

Service Innovation

Yearbook

2010–2011



European Commission
Information Society and Media

Service Innovation
Yearbook
2010–2011

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Foreword

by the European Commission

Dear reader,

This second edition of the Service Innovation Yearbook is a nice collection of highly important articles about open innovation strategies and developments. It also contains use cases and examples on how open service innovation is moving to the mainstream.

The yearbook is a co-publication of the European Commission and the Open Innovation Strategy and Policy Group, OISPG. OISPG is an industry-led industrial group advising on strategic priorities for service innovation, both towards open innovation ecosystems, as well as towards a framework for next generation user-centric (for citizens and businesses) service architecture and knowledge-intensive service industry.

We see the work as being extremely important to bring to citizens and businesses the kind of services which lead to high-quality life, and sustainable growth. When we achieve the goals of personalisation, affordability and new industrial growth in the same go, we are on the right track. The yearbook together with the previous (and forthcoming) reports by the OISPG are important indicators on the issues which need to be tackled broadly, together and in close collaboration with all stakeholders. These publications can also be found under the web page of the group (<http://www.openinnovation-platform.eu>).

It is also interesting to set the work and objectives of the group, and the contents of this yearbook, into the context of the Digital Agenda; the major Commission flagship in the information society domain. We can see many parallels both strategically and operationally between the Digital Agenda and the objectives and suggestions of this group.

During 2010, the group moved importantly forward with the new concept of user-centric services focusing on service convergence following the lifetime of a citizen. The events in a lifetime trigger the need for integrated services in highly context-sensitive way, leading to the need of common, open service platforms and also functional architectures. This user-focused architecture is technology neutral, but builds on the functionalities the next generation Internet can offer, the Web being highly mobile, actively interactive, broadband and highly personalised.

Some critical issues will be very central in this new architecture for services, one of the most critical being the concept of the identity being divided into the hard, official one, and the soft identity, which is build on the experiences and context of the citizen, all changing and developing during the lifetime. The citizen behaviour will be much based on the soft identity, whilst the trust and security is the core for the hard identity, which in turn is the prerequisite for next generation service concepts.

The examples you can read in this yearbook are highly interesting, relevant and very diverse.

I hope you all enjoy reading the Service Innovation Yearbook 2010–2011.



Bror Salmelin
Policy Advisor
Directorate-General for the Information Society and Media
European Commission

Foreword

by the OISPG

(Open Innovation Strategy and Policy Group)

We live in very challenging times and yet, if we reflect back just 50 or 60 years, it is clear that Europeans, in general, live in a much better environment and world. As we look forward, I believe that three important trends are converging which will help create a better future;

- accelerated digital transformations,
- mass collaboration, and
- a new paradigm of sustainability.

The advancement of Moore's law continues to enable and accelerate digital transformations whilst the development of social computing and the Internet of Services/Things will enable mass collaboration on a scale never seen before. In parallel, there is a growing realisation that we collectively need to take a more sustainable and long-term perspective on both societal and economic development and progress.

The confluence of these three trends can help improve the quality of life, enable an innovation economy and move us all towards a more sustainable trajectory for our societies and economies. For example, developments such as the future introduction of electric vehicles in Europe, which will require a whole new infrastructure, is an example of where digital transformations, mass collaboration and sustainability are coming together.

This past year saw the introduction of the Europe 2020 strategy and key supporting initiatives such as the Digital Agenda and the Innovation Union. At the heart of Europe 2020 is the idea of achieving smart, inclusive and sustainable growth; open innovation will likely be central to the envisioned transformation of Europe. Indeed, we are seeing the emergence of what might be called Open Innovation 2.0 where innovation includes all the actors in an ecosystem, leveraging the creative commons and where we will often see simultaneous technical and social innovation to enable rapid assimilation of the benefits of open innovation. Thus, in addition to open innovation, we will all need to be 'open to innovation' as brilliant technical innovations are of little use if they are not adopted or assimilated. In parallel we are seeing the role of the user come to the fore, with 'user-driven innovation' becoming a common part of the innovation vocabulary and process.

The shift from 'product' to 'service' will help with the establishment of a new sustainability paradigm. A simple example of this is the adoption of cloud computing which will enable new services models which are likely more efficient and effective than each company provisioning their own hardware and infrastructure. Additionally, cloud computing will also help shorten development time for new services, helping bring benefits faster to the market and to the broader society.

In this second Service Innovation Yearbook 2010–2011, you will see numerous examples of how open innovation and user-centred innovation for services are driving real benefits and progress. Thanks to each of the authors for putting pen to paper on their ideas and experience. Together with the commission, the OISPG is committed to advancing both the thought leadership and practice around open services innovation.

I hope you enjoy this yearbook: finally, I would like to acknowledge the great drive and impetus that the Directorate-General for the Information Society and Media has provided to establishing the OISPG and helping advance the practice of open and service innovation. Happy Innovating!



Prof. Martin Curley
Director, Intel Labs Europe
Chair, OISPG

Acknowledgements

Name	Organisation	Email
Aarts Emile	Philips Research	emile.aarts@philips.com
Almirall Esteve	ESADE Business School	esteve.almirall@esade.edu
Auer Thomas	Auer Consulting & Partner	auer@hrm-auer.ch
Bakici Tuba	ESADE Business School	tuba.bakici@esade.edu
Bell John	Philips Research	j.bell@philips.com
Chesbrough Henry	Center for Open Innovation Haas School of Business, UC Berkeley	chesbrou@haas.berkeley.edu
Chronéer Diana	Luleå University of Technology, Sweden	diana.chroneer@ltu.se
Corral Myriam	Ministerio de Economía y Hacienda (MEH)	myriam.corral@meh.es
Costello Gabriel J.	Galway-Mayo Institute of Technology and Galway	gabrielj.costello@gmit.ie
Curley Martin	Intel Labs Europe & National University of Ireland Maynooth	martin.g.curley@intel.com
Delaney Martin	Innovation Value Institute	martin.delaney@nuim.ie
Distinguin Stephane	faberNovel	stephane.distinguin@faberNovel.com
Donnellan Brian	Information Systems Innovation	brian.donnellan@nuim.ie
Edvinsson Leif	Universal Networking, Intellectual Capital, Norrtälje, Sweden	leif.edvinsson@unic.net
Erkinheimo-Mennander Pia	Nokia	pia.erkinheimo@nokia.com
Harjanne	Nokia	karoliina.harjanne@nokia.com
Karoliina		
Keeling Mary	IBM Institute for Business Value	mary.keeling@ie.ibm.com
Kerklaan Hannah	Philips Research	hannah.kerklaan@philips.com
Kuittinen Ossi	Finnish Innovation Fund, Sitra	ossi.kuittinen@sitra.fi
Kulkki Seija	Aalto University School of Economics, Center for Knowledge and Innovation Research (CKIR)	seija.kulkki@aalto.fi
Markkula Markku	Aalto University, Committee of the Regions	markku.markkula@aalto.fi
Roodink Carlien	Service Innovation and ICT (SII)	carlien.roodink@si-i.nl
Salmelin Bror	European Commission	bror.salmelin@ec.europa.eu
Speidel Klaus-Peter	hypios. Learn to love problems.	kspeidel@hypios.com
Stankovic Milan	hypios. Learn to love problems.	mstankovic@hypios.com
Turkama Petra	Aalto University School of Economics, Center for Knowledge and Innovation Research (CKIR)	petra.turkama@hse.fi
Wareham Jonathan	ESADE Business School	jonathan.wareham@esade.edu
Yeh-Yun Lin Carol	National Chengchi University, Taipei, Taiwan	yehyunln@nccu.edu.tw
edition by		
Honka Anni	European Commission	anni.honka@ec.europa.eu

1.1 Lead article: Open services innovation — a new mindset to find new sources of growth

When I wrote the book *Open Innovation: The New Imperative for Creating and Profiting from Technology* in 2003 [1], the term ‘open innovation’ was not in active use. I performed a Google search on the term at the time and the result returned about 200 page links. Most of these links were of the variety ‘company X announced that it opened its innovation centre’. Today, when I perform that same search query with the same term, Google returns more than 13 million results. And the majority of these results use open innovation to mean a new model of industrial innovation, which was the intention of my book written eight years earlier. For this reason, I am credited with originating the term ‘open innovation’ [2].

Earlier models of innovation emphasised innovation as an outcome of research and development (R&D) activities. These R&D activities led to the creation of new products, and companies that invested in R&D were fostering more innovation and creating barriers to competitive entry [3]. Alfred Chandler provided an extended account of the rise of the US corporation during the 20th century. A core element of his account was the ability of US firms to manage economies of ‘scale and scope’ that emanated from internal R&D investments [4].

The dominant conception of successful innovation towards the end of the 20th century was inspired by these insights. Innovation resulted primarily from internal R&D activities, and these led to new products, and even to new businesses. R&D was a barrier to competitors, and could enhance a company’s competitive position in the market. Some scholars modelled innovation ‘races’ between companies making heavy R&D investments, trying to be first to invent a new product or technology [5].

But this conception had its weaknesses, and over time these weaknesses culminated in a realisation that it was no longer a sustainable innovation model for most companies in most industries. One key weakness was the problem of ‘spillovers’ outcomes that were created by R&D but not captured by the firm that performed the R&D. As product market competition intensified, spillovers grew in size and importance [6], causing many companies to rethink their willingness to continue to invest in R&D [7]. Another issue was the anomalous situation in which smaller companies with less R&D capability unseating established incumbent

firms with much more extensive R&D investments. IBM was overtaken in hard disk drives [8]. Cisco surged past Lucent and its Bell laboratory network [9]. Leading pharmaceutical companies are struggling to sustain their blockbuster products and the deep internal R&D pipelines to develop them [10]. These outcomes were hard to understand within the internal R&D paradigm.

Taking a step back, though, revealed that another model of innovation could account for these challenges far more readily. Leveraging external sources of innovation could enable firms to innovate faster or more effectively in certain instances than relying exclusively upon internal R&D. Letting unused internal ideas and technologies flow outside the organisation through licensing, joint development, or spinoffs could identify new markets and new applications for technology. This is where the concept of open innovation was born.

Open innovation is defined as ‘the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively’ [11]. There are thus two sides to the model. One side is ‘outside-in’, bringing in external ideas and technologies into the innovation process. The other side is ‘inside-out’, enabling unused internal ideas and projects to go outside for others to use instead. And it is the business model of the firm that determines what to look for on the outside, and what to let go to the outside.

However, since the term has become much more widespread since the publication of the book eight years ago, the term has acquired other meanings, some of which are not consistent with the meaning given at the inception of the term. Open innovation is not simply outsourcing innovation or R&D. It is not simply a restatement of open-source software development. It is not synonymous with user innovation. New research is beginning to clarify these alternative approaches to innovation, and to sort out the meaning of the different terms [12].

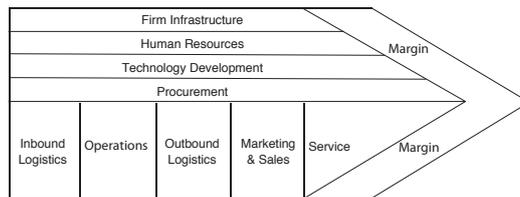
An important new development in open innovation is its increased application in services businesses. This yearbook is one important manifestation of this new development. To understand the importance of this, it is helpful to examine the product mindset in innovation, and compare that to a more services-oriented mindset for innovation.

The product mindset for innovation

Product businesses think of customers as consumers, who are at the end of the value chain. Product businesses design products based on their research into what their consumers want and are willing to pay for. Then they engage in their development processes, and these consumers receive the output.

This product mindset influences the very way companies conceive of themselves, and the value they add for customers. Michael Porter's classic book, *Competitive Advantage* [13], includes his depiction of a value chain in Figure 1.

Figure 1. Michael Porter's value chain



This value chain has been a powerful tool for conceptualising businesses, and how to innovate them. It is widely taught in business schools around the world. It is installed in the operating procedures of myriad companies as well. And it frames the way people think about their business. So it is worth taking another look at this figure, more than 25 years after it was first published.

The action moves in the figure from the left side to the right, in the direction of the arrow. Inputs come in on the left. They are transformed into outputs through the processes detailed in the figure. Some of the processes are core manufacturing activities (inbound logistics, operations, outbound logistics), while others are supporting activities (human resources, technology development, procurement).

Notice as well, though, that the product is the star in this figure. 'Service' comes at the very end of the process, just before the product gets to the customer. Some service is delivered to the customer as part of the sale (such as installation), but the lion's share of it is delivered after the sale in this approach. So service is conceived as the end of the process, to 'finish' the product's sale, or keep the product operating once it is purchased. The important stuff happens with the product. Competitive advantage (which is the title of

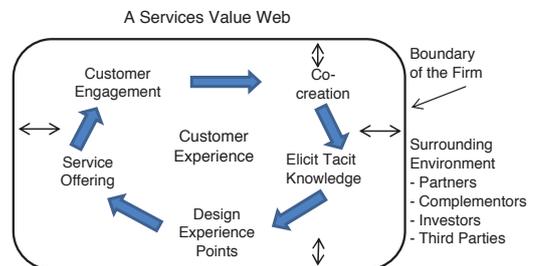
the book in which Porter published this figure) comes from having better products, or differentiated products, or the lowest cost products. This is the mindset of many executives towards their business.

Towards a services mindset for innovation

In the world of services, there is greater intangibility. Often, customers need to explain more about what they need in the way of services, and their needs likely vary from one organisation to another. Suppliers in turn can no longer dedicate themselves to 'one size fits all' thinking to serve these customers. They have to figure out how to give the customer what the customer needs, while also figuring out a way to do this profitably for themselves. This introduces a tension between standardisation (which makes providing the service more cost effective for the supplier) and customisation (which more closely matches the customer's needs, but may require different solutions for each customer).

When you think of your business as a service (whether you are making a product or providing a service), you think of your customers differently. Their role in the innovation process changes; contrast the services value web in Figure 2 with the earlier value chain of Michael Porter.

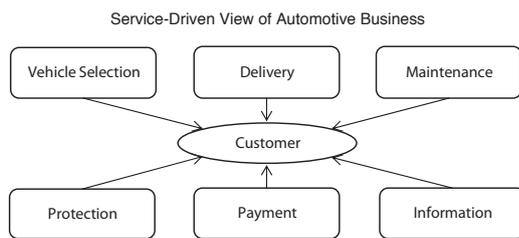
Figure 2. A services value web



To see the different mindsets in action, consider an automobile. In the product mindset, the car company must procure steel, glass, electronics, and other items. Its operations turn these inputs into a vehicle. That vehicle must be painted, accessorised, and shipped to a dealer. The customer purchases the vehicle from the dealer, who readies the car for the customer to drive off the lot. And the customer comes back periodically to the dealer for maintenance, to keep the car running.

How might a service approach to automobiles look? A service approach would not conceive of the car as a transaction, highlighted by the purchase of the vehicle, but would instead think of the car as a delivery method for providing transportation services over a period of time. So a services view might conceive of the offering as ‘transportation services’ or ‘mobility services’ or even transportation experiences. There is no single purchase activity that provides the climax to the process; rather there would need to be a series of ongoing interactions with the customer over time. A graphical representation of this alternative way of thinking might look like Figure 3.

Figure 3. An automotive example



Notice that new areas of value-added services activity come to the surface (picking up the customer, different payment mechanisms) that do not feature very much in the traditional value chain analysis. Meanwhile, the vehicle itself is only a part of the process, rather than the main event. In fact, the customer’s mobility services needs may vary from one day to the next, from simple movement from point A to point B, to hauling items, or something easy to park in an urban centre, or something able to drive long distances comfortably, or able to manoeuvre safely in snow and ice. If the customer was freed from having to own the vehicle, different vehicles could be provided whenever different functions were desired.

In a services-driven view of a business, services are front and centre throughout the business. Services are a profit making activity (as opposed to the cost centre of the product-based view), and services are used to differentiate the company from its competitors. The people running the function are at the core of the business, and are the ones destined for the top of the organisation.

As a further note on the automotive example, there are a growing variety of automotive transportation service business models. Some are as old as the taxi. Others are as new as the ZipCar, a way to hire a vehicle for as little as an hour at a time in various cities, or the experimental Car2Go service, being tested by Daimler in Ulm, Germany

and Austin, Texas. Payment methods have evolved as well, from outright purchase, to car loans, to leases, to payment by the day or by the hour or by the trip.

A services mindset for industry — lessons from the music industry

A services mindset can extend beyond a single company involving customers more deeply and more directly in the innovation process. More can be done, if we start to consider an entire industry. A services mindset can revive failing businesses, unleash new markets, and provide far more meaningful experiences to customers. This can be clearly seen in the music industry [14].

While the traditional record company is defined as a service business, their fundamental mindset is still that of a product: the end result of the process is the creation of the album or CD. Moreover, the innovation process is vertically integrated inside the music company. It is the record company that finds the nascent artist or band. It is the company that invests the money to get the band into the recording studio to cut the tracks of the new product. It is the company that spends the money and effort to promote the product to the wider world, getting the songs on to playlists at radio stations and TV shows, and setting up interviews with newspapers and magazines to introduce the band to the world.

In this model, consumers are the passive recipients of the music product offered to them. All the ‘work’ is done for them, until they became aware of the new band, and start buying the CD. This view of the consumer is a typical mindset of product-driven businesses. In this view, digital consumers are freeloaders, who will steal if they can, download for free if you let them, and only buy the full CD or album if you manage to withhold it from the online world and force them to go to a store.

But this model is past its sell-by date. Over the past decade, there has been tremendous change in the recorded music industry. The sale of CDs is down substantially. Record companies are losing money. Piracy is rampant, as many users download music illegally without paying any money. Legal online delivery channels are selling more songs, but these sales are not enough to compensate for the loss of the CD sales, and margins to the record company are reportedly lower through online channels. Plus the online channels typically sell single tracks, rather than entire CDs, so the price point per unit of music sold is much lower as well.

These developments have created a crisis for traditional record companies. In cases like this, it helps to get back to the customers, the source of value creation in the industry. What can be done to create new, more powerful, more valuable experiences for lots of customers?

An alternative mindset for the music industry

A services mindset would invite digital consumers to be co-creators of their musical experiences. Co-creators are not passive recipients: they are active, engaged seekers of new music. The bewildering array of online music is not daunting to these co-creators: rather, it is a rich ecosystem full of experiences to be discovered, enjoyed, and shared. Co-creators sample music widely, and buy the stuff that they like the most. One hot track leads to learning more about the artist, and what other tracks they have. One new style of music leads to finding out who else plays that kind of style. And what your friends are listening to is very important in choosing what you listen to.

Co-creators long to be freed from the tyranny of the CD. A typical CD has 10 or 12 tracks, and one or two of them are usually the ones that are the most interesting. With the advent of the digital world, new companies and technologies have arisen to aid in the co-creation process for listeners. A company called Pandora helps listeners find new music that has characteristics similar to the ones that listeners enjoy in the music they currently favour. Once listeners share their preferences with Pandora, Pandora's service will 'push' new music by other, perhaps unknown, artists that match these characteristics to the listeners to consider. The feedback provided by the user makes Pandora better and better at finding music that is more closely tailored to the listener's interests. Other companies such as BMAT and Lastfm also perform this function.

Another emerging part of the new digital music business is the patronage part of the industry. Patronage companies exploit the fact that some fans are *really* into certain bands. Their support goes far beyond buying a CD. ArtistShare lets truly committed fans support their chosen bands to a far greater degree than was previously possible in the traditional model. Patrons can receive specialty merchandise from the band. They can get special liner notes, or photos of the recording sessions. For the right price, some patrons will even get invited to attend the recording sessions, or the release party. While this model will not scale for millions of listeners, it doesn't need to, in order to generate the funds needed by new

bands to get their start. Sellaband is another company that provides a similar patronage model.

So this crisis in the music industry is really the death knell of the traditional record company business model. It is most definitely NOT the death of the music business itself. Music is perhaps more alive, more diverse, more engaged, and more connected to its audience, than it has been in a half century. The business models that will succeed in the future music business will be those that help artists connect to their audiences, that empower audiences to find artists they enjoy, that capitalise on the enthusiasm of fans for certain artists, and that spark co-creation between both groups.

Open services innovation: outside-in and inside-out

Open innovation in services again features both the outside-in and inside-out paths of open innovation in products. In the music context, sampling, mashups, and aggregating content and tastemakers together in one place are examples of outside-in open innovation. By contrast, opening up studio time, offering music through a wide variety of offline and online channels and inviting patrons to release parties are examples of inside-out open innovation.

Amazon is another service organisation that illustrates both modes of open innovation. Amazon shares its web page design tools with third-party merchants, and carries their merchandise on its website. This outside-in open innovation greatly extends the variety of merchandise Amazon can offer, without the risks of having to produce and stock that merchandise. Amazon also exemplifies inside-out open innovation via its Amazon Web Services, an offering that rents out its server infrastructure to customers for their own websites to operate.

Getting back to growth with open services innovation

This yearbook comes out at a time when economic growth remains weak and haphazard in many advanced economies. One powerful tool to restore growth in lagging economies is open services innovation. Adam Smith famously identified the importance of the division of labour in the innovation process. Another Nobel Laureate, George Stigler, noted that the extent of the division of labour was determined by the extent of the market. And Berkeley's most recent Nobel Laureate, Oliver Williamson, demonstrated that companies will take internal transactions out into the market whenever

the costs of doing so are less than performing that activity inside the firm.

If you assemble these three concepts, you arrive at a virtuous cycle of economic growth. Services innovation can lead to a new division of labour, which can reduce the costs of using the market for those service activities, which then increases the market for that service, thus enabling a further division of labour. And so the cycle continues. A quick example of this virtuous cycle is the payroll process firms use to pay their workers. Fifty years ago this was performed by payroll clerks inside the firm. Today most firms utilise specialist firms to process their payroll, an industry that did not exist 50 years ago.

Conclusion

Businesses today often labour under a product mindset as they innovate. What is needed instead is a new services mindset. This mindset will place the customer experience at the centre of a business's purpose. It will unlock greater value for customers in their dealings with providers. It will differentiate providers and enhance margins. It will redesign business processes and business models. And it will lead to renewed growth for the business, and for an economy of such businesses. This yearbook is thus a vital reference that comes at a critical time.

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 **Contact**
Henry Chesbrough
 Executive Director
 Center for Open Innovation
 Haas School of Business
 UC Berkeley
chesbrou@haas.berkeley.edu

1.2 Open innovation supporting the Digital Agenda

The Digital Agenda for Europe was launched on 19 May 2010 as the first flagship initiative under the very ambitious Europe 2020 strategy, guiding the work of the Commission for the future. It sets ambitious goals: such as creating an inclusive society, sustainable societal development and growth, based on advanced ICT infrastructures, like ultra fast broadband, and interoperable inclusive applications and services.

