understand and influence human behaviour. The data scientists bridge the technical competences and the social sciences.

Dynamic lighting service designers
These designers need to be able to empathise with the different stakeholders. In comparison with traditional designers, who focus mainly on users, they need to extend their scope and research the needs of a wider range of stakeholders. This will provide them with insights as input for various use scenarios. With the help of these scenarios they can search for creative ways to apply new technologies to alleviate the needs and provide new services for the different stakeholders. Next to these skills, they also need to understand the impact of lighting on people's mood and behaviour to be able to create desired atmospheres and experiences. In comparison to traditional lighting design, this also requires the application of dynamic and interactive lighting scenarios. Moreover, these designers need to be very aware of the ethical impact of their designs. This is particularly important for public spaces.

Both professions are needed on recurring basis; therefore more work is being created than one might think at first sight. The renewal rate of the infrastructure is relatively low: once broadband and sustainable energy provision is secured there is no need to change the infrastructure on short term again. The renewal rate for devices is slightly higher, because of the limited technical lifetime (such as electronics), and with new and better technology being introduced they may have an even shorter economical lifetime. The renewal rate for the software and applications is even shorter. The data scientist might find new emerging patterns that spark the development of new applications. New applications are launched daily in the smart phone business. Similar renewal rates may apply for software applications build on open platforms in the field of smart urban lighting. Also the renewal rate of services will be relatively high. New applications will give rise to the need for new lighting scenarios. Moreover, even when there are no innovations on the other levels in the system, regular new lighting scenarios will be needed to keep an area interesting and inspiring. On top of that changes in weather, seasons, type of festivities etc. might call for adapted lighting scenarios. So both professions are not just needed in the design and implementation phase of projects, but will be needed over the lifetime of the system to adapt the system to keep the city an attractive place to live.

Contact

The projects mentioned are done in collaboration with various partners. If you are interested, please contact us through: www.ili-lighthouse.nl or www.tue.nl/ili.

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Open for Business — Moving from 'Knowing' to 'Doing'!

Introduction

The crowd-based asset is the new source of innovation and economic growth. Organisations that embrace this new industrial paradigm will prosper. Yet, despite our awareness of the core assertion of open innovation thinking — that 'the assets necessary for creating innovation will not necessarily be collocated with those for commercialising them' — our openness to harness the power of the crowd has not embedded itself as widely and as fundamentally as it could or should. Perhaps we need to re imagine some of our trusted frameworks to make them more suited to, and of greater value in, a crowd empowered world.

In a super social world of ubiquitous, always on, low friction communication, the boundaries between the worlds we all inhabit individually and collectively are progressively blurred and indistinct. Crowds flow across one another and intermingle, transforming into a fog of tribes, trust and relationships. This new world is defined by the insight, asserted by Chesbrough, that the assets we require to innovate are increasingly dispersed, and, as such, this fluid and interlinked economy presents a vast pool of enormously valuable resource. If we can form the necessary connections in our cloud of crowds, the opportunities to innovate are boundless.

Crowd assets are the new source of innovation and economic growth. As the digital world witnesses both declining transaction costs and the emergence of the so called 'grown up digital' demographic as active agents in a commercial setting new models of business, collaboration and value creation are emerging. Whilst this generation may be harkening back to re-engage with more traditional notions of ideas of collaboration, sharing and trust the channel in which that engagement is happening is anything but traditional. Online connectivity has ushered in a massively extended ability for people to connect and create new opportunities without boundaries in a way previously unthinkable. Organisations that embrace this new industrial paradigm will prosper.

Aspects of the power of crowd-assets are already visible to us. In 2013, the world witnessed the continued rise of highly-efficient, disruptive shared economy models whereby crowdsourced innovation, drawing on mobile and remote expertise, financed $5 billion of democratised crowdfunding. While the breadth of investment is certainly impressive, the real power of crowdfunding comes from harnessing the wisdom of the crowd and creating a community of individuals emotionally and intrinsically motivated to spark real change. When compared to traditional commercial thinking and financing mechanisms, crowdfunding underscores a paradigm shift towards progressive funding that will transform global funding models.

While crowdfunding is a powerful mechanism for entrepreneurs to raise capital to finance their idea or project, crowdfunding espouses many non-monetary benefits. When entrepreneurs tap into larger social networks to pitch an idea, they begin to create mindshare and market share within a virtual community. The virtual community then becomes a critical resource for the entrepreneurs, not only for the funds provided to the project or business, but also for the ideas they share. For entrepreneurs, being in direct contact with potential customers is of tremendous value, as it allows market value, size assessment and direct product feedback. However yet to create real value from all this, the entrepreneurs must be comfortable and familiar with the notion that 'customers' can inhabit many roles as co-creators, advocate, innovators and investors.

In parallel with the emerging class of entrepreneur and small business, incumbent organisations which were neither founded nor shaped in this connected world still have opportunity to create value in this new economy if they can innovate through embracing crowd based models.

The innovation imperative is undeniable. Research from Bain and Company ([1]) indicates that companies in the top 25 % of their innovation survey grow significantly faster than others, achieving up to 84 % growth over a five-year period compared to 28 % for lower performers. Moreover, a recent Accenture survey ([2]) of senior executives in the US and Europe indicated that 93 % of executives surveyed regard their company's long-term success to be dependent on its ability to innovate. Only 18 %, however, believe that their own innovation strategy is delivering a competitive advantage.

Open-innovation thinking and extensive academic research consistently uphold the need for new innovation models that can potentially take us beyond the boundaries of the notion of what constitutes the organisation and there are sound examples of good practice with some notable successes. Still, even with the connectivity and collaboration developments inconceivable when Chesborough's first statement of Outside In models was made, such practices have yet to embed themselves as a natural and default mode in most organisations.

Why is there such a Knowing-Doing gap?

Is it possible that this new economic model causes us to reject our analytical decision support frameworks because they appear to be inherently redundant and of little value in the crowd empowered economy? The seminal ideas of Abernathy ([3]) were rooted in the boundaries of the organisation as they might have been regarded in 1967. By the same token, Williamsons' ([4]) thinking on reducing transaction costs might be challenged significantly by the notion that external and crowd based solutions more efficient.

Can we rely on models and thinking rooted in such a pre crowd empowered paradigm?

Do we lack the frameworks to assist us in uncovering crowd based opportunity within our firm?

Are we therefore left rudderless, without the necessary compass to navigate the opportunity presented in the new crowd empowered economy?

If this is indeed the case, help is at hand. In this paper, we assert that, with some minor adjustment, many of our more trusted models can assist us in making sense of the opportunities available by providing us with a new crowd aware set of lenses to analyse and decide. Furthermore, we will propose a new and simple framework to help identify crowd based asset classes that will provide a pathway to identify application at a business unit and organisational level — and by so doing allowing an organisation to thrive in a disruptive and crowd based world. We refer to this as the crowd asset model.

The Web 2.0 economy has fundamentally transformed the way people interact and communicate. Geographical boundaries are no longer real constraints for organisations. Technological and societal changes mean that the floodgates are open for easy access to minds across the globe. With these technological advances and new levels of access to people, firms are presented with a plethora of opportunities for collaboration, co-creation, and a sharing economy. Different players in the value chain come together to create, improve, and deliver new product and service offerings.

For businesses, the crowd has become the source of efficient solutions, shared assets, deep insight, co-creation and the mobilised groundswell of activism and evangelism.

The validity of the notion of value and insight being present in a crowd has long been established. In 1714, the British Government was desperate to solve 'The Longitude Problem'. Thousands of seamen were lost at sea each year due to imprecise longitude measurement. To solve the problem, the British Government offered £20 000 as a prize to the person who could solve the 'Longitude Problem'. Considered impossible by many experts, John Harrison, the son of a carpenter, invented the first 'marine chronometer', which provided a precise location of a ship's East-West position. The resolution of the 'Longitude Problem' is a testament to the power of crowd wisdom: an organisation or institution with a problem broadcasts it to a large group of disparate problem solvers. Those problem solvers are not blinded by the internal politics of the organisation; instead, they have the freedom to focus solely on the problem at hand. Moreover, while many individuals are indeed motivated by financial rewards, research shows that individuals are also swayed by intrinsic motivators: the respect and recognition from others. This is an incredibly powerful resource for firms.

In a more contemporary context, a powerful example of harnessing the crowd through open innovation is derived from InnoCentive, an organisation which serves as a platform for R & D development challenges that plague leading Fortune 500 companies. Organisations like Eli Lilly and Proctor & Gamble (as well as non-profit and government agencies like NASA, the Air Force Lab, and Rockefeller Foundation) post a challenge to InnoCentive's solver community of 270 000 members from 170 different countries. Through additional partnerships with The Economist, Nature Publishing Group and Popular Science, the network of experts with access to the challenge spans 12 million people. The prize for solving a posted challenge ranges from $10 000 – $100 000, but solvers are simultaneously incentivised by the acclaim for success.