The Digital Agenda interlinks technological and societal innovation. In the goal of reinforcing the Digital Single Market, it creates a framework for new kind of strong partnerships across all the actors in the knowledge society. ICT is a key enabler in all this, especially when we see the increased connectivity and interactivity new infrastructures provide. It relies on the next generation Internet which will be inherently interactive, genuinely broadband, mobile and strongly personalised, and thus will be the base for seamless, cross-border services.

The European Digital Agenda is highlighting some of the key issues needing strong pan-European actions in order to fully build on the potential this radical change of the value creation paradigms in the knowledge society brings. One of the most important challenges is the fragmented digital market and lack of interoperability for business and public services.

There is a common understanding of the need of pan-European platforms for cross-border services, such as in the areas of eHealth, government services and commerce. Demonstrations and pilots under the CIP/PSP programme are addressing issues like electronic identity management, cross-border procurement, eHealth systems, and e-Invoicing. Together with emerging legislation like the Services Directive, the work for the Single Euro Payment Area are all leading towards integration of these service platforms across the Member States.

One question is whether these emerging platforms can be aligned under common principles, common architectures to build a genuine single market ecosystem for services, and whether this could lead with other appropriate measures to a springboard for future service innovation in Europe.

Open, interoperable platforms and ecosystems are necessary for gaining a triple win in Europe. Simultaneously, we need to develop affordable, personalised services, businesses to provide them, and which are able to tackle the demographic and inclusion challenges also addressed in the Digital Agenda, offering ways to respond to Europe's societal challenges, and creating opportunities for new businesses delivering services for the benefit of all.

Open innovation creates the necessary lively and continuous interaction between public sector actors, users and service providers which is critical in the transformation of existing businesses and public services towards sustainable ones in the citizen centric knowledge society of today and tomorrow.

By acting together, we can make the difference, not only in innovation quality, but also to the speed of innovation.

A vibrant Digital Single Market based on next generation networks and platforms

A new generation infrastructure for innovative services

In the new generation of Internet that allows for a two-way communications with new tools and services, enabling users, including non-technical, to post information, to share opinions, videos and photos, to tag content, etc., and all this with unprecedented participation. This provides an example of distributed intelligence based on

the contribution of many users collectively that is fundamentally changing many of the models which had sustained the company and business so far. *Crowdsourcing* as innovative power is seen increasingly being used in services development and problem-solving.

The Digital Agenda thus sets as one of its key priorities fast and ultra fast Internet access to all, which is a prerequisite for bringing the collective intelligence together, in a spontaneous manner. Basic broadband should be available for all Europeans by 2013, and by 2020 all Europeans will have access to Internet speeds of 30 Mbps or above, and more

than half of European households subscribe to Internet connections above 100 Mbps.

When the user is provided with the tools and building blocks of this infrastructure, which they can use on an as-needed basis, they can remodel and combine the basic blocks to create services tailored to their needs. But, again here the speed is not the only remarkable change; it is the bidirectional rich connectivity and high-level of personalisation on the service platforms built upon this infrastructure which will make a significant difference, as services integration in a highly context-sensitive manner will be the winning key.

The Future Internet of Services is characterised by much richer content accompanied by many interaction mechanisms such as wikis, blogs, tagging, mashups, etc. All these tools have come to be called Web 2.0. But what Web 3.0 (adding semantics to the interactivity of Web 2.0) really means is not to introduce one of these tools in one site but to make the *transition to a new model in which user participation is key*, where high context sensitivity and personalisation will ensure the service quality for all.

Enhancing cross-border public services

Only by creating a true single market for this borderless exchange and trade of contents and services, and simultaneously having a careful consideration on the appropriate IPR approach, balancing content and service creator's rights and the users' rights we can achieve a fair, growing, and open playing ground for all actors, including citizens. The citizens will increasingly have the opportunity to be micro-entrepreneurs in their various simultaneous professional and private roles in the digital society, creating a new entrepreneurship. For this to be catalysed a true European Single Market for services would be crucial. Here the policy debate should lead to pan-European policies and legislative actions for the single market for contents and services.

Innovative environments, open innovation

Open innovation environments, created in several Member States, for example under the European Network of Living Labs [1] can be very valuable development and verification environments for large-scale pilots addressing technology-enabled societal innovation. They can help in determining the borders of applications: What is societally acceptable? Are there cultural differences? How we will achieve full inclusion in for all citizens? All are questions which require prototyping in real-world settings to stretch the limits.

We consider that the next generation Internet and its services are the computing and connectivity platform on which to build the *user-based innovation and new business models*.

This activity performed by the networked citizens, businesses, governments and NGOs gives rise to new forms of business and it creates new ecosystems of innovation not seen before.

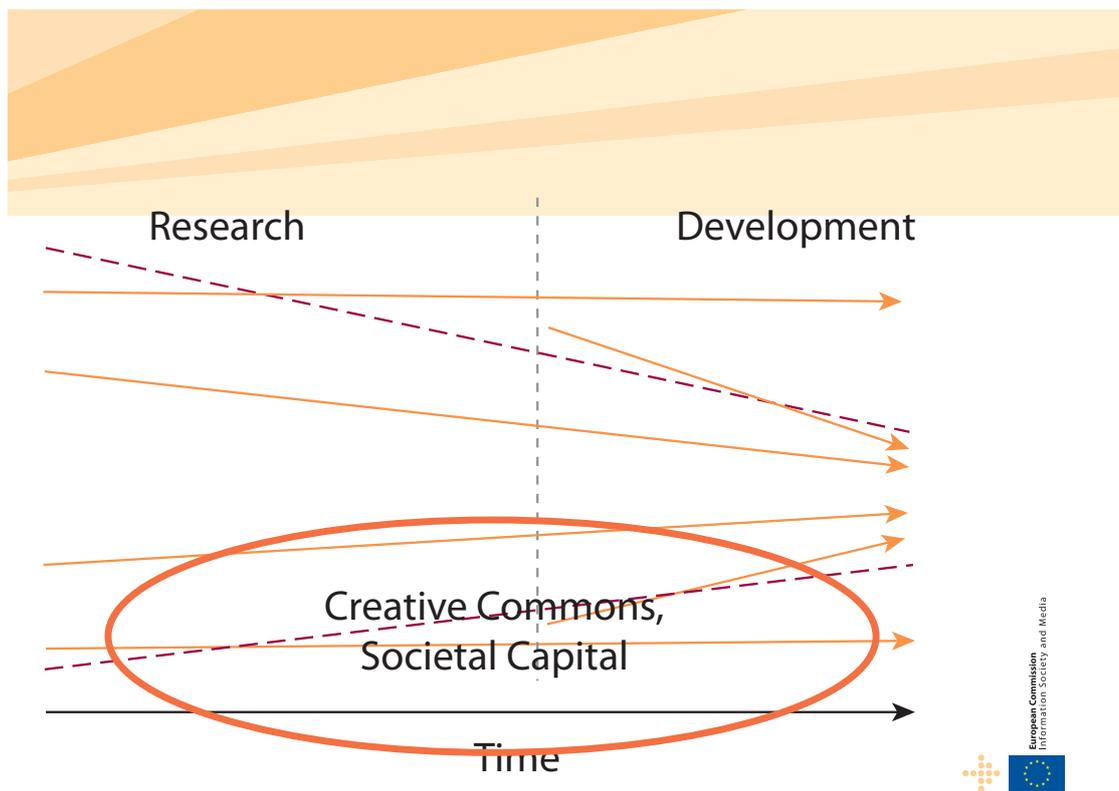
Open innovation goes beyond the traditional cross-licensing schemes, and beyond the collaborative projects needing to capture increasingly the creativity stemming from creative commons and societal innovation. We need to add to the ordinary Public-Private Partnership, the PPP, the fourth P, the People. Only this true PPPP can be called open innovation: to take innovation mechanisms outside of the domains where they have been so far, and especially in public services utilise fully the creative capital of the citizens for continuous development of services on open service platforms, enabled by the Digital Single Market.

This user-centric and even partially user-driven innovation model will lead to better scalability of services, and higher success rate, too. One can say that we make the innovation a continuous process, allowing for several cheap mistakes, but not heading to the disastrous big one, as is often the case in traditional linear and often vendor-centric development processes.

The bottom-up thinking with the common conceptual approach top-down can lead to a pan-European solution across the borders, with the application platforms organically growing. For the Single market development, it is important to have a simultaneous top-down policy and conceptual approach as well as the bottom-up development, and verification of what works and what doesn't.

So what is the difference between user-driven innovation and open innovation? In user-driven innovation, the customers or partners are integral in the ideation, development and development processes from the early phases onwards, and not only as objects for service innovation. In most cases, the user-centricity is, however, just a nice phrase and not really a business transformation because one still only goes through internal innovation capabilities. It becomes open innovation when one not only gets ideas from external sources but also lets external sources become key players in the process of turning ideas into a business. User-centricity can be true without open innovation,

Figure 1. Open innovation: It is extremely important for service development to build on the societal capital and creative commons, as this together with open innovation environments allows for real-world development, including the verification of results for rapid scale-up



but open innovation captures the user-centric service development objectives most efficiently.

In Europe, the *concept* of user-centric service ecosystems comprising all actors in the services developing open service platforms on a pan-European basis, is *as such* not a new one. However, the difficulty in implementing this new model was highlighted in the Helsinki Manifesto from 2006 where the question was whether a new service industry ecosystem could be built by the various stakeholders working together, co-creating and building value.

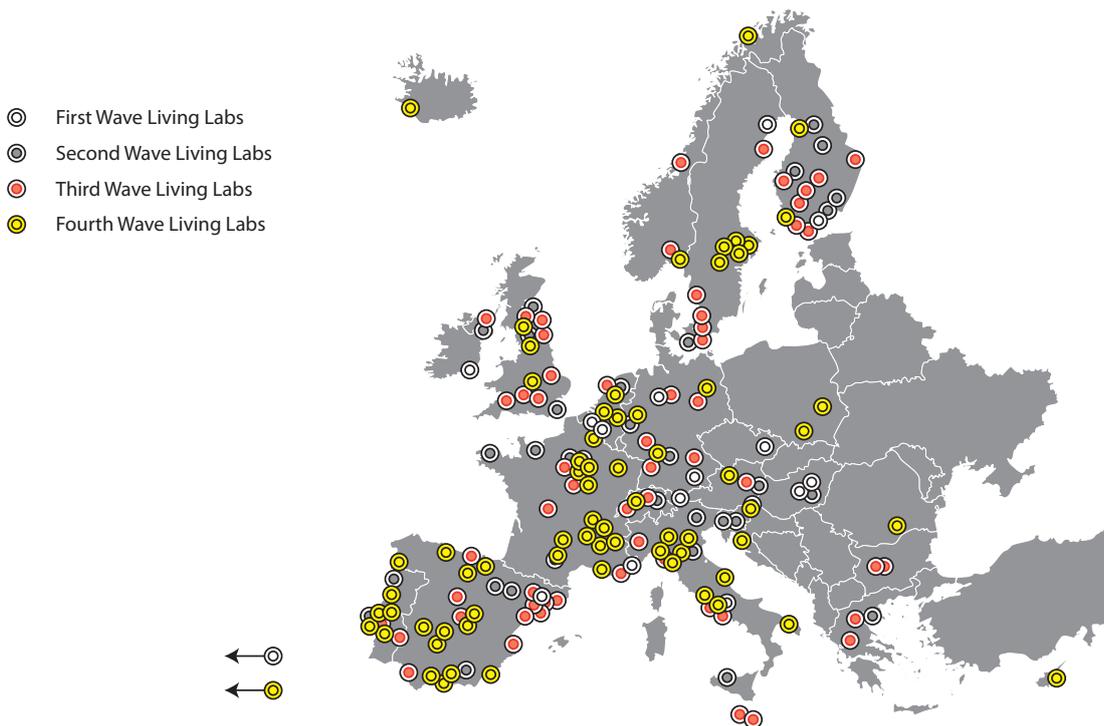
A remarkable tool, driven by the Directorate-General for the Information Society and Media since 2006, is the European Network of Living Labs [1] since it establishes a European platform for collaborative and co-creative innovation, where the users are involved in and contribute

to the innovation process. The regional dimension well covers all of Europe, and the time is now right to move to the next level of collaboration along application axis.

There are, so far, good examples of success in emerging collaboration in areas like energy and rural development. The nodes in the Living Labs network have also expressed their strong interest in collaborating in the forthcoming Future Internet PPP in various application areas, including public services.

In practice, this is shown already; enterprises develop interaction platforms with their core products, opening them up for individuals and SMEs to develop their applications on. This boosts the market of the platform (and related equipment) but also creates opportunities for the SMEs and even individuals to enter the Europe-wide market with their offerings.

Figure 2. Living Labs have developed to a network of 212 sites now and continue to spread all over the world, enabling open and user-driven experiments and tests: this helps to create cross-border ecosystems where everybody can get involved in innovation [1]



Interoperability by the bottom-up process in a favourable framework

Interoperability between the various functionalities common to all applications, like identity management, trust, security, mobility, service roaming (geographically and over different devices), financial cross-border transactions, IPR issues is a key element.

Open innovation models imply extensive networking in order to exploit the internal and external knowledge. New collaboration relationships and methods are required since networking usually leads to stronger and more spontaneous ties among partners like universities, public sector actors, users, and even competitors. In turn, this leads to new enterprise creation options through venturing, entrepreneurship and spin-offs and even through new business organisations like micro-enterprises [2].

Open innovation is essential for the service industry in order to get economic and social benefit it generates. It

provides several direct benefits to service providers and, consequently, to its consumers by delivering products and services which are better adjusted to the market, more flexible cost structures, increased creativity, adaptability, easier access to knowledge, and quicker and cheaper innovation cycles. To have this rich functionality interoperability is essential, and not only on a technical level but also on a *service convergence* level.

The role for the EU: leading the vision and acting on it

The EU has to take a strong lead for the trend of open innovations in services since over 70 % of EU employment is in the services sector and, according to Eurostat, 'services are the only sector of the European economy that has generated jobs in the last decades'. In comparison, the *Japanese* innovation strategy from 2010 states that in open innovation hubs the priorities are in integration and alliance strategies for issues like IP, local innovation environments, international collaboration on open

platforms, standardisation, human capital development and outreach (scalability) of the results.

From the European perspective, a strong interplay between the policymakers, legislators, and the application actors (public sector, vendors and citizens) is needed, to ensure the framework is safe, but also effective for these new services. New technologies bring also new issues to the table which need to be tackled on the pan-European level.

The list of examples of *common functionalities* are well addressed in the action points of the Digital Agenda, bringing together technology, society and policies all needed to boost the Digital Single Market development. Examples of actions mentioned are the new Telecoms Framework with regard to the protection of individuals' privacy and personal data, the European cybercrime platform, updates to the eCommerce Directive, likewise the eSignature Directive, transposing the VAT Directive by 2013 to support e-Invoicing, proposing measures to foster the Single Euro Payment Area, etc.

The public sector has a significant role in the designing of service reference architecture because it has the obligation to provide users (citizens, industries, companies, etc.) with open platforms and modular solutions, not locking them in to any single vendor. The public sector has also to enable effective joint development and exchange of best practice experience making services more affordable and inclusive for all in a pan-European approach. Combining these responsibilities with the user-centric, participative and open platform-based approach the outreach of development, towards full inclusion is also more easily achievable.

In open innovation, the development and deployment is seamlessly integrated in the 'real world' with 'real people', enabling higher quality services, but at the same time providing better scalability and faster innovation cycle for the services. Again, of course if the platforms for development are wide enough, as they can be when the ambition of the Digital Agenda is realised.

eGovernment as a driver for lead markets in the Digital Single Market

eGovernment services in the new ICT environments offer better quality, more affordable, services for citizens and businesses, and can reduce the administrative burden and cost significantly. Despite the relatively high availability of eGovernment services in Europe, the take-up of these

services is rather low. European governments have agreed to make user-centric, personalised and multi-platform services widely available by 2015.

These services should be available in multiple environments, building on one hand towards the trend for open service environments. These services should be interoperable across boundaries and borders. Empowerment of users requires openness and transparency of services, but again on the other hand, as previously mentioned, new thinking also on privacy and data security in general.

Many public services do not work across borders — not even across sectors — to the detriment of mobility and location-independent service roaming. Even if in many Member States the technology base is very similar, the details of the actual applications make the services incompatible. Hence a common dynamic architectural approach, based on interoperable services and functionalities is also of interest to the public sector as a service provider.

However, several single market initiatives and legal and policy instruments rely on the possibility to do business and interact with public administrations by electronic means. Examples of these are the Services Directive and the eProcurement Action Plan.

The Digital Agenda is thus proposing seamless cross-border eGovernment services in the Digital Single Market. To make this happen, the CIP (Competitiveness and Innovation programme) and the ISA (Interoperable Solutions for European Public Administrations) are the most suitable instruments. For the Member States, the Digital Agenda emphasises the importance of making eGovernment services fully interoperable, again driving towards common pan-European solutions.

For the purpose of defining the new user-centric approach by *Open User-Driven Services Reference Architecture* we have to consider as strategic drivers simultaneously:

- addressing societal challenges through open innovation in services
- capturing societal innovation
- social networks and social capital
- building a single market for services in Europe.

The reference architecture is not based on technological convergence, but on focusing on services integrated and converged following the life cycle of a person (or a business), with recurrent events triggering the services to be provided.

The Digital Agenda pushes the Member States to agree upon a common list of key cross-border public services corresponding to well-defined needs for businesses and citizens. These key services should be available online by 2015 bringing us a lot closer to a single framework for services, due to the generic nature of the key elements of the services mentioned.

Looking at these services from the service convergence perspective, i.e. several service elements being integrated on event-basis following the life cycle of an enterprise, or life events of a citizen implies a wide interoperability and common architectural approach across these modular services. To achieve a functioning business ecosystem delivering affordable user-centric services these platforms need to be open and fully interoperable beyond technology, Europe-wide.

To increase the value of this interoperability we should think beyond the current vendor-client relationship towards interconnected ecosystems, where the users participate actively throughout the development process of the services, from ideation, development to the final deployment, all driving towards a strong European web-based service industry. That new web service industry can truly be created in Europe, by acting together! It would bring the triple play into reality; flourishing industry, affordable services, and personalised inclusive services.

User-centricity in the services has well been recognised both by Ministerial meetings and, for example at OECD level, very much in a coherent way. Now it is time to turn these thoughts into action, as will happen with the very practical Digital Agenda.

The goals, from the Ministerial Declaration on eGovernment, approved unanimously in Malmö, Sweden, on 18 November 2009, are focusing on the citizen empowerment where users are centrally participating in design of the services.

The fully fledged services landscape highlights the need for interoperability and mobility of services (service roaming) also leading to strong back-office development.

High-quality services in an affordable way, in the changing societal landscape pose huge challenges to the public sector service providers, also leading to streamlining and simplification, and even in some cases to the total abandoning of the old service processes. New multichannel services need to be developed enhancing the role of the

citizen as an active subject in the services, and not only as the object as the case to the present day.

It is important to also address the all-inclusiveness of the new service economy enabling all citizens and businesses to fully participate in the society and economy. Inclusive services with active user participation in all stages are the best guarantee to reach the normally digitally or socially excluded groups.

A hot topic today is the availability of data in so-called open data clouds. The public sector information should be reused to simplify the services for citizens and businesses. Even more far reaching is the approach to free information from public sources, enabling new services to be created by mashup of that data. This leads to questions such as the security of the data, privacy, and dependency between services.

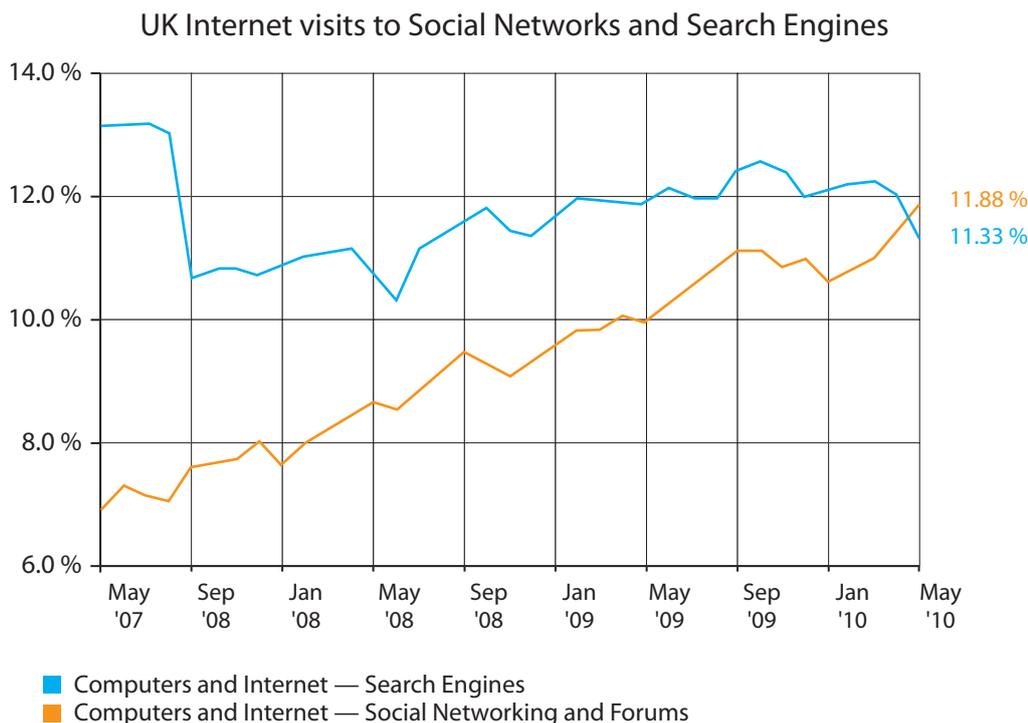
As a societal phenomenon, it is also noteworthy that in 2010 the social networks are surpassing the search engines in popularity on the Internet (Figure 3)! The behavioural change of people leads also to a new notion of privacy, and identity management.

The Digital Agenda sets a milestone for these actions to apply the European Interoperability Framework on national level by 2013 and implement the commitments in the Malmö and Granada declarations by 2013 as well.

The European Interoperability Framework for Pan-European eGovernment Services from where we obtain the following requirements, is again very much in line with the previous ones. It can be clearly seen that developing these services in close Public-Private-People Partnership would not only meet the objectives better, but also reduce the risks, and last not but not least, the developed user-centric services could better be deployed in wider constituencies.

- Services should be user-centred.
- Services can be easily found at websites.
- Services should be easy to use and understand in terms of language and structure (multilingualism).
- Services must be accessible to all members of the intended target groups (accessibility).
- Electronic services should add value.
- Electronic services should be compliant with the existing legal data protection requirements and privacy compliant as well as privacy-enhancing.

Figure 3. Social Networks passing Search Engines



Monthly market share in 'all categories', measured by visits, based on UK usage
 Created: 3.6.2010, © Copyright 1998–2010 Hotwise Pty. Ltd
 Source: Experian Hitwise UK

Considering the perspective from the full use of the societal capital, experience, and user-empowerment for better services the [3]:

- services should be context-oriented;
- services should have a 'one-entry-only', users want to see the administration as a whole;
- users want to be able to recognise an official site and the services provided at first sight;
- services should operate on the basis of a single data collection: information known by the government not need be requested time and again;
- users need to be able to trust the organisations that collect and manage sensitive personal information, data and digital identities: there is big concern about privacy;
- users want to decide for themselves which channel they wish to use to contact the government, in both context and time-dependent ways.

Conclusions

As seen from above, the ambition to create the Digital Single Market is well reinforced with multiple, and integrated actions stemming from interoperability demands from the public sector services across the Member States. The user involvement in all phases of development and deployment in the services create a unique opportunity to capture value in new business models and service provisions, thus creating from those perspectives favourable conditions for sustainable societal development and economical growth.

Open innovation environments based on the open and neutral character of the Internet highlights on its part, the need for openness to new and innovative business and societal models. A good reference on what is done now in the EU and by the Open Innovations Strategy and Policy Group OISPG can be found online (<http://www.openinnovation-platform.eu>) [4].

The Digital Agenda is also very explicit in the need for the industry to have open and interoperable solutions to fully exploit the ICT potential, especially that of the next generation interconnectivity and clouds. Hence industry-led initiatives aiming at standards and open interoperable platforms will be supported by various instruments. The Commission will bring all stakeholders around a common table driving co-creative and participative innovation as the new European paradigm. Examples of this are the new PPP initiatives, like the Future Internet PPP strongly involving the vendor and user communities.

When these PPP initiatives are developed and realised in real-world settings we also can stretch the limits further, by engaging the strong involvement of end-users, whether businesses or citizens. This, in turn, presents a unique opportunity to see what is acceptable and, on the other

hand, what is necessary, to fully exploit the possibilities that ICT enables from the citizen or business perspective. The solutions will be easier scalable, and by strong multidisciplinary and parallel resources, the development process will be timelier.

In Europe, we are well positioned with the new Digital Agenda to face the challenges of the sustainable societal and economical development, for a flourishing service industry, high-quality services and affordable, effective public sector services.

Under the leadership of the Commission integrating the policies, legislation and research actions for concrete actions for the Digital Single Market for services we can truly have a triple win.

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 **Contact**
Bror Salmelin
*Policy Adviser to the Director
 European Commission
 Directorate-General for the
 Information Society and Media
 bror.salmelin@ec.europa.eu*

1.3 Converting European research into value for Europe*

Investing in research is an investment in future value creation, but this can only be achieved if we have good connections between research and innovation policy and processes. There is a saying that research turns money into knowledge, and that innovation turns knowledge into money. In Europe we need better integration between our macro-scale research efforts and our innovation processes, and better accountability from the research community for value creation.

We also need to do a better job of linking policies, incentives and instruments that connect education, research, innovation and entrepreneurship. Macro measures of research spending are useful, but far from sufficient. One of the worst measures for R&D effectiveness is what you spend on it, and Michael Schrage at MIT has said that the poster child for that is General Motors. Instead, we should be measuring how efficiently the money we spend on research is converted into value: until we have such measures, the conversion rate will be poor. Andy Grove, one of the founders of Intel, was often quoted as saying, 'If you can't measure it, you can't manage it', and I think this is particularly true in research. While output measures such as research recognition, citations, and patents are useful, the most important measure of output value is often neglected. If Europe's research leads in terms of publications and citations, but lags in every other aspect of the innovation process, then all Europeans are doing is paying to enable Europe's competitors. However, it is worth saying that we are living in a new era of 'coopetition' where collaboration and competition go hand in hand and that this 'coopetition' can potentially lead to equitable progress.

Europe needs these new measures for conversion efficiency, and the research ecosystem needs to feel individually and collectively responsible for delivering value. For example, we could ask researchers to define 'value paths', that is, the likely ways in which their research could be exploited, early in the project. And we could make proving the value delivered by a research project a key part of defining it successful.

In effect, what I am suggesting is that the European Research Area should evolve into a European Research System or even a European Innovation system, in which

we look at the relationship between the money put in and the value we get out, and feed that information back into the next round of decision-making. It means managing European research more like a business.

In research, we also need to pay attention to innovations in research philosophy. In my field of information systems, the dominant research philosophy for the past few decades has been behavioural science, but the emergence of 'design science' [1], an alternate IT research strategy, promises to deliver increased value to its practitioners. Despite this, the behavioural-science approach continues to dominate. We need mechanisms that systematically recognise these paradigm shifts in research and then help them to propagate more quickly. This would help achieve a better balance between the supply and demand sides of research and innovation.

The accelerated adoption of open innovation also needs to be considered carefully. We are seeing the emergence of a new form of open innovation, perhaps to be known as Open Innovation 2.0, which involves all the actors in the innovation ecosystem — companies, suppliers, academics and even end-users — coming together to share experience, information and best practice, and to build strategic alliances and cross-disciplinary collaboration. The Open Innovation and Strategy Policy Group argue that Europe needs to perform a more systematic job of capturing the potential of simultaneous societal and technical innovation. Creating a pan-European innovation ecosystem with directed actions for building innovation capacity, amplifying research and innovation inputs and aligning spending with key priorities is critically important to get the best from European research.

Another key enabler for extracting value from research is an entrepreneurial culture that can see an opportunity and isn't afraid to take it. Martin Schuurmans, chairman of the European Institute of Innovation and Technology [2], has said that entrepreneurship is the glue that holds the 'knowledge triangle', of education, research and innovation, together. I agree — entrepreneurship shifts resources from low-value activities to high-value activities. I think Europe needs to be much more positive about entrepreneurship education, about lowering the barriers to calculated risk-taking (financial services excluded) and about stimulating high-expectation entrepreneurship. One particular weakness in Europe is the small proportion of public

* An earlier version of this article appeared in the EIRMA EIQ publication.

procurement that is spent on innovative and new solutions. This must be a key focus for future policymakers.

The 2006 Aho report [3] on an Innovative Europe included recommendations on public procurement and other important ways to stimulate innovation that need our continued support. It is crucial to create innovation-friendly markets, increase structural mobility and foster a European culture of innovation. We should also recognise the enormous value of the framework programmes as a vehicle for open innovation — it's one thing that American and Asian colleagues think that Europe is doing right in research.

On a different level, the world may need a new socio-economic model, one that does not depend on expectations of continued growth in a world of finite resources. European researchers are taking the lead in areas such as low-carbon technologies and there's plenty of evidence that we are moving towards a knowledge economy, but it still seems to consume lots of finite resources. The European Community needs to lead a global transition to a more sustainable basis, perhaps to an equilibrium model as described in *The Limits to Growth* [4], the report by Meadows et al. published in 1972.

The Lund Declaration [5], that Europe must focus on Grand Challenges, is a major step in moving Europe's research agenda from a rigid thematic approach to one focused on solving problems that affect us all, such as energy, ageing and congestion. As the majority of innovative solutions come from a stated need, we need to better balance Europe's

research portfolio between curiosity-driven work and the Grand Challenges. Eco-innovation must be pushed to the fore so that solving environmental problems can create commercial opportunities that lead to a virtuous cycle of research/commercialisation funding.

The publishing of the Innovation Union communication by Commissioner Geoghegan-Quinn is a major step forward towards a European Innovation economy, where innovation is central to achieving the smart, inclusive and sustainable growth envisioned by the Europe 2020 strategy. A core goal of the innovation union is to improve conditions and improve access to finance, to ensure that innovative ideas get turned into more jobs, improvements to people lives and create a green more sustainable economy and society. At her hearing before European MEPs Commissioner Designate Geoghegan-Quinn said that "Knowledge will be the crude oil of the 21st century". If Europe can be a leader at the process of refining ideas into usable and useful products the future will be bright.

ICT, the area in which I work, enables frictionless commerce. Can the European Research Area, or even a European Research/Innovation System, enable frictionless innovation? Can we establish a pan-European infrastructure that enables much faster innovation and exploitation of results? Can we create an 'intellectual supercollider' that enables the rapid interaction of people, ideas, opportunities and cultures to create new solutions quickly? I think we can. We just have to decide to do so.

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Contact

Prof. Martin Curley
 Global Director, IT innovation
 Director, Intel Labs Europe
 Chair, Open Innovation and Strategy
 Policy Group
martin.g.curley@intel.com

1.4 Innovation: A question of fit — the Living Labs approach

Abstract

In recent years, Living Labs has drawn a significant amount of attention to both the different flavours of its methodology and to the organisations that put it into practice it. Because of that, a significant amount of effort has been diverted to its understanding. However, very little in assessing its contribution and in comparing it to existing methodologies.

This work aims to cover that gap by summarising the most common European Living Labs methodologies and positioning them in the user-contributed innovation methodology landscape. And by doing so, assess its merits and appropriateness together with policy implications.

Keywords: Living Labs, Living Labs Methodologies, Innovation, Open Innovation

Introduction

Companies and countries compete first at the level of factors. There, institutions, infrastructure, macroeconomic stability and health and primary education are the key concerns. However, as societies and companies evolve, competition evolves from being factor-driven to be efficiency-driven. Then, the quality of higher education, market size and efficiency, financial sophistication and technological readiness are the primary elements that sustain competition.

Nonetheless, reaching the efficiency frontier is accomplished by incorporating known technological or managerial knowledge and imitating proven strategies and best practices. Once companies reach this frontier, competition becomes innovation-driven [1].

In the last decades, we have witnessed how progressively more companies and countries reached the efficiency frontier, effectively shifting to innovation as a key element for competition, together with important changes in the global scenario that radically transformed the way that innovation emerges and hence the way innovation is managed in companies.

The Internet has brought with it not only a virtually unlimited access to knowledge for a sizeable portion of

the world, but also the connectivity and coordination capabilities that allow processes like open source to appear [2] together with enabling the virtualisation and simulation of many processes [3] freeing them of costly laboratories and equipment and allowing them to be carried out, to some extent, by anybody with a personal computer at his disposal.

We have therefore, assisted the democratisation of innovation [4]. Consequently, when on 25 December 2006, Time magazine [5] selected the user as the person of the year for its front page, it was doing nothing more than publicly acknowledging the increasing importance of user involvement and participation in producing content and ultimately in innovation.

User involvement has taken a variety of approaches such users as creators, as in the case of lead users [6] or open source; co-creators in practices such as Design Thinking [7], participatory or user-centred design or simply being treated as passive subjects whose insights are captured and introduced in the innovation process, such as in the case of applied ethnography, usability, human interaction or market validation exercises.

Living Labs trials and organisations are situated in this fertile middle ground, considering users as equal partners in the process of innovation while gaining insights by actively involving them in the exploration process in their own real-life contexts.

This research aims to examine some of the leading methodologies in the Living Labs community, trying to find out through its comparison, where their strengths are situated, what spaces of inquiry they are addressing and by capturing the imagination and insights of users, that could foster innovation. Thus, in our study we address the following research questions.

1. Where can Living Labs methodologies be situated in comparison with other innovation practices?
2. What is the new contribution of Living Labs methodologies that differentiates them from the existing ones?
3. Where are Living Labs methodologies more appropriate in terms of the innovation problem being addressed?

The understanding of these questions is highly relevant, not only for the agents directly involved in innovation, such as companies or researchers, that must select methodologies to address innovation problems, but also to policymakers because of the Open nature of Living Labs, their capacity in developing the Information Society and the importance of the public sector in their development.

The paper is organised as follows. Firstly, we briefly review the concept of Living Labs and present the research methodology. Secondly, we describe four leading methodologies coming from CDT (Luleå, Sweden), IBBT iLabo (Belgium), CKIR (Finland) and i2Cat (Barcelona, Spain). Thirdly, we map Living Labs methodologies against others that also seek user involvement/contribution and analyse their unique contribution. Finally, we discuss where and when their use could be more appropriate and policy implications.

What are Living Labs?

Living Labs are commonly characterised as both a methodology that stresses user involvement in innovation projects and the organisations that focus on its use.

Living Labs are driven by two main ideas: (a) involving users as co-creators on equal grounds with the rest of participants; and (b) experimentation in real-world settings. Living Labs therefore provide structure and governance to user participation in the innovation process [8].

There is nothing that prevents the use of Living Labs methodologies in private companies or closed settings. In fact, some well-known companies have largely explored its use. Living Labs organisations are possibly even more interesting because of its open nature and its role as intermediaries in an open innovation environment [8].

Living Labs organisations, thanks in part to the support of the EU, have grown fast in the last two years and a network comprising 212 members from Europe, Brazil, South Africa, Mozambique, China and Taiwan has been established.

Our research took this network as the point of departure and examined the most established methodologies, drawing from a combination of secondary sources and field research derived from the active participation in the network and in Living Labs projects during the last three years.

Research design

There is a large network of organisations self-defined as Living Labs (the European Network of Living Labs (ENoLL)) and this research took this network as the starting point for data gathering. Out of its previous 129 members, a first-level investigation using secondary sources revealed a list of 48 Living Lab organisations that could be considered potential candidates.

Data collection occurred in five forms: (i) secondary sources such as published academic literature; (ii) participation in EU and national projects; (iii) participation and organisation of tracks devoted to Living Labs in academic conferences; (iv) Semi-structured interviews; and (v) participatory observation in Living Labs projects. As such, there were three major activities.

- (a) Participation in EU and national projects: The authors actively participated in the EU projects Laboranova and Collabs and in the regional Catalan project CatLab. These three projects were oriented partially or entirely to support Living Lab activities, with work packages devoted to the collection of methodologies and best practices. The work done in these projects provided an excellent starting point for the present research.
- (b) Semi-structured interviews: Interviews with 38 senior managers and researchers, including Living Lab directors were conducted, corresponding to 26 different Living Lab organisations. Interviews were transcribed via interview notes.
- (c) Participatory observation in Living Lab projects: Authors also actively participated in three Living Lab projects in the Catalan network.

These activities were supported by an active participation in Living Lab organisations for a period of four years with a significant engagement in both the European Network of Living Labs (ENoLL) and the Catalan network (CatLab).

Analysis methods

The research questions proposed in this paper ask for a combination of: (a) in-depth analysis of Living Lab methodologies (research question 2); and (b) its positioning in the cloud of user contributed innovation practices (research question 1). Research question 3 asks for the consequences of this positioning looking at the space that Living Lab methodologies occupy respect to other practices.

In order to answer question 2, our research focused on the preselected 48 Living Labs organisations, further clustering their practices into representative cases to be examined in depth. The result of this process are the four representative cases summarised in this paper where Living Lab methodologies have been systematised and in some cases published in academic journals (especially the Luleå case but also IBBT).

Research question 1 asks for a map of existing practices where Living Labs could be positioned against them. Because researchers are not aware of the existence of such a map in the context of innovation practices, one was constructed using secondary sources and the insights of the authors. This map also benefited from the discussion in several academic and non-academic conferences and from its informal discussion with both academics and practitioners.

Finally, research question 3, 'Where are Living Labs more appropriate?', is addressed by discussing the findings that support research questions 1 and 2, combining Living Labs' unique contribution with its position with respect to other methodologies.

Living Labs methodologies

CDT — TestBed Botnia, Luleå, Sweden

TestBed Botnia (<http://www.testplats.com>) was founded in 2000 having its origins in CDT, the Distant Learning Center of the University of Luleå and is the oldest Swedish Living Lab. Projects developed in TestBed Botnia come either from academia, where the Living Lab acts as an entrepreneur, or as a direct request from companies. The role of TestBed Botnia in the different projects ranges from acting as a coordinator, between companies, users and research institutions to simply providing administrative and managerial support. Their main source of financing is a mix of national/regional funding and private industry, however there is a growing stream of funds coming from projects commissioned by private companies. TestBotnia's turnover is between EUR 1 and 2 million.

TestBed Botnia covers a wide range of services, from needs-finding to ideation, conceptualisation, co-development or Living Lab testing mostly in mobile, new media and IT technologies. Their focus, in terms of methodologies is mostly qualitative, excelling in needs-finding, participatory design and lead-user involvement. Nevertheless, TestBed Botnia is also heavily involved in prototyping and, to a lesser degree, usability.

A sizeable community of users has been exposed to a large number of projects during the last eight years. Nowadays around 6 500 users from the region around Luleå actively collaborate in Living Labs projects.

Methodologies in TestBed Botnia revolve around co-development with an active and iterative approach. They have conceptualised its approach in a methodology named 'Appreciating Needs Method' [9] which consists of three iterative phases: Discovery and Dream, Design and Develop and Destiny and Dissemination.

FormIT [9] is the last iteration of the most used Living Lab methodology in CDT and TestBed Botnia.

FormIT methodology (Figure 1) tries to put users at the centre of the process by involving them through different methods and tools, mostly qualitative. In FormIT, three states of product/service development are differentiated: the design of concepts, the design of prototypes, and the design of the final system. The methodology evolves in a spiral through these three stages.

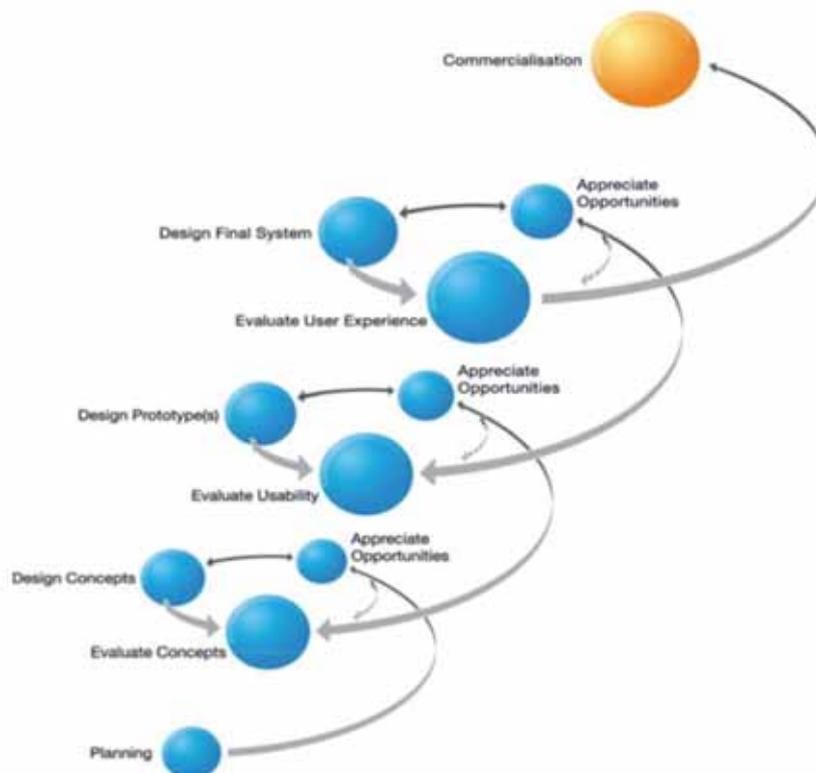
The design of concepts aims at needs eliciting and needs prioritising. Using rich narratives, users strive to find the best of 'what is' and dream of 'what could be'. The interaction with users in this phase intends to learn about needs and new possibilities situated in real contexts. After and based on the narratives, needs are prioritised and categorised and initial concepts are developed.

The second phase, the design of prototypes, is aimed at prototyping, developing rough mock-ups or products and solutions building on the results of the previous phase.

The third phase, the design of the final system, is aimed at concept valuation. In this phase, users test and evaluate the prototypes developed in the previous phases in real-life contexts. The iterative process often leads to changed or refined user needs with a focus on 'what will be', iteratively shaping the end product/service.

In each stage, we can find a three-step process that begins with the appreciation of existing opportunities in applying a new technology, process or product. Once the opportunities are clearly established, the process continues with a collaborative design of concepts, prototypes and the final system, depending on the stage. Real-life environment validation is maintained through the whole process as much as possible. This three step process is repeated until the results are considered satisfactory.

Figure 1. FormIT methodology



iLabo — IBBT, Belgium

iLabo in Belgium (<http://www.ibbt.be/ilabo>) also uses a three-step methodology plus a feedback phase [10]. In this case, probably the most salient aspect is the importance given to the context. This is in a way similar to the appreciation of opportunities phase that we encounter in the previous methodology, but here a special focus is devoted to the technological and socioeconomic context.

The first phase is contextualisation that after appreciating the technological and socioeconomic context evolves to user selection, finding groups of users whose insights could be relevant in this context. Here, we must acknowledge the importance that this methodology assigns to the selection of the 'right' users, using as a guide their relevance in the context where they are involved.

The second phase is concretisation, where departing from an initial measurement, the concept is developed. Concept development uses a mixture of co-development practices mixing users in the development process by techniques such as focus groups, co-design, etc.

The third phase corresponds to its implementation and testing in real-life environments using a combination of logging analysis and traditional qualitative methods. In this area, we must note the efforts for augmenting the capacity for gathering data and capturing the user experience by using mobile devices for ad hoc surveys.

Finally, an *ex post* measurement is conducted and on the basis of the final report, a new evolution of the project could be carried out, if appropriate.

Similar to the previous case, each phase can be conducted iteratively, but in this case each phase can lead not only to the previous one but also to contextualisation.

Maybe the most important materialisation of Living Labs in Flanders was iCity, conceived at the end of 2003 as a Wireless Internet Lab by the Flemish government and merged and integrated with IBBT at the end of 2008. iCity was conceived as a Living Lab focusing its activities on user-oriented research and collaboration between research centres, industry and government. Officially, iCity started

in July 2004 and was quickly endorsed by major partners such as Microsoft, Telenet, Nokia-Siemens, Concentra and Fujitsu-Siemens.

The structure of interaction with users in iCity involved an extensive use of technological platforms such as Bluetooth, meshed wifi, GPRS/EDGE/UMTS/HSDPA and Wimax. This integrated platform provided researchers and test projects with online information about location, time, user profile and the activity that end-users are performing. Also a certain degree of interaction was built on the platform allowing online surveys and mobile interviews on request. Test users were organised by project but also in communities such as Hasselt's City Reporters, alfafriends, and Hasselt Fire Department.

iCity focused on mobile technologies, more concretely on eHealth, eGovernment, new media, services and mobile devices. The Living Labs approach here tried to capture the user experience of large groups of users by using the methodology previously described together with extensive use of logging and data provided by the mobile platform.

i-MME is a good example of the type of project that was typical of iCity. i-MME used infrared techniques to provide extra information on works of art in exhibitions. The visitor could also share his experience and perceptions not only with his friends but also with future visitors. The objective of this project was to evaluate how this type of technology can interact and enrich art. Another project was Synthetron, with the objective to assist in reaching conclusive discussions with large groups of people (100 concurrent) using mobile devices. Llicos, based on LiveVu from Microsoft Cambridge, was another example of an iCity project, in that case aiming to assess the impact of communication services on mobile devices on relationships (videos of these projects are still available on YouTube (<http://www.youtube.com>) at the moment of writing when searching for 'i-city Hasselt').