Similarly, we could point to another example of crowd based wisdom applied in a slightly different way to create value: Wikipedia. With 23 million articles in 285 languages and over 100 000 authors, Wikipedia is a testament to the collective power of individual minds and to the innovative spirit of crowd wisdom: had we been tasked with predicting the success of Wikipedia over Microsoft Encarta, the latter probably would have been considered the likelier of the two candidates to succeed, as Microsoft is a well-funded company with extensive resources and an established infrastructure. Yet reality shows the opposite: with 365 million readers, Wikipedia is now the world's go-to source for knowledge, and that knowledge comes from authors all over the world, working for free for a cause they believe in. Wikipedia is the tipping point for the power of the modern crowd.

While the key illustrations here support the notion of looking outward for innovation and value, it also

is important to recognise that each has distinctive transactional relationships and the value is created in different contexts. As we will come to demonstrate, it is important to understand these dynamics in order to effectively bridge the knowing-doing gap.

If we accept that it is indeed more reasonable and beneficial to embrace the open business models and harness crowd-assets, why aren't there more organisations doing so?

The crowd asset economy challenges traditional business concepts and theory. In the world of the collaborative and shared economy, with its freemium revenue models where social applications with no revenue can go from launch to being valued in billions of dollars at the time of IPO, the boundaries of the organisation seem relentlessly transient and value creation models out of step with what was done before.

To traditional business thinking, the idea that Patagonia, the outdoor clothing firm, should set up an online platform to permit its customers to sell their used Patagonia products to those who might want them, but at no cost and with no revenue model for the company itself — they simply facilitate the sale — might seem at best counter intuitive and at worst foolish. Yet Patagonia recognises that this builds brand loyalty, introduces new consumers to the brand and, helpfully, provides further insight to the customers' perception and assessment of their product throughout its lifecycle. What is most important about it is that they have recognised that this transaction will take place anyway, but they have taken the choice to be involved in it and hence somehow direct it and benefit from it.

In addition, leveraging external R & D in the innovation process helps organisations to save both time and money. Development costs of innovation are reduced by greater use of external technology in the firm's own R & D process.

Where then do incumbent organisations turn to tools and frameworks to help make sense of the challenges? In a world where innovation becomes ever more common for agile emergent organisations innovating at market entry point, it may seem that the familiar analysis and decision support models are of less use and we are left struggling to identify the opportunity. Does this perhaps leave us without analytical models and method to act upon?

If this is the case, in order for your organisation to embrace the opportunity of the crowd empowered business, we must transform the current frameworks to reflect the current landscape.

One of the main challenges businesses are facing in the sharing economy is their strongly defined traditional and inflexible definition of business model and organisational boundaries. In this model, boundaries are either implied or explicitly expressed largely by the extent to which management control can be made to reach, and by a constrained view of where value can be created. This has the effect of closing the mind to engagement and collaboration models that have higher reciprocity, may link through several degrees of separation, and are inherently trust based.

It also prevents the adoption of innovation within the traditional notion of the value chain to find value creation opportunities which are novel or where traditionally we would have thought that only cost or threats might be found.

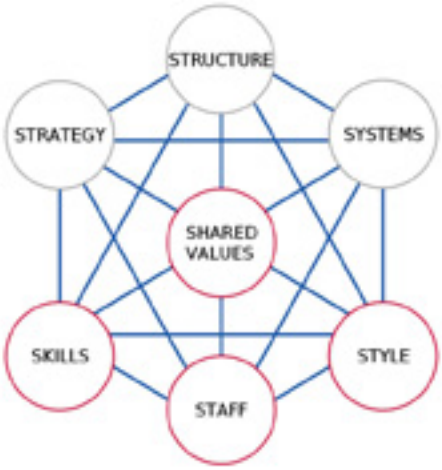
We contend that in a crowd empowered, open and collaborative economy, we cannot take such a rigid and firm view. Instead, we propose a move from this somewhat 2D monochrome world of the industrial economy to a multi coloured 3D perspective in the crowd asset economy.

While the crowd based view may appear challenging, it is possible to adapt some more familiar models to showcase the scope of the changes in order to analyse how we can introduce parts of them into our organisations, and for those common tools to act as guides into an otherwise obscure environment.

As an example, let us consider the McKinsey 7S framework. Developed by Waterman and Peters, this valuable and well understood framework has guided strategic development and thinking for thirty years by reminding us of the interrelated nature of seven key elements in an organisation and the need to balance, align and accommodate adjustments across these seven areas through periods of change. One of its great strength is that it does not seek to present an optimum arrangement, it simply reminds us that all the elements are linked and that a change in one will have implications for the others. This flexibility means it can be used as an analysis framework and a planning or decision support tool. A major development and an acknowledgment of an understating of the complex nature of organisations it has served us well.

However, presented in its two dimensional for it implies a defined boundary to the organisation as we might traditionally understand it. It subconsciously guides our thinking to imagine that our management approach begins and ends with that which we can directly influence, within our traditional notion of the management purview.

Figure 1: Original 7S Model



In a highly networked, crowd empowered world, the notion of a clearly delineated and vertically integrated organisation is a vision of stagnation and rigidity, and is therefore unable to embrace the opportunities that might exist to innovate within the business model and across products and services. We need to move the model into a 3 dimensional plane to unlock its renewed value. By allowing the individual extension of the 7 facets through an internally facing and externally facing plane, there exists an opportunity to innovate amending and/or enhancing through the crowd. This will allow businesses to look beyond traditional business models and constrictions and instead utilise and leverage crowd wisdom both internally and externally.

This simple adjustment can free our thinking to explore novel configurations of these elements into a more fluid idea of the organisation. In so doing it does not diminish the flexibility of the tool as it can still operate as analysis framework and a planning and decision support.

In this new form we can readily imagine accommodating the notion of cloud based systems, externally based skill sets, embracing multiple and perhaps transitory shared values, as part of the seven elements in our organisation.

It is possible to adapt other established models to similar effect and so reinvigorate them for the crowd based economy.

Figure 2: Updated 7S Model

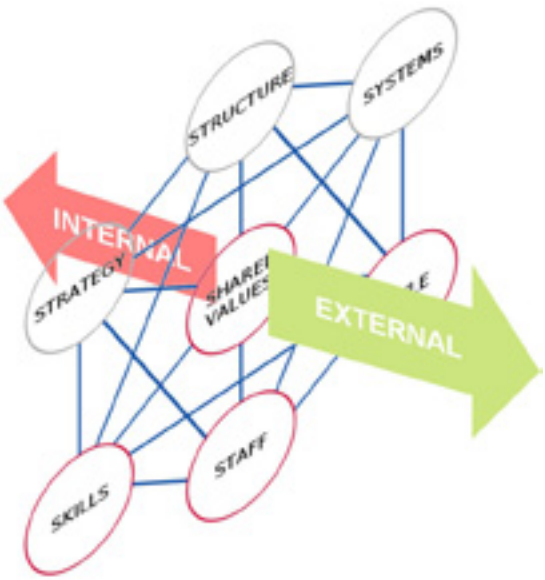
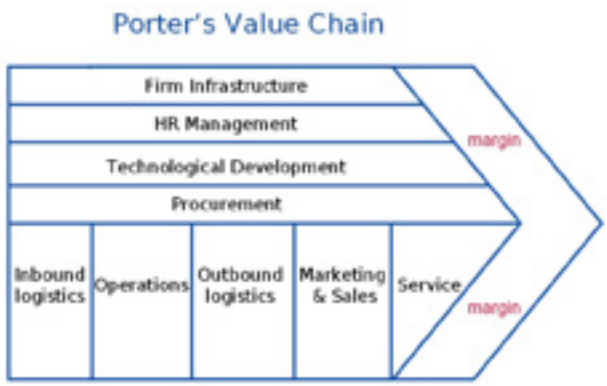


Figure 3: Porter 1



Porter's Value Chain is a value analysis tool that helps us to identify the value adding process, describes the 'business we are in' and, since its popularisation in the book Competitive Advantage, has been a standard tool for consultants and practitioners alike. However, its linear and process oriented model, separating primary and secondary activities, is generally illustrated and visualised with its arrow shaped 2D schematic that describes functions that we might typically associate with business units and, subliminally if not explicitly, binds our thinking into the traditional notion of the organisational boundaries.

The model has been adapted elsewhere to expand our understanding of how we can adopt more open crowd based models into an existing business model.

Yet we would like to take that a step further to reinforce and expand the point, by employing the device we used to adapt the 7S model. The use, scope and transformational power of the insight become more compelling and our notion of the boundaries of our organisation dissolve more readily into one where the idea of crowd driven innovation is visible. It illustrates comprehensively that value generation can be an open and collaborative process and that we can and should look to efficient crowd assets to innovate and grow.

This modest adjustment demonstrates that these models have continued application and value, and that whilst a crowd empowered environment requires us to open our thinking, we have no need to entirely abandon many of the good management practices we are familiar with, we simply need to adapt them to open our horizon of analysis.

The additional virtue of this modest adjustment to the Value Chain is that it is particularly helpful in demonstrating that innovation has a scope of application from the businesses unit level, to the firm and then beyond. This is useful for whilst change can be made at a business unit level and is not dependant on wholesale change, we contend that the true winners in a crowd empowered economy will be the ones who adopt a more wholesale and transformational model of their firm and not those who take a piecemeal approach tinkering a little here and there, flirting timidly with the crowd.

One useful visualisation tool to illustrate this is one developed by IBM's Institute for Business

Figure 4: Original Porter updated

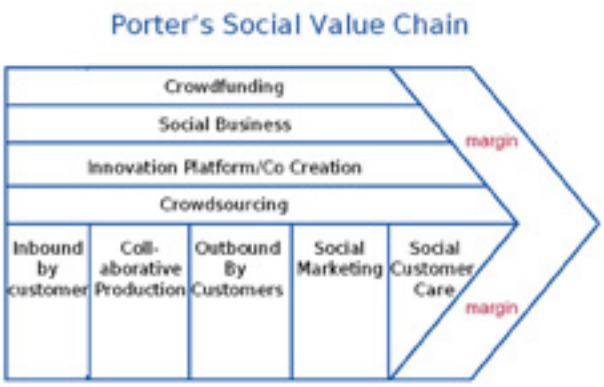
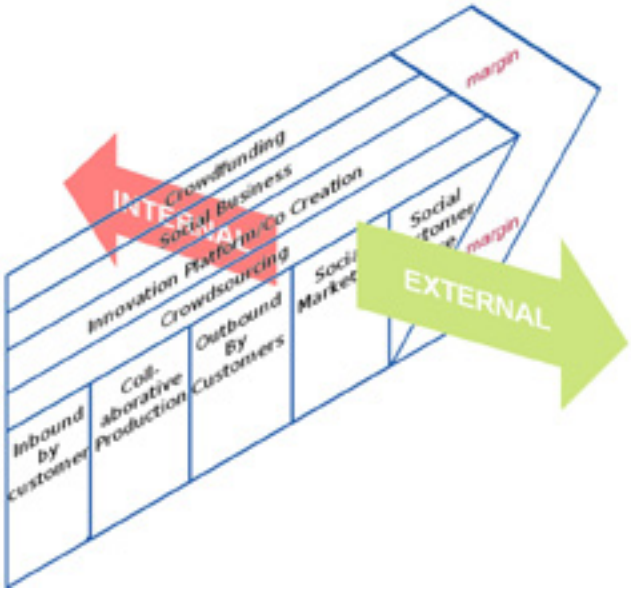


Figure 5: 3d Porter



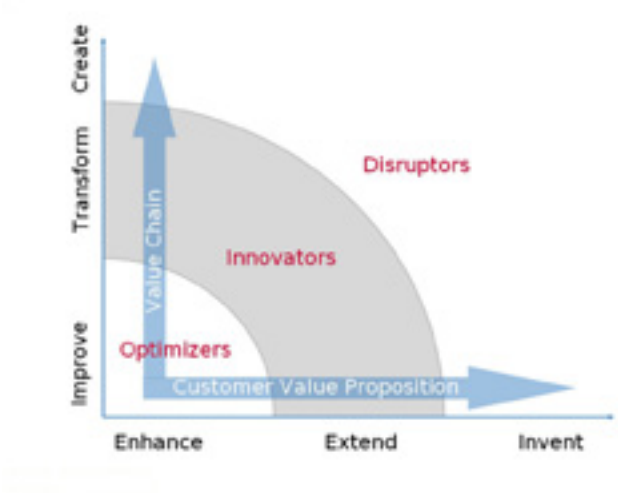
Value Analysis. This figure is typically employed to demonstrate the opportunity created by the introduction of new and disruptive technology and it shows, in a simple and understandable fashion, the breadth of response available to organisations in their readiness to embrace the opportunity. Some are more iterative and cautious, and seek to utilise the opportunity to enhance what they already do. The more ambitious ones employ the opportunity in a more transformational manner and see it as a chance to reinvent, transform and create entirely new opportunity. This same reference can describe the opportunity presented by crowd assets.

This illustration has a tremendous familiarity and simple, but practical, application to us, as we can all plot the location of our own organisations on it. In reality most will have two plots the 'as is' and the 'aspirational'.

The impact of the crowd economy is, however, so profound, driven as it is by economic, societal and technological factors, that, in order to prosper, a firm should move to the disruptive end of the graph, and do so before it become s a question of survival.

So in our ambition to move from knowing to doing we have established a better grasp of the dimensions of distributed assets through the restructuring of established frameworks. This allows us to look outwards as well as inwards, now we need to

Figure 6: IBM graphic



Source: IBM Institute for Business Value analysis, 2012

identify the practical application of the distinctive crowd asset classes that may have value for us. Let us consider some of the generic opportunities that present themselves.

As demonstrated in our examples, one obvious opportunity is crowdsourcing. If Henry Chesbrough coined the term 'open innovation,' Jeff Howe coined crowdsourcing and there is a strong philosophical connection between the two concepts. According to Jeff Howe, 'crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential labourers' ([5]).

This sits comfortably with Chesbrough's idea 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' ([6]).

While large cap organisations like Proctor & Gamble or GE utilise open innovation and crowdsourcing to breakthrough new products, small businesses and entrepreneurs can look to these activities as means of incrementally improving their products and services with other companies as partners or through crowd feedback. By opening up the research and development process to the crowd, small businesses can capitalise on the abundant knowledge base of the crowd.

A subset of crowdsourcing contains the concept of crowdfunding, a practice we have already referred to as a manifestation of the disruptive possibilities of the crowd asset economy. It is one of the most promising resources for restoring capital to businesses, defined as the collective effort of individuals who network and pool their resources, usually via the Internet, to support efforts initiated by other people or organisations. In its various forms, crowdfunding allows entrepreneurs and SME's to solicit capital from investors, using social networks and crowdfunding platforms to finance their businesses and projects. By doing so, individual entrepreneurs and early growth companies can solicit donations from individual stakeholders (including friends, family, colleagues, other business owners, etc.) by appealing to their intrinsic, emotional, and social motivations. Not only does crowdfunding solve the challenges of early-stage financing for the business owner or entrepreneur, it also establishes a strong communication link between the funders and the company, whereby the funders can offer feedback and suggestions for the product.

Crowdfunding enables enterprises to validate products by gathering a critical mass of funding (and customers) before the venture even goes to market (and in some cases, before the product even goes into production!), ultimately mitigating the risk associated with a new product because the mass of customers already exist. This new mix of the collective creative with productive capacity and execution enables enterprises to identify, collaborate, and produce in an entirely unprecedented manner.

Establishing a strong communication link between the business owner and the crowd paves the way for open business models. According to Henry Chesbrough, 'Open business models enable an organisation to be more effective in creating as well as capturing value. They help to create value by leveraging many more ideas because of their inclusion of a variety of external concepts. They also allow greater value capture by utilising a firm's key asset, resource or position not only in that organisation's own operations but also in other businesses.

Open business models can help businesses from a revenue perspective by licensing its own technologies to other companies and by using outside resources for internal innovation, research and development initiatives. This saves the small business both time and money, in addition to incrementally innovating existing products and services.

Continual product innovation is essential for businesses to remain competitive and profitable. Crowd-empowered mechanisms like co-creation and open innovation are central to this process. Co-creation is defined as form of marketing strategy or business strategy which emphasises the generation and ongoing realisation of mutual firm-customer value. It views markets as forums for firms and active customers to share, combine and renew each other's resources and capabilities to create value through new forms of interaction, service and learning mechanisms ([7]).

Let's look at a way in which co-creation was utilised by a large corporate organisation. In 2005 the CEO of Intuit recognised the impact of co-creation with customers when Intuit customer service teams began experimenting with online support forums moderated by enthusiast employees. He asked the question 'how might we leverage user contribution at Intuit, both to enhance existing businesses and create new ones?'

Two executives came up with the idea for enhancing the company's tax preparation software for tax

professionals. The company built a new community around in-depth advice for obscure tax issues, causing tax preparers to interact with each other. The site attracted 400 000 unique visitors (equal to the number of tax preparers in the United States), and contains more than 170 000 pages.

For Intuit, the company learned about the kinds of tax preparation questions that professional customers have, and many people went on to purchase the software as well. The organisation is rolling this insight out into new products ([8]).