Helsinki and Finnish Living Labs

Helsinki Living Lab is an alliance of the Living Labs in the Helsinki Metropolitan area that was launched in November 2007. The initiative aims to work as an open umbrella providing a common branding and contact point to companies and the public sector interested in collaborating with Living Labs.

Furthermore, Living Labs and the Living Lab concept is scattered all around Finland where it is easy to find many initiatives from companies (particularly Nokia), universities and promotion agencies of different types,

together with innovation-focused programmes, for example, the Cluster programme.

Helsinki Living Lab aims to encompass Living Lab activities in three different cities (Helsinki, Espoo and Vantaa) by coordinating eight Living Labs with associated organisations that work as developers (CKIR (Figure 2), HIT, UIAH and Movense), enablers (Dimes, Tekes, Greater Helsinki Promotion and Culminatium) or utilisers.

Arabianranta is the city of Art and Design of Helsinki that occupies the district with the same name where the University for Art and Design (UIAH) operates and works as a developer in the Living Lab. In contrast, Forum Virium tests project-based solutions such as intelligent traffic management, software-based solutions, digital solutions for grocery stores, etc.

It is also important to mention the work of the universities of Applied Sciences where education is structured in a project-based curriculum. Most notably Laura, with Living Labs projects around healthcare and well-being such as the Well Life Center.

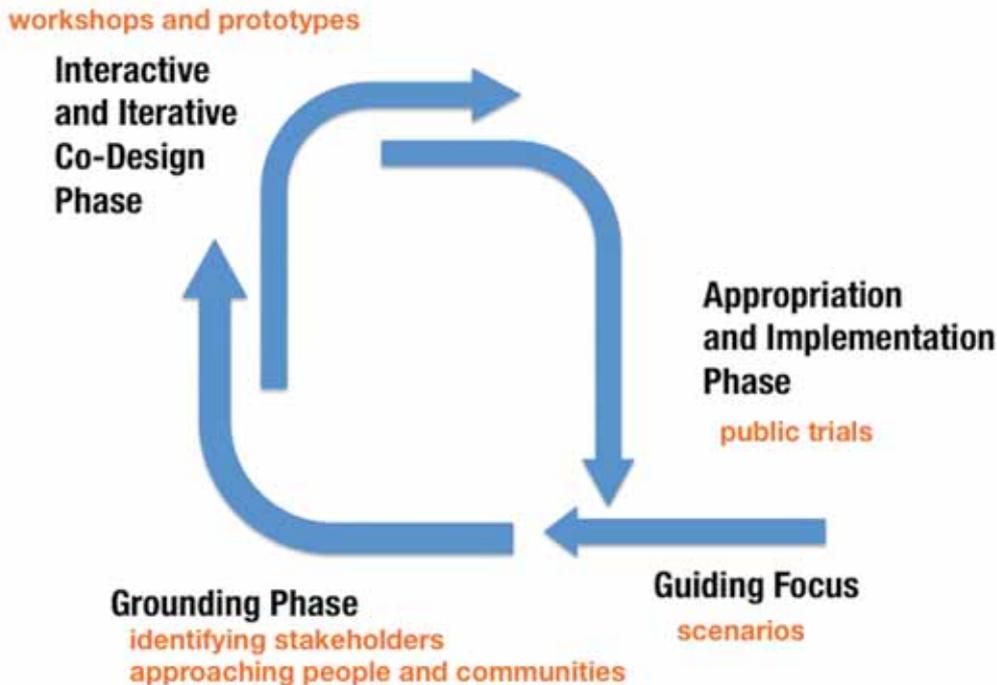
To our knowledge, a developed conceptualisation of Living Lab methodologies in Finland has not been published yet. Therefore, we will rely on initial versions presented in conferences that try to summarise current practices [11].

In this case, the methodology is guided by predefined scenarios that lead the focus of the project. It is again a three-phase methodology that evolves in a spiral.

In the first phase, called the grounding phase, a similar process as in the previous contextualisation one, is conducted, identifying stakeholders and selecting the group of users. The second phase, interactive and iterative co-design, covers the definition of concepts and the design of prototypes in a co-creative manner. Finally, the third phase, appropriation and implementation is where public trials occur and feedback is gathered.

A good example of the use of this methodology was ICING — Urban Mediator, an EU-sponsored project. The purpose of Urban Mediator was to provide a location-aware communication channel for communities fostering communication in city environments. Urban Mediator works as a web environment and also in mobile phones. The project was initiated in the spring of 2006 with the use of needs-finding workshops and ethnographic research. From that point of departure, Prototype I was co-designed with users (house managers, students, teachers, etc.).

Figure 2. CKIR, Finnish Living Labs methodology



A collaboration with the Art and Design Company and active citizens, further refined the prototype during the spring of 2007. An alpha version was available in July 2007, validated with students and Arabianranta residents in autumn 2007, and in November 2007, the first public trial with Urban Mediator beta was launched. The trial lasted from November 2007 until March 2008; during 2008 another iteration took place and Urban Mediator v.2 has been available as an open-source package since June 2008.

One example of the vitality of Living Labs projects in Finland is the city of Oulu (130 000 inhabitants): there the Innovation and Marketing Group of the City of Oulu acts as a Living Lab, setting up and analysing user experiences and laying out the service model. This group coordinates its work with a research group at the university of Oulu, VTT (the technical research centre of Finland with close links to funding agencies), the owner of the services, the mobile phone company (Nokia), the platform operator (TeliaSonera) and a business network.

The SmartTouch project is a good example of how Living Labs experiments are conducted and embedded in the real-life of a small town. SmartTouch has been funded under the ITEA Research Programme for the period 2006–08*.

* Eureka/ITEA Project — ITEA No 05024, three years (2006–08), 23 organisations in eight EU countries, 224 PY with EUR 300 million funding.

The objective of the project was to test the use of Near Field Communication (NFC) technology. Although this type of technology is widely commercially implemented in Asia, it was the largest piloting effort in the European Union.

Working together with users, service owners and project stakeholders, several subprojects were put in place and Nokia phones equipped with first and second generation RFID readers were distributed. Some examples of these subprojects follow.

- Bus ticketing (2004–08). City of Oulu bus operator and Fara piloted electronic ticketing public transport, allowing passengers to pay for the transport by NFC-enabled phones on nine buses. To complete the solution, an inspector phone was developed. Additionally, both the buses and the bus stations were equipped with info-tags allowing access to the latest news, plus bus stations provided information on the next bus arrival time and location in real time.
- Lock management in public sports halls (2006, Fara, City of Oulu, VTT). Citizens (10) using the sport facilities of Pohjankartano School in the evenings used NFC enabled smartphones to access the facilities at given times and dates.

- Elderly Meal Service (2006, City of Oulu, TOP Tuniste, Nokia and VTT). The application piloted with 10 users the use of a NFC-enabled phone for both meal ordering and distribution. Meal orders were placed by touching a picture tag-enabled menu. Meal delivery used tagged cars and routes to distribute the food, providing traceability.
- InfoTags (2007, City of Oulu, Telia Sonera, VTT). Around 1 500 'Infotags' were distributed through the city on buses, bus stops, theatres, restaurant Pannu and the Public house Leskinen, allowing users to receive news, order a taxi, load video material or go to the partners' websites.
- Theatre Evening Services (2007, City of Oulu, Telia Sonera). In this case, around 160 users validated NFC technology in a case of a single scenario: the Oulu City Theatre experience. Here, the ticket for the theatre could be bought by using a mobile phone, information was provided through tag-enabled posters where videos could be downloaded and refreshments could also be ordered through mobile phones.
- NFC in School Environment (2008). Around 1 000 students were able to access individual school timetables and classroom changes by touching an infoposter and received updated location information for physical education, homework, etc.

Catalan (Spain) experiences in Living Labs

In Catalonia and Barcelona, a Living Labs network was formed in 2006 to coordinate the different experiences and work of several research institutions that adopted the methodology, among them i2Cat and 22@ (Barcelona City Hall) conducted interesting projects where even if there is not a formalised methodology, we can rely on documented cases (Almirall and Wareham, 2008) and presentations given in conferences and workshops to extract their common characteristics.

From Catalan Living Labs cases (Figure 3), we can infer a reliance on a three-phase methodology conducted in a spiral, but with an important shift in focus from needs-finding and context assessment towards implementations in real-life environments that serve not only as a proof of concept but as a starting point for a public or commercial venture.

The first phase is devoted to group selection and here users are considered on equal basis with respect to the rest of the team (researchers, companies, etc.). However, the majority

of projects are in B2B, where users are nurses in hospitals, patients, IT technicians, etc. Great care is taken to involve the relevant set of users, not only because their insights could contribute to develop a better product or service but also because they could help in achieving a successful implementation in the market.

The second phase is devoted to the creation of an innovation arena where the project can be developed free from hierarchical structures of the participating institutions. Also, many times, this involves the use of some kind of infrastructure such as high-speed networks. We must note that Catalan Living Labs rely extensively on the use of research infrastructures, such as Internet2 (high-speed Internet) research networks, sensor networks, etc., for experimentation, that way they leverage the presence of research institutions that allow them to employ a premium exclusive infrastructure not available for general use.

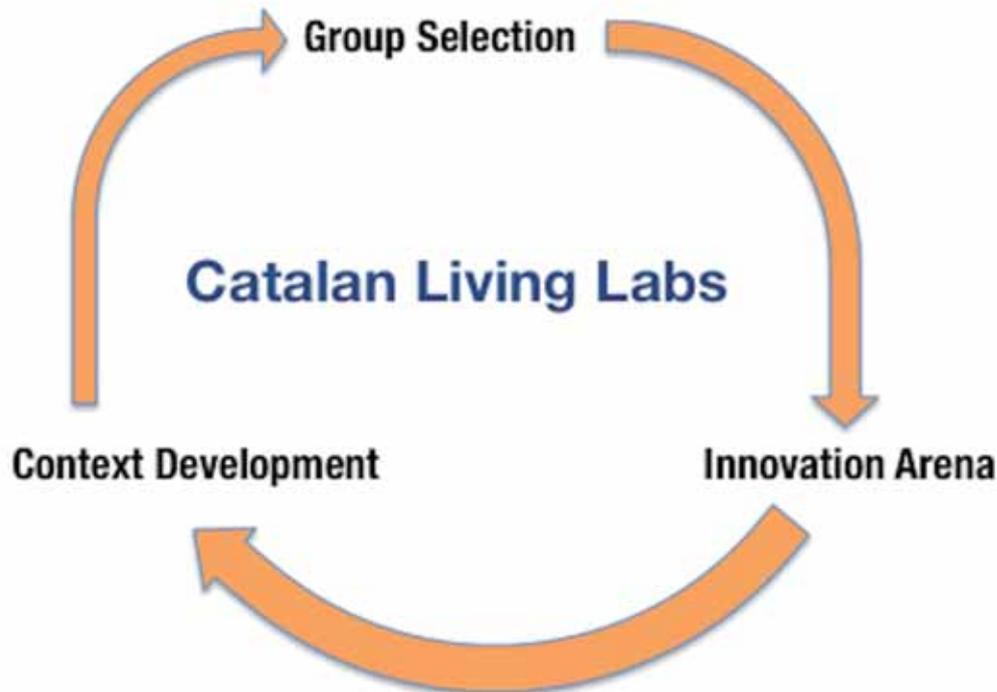
The final phase corresponds to the actual experimentation in real-life environments, paying special attention in experimenting and developing business models that could make the project sustainable. Many of the projects are in the public sector and special care is taken to involve public institutions in order to pave the way for future deployment if projects are successful.

Maybe the distinctive characteristic of this methodology is the development of an innovation arena, in the form of projects explicitly supported by all organisations who allocated resources to them, with the objective to reduce the uncertainty and therefore the associated risk, while creating an initial demand by involving the relevant actors and showing its viability in real-life environments.

A typical example of Living Lab project from the Catalan network was Opera Oberta (Opera Oberta, 2001) that explored the use of high definition videoconferencing and high-speed Internet in the context of live Opera. i2Cat and the Liceo Opera Theatre teamed up to explore the use of high definition videoconferencing for opera retransmission, they settled on a team comprising opera experts, telecom operators (Telefónica), private companies with videoconferencing expertise and equipment (TechnoTrends), university researchers (UPC, Technical University of Catalonia) and equipment manufacturers (Texas Instruments and Barco) together with a small net of theatres and universities where opera will be retransmitted.

Building on a significant success with the first experiment and the support of i2Cat, the project evolved and diversified

Figure 3. Catalan Living Labs



in two main directions. The first one was its use in education by a large network of Spanish and European Universities; this gave continuity to the project and enabled more actors to intervene on a regular basis.

The second line of evolution was its transplant to other artistic manifestations beyond opera. Cultural Ring (Cultural Ring, 2003–09), linked a dozen Catalan centres and encompassed around 20 groups that regularly used the scientific high-speed Internet2 network deployed in Catalonia for art interaction.

Another case is Teleictus (Teleictus, 2007) that addresses the problem of having round-the-clock expertise in diagnosing and treating brain strokes. Again, it implements HD videoconferencing, linking a reference hospital (Hospital Clinic in Barcelona in the initial test) with a satellite hospital (Vic General Hospital in this case), together with the use of high-speed Internet for the diagnosis and continuous monitoring of patients.

In a case similar to the previous one, i2Cat assembled a team comprising telecom operators, equipment manufacturers, doctors and nurses, hospitals and funding agencies of both the Information Society and the Healthcare system that by experimentation, trial and error, materialised an

initial experience that was rated as very successful. The project evolved and at the time of the writing is being deployed across Catalonia.

Probably, organisational and service innovations are more visible in this case, because of the high degree of codification that healthcare requires. This aspect of Living Labs as facilitators of organisational change in interdisciplinary projects can be easily appreciated here, in highly regulated public settings like healthcare.

Living Lab methodology contributions

These four cases provided a description of representative Living Lab methodologies that cover a wide spectrum of actual practices in the Living Labs community. Although each one has its distinctive flavour, all of them share some common characteristics. In all cases, we can observe the presence of an user incremental iterative process, which evolves from simple conceptual ideas to concrete implementations of novel products or services.

In the case of CDT, this evolution is presented in three phases: Design Concepts, Design Prototypes and Design Final System. In the case of IBBT iLabo we find: Contextualisation, Concretisation and Implementation.

In the case of the Finnish Living Labs: Grounding phase, Interactive and Iterative Co-Design phase and Appropriation and Implementation phase. And finally, in the case of the Catalan Living Labs: Group selection, Innovation arena and Context Development.

Living Labs present their methodologies as differentiated on the basis of three main characteristics (Almirall and Wareham, 2008): user co-creation since the initial phases of the innovation process, experimentation in real-life contexts and Living Labs as a Public-Private partnership.

Table 1 summarises how these three characteristics are implemented in each one of the four cases studied.

Regarding the role of users, central to Living Labs methodologies, the first characteristic that we can observe is their insistence on engaging users in the early stages of the innovation process.

In the case of Botnia, this engagement has a very defined objective, collect user needs and engage them early on in a co-design exercise. A similar approach, with similar objectives, can be found in the case of the Finnish Living Labs; however, a greater emphasis is placed in the selection of users.

In IBBT iLabo, we can also find this accent in selecting the ‘right’ subset of users. However, in this case the purpose is not restricted to capturing unaddressed user needs but grounding the project in a concrete context and because of that, finding elements of concordance or dissonance between the project and its context.

A similar approach, maybe expressed in more concrete terms, can be found in Catalan Living Labs. There, we can distinguish in their descriptions, concrete elements of user expertise, for example a as nurses or technicians. This expertise materialises in concrete insights when confronted with concrete implementations.

Therefore, in all cases we can find a clear motivation for involving users early on in the innovation process in order to capture either market knowledge about preferences, needs or suitability of the implementation, from the contextualisation of the proposal in a concrete reality or the capture of more specialised domain-based knowledge.

Living Labs methodologies aim to incorporate and evolve this knowledge in products and services through co-creation.

Table 1. Implementation of the main Living Lab characteristics in the four cases presented

	User involvement	Real-life contexts	Public-Private Partnership
Living Lab Botnia	— Capture of user needs.	— Locus for appreciation of opportunities.	— Living Lab is a Public-Private Partnership.
	— Co-Design and Participatory Design.	— Evaluation and validation of prototypes.	— Facilitates multi-stakeholder involvement in projects.
	— Gathering Domain and Market-based Knowledge.		
iLabo IBBT	— Contextualisation of prototypes for new products and services.	— Focus on data gathering.	— Living Lab is a Public-Private Partnership.
	— Selection of the ‘right’ users is a key element.	— Attempts to capture insights from a large group of users.	— Facilitates multi-stakeholder involvement in projects.
Helsinki and Finnish Living Labs	— Needs funding.	— Use of geographical context for selecting users (citizens, students, etc.).	— Living Lab is a Public-Private Partnership.
	— Co-design and participatory design	— Public, open trials.	— Collaboration with town and local authorities facilitates trials and the uptake of new products and services.
		— Validation of prototypes.	
Catalan Living Labs	— Selection of ‘relevant users’.	— Specialised contexts: hospitals, opera theatres, etc.	— Living Lab is a PPP.
	— Fostering social entrepreneurs and lead users.	— Emergence of new solutions and meanings.	— Creation of initial demand, especially in the public sector, ensuring sustainability.
	— Gathering of domain and context-based knowledge.	— Large public trials together with small specialised ones.	— Facilitates trials in public contexts, very relevant in highly regulated environments.
		— Unexpected opportunities because of the real-life context.	

Proposition 1. Living Lab methodologies aim at capturing market and domain-based knowledge from selected groups of users, incorporate it in products and services and iteratively evolved them through a co-creation process.

However, probably the most distinctive characteristic of Living Labs methodologies is their focus on real-life environments as the locus of research. Again, we can find some differences on how Living Labs seize the opportunities that this choice provides.

In Botnia Living Lab, we can observe how proposals derived from user needs, are confronted with real-life situations ranging from scenarios to real-life environments as research progresses. From this confrontation, new opportunities emerge that researchers and users together, seek to appreciate and evolve, incorporating the results of this evolution into the next iteration of products and services.

iLabo elaborates even more around this process, conceding high importance to the context and hence to the selection of the right context. The idea is that, in order to allow for the emergence of new uses and meanings that could be appreciated and incorporated into the resulting product or service, the selection of the right context is highly relevant.

Another distinctive characteristic of the methodology proposed by iLabo is its aim to involve a large number of users, because the emergence of new understandings, uses and meanings will be favoured by a large number of interactions.

This is also in line with Catalan Living Labs that understand that this emergence can be fostered by increasing the number of users and the randomness in the context.

Catalan Living Labs also aim at capturing domain-based knowledge that is many times tacit, becoming codified when applied to a certain context (e.g. in the case of nurses).

Real-life contexts are therefore much more than a more realistic scenario for validating proposals, but an arena where new meanings can emerge and tacit knowledge can be captured.

Proposition 2. Living Labs aim to bring to the fore new understandings, meanings, and capture tacit and domain-based knowledge by situating and evolving innovation projects in real-life contexts.

The third distinctive characteristic of Living Lab methodologies, especially when compared with their close siblings such as participatory design, is the insistence in Public-Private Partnerships. Nevertheless, this emphasis does not seem to reflect in many of the methodologies presented.

In fact, in Botnia and iLabo, it is referred to as institutional support; however, it is not clear whether this support materialises into something more concrete.

In contrast with this situation, Finnish Living Labs appear to take advantage of this public involvement because products and services in trials, if successful, will be adopted by public institutions supporting them (e.g. cities in the case presented).

A similar situation is the one that we encounter in Catalonia, where the uptake of services by public institutions is facilitated by their participation. However, in Catalan Living Labs we can observe one more element worth mentioning: the use of the partnership to penetrate highly regulated and complex environments such as the public health sector.

Proposition 3. Living Labs take advantage of Public-Private Partnerships for generating an initial demand and lowering barriers in complex multi-stakeholder or highly regulated environments.

Mapping user involvement in innovation

Answering the first and second research questions regarding the positioning of Living Lab methodologies against other practices and their unique contributions requires positioning these practices in the landscape of the rest of user-contributed methodologies for innovation. Therefore, mapping them graphically (Figure 4) offers the opportunity to portray their relationships in a very intuitive form while being able to easily position them among the rest of methodologies.

The first dimension of interest is directly derived from the main characteristic of Living Labs: the involvement of users in a co-creative process. In that dimension, we can observe a diversity of practices, from the ones where users are treated as subjects of study from whom to gather reactions and behaviours to other type of practices that seek to involve users in the innovation process in a more active manner or as co-developers.

Therefore, in this dimension two ends can be distinguished. One that regards users as subjects of observation, as in human factors, ergonomics and traditional R&D. And another where users are co-creators, such as in the case of lead users or open-source communities. In the middle of these two ends we can find most of the most popular methodologies, such as participatory design, co-design or design thinking.

The second dimension of interest is also directly derived from our subject of study: Living Labs. There, our motivation is not the contribution of individual users but the result of their collaboration and interrelation. Therefore, we are addressing the degree of collaboration, ranging from none or a small group of closely interrelated users to networks or large open platforms. Translating this idea to innovation literature, degree of openness is the concept that best captures this meaning.

Following the first axis — the level of user involvement in the innovation process — we divided the methodologies in to five different categories.

1. Traditional: Considering innovation as a process similar to engineering, led by experts.

2. User-Centred: Users are mostly passive subjects of study. This is the case of usability testing, Human factors and Applied Ethnography.