The concept of collaboration is exemplified in the ideas of the shared or collaborative economy. Often seen as being a P2P phenomenon, it has valuable application in the B2B and B2C world to.

The crowd offers small businesses and entrepreneurs tremendous resources in execution through collaborative production of products, collaborative logistic solutions and efficient exploitation of assets. Car sharing, hackerspaces and shared workspaces speak to the willingness of consumers to connect with strangers to achieve some sort of shared goal. Technological innovations like 3D printing underscore the growth of collaborative production and distributed infrastructures. For small businesses, this means reducing costs by opening up production to the crowd and engaging the crowd for open and distributed innovation.

What more can be done to unlock this crowd asset economy to all? Porter's model demonstrates how the existing Value Chain might be extended to take recognised functions and offer a crowd based twist. Yet this poses limitations by binding us into a recognised and established framework. Our aim is to free the thinking further still to allow for a range of innovation from the iterative optimiser to the disruptive strategic challenger and to be able to apply this analysis from the business unit level to a fully crowd empowered enterprise. As alluded to earlier, the characteristics and approaches to unlock these opportunities vary by the nature of the location of the value, the style of the collaboration in terms of its power relationship, and where we might place ourselves in the resulting value chain. To help make sense of this diverse spectrum of opportunity we are presenting an analysis tool that sets out the key crowd asset classes and how they can be identified and used.

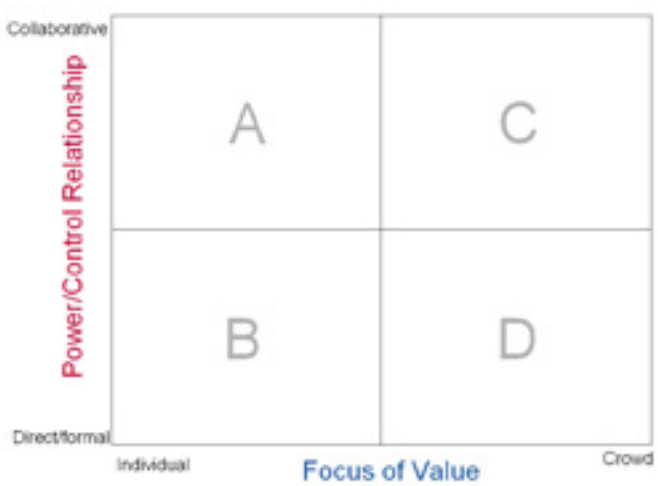
We have classified crowd assets as falling within four main classes which are, as with all good frameworks, plotted into a quadrant defined by two axes. One axis expresses the spectrum of focus of value within a crowd. That is to say, is it vested in an individual who lies unidentified in the crowd and must be sought out? Or is it perhaps a group of agents in the cloud that create value through a series of coordinated but discrete activities? Or is it the entirely of the crowd acting in concert that creates the value?

The second axis is an expression of the power or control relationship between the organisation and the agents. This can range from a formal managed and controlled transaction with a clearly defined and direct management relationship to a situation where there is no power to directly influence or control the agents one can only nurture and encourage the crowd to mobilise the crowd.

Let us consider more closely what each quadrant represents and what typical type of activity we might find in each (Figure 7).

A. In this sector we consider assets that are found in the application of a crowd of individually skilled interventions that are collaboratively

Figure 7: Crowd Asset Diagram



harnessed to create value. This might include wiki creation and open source code writing, where the skills are vested individually but create value collectively and are bound collaboratively to a common end. An organisation might provide a platform or context for this type of activity to take place and some attractors to encourage it but the relationship is a less managed one, and takes the shape of a coaching role.

B. In this sector we consider specific skills that might be vested in a single individual or small group but these individuals exist, unbeknown to us, in a crowd. Here the skills are usually highly individualistic or deep and the value is created by attracting or locating these resources for a specific activity. This might include crowdsourcing highly specific innovation and R & D, design skills, or crowd sourced recruitment and is very much the heartland of open innovation. Typically this is a more highly managed relationship.
C. In this sector we can envisage the value from a mobilised group to take action. Here the crowd is the vehicle that fuels the activity, relying on the extended trust tags that ripple out hand to hand. This is the 'strength of weak ties' as observed by Granovetter ([9]). This 'groundswell' relies on the aggregation of many small acts. The value is found in the swell, volume and pressure of activity and is reliant on influence and affinity. It is, however, a very difficult situation to manage or control in the traditional sense and so nurture, nudge and influence are the main methods employed here. This might include crowdfunding, campaigning, brand value development and viral marketing, or micro commerce transactions.
D. In section D we find the crowd connected infrastructure, where a series of discrete activities vested in individuals can create value when brought together as an operational services or collaboration. So each act has limited value in itself but when coordinated they provide a valuable function. Here we might find innovative service delivery like P2P delivery mechanism, open source production, and collaborative consumption models that require a group of participants to deliver.

The crowd asset model maps the breadth, spread and specific dynamics of the way in which crowds deliver value. It can be used to identify where there is value within the organisation that can be unlocked by utilising and integrating crowd based activity to a business model.

It is possible for us to map onto the matrix value creation activities that currently happen within an existing organisation and investigate the potential for using crowd assets to transform the process. Hence if we rely on the deep and specific skills of individuals to create value, the sort of activity found in area B might unlock new value for us.

This is a tremendously diverse and flexible landscape and includes opportunities to reduce transactional costs by harnessing external resources to transact process, deliver deep insight otherwise not available, and unlock dormant assets that would require costly or unavailable internal resource by perhaps sharing a patent library with a crowd asset for example.

At the same time we can identify opportunity to re-focus or adjust our position in the value chain by applying specific competencies or facilities within a crowd enabled environment.

It is important to recognise that the model does not provide an optimum solution or configuration and that it is merely an analysis and decision support tool.

By using our reconfigured familiar frameworks we can free our point of reference to consider what we might once have described as the organisation to embrace a much wider set of participants to be included within that on either a temporary or permanent basis. The crowd asset model allows us to consider the value creation opportunities available by letting us locate value creation opportunity by crowd based and open models.

Let's Consider this via a couple of Practical Examples.

GE and Quirky have applied multiple crowd-based mechanisms to invent new products for the global market. Like most companies of its size, GE has the money and the manpower to create and bring new products and services to market on its own. Yet recently, in an effort to expand its product portfolio and bring in external ideas, the organisation announced a partnership with a small company called Quirky. Quirky makes invention more accessible by bringing products to market through an online collaborative portal. Users (mainly inventors) submit ideas through the crowd sourced panel and the organisation selects which ideas it wants to bring to market. Once an idea is selected, the production team within the company works with the Quirky Global Community, covering all parts of the innovation ecosystem, beginning with ideation and ending with sales. Through distribution agreements with companies like Home Depot, Target, and Best Buy, Quirky is able to bring their users and inventors platforms to market.

Together, the GE and Quirky team created a platform on which the users can access GE's patents. In

exchange for providing access to its patents, GE will receive a portion of the revenue from the product once it hits the market. If the invention makes it to market, the inventor is paid back 12.6 % of whatever revenue the invention makes. GE, on the other hand, is actively adding new items to their portfolio of products by engaging with inventors and problem solvers from the outside. The basis of the Quirky/GE partnership is the development of connected home devices. For example, one of the main products expected to hit retail shelves for the holiday season is the Egg Minder, a mobile-connected smart egg tray that keeps track of not only how many eggs you have in your refrigerator, but also tracks how fresh the eggs are. If the egg tray suspects an egg is going bad, an LED light shines over the egg. Once the Egg Minder senses the tray is low on the numbers of eggs, it sends a push notification back to the owners' telephone, letting them know it's time to purchase more eggs. According to Quirky, while there was one main inventor of the Egg Minder, 2 383 influencers helped bring the product to market.

By using crowd-empowered mechanisms like co-creation, open innovation, and crowdsourcing simultaneously, organisations can create value chains that let more people into the process of innovation and value creation, while still controlling the process. Traditional methods of innovation are often concentrated in a company's internal R & D or innovation lab. For GE, crowdsourcing highly-specific innovation, R & D, and design through Quirky's community of engineers and members is not only efficient, it cuts innovation costs by creating an expansive value chain whilst retaining control over the process (see Section B in the Crowd Asset Model).

Following the announcement of their patent-sharing agreement in April 2013, GE announced in November that they will be investing $30 million dollars in the partnership with Quirky and the two companies will work together on 30 products over the next five years. According to Beth Comstock, GE's Chief Marketing Officer, 'There are a host of consumer applications that we haven't had the ability to focus on. That just isn't our core business' ([10]). While consumer applications may not be GE's core business, the Quirky team understands the brand value GE brings to the table. Through this collaboration, customers are able to purchase innovative products from a household brand — and with that brand trust comes the confidence in its functionality. See section C in the Crowd Based asset model below.