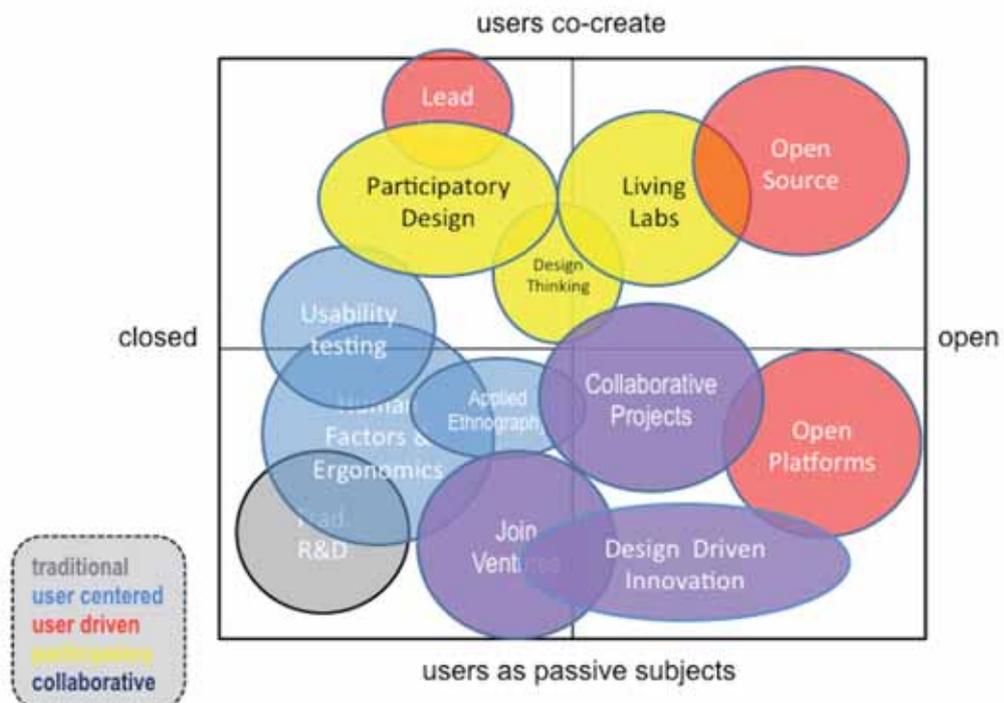
3. Collaborative: Collaboration in terms of interchange, between different actors is stressed, ranging from closed networks to open market places. There we find Joint Ventures, Collaborative Projects and MarketPlaces.

4. Participatory: Seeking to involve users on equal grounds to the rest of partners in a co-creative process. Here we have Design Thinking, Participatory Design and Living Labs.

5. User-Driven: The user drives the innovation process. Such is the case of open source, lead users or open platforms.

If we look closely to the different categories we will observe that the division goes beyond governance. In fact studies such as usability testing try to capture a quite simple piece of knowledge, user preferences in that case, while any user-driven methodology tries to capture a type of knowledge where the direct involvement of users is necessary in order to extract it.

Figure 4. Mapping innovation methodologies



In order to further clarify the dimension, let us provide some contrast with examples situated at opposite ends of this dimension. A good example of considering users as passive subjects is the Google experimentation process. Everyday tens or hundreds of experiments are being carried out by Google, testing the reaction of users to many subtle changes to its applications. Users are completely unaware of it and in order to get this knowledge about their preferences, their involvement, beyond the normal use of applications, is not needed.

At the other end, we can find any open-source process. For example Lego Mindstorms has been developed mostly by users, who, refusing the platform provided by Lego, built their own. Here, it is obvious that the direct involvement and engagement of users was necessary in order to surface and develop the type of platform that suited their wishes and needs.

Proposition 1. Governance of user participation in innovation methodologies depends on the relevance of user involvement in the process of capturing knowledge from users.

The second dimension of interest is openness. The relation between the level of complexity of innovation and openness is known [12]. If complexity is low and the problem to solve well understood, then a group of experts in a closed environment can produce equal results as in a decentralised environment, saving the cost of coordination. However, when complexity is high and the problem to address is not well understood, it clearly benefits from contributions coming from a larger number or agents with diverse points of view.

There is a direct correlation between this understanding and the type of knowledge that users contribute. If the result of user participation is the capture of domain-based knowledge, then a closed group of selected users will work well. This is the case of lead users, where users contribute with their unique insights or applied ethnography while anthropologists try to capture behaviours and cultural preferences in the form of tacit knowledge. On the other hand, if we try to capture market-based knowledge, forecasting the preferences of users towards a new product or if a new business model will work or knowledge that will benefit from multiple contributions and multiple points of view, again the example of open source applies, we need to open the innovation process.

This understanding has also a direct correlation regarding user experience. If we aim to surface needs or known preferences, then a closed environment with the right

selection of users will work well. If, on the contrary, we aim to find unexpected uses, we need the creation of new meanings in a social environment [13] and this is only possible in an open environment.

Proposition 2. The level of openness in user-driven innovation relates to the type of knowledge or user experience to be captured.

Nevertheless, there is a third dimension that we didn't plot in our diagram. It relates to experimentation, to how the knowledge capture is conducted.

We can observe how many methodologies are based on observational or reflective type of interactions, such as interview, focus groups or ethnography, while others aim to conduct research and experiment with mock-ups in semi-realistic situations and finally others opt for situating prototypes in real-life environments.

We can easily relate this choice to the level of codification and awareness of the knowledge being captured. In fact if we are talking of codified knowledge, in the form of, for example, known preferences, then an interview may suffice. On the contrary, if we need to learn about preferences that only make sense in real environments and of which users are not aware of, then experimentation in real-life environments is unavoidable.

Proposition 3. The locus of experimentation relates to the level of codification and awareness of user-knowledge.

Situating Living Labs

Considering the previous framework, our first task is to situate Living Labs methodologies in its dimensions. Given that Living Labs define themselves around (a) the co-creation with users and (b) situated in real-life environments [8], it seems natural to explore first these two dimensions.

Regarding user involvement, we can distinguish two types of situations. First, all methodologies insist on needs finding and capturing domain-based knowledge with interviews, focus groups and co-design methodologies.

But, at the same time, all the methodologies considered aim to capture the insights of users through exploration in real-life environments. There, we can find an insistence on the context as the locus for developing new meanings and surfacing new uses.

Therefore, in Living Labs, exploration in real-life environments is, as we have discussed in the framework, a way to codify and surface context-specific knowledge about preferences and uses together with a process of validation and contrast of evolving prototypes.

This process of capturing and incorporating knowledge into different generations of prototypes being contrasted in real-life environments is what provides sense and justifies the fact that all Living Labs methodologies progress through an evolution in spiral by successive refinement.

Finding out something more about the objective of the process is easily done if we look at the stopping rule. Living Labs group several constituencies, namely researchers, public administration, users and companies. Living Labs methodologies evolve through successive prototypes in a concrete context until all constituencies are satisfied by the result. We are looking therefore to context-related conformity. Or to put it in other terms, to the level of fit of a certain product, service or process related to a concrete context and perceived by constituencies coming from the social, technological and economic sectors. Therefore, Living Labs results must fit:

1. Technologically: ensuring that the technological solution is viable and fills a space of opportunity.
2. Socially: assessing the social and user acceptance in terms of needs, interface and uses-meaning.
3. Economically: assessing its viability in terms of business model and sustainability.

We know that most innovations occur in mid-low level of knowledge [14] and it is in this area where most value is captured. Globalisation, by making high-level knowledge increasingly public and free, excluding it to a great extent from being a competitive advantage, has accentuated this aspect. Living Labs seem to revisit this process, this time with a direct presence of all the constituencies in

the innovation process and most of the time with a strong support and involvement of the public sector.

Conclusions

Our first and most obvious conclusion in portraying the process, carried out in Living Labs as a process of fit, is that they will be more relevant where the fit of a particular technology or set of technologies to a precise context is more significant. Therefore, products and services that depend more on their soft characteristics for user acceptance and economic viability seem to be more appropriate.

The second conclusion is that Living Labs will be more appropriate where the fit is less trivial. Indeed, if the fit is trivial, it can possibly be inferred from observing users without having to involve them. At any rate, in situations with multiple stakeholders, conflicting interests and a large space of solutions, the innovation problem may only be addressed by involving all constituencies and, through its active participation, aiming to trap into their tacit knowledge that will be incorporated in solutions to be validated in real-life environments.

In this context, it may be worth revisiting the concept of wicked problems, originally proposed by H.J. Rittel and M.M. Webber (1984) [15] in the particular context of social planning. In solving a wicked problem, the solution of one aspect of the problem often reveals another, possibly more complex one. These types of problems are common in social contexts, specially coming from the public sector. There is no perfect solution for wicked problems, but there are many solutions that 'fit', in this respect, Living Labs seem specially appropriate for them.

Both conclusions can be easily translated into policy by portraying Living Labs as a resource that allows exploration in situations where the solution of the innovation problems is hidden behind a complex web of stakeholders and possible solutions.

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Contact

Prof. Dr Jonathan Wareham

Director of Research
 ESADE Business School
 jonathan.wareham@esade.edu

Prof. Dr Esteve Almirall

ESADE Business School
 esteve.almirall@esade.edu

1.5 Path towards user-centric services

The following document illustrates how a new concept of user-centricity can be the driver for next generation web services architecture, based on the idea of service convergence on technical convergence and next generation networks we see currently emerging.

It is also shown how progress with this next generation service architecture can be interlinked to the Digital Agenda for Europe on several levels ranging from policy to infrastructure development.

The document also demonstrates how this collaborative work with all stakeholders could be fostered in a fruitful and timely manner. The work is based on the thinking which lead to the OISPG report of user-centric services by Myriam Corral [1].

Introduction

The idea is very much to follow the process approach we have seen successfully followed in manufacturing industries when developing their manufacturing efficiency and controllability, thus increasing hugely the productivity, but also at the same time mass customisation ability, in an affordable way. In manufacturing industries, the industrial activities were decomposed into processes, which supported the events following a product life cycle from design to recycling, including the manufacturing and customer processes. Industry-wide standardisation on the process level made it possible to move to highly flexible and efficient manufacturing infrastructures, and supply chains, even virtual factories where companies worked very close in business ecosystems.

When applying the same thinking to services for the citizens we need to *set the citizen in the centre*, to ensure that (s)he gets the service (s)he needs, in timely and affordable manner, irrespective of the current context. When looking at the current level of development of eServices they too often stem from just electronically managed information *distribution and limited interaction* between the authorities and the citizen.

The approach

The citizen is far from being empowered and needs to know far more in detail what is needed in each contextual situation. This citizen-centric approach leads to *service convergence*, where the needs of the citizen are fulfilled by integrating service offerings from several service providers, both public and private ones simultaneously. This approach also interlinks global infrastructures (like

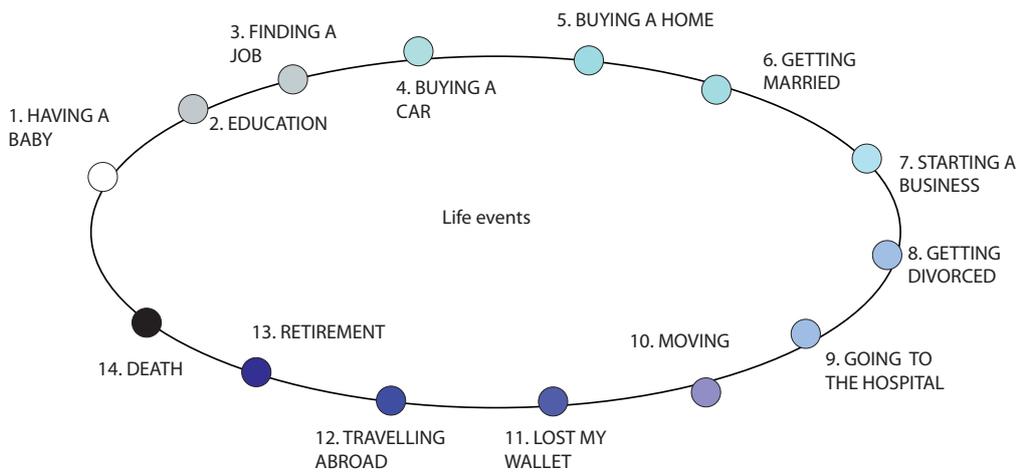
identity management) to very local offerings related to the service delivery itself, when the service is not entirely electronic.

There are rather few organisational (back-office) changes visible in the public sector service arena, even if we are currently witnessing the rise of the empowered user as an individual but at the same time, also through various value-based communities.

Technology development supporting networking, peer-to-peer relations and value communities is evident. The challenge is now fully to capture changing societal behaviour to integrate service offerings to citizens, enabling personalised, mobile, highly secure and timely service offerings. For the public sector, the win is in affordability of the services by reorganising the back-offices and standardising the components of the services (metaprocesses in the following text), and for industry, the citizen-centric approach backed by policy actions leads to new business opportunities in the future, not yet existing business landscape. We can take a strong analogy on how the mobile industry was created in Europe, led by public procurement, open industrial standards, and then consolidation of the European mobile telephony market when technology changed to digital and society had already begun to use the new technologies. Simultaneous societal, technical and policy framework innovation enabled the creation of a wealth generation industrial sector in Europe. The same can now happen with next generation service industry, but the time window is rather short.

The approach suggested is based on setting the citizen in the centre, and looking at services from the *life-cycle, event-based* perspective (Figure 1). Even if these events (birth, going to school, getting permissions, getting married, being

Figure 1. The life cycle of a citizen consists of events: these life events lead to the use of basic public services in an integrated way. Mapping life event -> Service provision



Life events	Basic Citizen Public Services
Having baby, finding a job, buying a car, buying a house getting married, getting divorced, retirement	Income taxes: declaration, notification of assessment
Finding a job	Job search services by labour offices
Having a baby, finding a job	Social security benefits
Travelling abroad, buying a car	Personal documents: passport and driver's licence
Buying a car	Car registration (new, used, imported cars)
Buying a house	Application for building permission
Lost my wallet	Declaration to the police (e.g. in case of theft)
Education	Public libraries (availability of catalogues, search tools)
Having a baby, getting married, getting divorced	Certificates (birth and marriage): request and delivery
Education	Enrolment in higher education/university
Moving	Announcement of moving (change of address)
Going to the hospital	Health-related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)

hospitalised, etc.) are rare when looking at each individual, they happen millions of times in Europe yearly, thus creating *repetitive and reusable processes for service convergence*, i.e. different service offerings being integrated on a *contextual and event-based level* to fulfil the citizens' needs, on highly personalised and context-sensitive bases.

Figure 1 illustrates the life cycle with some of the most important events described.

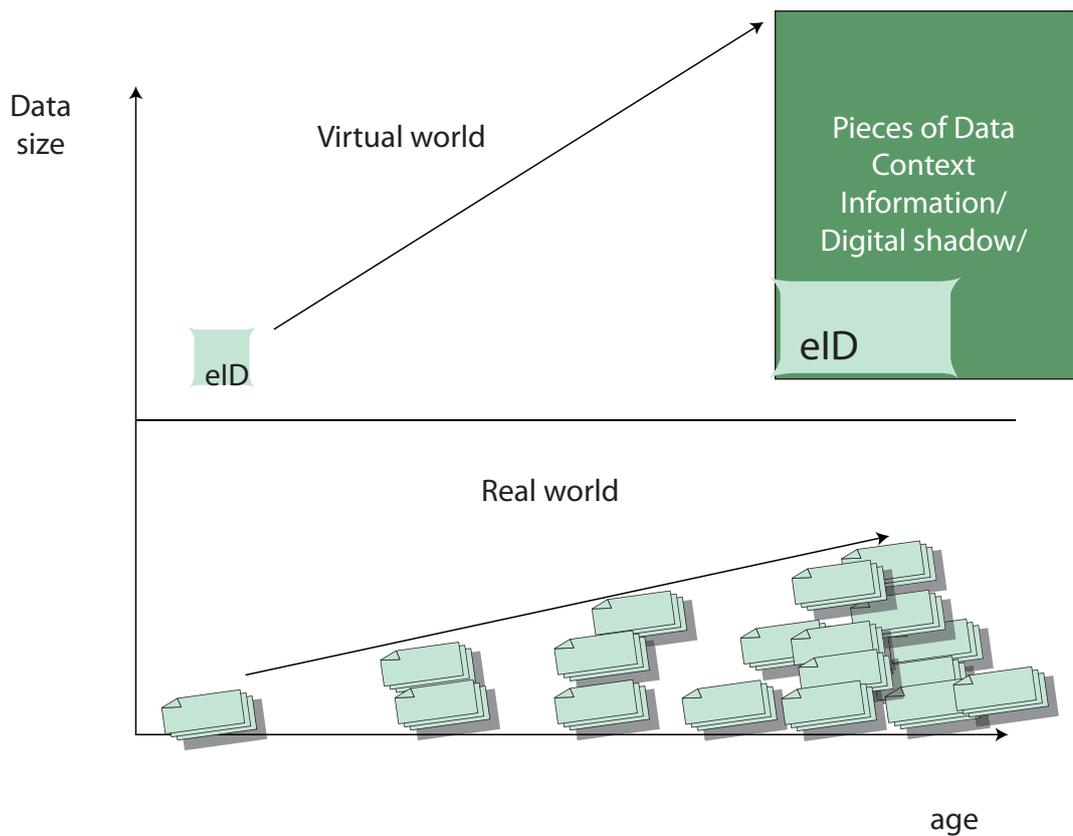
This approach also allows a *high-context sensitivity and personalisation of services*, and that the context is affecting centrally the mediation/interaction process between the integrated services and the citizen. Depending on the identity, and especially on the soft footprint of the identity based on the experience of the user, both delivery and

customisation of the service can be very different, also based on the trust building processes. Figure 2 illustrates how the identity footprint grow on an individual basis depending on the experience and contextual content of the life of the citizen.

Identity and personalisation

When a person is born, they receive their core, formal identity represented by an ID number and some basic data. This hard identity grows with formal education, moves, passport and other formal documents. But, actually the experiences of the citizen during their lifetime, schooling, context where they live and also lifetime situations will affect much more the mediation and integration process of that person

Figure 2. The footprint of identity-related experience (soft identity) increases more rapidly than the 'hard' identity with lifetime: soft identity will largely determine the behavioural difference of people towards personalised and context-sensitive services.



in his/her lifetime situations. Based on trust and experience towards the service providers or service integrators, the personal behaviour between citizens can differ in quite radical ways. The identity of a citizen determining his/her behaviour can thus be *separated in to hard and soft identity*, where the soft identity is much more experience-based and context-sensitive than the official, hard one (Figure 2).

This approach together with the user-centricity leads to the concept of the user giving consent to different service providers to access his/her personal records following the trust and the context of the services which are offered to him/her. Some of the privacy data can be released by implicit consent, some require more user involvement and trust building between the parties. Often a public sector organisation can be the trusted third party for the citizen, bringing all the needed service components together.

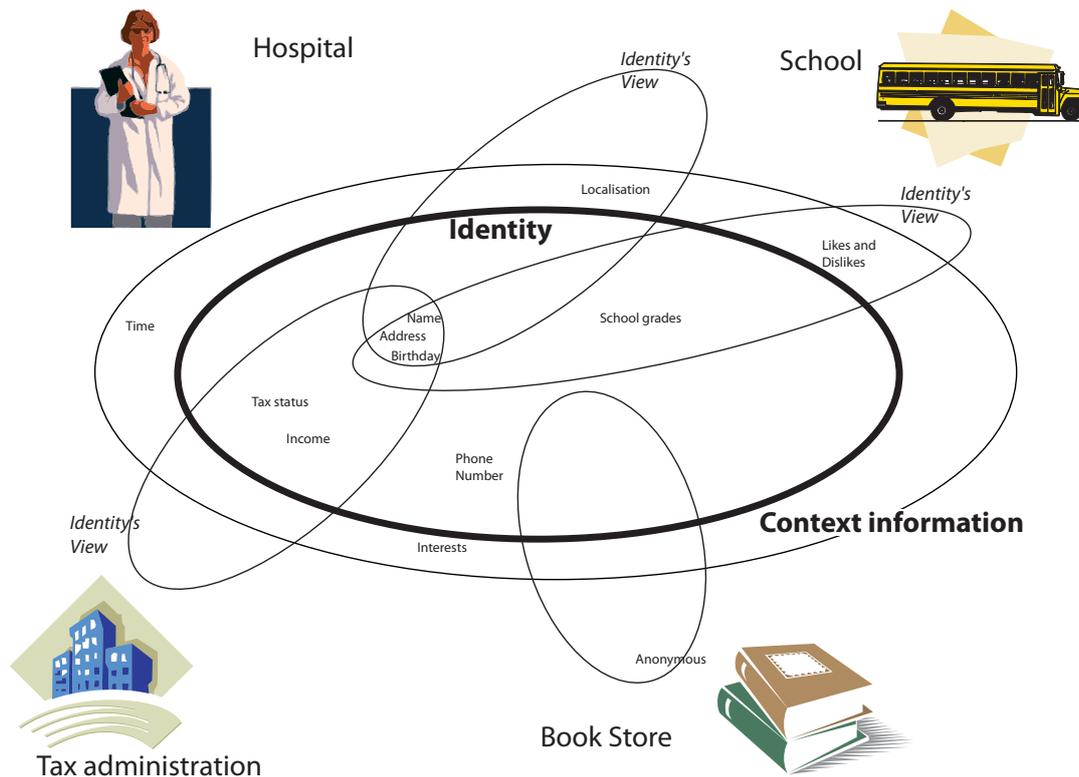
User-centricity is a service process approach, where the services are not considered from a technology or service provider perspective but from a user needs perspective.

This user needs is situation and context dependent and the mediation process of integrating and personalising the service will be central. The mediation will happen close to the user, led by the user's actual needs.

Functional modules, metaprocesses

When following the life-cycle approach illustrated in Figure 1 to analyse the major life-cycle events, we end up with a set of *generic functionalities, so-called metaprocesses*. By combining these metaprocesses we can end up with the service integration in the life-cycle events, leading to fulfilment of the needs of the user in that situation. These metaprocesses are functionalities enabled by the reorganisation of the service provision, having high interoperability between the actors, and a new contextual layer, actually performing this service integration. Very often, a public sector actor can be the trusted party carrying out this integration as it possesses a critical component: the hard identity component in that no-one else has.

Figure 3. Depending on the context, the user gives consent to disclose more or less of his data: there are different context-dependent views to the identity of the person



In the OISPG report for user-centric services, there are cases elaborated more in detail, like birth, education, hospitalisation and moving. This led to a generic set of metaprocesses, which now in turn need to be analysed on a process level, to enable the modular application independent structure for the elementary building blocks for these service processes, in rich user context.

The metaprocesses need to be interoperable, creating an open reference model for next generation service development and delivery. However, what is furthermore needed is the opening up of these metaprocesses to real-world service processes, enabling the actual service convergence. To achieve this, both research and policy/piloting actions are needed on a large scale. The piloting has to happen in real-world settings, to be able to assess how far societal and public sector innovation can accommodate this user-centric approach for services.