Another example is that of Local Motors. John B. Rogers was serving in the United States Marine Corps when he came up with the idea of Local Motors. Like his predecessors at Tesla, Rogers wanted to bring environmentally conscious cars to market. By focusing on efficient design and manufacturing, Rogers wanted his buyers to be co-creators participating in the process, a type of business model that would prevent unbought cars from rusting over in dealership parking lots.

Rogers channelled his vision into what is now known as Local Motors, the world's first open source car company. The company brings together a global community of designers, engineers, fabricators and car enthusiasts to build new automobiles through distributed manufacturing channels. Local Motors also has partnerships in place with large enterprises including Siemens, Shell, and BMW. As part of their partnership with Siemens, Local Motors uses their computer-aided design (CAD) software and recommends the software to its global community of 30 000 designers.

Local Motors also works with large enterprises through hosted challenges, whereby the enterprise may outsource a design task to the Local Motors community of designers in exchange for cash prizes. For example, in 2012, the BMW Group challenged the community to define the future 'premium vehicle' in exchange for a cash prize. The parameters required the designers to address issues such as interior design, connectivity, and functionality.

In November 2013, Local Motors and the United States Army Rapid Engineering Force (REF) announced a partnership in which the organisations would jointly develop an online platform, aptly called the Army CoCreate, to enable the design and development of safer and better performing gear for warfighters. The Army CoCreate platform will bring together civilians, soldiers, scientists and inventors to develop these solutions and quickly get them out to soldiers on active duty. 'Soldiers are living and breathing the fight, day-in and day-out, so they have the best ideas for new capabilities to solve their most urgent challenges,' said Sergeant First Class Adam Asclipiadis. 'We need to connect those ideas to the people who can make innovations a reality' ([11]).

The initiative is divided into four phases. The first phase is centred on ideation, where Army CoCreate users brainstorm and submit ideas about the main challenges. Members of the Army CoCreate community vote on the ideas, determining which concepts will be selected as the main project. The second phase is about suggesting solutions to the challenges. Designers, inventors and enthusiasts can submit their sketches, designs and ideas for solving the challenge at hand. The third phase is about project selection; in conjunction with the

Army CoCreate Community members, the REF will select projects to develop. In the final stage, the Army will prototype the products using 3D printing and other technologies within the REF expeditionary laboratory. This is an excellent example of the manner in which organisations can use distributed infrastructures for production, crowdsourcing highly-specific R & D challenges, and connected infrastructure and operational services. By partnering with the RAF and engaging the Local Motors community of users, the two organisations will be able to ideate, create new products, and produce them more efficiently and with greater speed than if either organisation was operating independently. See sections B and D within the Crowd Asset matrix.

The crowd asset economy is the natural extension of the open innovation principles and we are still at the early stages of this new and exciting period.

We need to consider how we should develop and accelerate the adoption of the openness that will drive our new economy. These models and frameworks go some way to help in that process but the scope for experimentation and exploration within this is enormous. We believe that the spirit of openness and crowd empowerment should also lead this process and would like to open up the sharing of experience, evidence and practise to you the crowd. By engaging in an open exchange and collaboration in developing open source thinking on this subject we will embed and expand it more quickly.

For example, to operate within each or any of the four sectors of the crowd asset model requires different and sometimes new approaches and methodologies to those which we might be used to. If we were to consider the ability to understand and employ this new crowd based perspective as a competence or strength could we possibly map the characteristics that would evidence that an organisation possessed the skill? Might these include, for example, an organisation that rejects notions of highly defined, inflexible and segmented classifications of those with whom it has relationships? So the organisation that can understand and manage a circumstances where a customer can also be a collaborator, co-worker and innovator, simultaneously might have a significant strength and competitive advantage in a crowd empowered environment? If we can clarify these skills can we then develop them and, in so doing, move amongst the dimensions of a SWOT matrix to both develop strengths, reduce weakness and, by extension, embrace the opportunities offered?

To this end we plan to create a community of crowd asset exponents who can progressively develop the crowd asset model. This will be done through the sharing of insight and application via a cloud based community which 'does' the business of harnessing the opportunity opened up by the crowd. We can then develop novel applications of the framework to unlock greater value, chart and map key competencies and techniques, and create a catalogue of real world examples of the spread and application of the crowd in a business, civil and social contexts.

We began this article with a statement that the crowd asset is the new source of value and innovation, founded on the notion that the assets for innovation and value may well be located within the crowd. We also suggested that this approach was far from normal business practice and whilst we may increasingly recognise intuitively that there are possibilities here we are not moving from knowing to doing in anything like the numbers we could and should. Furthermore, we suggested that it may be that we need help to recalibrate our thinking to more effectively adopt the crowd empowered approach and that, by adapting some of our more familiar and well used frameworks, we might broaden our perspectives.

Through the introduction of the crowd asset model we can more fully appreciate the possibilities of the crowd empowered approach and how it is the natural extension of the open innovation model. We are now more readily able to move from the knowing to the doing stage. Yet at the same time we have acknowledged that this approach is still in its infancy and that the evidence and practicalities of this are somewhat thin on the ground. We ask you then to join this movement, this groundswell, and together as a crowd we will provide the engine, insight and inspiration for the next phases of economic and entrepreneurial dynamism that we all so desire.

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Lawyers and Innovations — Do They Mix?

Introduction

Is there such a thing as an innovative lawyer? Asking that question, we approach shallow waters. It is very easy to misunderstand the hail for innovative lawyers to mean a legal 'happy hour' or 'anything goes', let alone have the thousands of misunderstood mistreated inventors get wrong kind of consolation for their misfortune. My main message is not, that legal point of view should be disregarded. Legal work has to deal with very difficult legal interpretation and very often — for securing the company's legal position — legal department really is the killjoy and rightly so.

However, I still believe there is room and reason to ask the question, especially bearing in mind our legalistic, law-abiding European tradition. Large part of our legalistic belief is based on trust to national institutions. Hundreds of years of legal tradition educated our lawyers to a national, even local mindset. Global trade however has changed this mindset. New, puzzling legal issues arise especially regarding global transactions. Another boost to change comes from technology: when the implementation of completely new innovations is at hand, there may well be very blurred scenarios regarding legal guidelines.

These special circumstances require special kind of adaptability. I start by taking up some personal experience from the early years of my career.

The Problem: Implementing New Technology in Virgin Business Landscape

March 1990, 27 yrs old, I got my first 'real job'. I worked in the media industry, for the Finnish Cable Television association. Already before my first working day the papers had been piling up, many of them different kinds of licensing agreements, mostly for the licensing of satellite TV programmes for distribution in the Finnish cable TV systems. Basically my first task was to see what these agreements were all about.

Cable TV was stepping into the world of internationality. We were buying satellite programme services from the US or the UK, in some cases France, and the cable TV companies were packaging these services to suit the tastes of the Finnish customers and negotiating on the terms of the how it could be done. Copyright was a major issue. We had to learn the language of international dealing. At first, I had only my travellers' dictionary and I looked up to see what is a 'waiver' or 'disclaimer', of not much help.

Usually I tell this as a joke to the young law students in Finland, assuming that things are much better now and the universities offer ample amounts of info how the international dealing works. Unfortunately, this seems not to be the case even today. I am afraid our legal education system is still stuck with our national legal system, national context, that is to some degree harmonised by European legislative efforts, but still fragmented. We do not have a strong foothold of international agreement practices. This is still something that is learned by doing — which is not a bad thing in itself, but may require some 'trial and error' in the beginning.

Counsel State of Mind

What does a traditional legal counsel think, what are his duties and what is expected of him? A traditional legal counsel has to deal with legal compliance, of course. That is the first obligation. This includes rules, legal procedures and codes of conduct (practices, non-legal sources of behaviour). The basic source of law is the national legislation. Every Finnish lawyer has to look at 'Suomen laki' (Finnish Law) to see the correct legal status of a situation. This indicates also a fundamental trust to the national legal framework. Language is national and the code-system is national. A clever Finnish lawyer also knows what the Finnish Supreme Court may have stated in a milestone case way back when. The activities are however bound to national circumstances. A lawyer like this may well state in a company board meeting, 'no, this is illegal', 'nocando', and it is a valid answer based on solid national law and legal practice. That negative conclusion also easily becomes the decision of the company.

Having adapted this mindset I soon discovered, that my quite recently obtained legal education was not going to work for me in the tasks I was exposed to. The very same pattern re-occurred later when working in the mobile telecommunications operator business. It became in fact mandatory to look at things from a different perspective.

It might be difficult and even dangerous to use the characterisation 'innovative lawyer' of anyone, remembering especially, what happened in the economy when accountants started to be creative; creative accounting was not such a successful social experiment. 'Innovative lawyers' should not repeat the same exercise. But still I would like to use the notion 'innovative legal counsel', and explain what I mean with it.