In Figure 4, we can see the core metaprocesses, and how some of them are already quite advanced, but at the same time how some of them require further debate on the role of the citizen in the service process, and how to

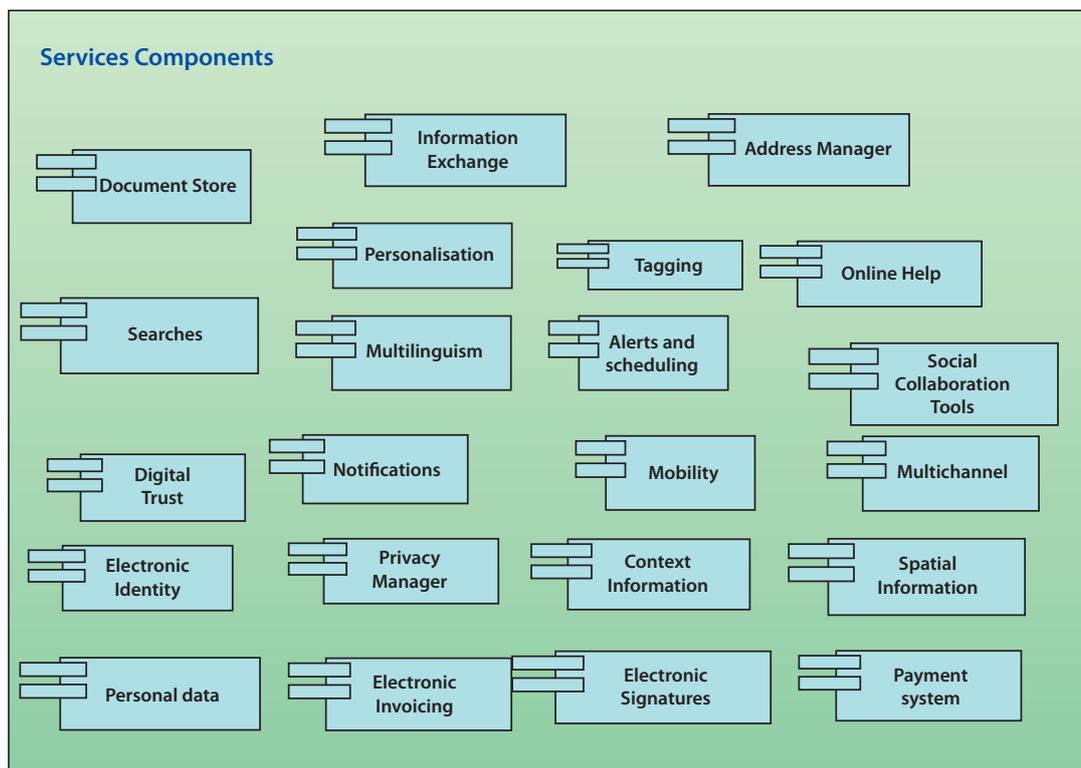
make the framework acceptable legally and politically to accommodate this new approach.

Equally, it is visible that the service process requires significant changes in how the public sector services are organised. One should not look separately in silos anymore, representing a certain eService, but more holistically, for example in a situation like being sick, several of these metaprocesses need to work together, not only the 'eHealth' ones, as they represent more the offering than the integrated need of the citizen in that very contextual situation.

This exercise becomes very interesting and timely when we see the need and drivers to create better quality services for citizens, in an affordable and efficient way, keeping at the same time, the very high customisation and personalisation of the services.

Many of the actions are directly related to the Digital Agenda for Europe. From the approach described here, we also see that there are things which need to happen

Figure 4. Analysing services in life events of citizens leads to a rather limited number of basic functionalities, metaprocesses, from which the services fulfilling users' needs can be composed



to make this whole concept feasible. Issues like electronic invoicing (SEPA) is quite well advanced, but becoming more critical, for example the identity management-related blocks, as they require also new thinking from the service fulfilment and personalisation perspective, in the spirit of the concept of identity footprint.

Trust and eID will be the central components in user-centric service architecture.

When looking in more detail at the metaservices mentioned above, we can also see how they can be classified on different levels depending on how automated the processes can be. Those more close to the entity (citizen) will likely require more policy debate on the new role of the empowered citizen in the services landscape.

When looking at the different metaprocesses, we see that those close to the entity (citizen) are the most critical ones

regarding societal innovation and acceptance, and likely will require quite a lot of policy debate, even towards new relationship between the citizen and the society.

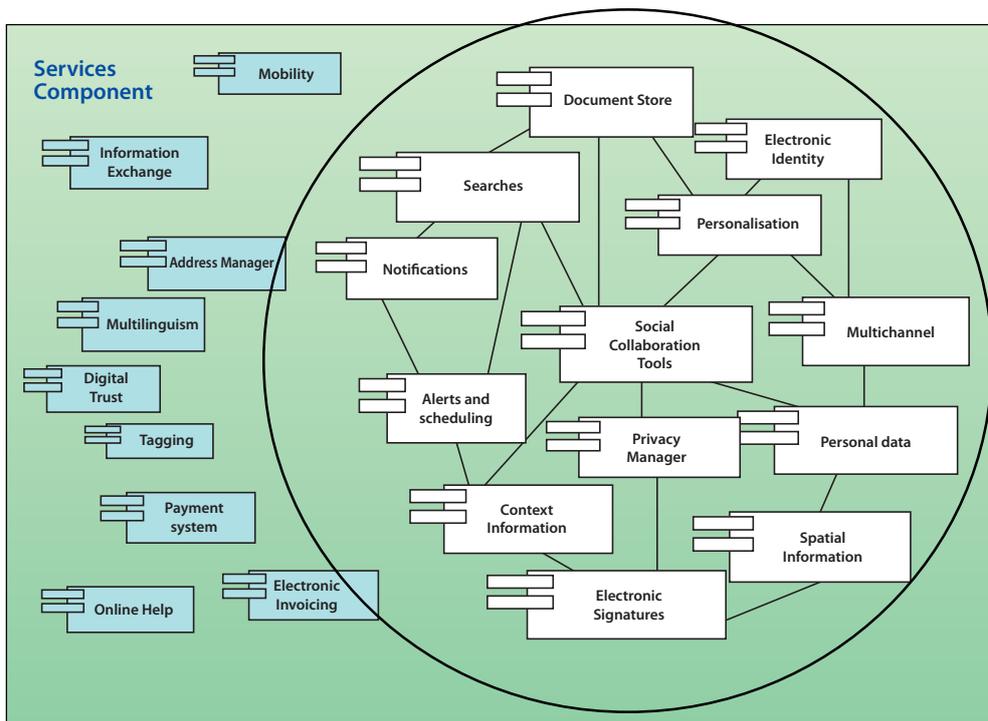
On the other hand, those metaprocesses which are close to the service-service interaction can be (relatively) easily automated, and in this, the personalisation component is much weaker (Figure 5). As this is the case, the issue is more architectural and technical than related to policy.

It is likely that the family of metaservices will be enhanced somewhat with more value community-based tools, mainly centred on social networking, but again as seen from the following figure, most of the modularity will be reusable as such. The value community building to support the citizens will likely be one of the new critical service components, also partially answering to some of the demographic issues in service provision.

Figure 5. Classification of metaprocesses can be based on the personalisation needs, i.e. those close to the citizen need citizen sensitivity and negotiation in the integration whilst those further from the citizen can be automated

Entity	Entity-Service	Service	Service-Service
e-Identity	Tagging	Semantics	Privacy Manager
Personal data	Personalisation	Multichannel	Digital Trust
Context Information	Electronic payment	Multilinguism	Notification
	Electronic invoice	E-accessibility	
	Electronic signatures	Online help	
	Document Store Service and information Exchange Service	Searches	
	Address Manager		
	Geolocation		
	Notification		
	Alerts and scheduling		
	Mobility		
	Social Tools		
	Privacy Manager		

Figure 6. In the future, metaprocesses for service integration will likely also include elements for social networking



Conclusions

When looking at the structure of the Digital Agenda for Europe compared to Figure 4, we can see a clear structure linking the policy, legal and innovation elements together. Some of the metaprocesses are far progressed, such as the Single Euro Payments Area (SEPA), whilst some other ones require a fundamental policy and even political discussion about the change drivers. This is true in the very central elements of, for example, security, personalisation, trust and identity management.

From the conceptual perspective, we see also that there are prerequisites which need to happen before the foreseen reference model for user-centric services can be a reality. Those are partly infrastructural issues (connectivity, broadband, payment infrastructure, identity management) and others can be developed, largely by examining them in large-scale pilots, through societal acceptance. Some of these issues, for example CIP pilot actions, have already been touched upon within the Directorate-General for the Information Society and Media of the European Commission.

Combining the user-centric event-based approach for services with creation of the framework conditions for open innovation in the DAE is opening a window for the next generation web service industry for citizen-centric services in Europe.

The industrial group OISPG is able to support this conceptual approach to create open service innovation, development and delivery ecosystems together with other relevant stakeholders.

In the research programme and especially in the CIP programme, the metaprocesses could be opened together with the process owners (users and current service providers, mainly public sector) in a real-world setting. Living Labs, i.e. environments enabling testing and verification of new approaches and the acceptance of those approaches to the population at large is also essential, just to stretch the limits, to get examples and to see what is acceptable and what is not. Ideally, the merger of societal (behavioural) innovation with technological innovation setting the user in the centre would be the right approach for radical breakthroughs, for sustainable development in the longer term. Finding societal innovation and the barriers to it is crucial when fostering entirely new service concepts and developing new industries and entrepreneurship in the changed environments.

It is also noteworthy that substantial work to open and define the service processes could happen in the context of the Future Internet Public-Private Partnership requiring strong collaboration across all stakeholders following new participative and collaborative innovation models.

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Contact

Myriam Corral
 Jefe de Área de Desarrollo
 de la Subdirección General
 de Tecnologías de la Información
 y las Comunicaciones (S.G.T.I.C)
 Ministerio de Economía
 y Hacienda (MEH)
 myriam.corral@meh.es

Bror Salmelin
 Policy Adviser to the Director
 European Commission
 Directorate-General for the
 Information Society and Media
 bror.salmelin@ec.europa.eu

Trends and Country Reports

2.1 Aalto University — the forerunner of European university reform to increase societal impact

It is easy to endorse the EU 2020 strategy's ambitious goals. But good goals are not enough, as the Lisbon Strategy has shown. Renewal comes through faster innovation processes and swift implementation. The quality of a society is largely determined by its capacity to generate genuine learning, work together, and produce new visionary knowledge. Lessons for innovation from university-industry forefront developments need to be applied to strengthen the required broad competency base throughout Europe.

In this article, I will describe the changing role of universities with respect to the EU 2020 strategy. I will concretise my message by linking it with examples and relevant concepts being carried out in building the new Aalto University as a pioneer endeavour in realising the European university reform. The focus of this article is on societal innovations and on societal impact. Thus my message can be summarised in the following three statements.

1. We need strategic design based on research and foresight. The key is commitment to 'Inventing the Future'.
2. We need an entrepreneurial mindset based on curiosity and enthusiasm. The key is 'Venture Garage Mindset'.
3. We need working together mentality based on sharing and co-creation. The key is 'Passion to Learn'.

Grand societal challenges and the EU 2020 strategy

The economic crisis, climate change and demographic ageing have created challenges both for decision-making and people's everyday lives. Although the transformation brought about by digitalisation and globalisation were recognised years ago, its revolutionary force was neither realised early enough nor taken seriously enough.

The EU political leadership has stated the need for renewal. It can be summarised with the following: 'The crisis has wiped out years of economic and social progress and exposed structural weaknesses in Europe's economy. Europe's primary goal today must be to get Europe back on track' [1]. The track, however, is not the same as it used to be. We need to invent the future for Europe. The

measures needed now concern all aspects of governance in the public and private sectors.

The ongoing global change will have an enormous impact on everything. The European Parliament resolution of 5 May 2010 on a new Digital Agenda for Europe stated: 'This digital revolution can no longer be thought of as an evolution from the industrial past but rather as a process of radical transformation' [2]; and the Opinion of the Committee of the Regions approved on 6 October 2010 had the same message, 'the Information Society has been a tremendous accelerator of economic and social progress. The required transition from an information society to a green knowledge society can even be seen as a type of paradigm shift' [3].

Recognising the recent knowledge society development and the need for renewal, decision-makers in all countries and regions worldwide, need a deep and broad understanding of the critical success factors affecting the intellectual capital, and through that, the economic, social and ecologic systems of societies.

In presenting his programme for the new Commission, President Barroso laid out his vision for where the European Union should be in 2020. To make the desired transformations happen, Europe needs a common agenda: the EU 2020 strategy. The Commission has, for this purpose, drafted an evaluation of the Lisbon Strategy [4]. The main findings can be summarised as follows.

- The Lisbon Strategy has had a positive impact on the EU even though its main targets (i.e. 70 % employment rate, and 3 % of GDP spent on R&D) will not be reached.
- The Lisbon Strategy focused on the right structural reforms. R&D and innovation, labour markets (flexibility, skills and lifelong learning), the business environment and consolidation of public finances which are all crucial areas when preparing the EU for globalisation, ageing and enhancement of the EU's prosperity.

The European Commission has launched the Europe 2020 strategy to exit the crisis and prepare the EU economy for the next decade. This strategy is defined in detail in the seven flagship initiatives which are focused on the areas in most need of attention at the EU, national, local and regional levels. Within each flagship, both the EU and

national authorities will have to coordinate their efforts so they are mutually reinforcing.

The crucial role of better use of existing knowledge and new mindset for knowledge co-creation can clearly be recognised from the above.

Universities responding to the challenges

University Reform is an indispensable prerequisite for meeting the challenges posed by globalisation and changes in operating environments. In order to comprehend the significance and required depth of change in university role, structures, processes and working culture, it is important to unveil the strategic core of what is happening at the EU level.

The European Commission has launched the Europe 2020 strategy to exit the crisis and prepare the EU economy for the next decade. Research, innovation and learning play a crucial role in all of the defined three key drivers for growth:

1. smart growth (fostering knowledge, innovation, education and digital society);
2. sustainable growth (making our production more resource efficient while boosting our competitiveness); and
3. inclusive growth (raising participation in the labour market, the acquisition of skills and the fight against poverty).

A comprehensive change shifting the emphasis of financial resources in accordance with the above mentioned prioritisation lies at the core similarly to the development of the required competence allowing for the materialisation and implementation of the new innovations. These challenges emphasise the importance of universities as producers of new knowledge and expertise. As academic institutions have learned to define and comprehend their third mission, many universities have repositioned themselves to better interact with and serve the surrounding society and to learn from the interactions.

Scientific breakthroughs and innovations are ever more frequently results of multidisciplinary research cooperation, with one field of science studying and feeling the borders of another. Multidisciplinary research can be fostered

within interdisciplinary research programmes, major research consortia or by establishing multidisciplinary research institutes. Multidisciplinary approaches are also reflected in teaching.

A particular challenge for universities stems from political decision-making that requires significant results in the near term, instead of in 10 years' time. Universities, as their operational structures and culture exist, are not yet ready for this. Huge development work is imperative for universities to be able to change their own operational processes. The key stepping stone is the disassembly of silo structures and accomplishment of an in-depth collaborative working culture. This can be simplified by means of two principles: the Triple Helix collaboration model (universities-enterprises-public administration) that has been in the spotlight for decades and needs to be made functional. And second, the Knowledge Triangle collaboration model (research-education-innovation) that accentuates the synergy between university's different functions needs to gain ground.

It is extremely important to emphasise, however, that universities need not be identical. Cooperation and learning from best practices can help each university to specialise in its own characteristic role.

Aalto University — striving to make a change

When defining the new university policy, we need to understand the change in the focus of education: from the traditional teacher-centric model to a learner-centric model, where a new networking culture is the key for success.

Education as such will not entail the desired, positive outcomes. Teaching and learning will yield the targeted added value when integrated with research and innovation in accordance with the Knowledge Triangle principle more intensively than before. Part of university studies, depending on the field, needs to be dedicated to the in-depth study of the theory underlying science and another part should focus on real-life processes and challenges posed on their development.

Digitalisation, i.e. ICT and its applications, need to be further developed and implemented effectively both in education and working life. The new challenges to education are demanding, but as international competition becomes increasingly fierce, innovative and even radical measures are necessary in order to move forward.

The changing role of universities promotes lifelong learning and especially competence development of those already in working life. Building the new Aalto University is a pioneer endeavour materialising the European university reform. The new University is created on a foundation of strategic basic research, with a unique voice in formulating a policy on global innovation. Part of the ongoing planning process is to define the activities and concepts for social, cultural and economic impact, which include lifelong learning, continuing education and other working life education and development services.

Aalto University started its operations in January 2010 as a foundation-based university built through the merger of three top universities: Helsinki University of Technology (TKK), Helsinki School of Economics (HSE) and University of Art and Design Helsinki (TaiK). The mission of Aalto defines the unique target level of the strategic role of the University as follows: *Aalto University aims to make a change through top-quality and interdisciplinary research, pioneering education, continuous renewal and by boldly surpassing traditional boundaries. Aalto University educates the visionaries of our future society: responsible,*

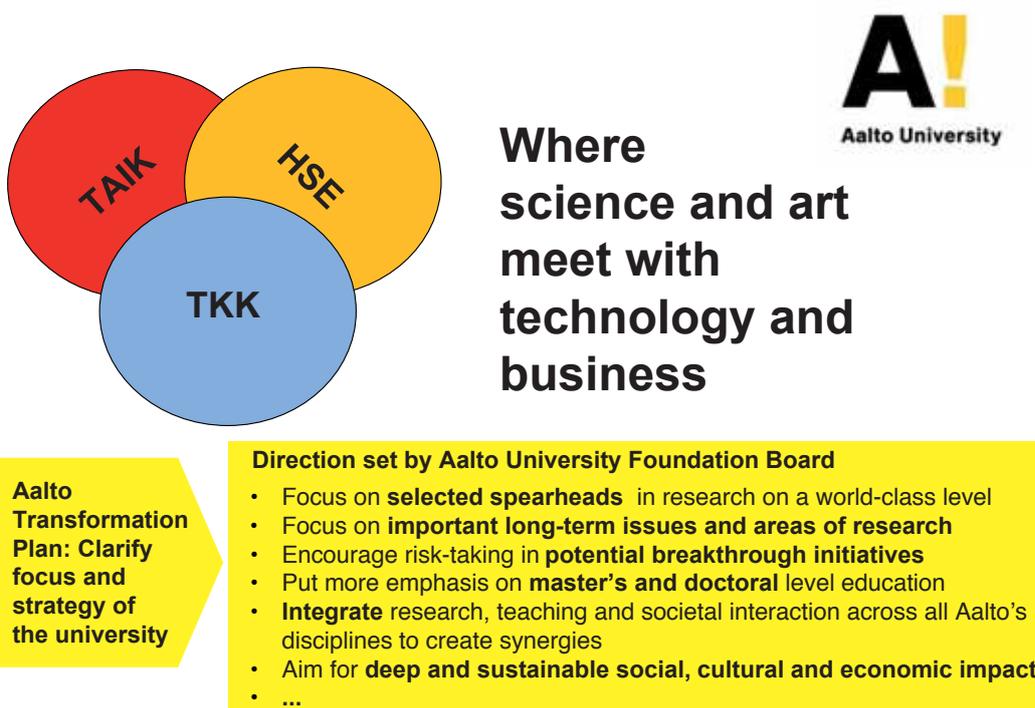
broad-minded experts with a comprehensive understanding of multifaceted problems (Figure 1).

Merging the operations of three leading universities opens up opportunities for internationally unique activities by drawing on multidisciplinary and the strengths of each university. When setting objectives for impacts, the University Board emphasised in-depth and sustainable societal, cultural and financial impacts as well as integration of the various functions within Aalto and to fully benefit from the synergy created. In addition, these alignments accentuate the focus and risk-taking in potential breakthrough endeavours.

Some unique features of the Aalto birth can be described by the words of Professor Yrjö Sotamaa, the former president of the University of Art and Design [5].

‘Aalto University is a wild flower. It was not a result of committee work. When preparing founding of a new university to Finland in autumn 2005, I had the innovation capacity of the nation in my mind. How to increase the innovativeness of the whole society and direct this capacity to creating better world? That’s why I called

Figure 1. Aalto University a foundation-based new university merging three universities



the project at first ‘the Innovation University’ ... Our formula of successful reform had six core ingredients: (i) big enough reason to face the grand global challenges and deal with problems; (ii) clear need for increasing innovativeness of the society; (iii) radical idea (art+science+design+business+technology) where art and design play a radical role; (iv) good cooperation between different actor of the society (universities, industry and the government); (v) seeing the new university as a national investment (the total investment is over EUR 1 billion in five years); and (vi) the right timing (elections and new government). I can state that the project could not be realised at the present moment. But it can be said that the right idea was presented at the right time. Like a wild flower.’

Digitalisation in the knowledge society: the need for new developments in education

Digitalisation cannot be separated from the development of lifelong learning and human capital and the measures needed to promote them. Perhaps the key to success is how well and how widely across the EU in practice work communities and the general public can be encouraged to play an active role in creating a substantially more innovative and productive Europe.

The hope for transformation requires above all changes in working methods and culture. There are wide cultural differences between different countries and regions with respect to what needs to be done and how and within what time frame the transformation can be achieved. The basis for future success everywhere is an environment that promotes human capital and innovativeness. It is important to bear in mind that quality of life is a key motivational factor.

In Finland, the principle of lifelong learning has been defined as the foundation of legislation guiding education since the mid 1990s. In practice, this principle was already applied. But only digitalisation has made it possible to implement the change in practices and policies, regardless of the learners’ life situation, time and location.

The positive impact of ICT as a facilitator of networking as a learning aid has been self-evident for a long time. The global impacts on the education system are immense. The challenge in this has been the accomplishment of a profound change in studying and working cultures. In order to respond to those who question the necessity of

change, or who doubt whether any real benefits can be gained, or who worry that the change will bring along problems, a few simple explanations are needed:

The number of students in higher education (HE) is growing rapidly, especially in developing countries. In less than 10 years the enrolment has more than doubled, and this increase is part of an ongoing trend. There is no way of physically accommodating this new influx of students on old or new campuses. At the same time, in the EU, the shift away from an industry-based working culture, towards a knowledge- and innovation-based culture, creates new job opportunities, however requiring new skills and competencies and focused investments in knowledge creation. This means that investments in HE per student should increase, but that is not possible, at least not in most countries. In addition, there is a huge demand not only to increase the enrolment per age group to HE, but also to change the perspective from education to lifelong learning. The driving force for those who want to be winners in a competitive global ideas market is the passion to learn, and I do not mean just every now and then, but from cradle to grave. In business terms, this means target-oriented career planning, where risk-taking and positive attitudes to change are drivers of success.