Later, the copyright negotiations concerning ringtones and copyright were one telling example of

the situations you might end up in when new business enters the area of established institutions like copyright. These kinds of situations require flexibility and imagination — and the knowledge of legal risk-zones.

The Innovative Lawyer

'Nocando' is not an acceptable answer to an innovative lawyer. He has to at least try to help the organisation to go over and beyond the problems they are facing in their activities. Sounds easy but it can be very tough in practice. It simply raises the requirements and skills of legal profession to a new level.

What was typical in cable TV and mobile operations I worked with in my youth? Both industries had no prior models of operations. The legal framework was in the making in the Ministry of Traffic and Telecommunications. The Supreme Court had said absolutely nothing of cable television. This kind of situation underlines the need to creativity and to understand, what is relevant in the past in today's circumstances. The nature of the work evolves from legal compliance towards risk management. In a dynamic world, a 100 % certainty may kill the business, because nothing can be done. If you want to play absolutely safe, you cannot play at all, as the environment is complicated and uncertain.

The innovative lawyer looks at other sources of law besides the national. The international agreements become crucially important sources of information, because that's how business is carried out internationally. The national legal framework offers some kind of institutional support to various activities, but problems in general have to be solved applying international standards and practices. There you have to have creative mechanisms to solve them. It is not possible to rely on solutions based entirely on national law.

Many corporate directors complain in EU that the European legislation is impossible. This may well be intentional lobbying, and have less foundation in reality. Some of it is however clearly based on institutional facts. But here's a puzzle: if you look at the successful international services, like social media or search engines, you realise that somehow these services have managed to go passed and beyond these problems. Someone in the organisation carried out the analysis and took the company boldly over and beyond the problems emerging from 28 different legislations. What is all the more surprising; what the European large companies could not do, seemed a piece of cake for the Palo Alto college boys who soon gathered hundreds of millions of customers in a market that was claimed to be impossible — mostly by the traditional, nationally inclined lawyers.

New Types of Risks

In a fast-moving, very innovative business landscape, the risks involved maybe of a different kind compared to the more traditional and familiar ways of running businesses. Some years ago I witnessed a negotiation process around a new, highly

Figure 1: The Innovative Lawyer

interesting technological innovation that was new and appealing to the customers. To continue with the solution however required consents from several IPR-rights-holders of different kinds.

The very complex negotiations — that at one point even involved even the state in a possible law-making role — ended in a failure and nothing was accomplished. I paid attention to the reaction of some of the right-holders; they seemed to be celebrating the outcome as some sort of victory. That was quite understandable in the heat of the process, as an emotional reaction, but looking back, what were the actual consequences of this kind of result?

First of all, the technological expertise was never taken into commercial use. This resulted in loss of R & D related investment and the eventual cancellation of the development of the said technology. The group of R & D specialists was dismantled. In a couple of years alternative technologies appeared, in other parts of world, by other companies, and suddenly the market was invaded by these newcomers. At the same time, the expertise in this case had already been lost and there remained no possibilities to gain back the loss of that expertise later, when the technology and services really took off.

Secondly, on the right-holders' side things were not any better, either. They had lost the expertise of the issues, they had a lack of business understanding, lack of ability of quick reaction when the game later changed, and at the moment it is fair to say, that they have and will not have any role in the business in the future, either. What was achieved seems no longer a victory but a less successful decision to stay out of a certain strongly developing market. As the issue is related to Internet services, it looks rather evident, that there's no way to gain back momentum, as the competition takes all the time big leaps in the development.

From legal perspective, this case (of which I am not at liberty to speak more openly), illustrates a new kind of technology related-risk — the risk of not seeing the value of participating in the processes of developing new tech-related businesses.

A senior business executive once expressed to me, that even though a planned cooperation between two companies involved many risks, and much uncertainty, the executives of both companies shared a common belief, that if their talented people were put together in a tech-related business development project, something good would emerge. The results may even be very different from the original plans, but the point was to get going rather than having tens of talented people waiting for a go. The cooperation in this case was not successful in the end, but both companies were able to develop a much better understanding of the underlying issues and make successful follow-ups based on their increased knowledge and experience of the underlying technologies — trial and error at its best.

These types of risks — the risks of keeping out — are usually outside the legal equation, but are very essential, as they may also lead the company to a dead-end and oblivion.

Eyes Open!

Regarding the emerging Internet businesses, one of my recommendations would be that the innovative counsel 'wannabe' would take a close look at the successful service providers, learn from them how they have structured their services, composed their terms, rights and obligations — learn how the trick was done. To have eyes wide open for best practices, especially when they are openly in the public like the Internet service contracts. One of the most interesting documents I have ever encountered in this respect is in fact the Facebook statement of rights and responsibilities.

As a customer, I may find it hard to accept everything — the consumer is not necessarily on the driver's seat regarding that agreement, despite the creation process utilising a form of virtual democracy. Many terms would have been negotiated differently in an equal setting. But it does not cease to amaze me that in this very short document, all together maybe not more than some 8 pages, the company has managed to display the complex relations between the company, its customers and advertisers, and all their internal relations, rights and obligations. Looking through the agreement is definitely worth the time an innovative 'wannabe' lawyer spends reading it. Besides, as nearly everyone is in the Facebook today, this is a binding service agreement nearly everyone has closed.

Facebook is also using a choice of law–strategy, using the California State Law. You are welcome to submit your legal claims in the Santa Clara County Court. Personal information is taken over to the US, where it is processed under the US legislation. What is even more amazing, FB is not relying to open standards, creative commons, 'open source' or anything we academic lawyers would have thought had paved the way to the Internet future. FB is not anti-copyright or copyleft. No — the FB uses standard proprietary definitions — you own what you upload to the system. You grant FB a global, non-exclusive licence to any material subject to copyright. The arrangement is legally a very simple one. It is a very simple way of organising an immensely complicated operation.

Figure 2:

© iStock

So, my claim is — if you want to learn, what innovativeness in legal context means, look at the agreements of the leading players in the world. An innovative legal counsel can make all the difference — I find these documents among the best examples of legal innovativeness. You might not like them, but OMG, they work. Apparently there are innovative counsels somewhere. Who wouldn't want them in their corporations? Like the Eagles' Don Henley characterised their manager Irwin Azoff, 'he maybe Satan but he's our Satan!'.

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Build Your Open Innovation 2.0 Culture ... the Rise of Humor-driven Innovation*

Introduction

Business guru Guy Kawasaki believes that people generally waiver between two dominant mindsets: microscopes and telescopes. Microscope thinking focuses on understanding and improving existing processes, whereas telescope thinking gazes outward at new possibilities. He champions the telescope approach for forward looking organisations. In this article, we would like to telescope into the future with humor-driven innovation as an addition to the open innovation spectrum.

Innovation: Data or Design

Innovation has always been important for organisations, but nowadays it is crucial for maintaining a competitive advantage in many markets; innovation capability is even seen as one of the most important determinants of the performance of an organisation ([1]). The idea of an organisation as a stand-alone entity is now inconceivable. Businesses are increasingly operating in hive-minds of strategic alliances and partnerships to share risks, to access capital or to gain access to knowledge and skills. And they are operating within fast-responding supply networks to deliver customer value. This is what open innovation is about, connecting with the outside world.

There are many ways to see the world as well as innovation. Closed versus open. Incremental versus radical. There is also another angle, with what resources we take as the core. Data is one of them, design another. Typically, data is where Google stands for. Numerical analysis of what works best. Apple is the other side of the virtual spectrum. Intuition, designing and molding the wishes of the customer. This results in two main streams in innovation: being data-driven or design-driven.

Data-driven Innovation

How do organisations come up with new ideas? Most of the time fresh ideas occur from happy accidents or by using techniques such as brainstorming. If you are part of the big data movement, you would say that brainstorming is unreliable. With data-driven innovation, innovators generate ideas by exploiting existing or new data sources and analytics to develop novel insights, particularly by answering queries. More data is generated today than ever. 90 % of the data in the world today was created in the last two years alone. Several researchers call data 'the innovation story of our time' as analysing large sets of information and cutting-edge experimentation will become a key driver of competition underpinning new waves of productivity growth and data-driven innovation. Probably the biggest difference between enterprises that are native to data and others is how they approach strategy. Non data-driven companies tend to undertake research in order to gain a deep understanding of the marketplace. Then strategy consultants spend months interpreting the data, decide what it means and suggest a course of action.

Data driven firms like Facebook, Amazon and Google, on the other hand, take the hacker way. They run experiments — thousands upon thousands of them. From colours used on a button to different websites to see which site will increase sales, all in real life and with real customers. Based upon quantified results, the experiments determine what the strategy will be.

Design-driven Innovation

On the other side of the spectrum, you can find design-driven innovation. Where data-driven focuses on facts, design relies more on intuition and interpretation. Design has become a decisive advantage in countless industries, not to mention a crucial tool to ward off commoditisation. We have seen this with many Silicon Valley based companies in which designers rule the scene. Apple of course being the dominant example, but also many web based startups like Pinterest or Youtube exemplify this direction. This connects well to the lean startup movement: fail early and often.

Design driven innovation is a process concerned with a product's meaning, not just its use and usability.

In the process, you start by empathising with a specific user in order to uncover a core need and an unexpected insight that will drive innovation. User + need + insight define a point of view (POV), which will focus your process. You quickly ideate as many ideas as possible based on that POV, before focusing on a few ideas that you can make practical. You then prototype and test multiple ideas quickly with your users, meanwhile building a high class solution that incorporates your findings from each prototype. At every stage, you loop back to make sure that what you are doing is consistent with your POV, and often change both your POV and your solution. Or pivot, in lean startup terms.

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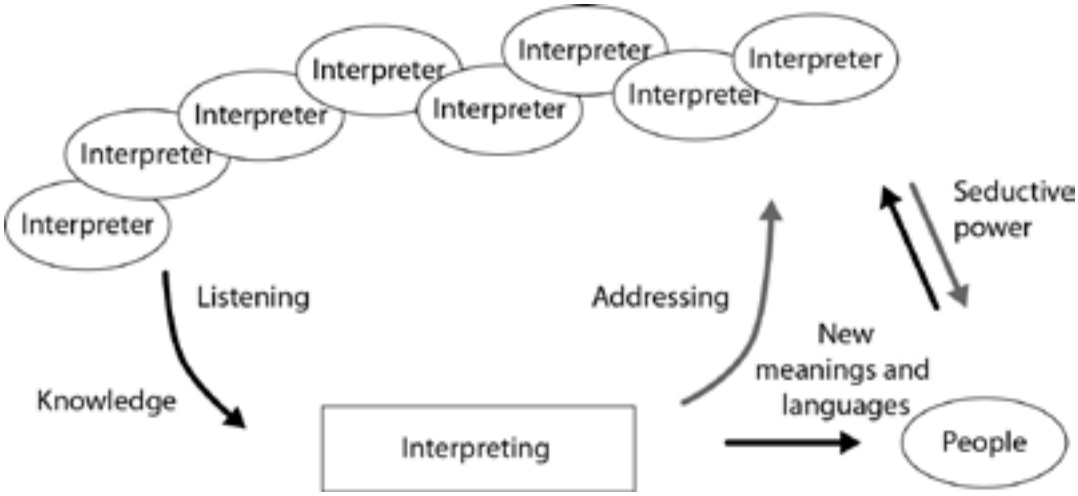
Figure 1:



So nothing wrong with that … or maybe it is?

Data-driven and Design-driven are both great in many innovation strategies. When designers lack influence, superb products become almost impossible. If an organisation wants to be responsive and innovative, organisational culture needs to provide support for that. So you would also need a connecting culture. Several issues arise with these ways of working:

- Limited purpose for radical innovation. Combining user centred-thinking and design-driven processes does not always work in radical changing environments, because the user does not know where to go to. Experiments show what people use, but, before getting there you might want first to create the dream on which you can build your experiments. Here the famous equation of 'Building faster horses' enters the scene.
- The issue with perfect worlds. There is no company who does not think adding design to a product or service. However, when is something too much? As you can see in many (home and house) design magazines, humans do not play a central part in the final scene and picture anymore. The solution is perfect. Or in smart phone terms, the product cannot be opened or altered after release. There is no further tinkering possible. This connects to the styling aspect of design, but becomes more dominant in innovation thinking. If not perfect, it is not good enough.
- If our data is currency, who's the bank? It's a question that every innovator should be giving serious thought to. Those who don't may soon find themselves on the outside looking in at a data-centric economy that has moved on without them. Our data is hot property and everyone wants a piece of it. For consumers, it begins to feel like around every corner there's yet another company, service, or app. that takes our data for their use. Consumers start to question the real, tangible value it brings to them, other than being perceived as entangled in the big data game.
- Thanks to the crisis and existing management techniques, many organisations suffer from being overly organised and dead serious. This can be a real problem. Take for example a drugs company. You see more and more that scientists in an organisation are unable to communicate effectively with scientists from different disciplines. The result is a lack of 'mental' energy in organisations. Energy is vital for any innovation approach to succeed. Both described innovation strategies, take energy for granted. However, mostly it is not there.

We would argue that decision-making and advocacy require a larger palette of insight than design or data alone. So how to overcome these challenges? One of the elements will be the ability to talk and work with people in different professions. We would like to introduce an adjacent territory to 'fix' the flaws of choosing a data-driven or design-driven innovation process. This would involve adding the human element and thereby humor, mainly to create a culture to open to all kinds of techniques.

Introducing Humor

Much research has been done in how innovation can be stimulated in organisations. Crossan and Apaydin ([1]) name three levels of determinants of innovation: leadership, managerial levers and business processes. Others name the organisational structure and systems ([2]), knowledge diversity in a group ([3]) or motivation ([4]) as important to foster innovation. We are however interested in another

way of stimulating innovation in organisations; namely creating an organisational culture that promotes innovation in the organisation by focusing on humor. Humor is a group of traits that include tolerance for novelty, ambiguity and change. Humor is a natural stimulus for creativity and innovation. Humor also implies play and fun. Humor does not necessarily mean being a comedian on stage. Humor is seen as a common element of human interaction. There are several theories of humor:

- Relief theory focuses on how humor is used to relief stress or to remove tension. An example can be someone making a joke to 'break the ice'. Another example would be CliniClowns, that offers distraction and joy to sick or disabled children in hospitals.
- Incongruity theory states that people laugh when something surprising happens: when the status quo is challenged and patterns are broken. Likely, this happens in a joke or many of the virals on Youtube.
- Superiority theory explains how people use humor to feel superior over others. It can also be used as a social corrective: people laugh at stupid actions of others.

Humor from employees stimulates readiness for change, thus the organisation should foster internal approval of positive humor and the expression of laughter and external activities that naturally provide a social context that induces humor. Humor creates an energy burst. For an organisation to be innovative there has to be a culture that supports innovation and innovativeness. As you can imagine, designers and data scientists are people before being designers or data scientists.

Culture Defines Us

We are all influenced by the social and economic context where we live in. While culture is a slippery concept, it is something so ubiquitous that we take values and attitudes implicitly for granted. With more and more people being a global citizen and worker, we are more and more likely to be working with people influenced by attitudes and values different to our own. The most harrowing one is happening in the workforce. Whether your colleagues are virtual, born in a different country then you, you see a big divide in the ageing and therefore also the phase someone grew up in. In short, we all come from somewhere and lived in a context. If you started studying in the 1990s, Internet started to emerge. Explaining to Generation Y that there was something like Gopher, the game Snake on your Nokia phone or the newness of ecommerce in the previous millennium, you immediately realise there is a generational legacy gap. This creates enormous challenges for organisations to thrive. Let alone innovation.

The Rise of Humor-driven Innovation

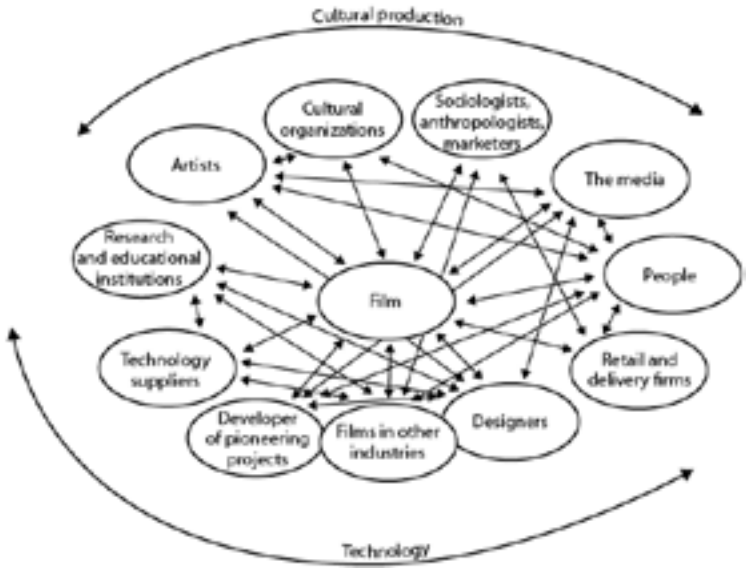
Organisational culture is a set of shared mental assumptions and values that guide interpretation and action in organisations by defining appropriate behaviour for various situations. It is seen as an important resource of competitive advantage by multiple scholars. Since culture is a resource that is difficult to imitate, it has the potential to provide an organisation with a long-term advantage over their competitors. People are still the most important asset in most industries. In an era of collaboration beyond any differences — geographies, class, etc. people get together with a sense of purpose rather than with a sense of function. This paradigm shift needs organisations to redesign themselves to best leverage its people factor.