All of the above means — and also requires — an unprejudiced attitude towards development and the implementation of new methods. Technology needs to be harnessed to support lifelong learning and to produce new and diverse productivity-enhancing activities. The buzzwords like technology-enhanced, open, distance and flexible learning or e-learning are concepts developed to tackle these challenges. The advantage of the use of information networks — e-learning in general — in comparison to conventional learning, is that one can now find a lot of challenging and useful information accessible, and that an individual can set goals as high as he or she may wish.

The same applies to states. A few countries try to make giant leaps in their own education system; we can learn by benchmarking their successful experiences. And in addition, within each state, those who wish to be the engines of development can compare their insights and learn from congenial developers in other countries. The decisive success factor for states is the desire for learning to learn the abilities and skills in multidisciplinary knowledge creation. This means that e-learning is no longer about moulding traditional information in such a way that it can be transmitted through the Internet, but it is about new social skills and a new working culture.

Innovation ecosystem

Innovation policy is in turmoil worldwide. The Finnish innovation system is at a crossroads due to both internal and external factors. The Government's Communication on Finland's National Innovation Strategy to the Parliament sets the goal of pioneering in innovation activity in selected sectors of innovation. The Communication presents four strategic choices deemed crucial for the future of the Finnish innovation system:

- *Innovation activity in a world without frontiers,*
- *Demand and user orientation,*
- *Innovative individuals and communities, and*
- *Systemic approach.*

The Strategy highlights the increasing role of information and knowledge in society as well as stressing the urgency in addressing the challenges induced by globalisation. An international evaluation of the Finnish national innovation system was conducted by an independent outside panel. The message of the panel highlights that *while Finland is quite well-positioned to meet future challenges, there is a unique opportunity for further reforms.* The panel also takes a strong stance for the university reform and encourages it to go further than what is currently being suggested.

With respect to the Finnish national policy, the Aalto University Board has defined the following three levels and areas to be among the cornerstones of Aalto's focus. To support their materialisation, specific activities need to be planned and implemented in the coming years.

- **Influencing national agenda:** *Aalto will by 2020 become the most important player in setting the national science, creativity and innovation agenda.*
- **Global forerunner:** *Aalto will by 2020 develop its strengths as a globally unique hub of excellence in research, development and innovation.*
- **Real-life and real-case approach:** *By 2020, the concept of the Aalto Living Labs based on the real-case approach and with selected strategic partnerships will provide Aalto with a pioneering world leader role in teaching and learning in open innovation and shared knowledge creation processes.*

These Aalto Vision 2020 sub-themes guide the development of the entire impact activities in the diverse University units, and for their part, more detailed development phases will be defined in an action plan (Aalto Societal Impact Roadmap).

Aalto University bolsters its societal impacts persistently by adopting a broad view of the competences needed within the concepts of regional innovation ecosystems and on an in-depth understanding of the scientific foundations underlying their different parameters. This means that Aalto University is taking a determined approach to strengthening the foundation of innovation activities with its research and teaching activities.

The Aalto innovation ecosystemic concept focusing on societal impact is a complex entity. On the one hand, it embraces an in-depth insight into the operative management capabilities required in global markets (such as user centricity, concept development, innovative core processes and network engagement) that are fostered and utilised typically by many multinational corporations. On the other hand, the concept is based on societal leadership capabilities (such as foresight and insight generation, sustainability, life-cycle agility and cultural fostering) required in responsible societal leadership but the development and implementation of which are still underway around the world.

The persistent research and development of theories and practices related to global change enhance Aalto's preconditions to reach the efficiency targets defined in Vision 2020. The basic parameters underlying the systematic demands in this endeavour are the networked working culture, architecture of ecosystems, orchestration of change, and value creation through collaboration. This ecosystemicity, together with other impact factors, manifests the comprehensive and in-depth insight at Aalto into what innovations are and how they can be realised.

The themes described above and, in particular, the ecosystemic thinking related to them pose core challenges to societal decision making, as well, as the EU is revising its Lisbon Strategy into the EU 2020 strategy. The innovation policy calls for profound changes in education cultures, processes as well as structures. New networking capabilities are at the heart of competitiveness policy. The 'kernel' itself is cutting-edge research. Working life competence development needs to be integrated with the increasing importance of the role of universities in science, technology and innovation policy.

New innovative landscapes

Today's university operations are, first of all, overly fragmented — units are too small and efficiency measurements guide them excessively towards independent science publications and projects accentuating their own operations. New significance can only be created, first and

foremost, by drawing on solid research expertise and both cross-disciplinary and international collaboration which envisions innovative research initiatives. I sketch the systemic approach and the R&D needed to create such a new operating culture in Figure 2.

This preferred direction can only be reached by integrating multiple interests and motivating the most promising organisations and key people to focus on creating such a mega-endeavour. This requires a new attitude also from financiers and University management. Our eyes must open up to these huge global opportunities, and all the parties involved should be both bold and capable enough to create a system of endeavours based on strategic partnerships. This system is built both on the in-depth research activities within diverse disciplines, and multi- and interdisciplinary collaboration between diverse disciplines.

This preferred development also calls for a new university culture capable of challenging the traditional ways of working and thinking. Universities need to begin recognising new innovative landscapes as immense opportunities, now more than ever.

Aalto University creates a solid foundation for societal impact by integrating the separate activities of different departments and other units and developing synergistically

connected entities securing prerequisites for close university-industry cooperation in the spirit of the Knowledge Triangle. Examples of such entities currently underway are:

1. **Aalto University Factories** are dynamic learning, teaching, research and collaboration environments where academic teams, companies and public communities come together. The workshops support internationalisation, open innovation and new ways of teaching and learning, as well as multidisciplinary. The research data created in these workshops integrates seamlessly into Aalto University teaching.
2. **The Learning Centre** serves as a window for Aalto University to its immediate surroundings. The Centre provides facilities and expertise for the professional and continuing education of both its own staff and external parties, offers versatile information services, and organises exhibitions and conferences. The goal is to create a venue of vibrant activity where researchers, students, companies, societal agents and the greater public can meet in the name of research, arts and education.
3. **Open innovation activities** are founded on both pre-existing and new forms of cooperation offered to universities and companies by national and international

Figure 2. The Aalto approach to increasing societal impact



financiers such as Tekes and the EU. Examples of these are the EU framework programmes, EIT, and National Strategic Centres for Science, Technology and Innovation (SHOK).

- 4. **Strategic partnerships** provide opportunities for sustained and trusted cooperation between the University and other organisations in selected research, innovation and competence areas.

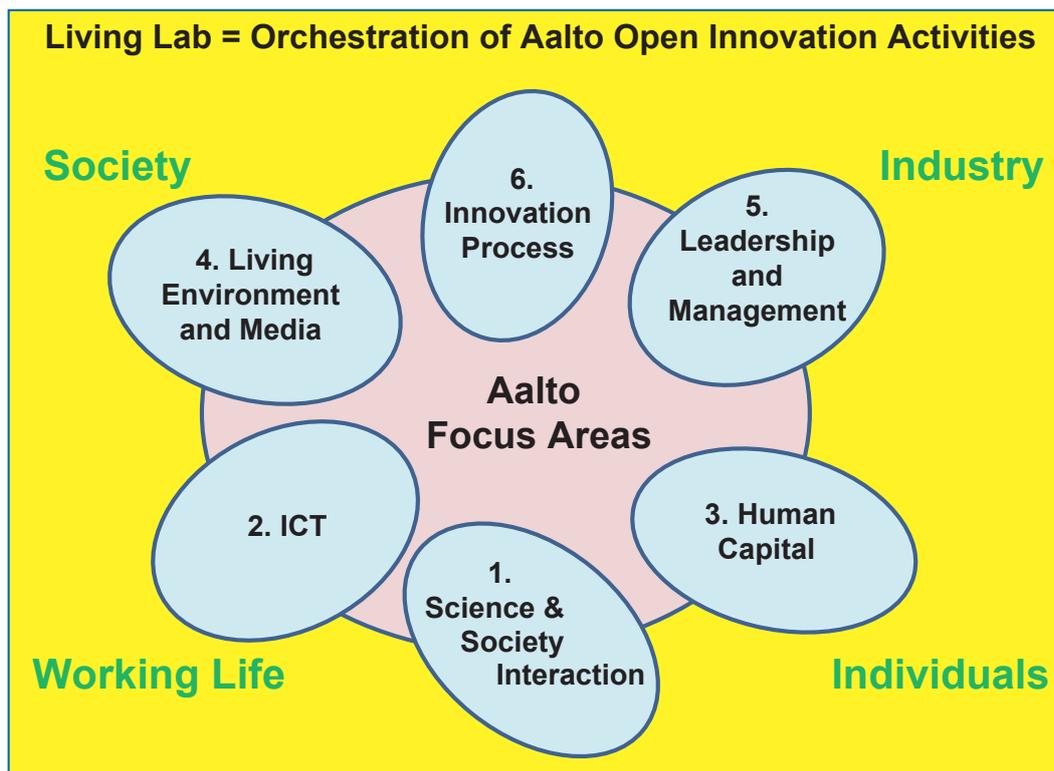
Aalto University in itself and on a broad scale intends to be a real-life living lab. On the other hand, several units within Aalto already are running subject-focused Living Lab operations. The need to create a cross-disciplinary operating culture that examines societal phenomena multidisciplinary has been documented in Aalto’s strategic alignments. Upon University transformation, we have drawn guidelines depicting what is meant by networked Aalto Living Labs operations. At the same time, this materialises as intensified collaboration between diverse operators from the different parts of the University with the aim of increasing societal interaction with and impact on society significantly. The concept and its activities are

based on university-level research, development and innovation (RDI). Open innovation integrating research, teaching, learning and different collaborative developments is a feature characterising all these activities. The six RDI areas in Figure 3 are based on the existing strengths of the Aalto faculty.

These all are new openings based on the existing Aalto strengths and activities, as well as the defined development needs. However, making new organisational structures is not a priority activity. Instead, the first phase of the strategy process has stressed the definition of the Aalto Vision 2020, based on the general aims and objectives set by the Aalto Board and the review and planning process integrating different elements within the University activity spectrum.

Within the three missions of universities (research, education and societal interaction) the work for the transformation plan has followed the following route: Vision 2020 → concepts and processes → culture and capabilities → structures. In increasing the societal impact of Aalto, the guiding principle has been that societal impact is an

Figure 3. Aalto Living Labs focus on methodological RDI integrated with the Aalto focus areas



essential part of research conducted by all Aalto units in addition to developing the theories in parallel with implementation and also learning by doing.

The research of all departments and other units has undergone a thorough international evaluation carried out by more than 60 experts from 20 countries. Based on the results of this Research Assessment Exercise [6] and building on the current capacities and interdisciplinary opportunities, the University has identified four broad themes spanning the entire University:

- Digitisation
- The service economy
- Energy and sustainable use of natural resources
- Human-centric living environment.

One example of the results of the research evaluation is shown below. Quotations are from the assessment (summer 2009) focusing on architecture, design, media and art research.

There is an opportunity to build a significant strategic role for Art and Design in the Aalto context. This not only brings real competitive value to Aalto but also (by virtue of its strategic potential) positions TaiK as a key partner in the development of this merger.

The school size makes TaiK a significant minority in the new University, but intellectually and culturally TaiK has a massive contribution to make. In general:

- **Art and Design is an integrator:** *In the Aalto context, it will have a growing role in bringing the University together in integrating research efforts in powerful new combinations.*
- **Art and Design thinks holistically:** *In the Aalto context, this opens the possibility to leverage art and design as a key innovator in addressing complex problems — such as the environment, healthcare, technology and a range of aesthetic, cultural, historical and theoretical questions — that require holistic approaches.*
- **Art and Design leverages visualisation:** *In a complex world, information can be overwhelming both in volume and in the range of typologies. Art and Design visualisation can be a key in enabling more comprehensive (less reductive) understanding of information.*
- **Art and Design contributes to the cultural industries:** *It generates cultural economies within society.*

- **Art and Design underpins radical social software and collaborative knowledge building developments:** *It generates innovative values grounded on open-source models and social capital.*

Aalto Camp for societal innovation: innovation union

The Finnish innovation system is regarded as structurally high quality, rated possibly among the top national innovation systems in the world. Despite this, we know that the current innovation practices in Finland — or anywhere else — are not nearly adequate in terms of the challenges that lie ahead. We need a new generation innovation paradigm — both in theory and practice.

The next wave of innovation activities will find its key challenges in societal and social innovations. Narrowly focused product- and technology-driven innovation has transformed into practical conceptualisation of innovative services. At the same time, the shift offers new prerequisites for leadership of innovation.

Aalto Camp for Societal Innovation ACSI (<http://www.acsi.aalto.fi>) is a new-generation innovation agenda. It will operate in a multidisciplinary, communal and dialogue-oriented way. The participants collaborate in teams which are supported by a steering process and material aid to help promote their selected programmes. Methodologically, Aalto Camp is based on the Knowledge Triangle that integrates research, education and innovation so that the operating model can also be applied within the Aalto University in degree programmes, continuing education and multidisciplinary research activities.

ACSI as an innovation agenda brings forth a concept, operating mode and network for the development of a global innovation platform. It gives rise to an international, self-fortifying innovation community integrating research, learning and innovation. New types of frontier zones and developer forums will become apparent in connection with ACSI. These integrate different disciplines and nationalities into innovation nodes that open new doors both for society and university.

The European Council has defined very clearly the cornerstones of the EU 2020 strategy. Aalto University (the only university whose name is included in the Innovation Union communication) has much to offer with respect to the Grand Challenges. According to the Commission, innovation is essential for European future. Innovation

is the foundation of the smart, sustainable and inclusive growth the EU 2020 strategy is aiming at, and the Innovation Union is one of the seven flagships announced in it. The aims are to improve conditions and access to financing of research and innovation, and to ensure that innovative ideas can be turned into products and services that create growth and jobs.

The following three statements included in the executive summary of the Innovation Union form essential guidelines also for ACSI.

1. *We need to get more innovation out of our research. Cooperation between the world of science and the world of business must be enhanced, obstacles removed and incentives put in place.*
2. *European Innovation Partnerships should be launched to accelerate research, development and market deployment of innovations to tackle major societal challenges, pool expertise and resources and boost the competitiveness of EU industry, starting with the area of healthy ageing.*
3. *Our strengths in design and creativity must be better exploited. We must champion social innovation. We must develop a better understanding of public sector innovation, identify and give visibility to successful initiatives, and benchmark progress.*

By the Innovation Union, the EU promotes a vision, an agenda as well as a clear distribution of tasks and robust monitoring procedures. The European Commission is committed to do what is necessary to make the Innovation Union a reality.

ACSI will create an innovative operating mode that incorporates the annual Aalto Camps into universities' research, teaching and innovation activities throughout the year. The international ACSI community produces innovative solutions meeting the needs of real-life cases of society and enterprises.

After an experimental phase of 18 months, ACSI is now focusing on conceptualising. An eight-day ACSI Proto Camp in summer 2010 operated in a multidisciplinary, communal and dialogue-oriented way. The participants collaborated in teams (Figure 4) which were supported by a steering process and material aid to help promote their case processes. Methodologically, Aalto Camp is based on the Knowledge Triangle that integrates research, education and innovation so that the operating model can also be applied within the Aalto University in degree programmes, continuing education and multidisciplinary research activities.

Aalto Factories — the concept already in implementation

By definition, Aalto Design Factory is an experimental co-creation platform for education, research and application of product design — where 'design' has a broad meaning. Three factories started their operations in the fall of 2008: Design Factory, Service Factory and Media Factory. According to its annual report, the second academic year of Design Factory has shown that there really is interest in the core idea of Aalto University, and especially its practical applications. In other words, plans for the future are important, but so are the showcases and evidence showing

Figure 4. Dozens of workshops using the Learning Café — methodologies have been organised to plan and implement new innovative landscapes on the platform of Aalto University



that change is truly proceeding, day after day. At this point, almost 15 000 visitors — students, teachers, researchers and numerous parties from outside of the academic world, both national and international — have experienced the Design Factory [7].

The Aalto Factory Park (AFP) is a strategic part of Aalto University’s ecosystem aiming for deep and sustainable social, cultural and economic impact. It consists of thematic and multidisciplinary Aalto University Factories, which are platforms for synergic integration of research, education and innovation activities across Aalto’s disciplines in their focus areas (Knowledge Triangle perspective). Also, other horizontal activities have the potential to operate in Aalto Factories.

The core of the AFP Concept (Figure 5) is the systemic orchestration of real-case operations using and integrating forefront research, learning and innovation activities through multi- and interdisciplinary themes. This is based on developing and utilising key collaboration and knowledge transfer processes within the university-industry-society interface.

Factories provide physical and virtual facilities, coaching and facilitation to increase collaboration between

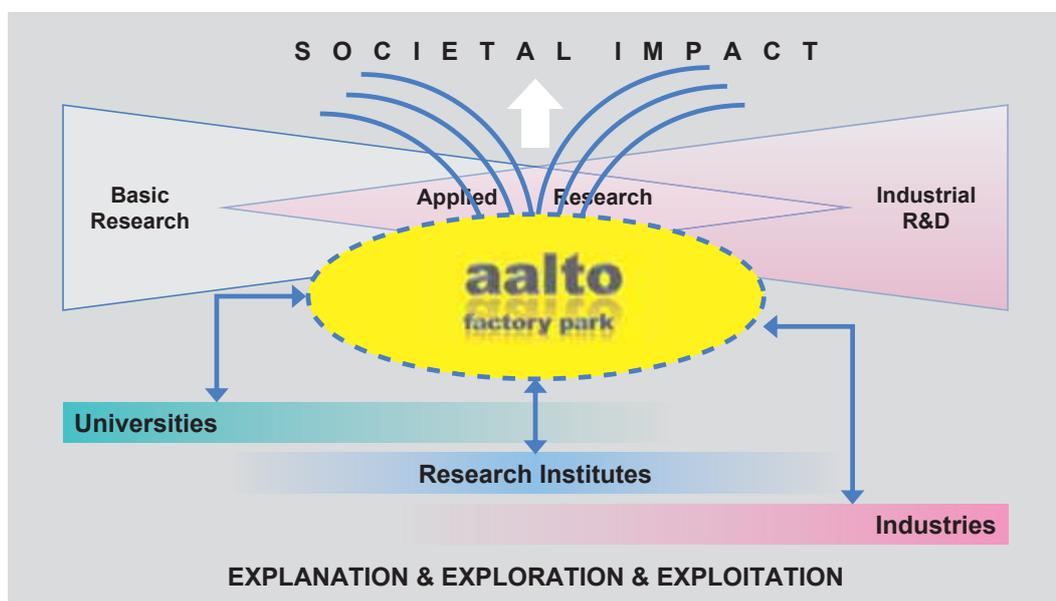
academia, industry, and society (Triple Helix perspective). Factories enable and inspire knowledge co-creation and make Aalto more visible and easily accessible.

Factories create the desired working and learning culture in the Aalto community, including all its stakeholders and customers. Factories serve all Aalto units as knowledge-sharing and co-creation locations by bringing different actors together to experience new ways of working, experimenting, and learning.

The main features of Aalto Factories follow.

1. Factories encourage an open and creative mindset through multidisciplinary attitudes and innovative working processes.
2. Factories are attractive open innovation platforms for a network-centric working culture, combining both academic rigor and practical relevance. Factories are mental, physical and virtual spaces for collaborative value creation through learning by research, development and innovation RDI.
3. Factories compose and maintain Aalto’s knowledge assets related to their respective thematic areas.

Figure 5. Aalto Factories based on the Aalto Factory Park (AFP) concept are a strategic part of Aalto University’s innovation ecosystem



RDI = Research, development and innovation

Factories echo and reflect the foresight-based landscape and ecosystem of their thematic areas.

4. Factories research and develop methods and practices which are needed in the science-society dialogue as a part of the national innovation ecosystem and Aalto in-house development.

Aalto's departments and other Aalto units are administrative home bases for the researchers and other professionals working in the Factories. Some of these professionals have partial/fixed-term work roles in the Factory, for instance 20–50 % of their annual working time. The Factory work is included in tenure and other tracks. Factories have a small core staff of their own.

For successful knowledge co-creation and knowledge transfer, some more effort will be needed for research and modelling of the whole Aalto Factory concept. The new Aalto Tongji Design Factory in Shanghai has already been an extraordinary learning experience in that sense.

Summary: the need for pioneers to show the way

Implementing the EU 2020 Flagships requires a major Europe-wide change in mental attitude: willingness to work in a horizontal and multidisciplinary fashion, overcoming traditional boundaries, breaking silos and a mindset change towards collaboration.

There is an awareness of the need for change and this is apparent in policy guidelines. Digitalisation cannot be separated from the development of lifelong learning and human capital and the measures needed to promote them. Perhaps the key to success is how well and how

widely across the EU in practice, work communities can be encouraged to play an active role in creating a substantially more innovative and productive working culture.

Learning is an essential part of work. In this respect, there must be a major working culture shift towards efficiency, productivity and joy in learning. Small incremental steps are not enough. Foresight, ecosystem orchestration and network capabilities with digitalisation as an enabler can build the necessary concepts and platforms for the paradigm shift. The core processes of innovative environments cannot be managed without the active participation of all and delegation of responsibilities.

Digital Agenda for Europe and other EU Flagships have enormous potential to act as incentives to all actors in Europe to reform their own service and production processes in a framework of European cooperation. Regions and cities across Europe should overhaul their own structures, working methods and processes on the basis of benchmarking and cooperation with each other, as well as with universities and businesses. The EU must adopt a new purposeful approach and take advantage of pioneering regions, active researchers and experimenters which develop new solutions for the future for the benefit of all.

A new pioneering Finnish initiative is the 'Energising Society' research programme (<http://www.rym.fi>). In the work package 'Regional Innovation Ecosystem', ACSI operates as an instrument for developing and implementing concepts and methods in societal innovations needed for the new innovation ecosystem. Special focus is on the Knowledge Triangle methodology and concepts and rapid prototyping. This is actualised through the integration of research, learning and innovation into a coherent series of tasks within this research programme.

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Contact

Markku Markkula
 Aalto University,
 Advisor to the Aalto Presidents,
 Societal Impact,
 Committee of the Regions, Member,
 rapporteur for Digital Agenda
 for Europe
 markku.markkula@aalto.fi

2.2 The underlying mechanisms of open innovation intermediaries

Abstract

The continuous popularity of open innovation as a methodology for sourcing innovation in companies has offered a novel perspective on the increasing need that companies face for accessing and competing on innovation. However, new challenges have arisen: (i) identifying optimal solutions; and (ii) engaging the best partner, in a universe that is no longer confined to the boundaries of the firm. Open innovation intermediaries, aiming at addressing these challenges, have grown in numbers and achieved a global presence in recent years, leading to an increasing interest in research that explored its role and operation.