So we see the emergence of an innovation process that focuses on a very human element. Humor-driven innovation is about creating an organisational culture that embraces innovation with a smile. It is about accelerating openness to new ideas, stimulating risk-taking, a focus on achieving results and support from management. Based upon earlier research.

The main attributes for humor-driven innovation are as follows:

- Humor is personal and culturally dependent. Products are easily scalable thanks to the culturally neutral data-driven and design approach. Scalability used to be a plus, a scarcity only possible for the big companies. In online worlds, scalability is a non-issue. This creates copycatting behaviour and continuous attacks on the business profit. If you want to stand out in the crowd you need to connect to local cultures. This involves additional thinking.
- Provocations. Provocations are deliberately unreasonable ideas that would be immediately vetoed by those who are not in the process. In our research, we have seen adding humor makes people think more in provocations and become unreasonable in a positive way;
- Alternative approach. Like with provocations, the techniques used within humor-driven innovation build upon the existing frameworks of open innovation, but adds alternative approaches like copycatting, exploring organisational taboos to accelerate innovation;
- Realisation that there is no perfect end state. It is about continuous progress; with humor, especially the group processes are important for the creation of an innovation culture. From our earlier research, we find that the process brings light and airiness in any organisational culture.

Figure 2:
Interpreters in a collective research laboratory



Quadruple Helix

This connects as well to the concept of quadruple helix as a successor to the triple helix thinking in the public domain from Henry Etzkowitz and Loet Leydesdorff.

Good collaboration between the research community and industry needs to be reinforced with stronger innovative public procurement component. Those components should take the citizens actively into the innovation process, to create the new markets for products and services. 'If citizens are not involved we enter up to the old linear paradigm and loose the win-win aspect of creating new markets', as said by EU advisor for Innovation Systems at the European Commission DG CONNECT Bror Salmelin. But how to connect to citizens? Humor might be a very effective tool for that. In advertising worlds, mixing an official message with humor is an obvious approach to create impact with the target audience. Adding some fun to the helix might be a good one, and at least promises to be a cool new adventure for EU ...;-)

Conclusion

Colin Powel once said: 'Surround yourself with people who take their work seriously, but not themselves, those who work hard and play hard'.

We innovators are very fond of describing and explaining how the world should work in terms of metrics and models. The more models the better. Also the quantification of innovation is important. However, we all know this does not buy innovation. Innovation is not a concept you can streamline as such. A central point that we tried to outline in this article is that when organisations are going through huge changes, changes that require new thinking and new roles, you may want to incorporate natural stimuli. Humor is one of the most common elements to create new thinking. It is time for humor-driven innovation.

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Socio-Economic Impact of Open Innovation 2.0

Introduction

Open Innovation 2.0 is about extensive collaboration among all the stakeholders in the innovation ecosystem, sharing ideas, results of intellectual creativity and co-creation among all involved. To understand and assess the socio-economic impact of the Open Innovation 2.0 it is important:

1. for the communities in making decisions that promote long-term sustainability, including economic prosperity, employment, a healthy community, and social well-being;
2. for the market in creating new products or services considering the users' needs; and
3. for the policy makers in creating new policies for citizens' and businesses' welfare, and sustainable government.

In the core of the social and economic impact of Open Innovation 2.0 are the shared values, shared ideas and shared wellbeing for all the innovation ecosystem participants.

Communities/Users/Citizens Perspective

The communities/users decide the real value of the Open Innovation 2.0. Nowadays the citizens are more "open" in participating in decision making on their economic and social prosperity. The communities are well aware of the real impact on their social and economic life, while they can influence in political decisions or creation of services for the market. The citizen/user is now an integral part of the innovation process, who can make real change. In the innovation participation process, the rise of the new communities that takes Open Innovation 2.0 as the baseline has an impact on society.

There are many opportunities once the worlds of information, monitoring and communication have been brought together. Sharing content and creativity through the Internet will create new and better work/life balances for citizens: wherever and whenever. Wearable technologies supported by Internet coaching will create well-being lifestyles for young people and the elderly. The healthcare costs will be controlled through communication as needed. Sustainable energy, sustainable water and sustainable material use will become essential part of citizens daily practices.

Market Perspective

Businesses want to grow and reach sustainability in the market. With advances of the global information and communication technologies, the processes and practices of creating innovative product or service are evolving at an increasingly rapid pace. The innovation in product, service or delivery must raise and create value for the market, while simultaneously reducing or eliminating features or services that are less valued by the current or future market. Industry/market is well aware that it is not possible anymore to create new services alone, isolated from the rest of the world and "force" the users to adopt or buy these created services. Otherwise, it will result waste of time and resources, as the buyers will not be interested in using these services. As a part of the Open Innovation 2.0 ecosystem, industry/business/service providers become more "open" engaging the "buyers" or "users" in the co-creation of services. The users can be both consumers and innovators/participants, given all of the supporting conditions. At the same time market operates within the boundaries of regulations created by the governments. Open Innovation 2.0 approaches allow the industry to influence in the regulatory decisions adapting them into the dynamic market needs. Businesses will grow in more sustainable manner with support of the other ecosystem participants.

Policy-makers Perspective

Over the last decades political approach and more importantly, the political mindset about innovation has drastically changed. In particular, today the political leaders believe that successful innovation is accelerated when a wider spectrum stakeholders participates, thus applying Open Innovation 2.0 approach, therefore creating better value for the wellbeing of the citizens and businesses.

From the world political leaders:

- On Dec 3, 2010, Neelie Kroes, Vice-President of the European Commission and Commissioner for Digital Agenda gave speech: "Unlocking the digital future through Open Innovation" during the 4th pan-European Intellectual Property Summit, where she clearly stated that openness is central to succeed in this digital revolution and that we should create maximum room for user-driven innovation ([1]);
- On May 9, 2013, Barack Obama, the president of the United States of America, in his opening speech of expanding manufacturing innovation centres, he stated: "We are seeing the pooling of research, of risk and the potential for breakthrough in manufacturing technology that only happen when we bring everyone together" ([2]).

In the core of the policy makers is to make the citizens "happy" in their ways of living, create sustainable government where the citizens can prosper,

create welfare for the businesses to grow and create jobs for the communities. The sustainability of the government lays on the wellbeing and "happiness" of the citizens and businesses.

The efficient interaction and collaboration among the three: (1) the communities/users, (2) the market and (3) the policy makers, should meet in order to secure maximum economic and social impact for all the stakeholders involved in Open Innovation 2.0 ecosystem. Collaborative skills, shares ideas, values and processes need to be in place to make the collaboration efficient, and generate wealth for the society, market and the governments. The key driver and enabler of these is the ICT: information and communication technology.

In the past years considerable attention is drawn to this topic trying to solve the issue of the effective (Open) Innovation (2.0) ecosystem to reach maximum societal impact. Most of the studies offer models, methods and approaches to assess the impact or to create value for the exosystem participants. Other studies also offer concrete actions to reach results. For example, "OSI: Socio-Economic Impact of Open Service Innovation" study supported by the European Commission ([3]) offers both models and actions.

Despite the fact that individuals, market and the politicians share this vision of the effective Open Innovation 2.0 ecosystem, the practical actions are still too slow. At least, we have not seen strong evidences yet that in the practical level it is happening. In the meantime, due to rapid digital revolution, new studies appear offering new actions for solutions, while the previous offerings of actions are not even being tested. Despite the awareness of this vision of the societal impact, the Open Innovation 2.0 ecosystem participants are still too slow to make decisions on their interference.

It's the ***Fear*** for *change, failure, uncertainties and impossibility*, which hold the parties back to make decisions and actually do it.

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Failure should be seen as opportunity for getting stronger, creating better solutions, better lifestyle and better governments. *Change* is the only constant in life. So, better to learn to embrace, enjoy change and turn it into welfare. *Uncertainties* are the mysteries for the future, that one can discover more opportunities for wellbeing. To paraphrase Nelson Mandela: "It always seems *impossible* until it's done" ([4]). Urgent actions are needed to move from vision into action. Quick decisions should be made by all the parties (individuals, markets and governments) to be able to enjoy "the fruits" of the shared values accelerated by the Open Innovation 2.0. To overcome the ***Fear*** new "experimental" and "risk taking" mindset is needed, as on the one hand, failure is natural in experiments and, on the other hand, experiments can be a start of something big, desirable and important. Think about of a start of shared values in an exclusive society, market, economy and government, driven by Open Innovation 2.0. Now let's do it!

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