There is, however, a lack of research that specifically explores their matching mechanisms. This paper aims at addressing this aspect, characterising mechanism archetypes, exploring their limitations, underlying tensions and conflicts.

Keywords: Open Innovation, Innovation, Innovation Intermediaries, Open Innovation Intermediaries

Introduction

While providing solutions for the problem of sourcing innovation, a new problem has arisen: how to find, select and engage the right partners and the right solutions in a space that is increasingly global. In response to these needs of companies to look outward, a new set of actors, open innovation intermediaries, have emerged, aiming to provide original solutions to these challenges.

Their novelty, rapid growth, and consequent success [1] have led to an increase of interest and research in how they provide value for their clients. Specifically, research has offered a broad view on how open innovation intermediaries function and operate as entities that match supply and demand in an innovation context [2] [3] [4].

There is, however, a lack of research that specifically explores the matching mechanisms that open innovation intermediaries use. Here, we can consider the incentives and behaviours of individual agents as seekers and providers of potential solutions, and how these attributes are embraced, formed and aligned with the actual platform infrastructure.

Examining the area of online mechanism design in detail, we find some research oriented towards online platforms [5] and prediction markets [6]. However, open innovation intermediaries have not been addressed from the point of view of mechanism design. Mechanisms present interesting characteristics because often, the objectives of the intermediary cannot be accomplished by promoting full information revelation exclusively. Other aspects need to be considered, for example cognitive and behavioural biases, search strategies, information asymmetry, etc., or as in this case, the recombination of ideas through collaboration.

This paper therefore aims to address open innovation intermediaries from the point of view of the underlying mechanisms that they employ, addressing the following research questions.

- What are some main archetypes of open innovation intermediary mechanisms?
- What specific processes are supported by these mechanisms?
- Are there any underlying behaviours and intentions of agents that are poorly addressed by the mechanisms? If so, what implications for mechanism design might such considerations offer?

In order to address these research questions, we identify several important antecedents of open innovation intermediaries mechanisms from a combination of primary data as case studies and secondary data from professional, scientific and online sources. We place the mechanisms along two dimensions of interest: (a) their ultimate objectives that range from finding the 'right' connections between actors to finding the 'right' solutions to challenges; and (b) their level of support for recombination as a basic process for creating innovative solutions.

Our overall findings suggest that information intermediaries are not homogeneous. Rather, the variance in their purpose is larger than what one otherwise perceives in the literature. Open innovation intermediaries are a vastly heterogeneous phenomenon, and the underlying mechanisms with which they support their operations vary in a similar degree.

Thus the present research contributes to existing literature by: (a) presenting a new research discourse considering

online open innovation intermediaries from the point of view of their platform mechanisms; (b) disclosing distinct mechanism archetypes employed by open innovation intermediaries; (c) surfacing some important underlying variables that are generalisable across mechanisms that vary with purpose; and (d) deriving the tensions and limitations of each mechanism.

Literature review

This work draws on two strands of research: open innovation intermediaries and online mechanism design. Even though both strands have been comprehensively analysed separately, there is still a lack of connection in the literature characterising the mechanisms used by open innovation intermediaries. Thus, in this section of the paper, we will first focus on open innovation intermediary literature, then online algorithmic mechanism design and finally we will link these two strands in order to characterise and discuss the mechanisms used by open innovation intermediaries in the following section.

The intermediary literature was examined through several aspects under various strands of thoughts in the past decades [7]. The research in this strand also expanded with the rise of a distinctive type of intermediary: innovation intermediaries. Howells [8] delineates an innovation intermediary as ‘an organisation or body that acts as an agent or broker in any aspect of the innovation process between two or more parties’ (p. 720).

Most of the studies on innovation intermediaries mainly focus on the role of the intermediaries in innovation process [9] [8] [10]. Stewart and Hyysalo [11] identified these brokers’ role as ‘creating spaces and opportunities for appropriation and generation of emerging technical or cultural products’ (p. 306). These activities can include collecting, developing, broadcasting and eliminating knowledge and information. Specifically in his paper, Howells [8] provided an extensive analysis of literature in which he defined main conceptual strands of work and concluded that most of the studies have not generally been well-grounded theoretically. Chesbrough [7] also emphasises the role of intermediaries as they assist the movement of ideas; the ideas can flow out of places where they do not fit and be placed in other companies where they fit better. Lakhani et al. [22] explored knowledge brokering as a new way of escalating the value of external sources of innovation through the analysis of Innocentive.

A few studies used typologies and frameworks for intermediaries in the literature but they mainly focused

on the role and function of intermediaries [8] [11] [12] [13]. For instance, Howells [8] provided 10 functions based different roles and functions of innovation intermediaries. Recently, Diener and Piller [13] analysed 43 selected open innovation intermediaries, based on their methods, sectors, cost, and project structures for open innovation. However, these typologies of intermediaries only approximate the general ground of innovation intermediaries, which because of their novelty and continuous appearance of new proposals, remains fairly open.

With the rise of open innovation concept, one type of innovation intermediaries, online open innovation intermediaries, have received great attention in the recent years [7] [14] [2]. Solving the problem, selecting, connecting and engaging potentially successful innovations at global level is certainly not at the reach of many companies, even if large. Open innovation intermediaries approach this problem with a variety of approaches, ranging from creating communities to crowdsourcing or maintaining a network of potentially relevant contacts that could be exploited a posteriori. The literature on them is mainly composed of case studies of intermediaries such as cases on NineSigma, yet2.com and InnoCentive while mainly focusing on managerial implications [15] [2]. Only a few empirical papers have been written so far on open innovation intermediaries [14] [2] and most of them were concentrated on their performance [14] [8].

The Mechanism Design field is a sub-theme of game theory that deals with a particular class of private information games where the designer can choose the game structure and is interested in its outcome. Mechanism Design aims to implement desired social choices in a strategic setting as agents’ preferences are private such as in the case of auctions [16]. However, open innovation intermediaries refer to algorithmic mechanism design and online mechanisms such as prediction markets and it is there where we will focus our attention.

With the rise of the Internet, the methods of mechanism design have extended to a more dynamic environment where online mechanisms are required [16]. In online mechanisms, information is revealed online and the decision must be made dynamically without knowledge of the future. Thus, the basic setting of an online mechanism design involves an agent trying to maximise the difference between its value from sequence of decision and its possible infinite while assuming that agents are risk-neutral [5]. Parkes’ paper [5] emphasises that the current literature is limited on the design of revenue-maximising online mechanisms in a model-based environment.

Prediction markets aim to solve the information aggregation problem by relying on the information

of a large number of agents in order to predict future events [16]; thus, the prediction market is one mechanism designed to extract a forecast for a random variable or set of variables through aggregating knowledge and opinions about the likelihood of future actions [6]. The literature on prediction markets is mainly based on empirical analysis on markets [17] [18], extensive literature analysis on prediction markets [19] but mainly focuses on the accuracy of the prediction markets [20].

Yet, to our knowledge, there are only a few studies and frameworks that address in detail the whole range of innovation intermediaries and mechanisms of intermediaries. Only the study of Antikainen and Väättäjä [21] focused on rewarding mechanisms in online open innovation intermediaries.

In short, while both of the strands have been studied in depth, to our knowledge, there has been a little linkage among these lines of research. This is why our study will aim to provide a first approximation to it, through characterising and analysing the underlying mechanisms in online open innovation intermediaries.

Research design

In order to conduct this research we examined 45 open innovation intermediaries through secondary sources such as published academic literature, data collection from their websites, semi-structured interviews with intermediaries

and companies using their services. As such, there were three major activities.

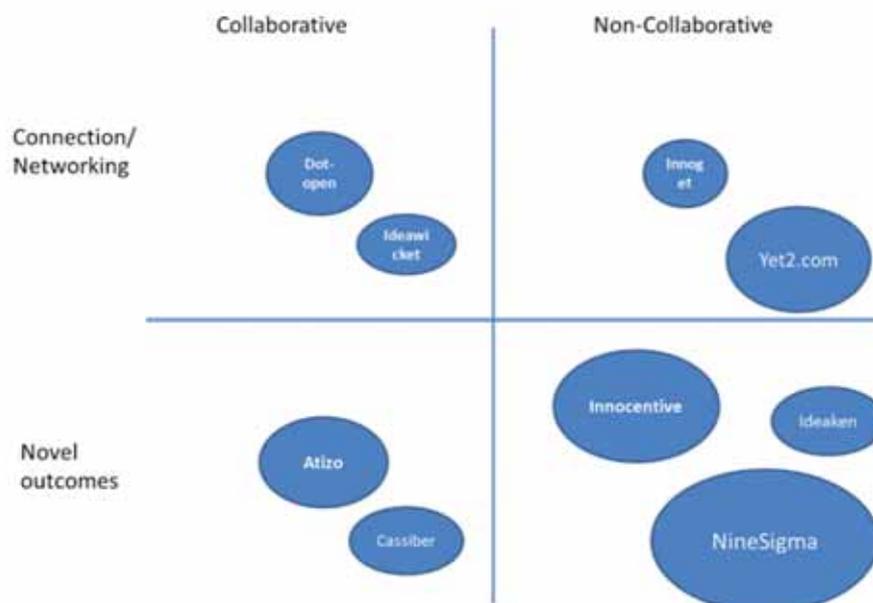
- (a) Online data collection: Websites of the 45 intermediaries were visited and the relevant information grouped, classified and clustered.
- (b) Semi-structured interviews with open innovation intermediaries; Interviews with eight managers, researchers and directors of open innovation intermediaries were conducted, corresponding to five different open innovation intermediaries. Interviews were transcribed via interview notes.
- (c) Semi-structured interviews with users: Interviews with seven managers from companies using the services of open innovation intermediaries were conducted.

Data collected from the interviews and secondary sources was used to perform this clustering and derive the archetypes and once they were distilled, their characterisation and results were again contrasted with the insights coming from the interviews.

Characterising online open innovation intermediaries

Open innovation embraces the process of cultivating and internalising value from opportunities external to the firm, as well as the skillful deployment of internal discoveries to external deployments [7]. Sourcing innovation outside the boundaries of the company could effectively provide a

Figure 1. Clustered online open innovation intermediaries based on the dimensions



solution to the innovation problem, but at the same time, creates a new one: How to select, connect and engage the best solution among the vast number of possibilities that exist globally? Open innovation intermediaries aim at providing solutions to this problem.

Because the objective is to connect with relevant actors beyond the existing network of the participating companies, open innovation intermediaries normally opt to use, totally or partially, a technological platform that allows them to operate globally, taking the form of online open innovation intermediaries.

This Internet-based technological platform allows easy connection to the open innovation intermediary providing awareness of the needs of seekers and the offers of solvers. Also, the innovation platform is the locus where much of the matching process takes place, totally or partially. Incentives are provided in the form of cash prizes and non-monetary awards mostly signalling reputation. Commonly, negotiations such as licensing or co-development, together with the process of refining the proposed solution, take place there.

Therefore, a first element for characterising open innovation intermediaries comes from looking at the interaction process that takes place in the platform. There, we can find at one extreme, an approach that fosters a collaboration

process among participants, such as Atizo, while others use the platform as a search tool, looking for solutions provided by individual partners, examples of this approach are Ideaken or Innocentive.

A second dimension that we find relevant comes from identifying the objective of the process. In fact, if we recall the common objective of open innovation intermediaries, we find that it covers a wide area, ranging from selecting to connecting and engaging and implementation. In this continuum, a big difference exists between finding potentially relevant partners and identifying concrete solutions with or without corresponding implementation.

In Figure 1, we provide a visualisation of some of the intermediaries considered, situated in these two dimensions. We added a third, one, the size of the intermediary graphic representation, which is correlated with the size of its community.

This clustering exercise, allowed us to identify five distinct clusters and therefore their underlying mechanisms. We named these mechanisms: (i) broadcasting search (supported and unsupported); (ii) brainstorming with ranking; (iii) Networking/Connect; (iv) Expert Group; and (v) License out (Figure 2). We will briefly examine these five mechanisms while providing examples that could help in their characterisation.

Figure 2. Online open innovation intermediaries mechanisms

	Collaborative	Non-Collaborative
Connection/ Networking	Networking Expert Group	License out Connect
Novel outcomes	Brainstorming with ranking	Broadcasting Search

Broadcasting search (directed/undirected)

In broadcasting search, companies post their problem or need with its details and requirements to the community with a preset monetary award for the best solution. Mostly, this problem or need is defined as a challenge. Thus, intermediaries such as Innocentive act like knowledge brokers between ‘problem seekers’ (companies with a problem or need) and ‘problem solvers’ [22]. For instance, in the case of Innocentive and NineSigma, corporate problems are posted as challenges and innovators are invited to submit their proposals.

One significant feature in this mechanism is that seeker companies work in consultation with the operations staff of the intermediary in the process of preparing the description and requirements of the problem or need; screening the submitted proposals; monitoring the whole process; or guiding the community. We observed that most of these intermediaries such as Innocentive (RTP), Ideaken, Ninesigma (RTP), Crowdspirit, Brainstorm Exchange, Guru, Fellow Force, and Sitepoint follow this type of mechanism.

Similar to the supported version of the broadcasting search mechanism, unsupported broadcasting search also involves the same steps in which companies post their requests to the community platform seeking innovations such as, ideas, patents and innovative products and technologies. However, in this case, this variation of the mechanism does not provide any support or monitoring during the process.

Brainstorming with ranking

Broadcasting search could, in principle, work well, provided that a clearly defined problem exists. However, many problems, especially when they are in the exploratory phase, are ill-defined. For a long time now, a mechanism has existed that addresses this particular situation: brainstorming.

In brainstorming with ranking, companies post their problem or need with its details and requirements to a community looking for the unexpected solutions or ideas. Ideas are generated and collected in brainstorming phase. Later on, the best ideas are picked and the award divided. Here the main role of community is to generate ideas through brainstorming and filter them through voting.

For instance, Atizo has ‘Idea Projects’, brainstorming projects with ranking where the process can be divided in to three steps. First, customers prepare a briefing of ideas and assign an award. Then the ‘Idea Project’ is announced in the platform and as many ideas as possible are collected

in the online brainstorming phase and finally the proposers of the ‘Idea Project’ pick the best ideas among them and divide the award. Here the main role of the Atizo community is brainstorming, generating new ideas and filtering them online. Also, Atizo uses its community to filter the ideas through an internal voting system.

License out

Rather than uploading a challenge for possible solutions, solutions can also be posted publicly seeking for adopters that could find them worth adopting. This is precisely the objective of this mechanism. Although its similarity to broadcasting search is evident, there is a clear point of divergence. In this case, companies don’t look for solutions but for relevant leads that will be further developed outside the system.

This mechanism provides companies and people with a way to make a call for proposing their ideas; market-ready products or market-ready technologies. This involves a licensing-out agreement between the organisations and community members. For instance, Innoget provides a service in which companies can offer their innovations in terms of patents, ideas, innovative products or technologies to the community. Similarly, yetz.com cultivates the connection between needs (mainly technological) and capabilities through their online marketplace of technology for licensing available know-how in terms of a patent, product, or even idea.

Connect — networking

As relevant as well-defined solutions are, companies understand that developing their networks without an immediate objective is also important, that is why organisations do not only look for a solution but are also interested in communication with their ecosystems and opportunities for collaboration. This can be through seeking investors, startups, partners, customers, etc. For instance, *dotopen* is an online communication platform for organisations, works more or less like a LinkedIn for companies, within which decision-makers can research, discover and contact potential clients, competitors, investors, suppliers, and other partners. They also develop tools in order to improve their users’ ability to strategically collaborate.

Expert groups

Expert groups have always considered themselves important in the creation process; a recent example is the reliance on ‘interpreters’ in Design Driven Innovation [23]. Open innovation intermediaries are uniquely positioned to provide these services, connecting companies with groups of experts that could assist in validating and providing ideas that could be included in present

Table 1. Five mechanisms

Name of Mechanism	Mechanism description	Companies
Broadcasting search	Directed Broadcasting Search: — Companies post their requests (problem, need) with its details and requirements to community — A preset monetary award for the best solution — The whole process is supported and monitored by the experts — No collaboration within the community	Innocentive (RTP), Ideaken, ,Crowdsprit, Brainstorm Exchange, Guru, Fellow Force, Sitepoint
	Undirected Broadcasting Search: — Companies post their requests (a call for ideas; market ready products, technologies, to license) with its details and requirements to community — A preset monetary award for the best solution — Not supported and monitored by the experts — No collaboration within the community	Innoget (lbox-in), yet2.com (browsing technologies), Ideawicket (call for market ready products), Openad (purchasing ideas)
Brainstorming (with ranking)	— Companies post their requests (problem, need) with its details and requirements to community — A preset monetary award for the best solution — Ideas are collected in brainstorming phase and filter through voting — Customers pick the best ideas among them and divide the award — Collaboration within the community	Atizo (Idea generation),Crowdsprit, Cassiber, yet2.com, Fellow force, Hype, Ideas to Go, Ideawicket
License out	— Companies and individuals aim to license out its innovations (patents, innovative products and technologies) to community	Innoget (lbox-out), Openad (licensing ideas), yet2.com (licensing technologies)
Connect/networking	— Companies use platforms to discover and contact with potential clients, competitors, investors, suppliers, and other partners — To build an ecosystem based on what they are looking for (solutions to common issues of industry, regional or cross regional)	dotopen (communication platform), Communispace (Global Insights), Ninesigma (Linked InnovationSM), Ideawicket (joint development)
Expert groups	— Intermediaries generate expert groups from the community according to the defined needs and problems of companies	Atizo (concept groups), Ninesigma, Crowdsprit, Ideas To Go

or future strategies. Atizo (concept groups), Ninesigma, Crowdsprit and Ideas To Go are some of the intermediaries with a service that implements the ‘Expert Group’ mechanism. Accordingly we can summarise all these mechanisms in Table 1.

An algorithmic perspective

From a formal point of view, an electronic open innovation intermediary is an online electronic market where a number of participants endowed with a well-defined utility function representing their preferences behave in a selfish rational way, aiming at optimising their utility. We term such rational selfish participants, agents.

Such an electronic market functions on the base of established rules of conduct that can be formally described in an algorithm. Agents are motivated through a payment. We term such a solution, a mechanism.

Definition 1.

A mechanism
A mechanism $m = (f, p_1, \dots, p_n)$, consists of two elements, an objective function f and a tuple of payments $\langle p_1, \dots, p_n \rangle$.
Specifically,
(a) A mechanism defines for each agent a set of possible alternative strategies $a \in A$;

- (b) each agent has private information termed type $\theta \in \Theta$, termed type that acts as a signal and a valuation function $v_i(\theta_i, a_i)$ that specifies a value for each possible alternative;
- (c) a mechanism enables an allocation rule $f(v_1, \dots, v_n) \in A$ that determines an output function $f = f(a, \dots, a_n)$;
- (d) a mechanism provides a payment $p_i = p(a_i, \dots, a_n)$ to every agent.

Definition 2.

An implementation
A mechanism is an implementation with dominant strategies (in short an implementation) if for each agent i there is a strategy $a_i \in A$ such that for all possible other strategies of all other agents a_{-i}, a_i maximises its utility $u_i = p_i + v_i(a_i)$.

Definition 3.

Mechanism design optimisation problem
This is a mechanism definition problem when given a set of possible outputs L and an objective function $L(f, \theta)$, termed social choice, we require an output $f \in L$ that maximises L or in the appropriate case and given a factor c , we require that any other output $f' \in L, L(f, \theta) \leq c L(f', \theta)$.

A key definition in the area is incentive compatibility, also called truthfulness. Intuitively, we say that a mechanism is truthful if agents can never gain by lying or by not revealing the truth, that means that a player i will prefer to tell the truth v_i to the mechanism, rather than a possible 'lie' v'_i , because v_i gives him a higher utility. Formally,

Definition 4.

Incentive compatibility

A mechanism $m = (f, p_1, \dots, p_n)$ is called incentive compatible if for every player i and every $v_1 \in V_1, \dots, v_n \in V_n$ and every v'_i we have $v_i(a) - p \geq v_i(a') - p'$ where $a = f(v_i, v_{-i}), p = p_i(v_i, v_{-i})$ and $a' = f(v'_i, v_{-i}), p' = p_i(v'_i, v_{-i})$.

Electronic open innovation intermediaries implement through different algorithms, mechanisms with many elements in common. All of them share the objective of capturing the imagination of the agents around a proposal, termed a challenge, and engaging them in a process — collaborative or not — of successive refinement, until an external actor — the seeker — values and rewards them accordingly to its preference function.

We have therefore an objective function, consisting in the contribution of ideas or solutions and their associated payments. The objective of the mechanisms and their implementation in algorithms is to maximise the objective function producing a selection of the best ideas, diverse enough to cover all or the most relevant angles.

Notable differences exist however in the implementation, ranging from the level of involvement of the intermediary in the preparation of selection of challenges to the extent that collaboration between the agents is fostered or allowed. Therefore, it is interesting to examine to what degree the different implementations could succeed in optimising

the objective function while being incentive compatible. Moreover, we aim to explore the conditions necessary for maximising the objective function together with the limitations imposed by each concrete implementation. In the following section, we are going to concentrate our work on the two mechanisms that because they have a clear objective of providing novel outcomes, are endowed with payments.

Broadcasting search

The underlying mechanism of Innocentive has been studied in detail [22], being characterised as 'broadcasting search'.

Briefly, on one side Innocentive distinguishes between two types of agents: seekers and solvers. Seekers are agents that propose problems, known as challenges, and solvers suggest solutions.

On the other side, although Innocentive distinguishes between four types of challenges, namely: Ideation Challenges, Theoretical Challenges, Reduce to Practice (RTP) Challenges and Request for Proposals (RFP) Challenges, all of them share the same mechanism.

Proposition 1.

The broadcasting search mechanism is Incentive Compatible. Given an agent i with a solution s_i and a valuation $v_i(s_i)$ let us assume that agent i declares $v'_i(s'_i)$ where $v'_i(s'_i) < v_i(s_i)$, it risks that an agent j proposes s_j with $v_j(s_j) > v'_i(s'_i)$, winning the prize. Therefore it is in the best interest of i to reveal s_i instead of s'_i .

Proposition 2.

The maximisation of the objective function in the broadcasting search depends on the number, expertise and diversity of the participant agents.

Mechanism Broadcasting search

Input: challenges $c \in C$ — challenges proposed by seekers
 Payments $p \in P$ — payments rewarding solvers
 solvers $a \in A$ — agents addressing the challenges

Output: solutions $s \in S$ — proposed solutions

Mechanism Broadcasting search: $(c,p,a) \rightarrow s$

repeat

for each $c \in C$

$s_i \leftarrow sol(a_i)$ — agents propose solutions

return s — set of solutions developed by solvers

end

The utility for an agent i of proposing a solution $s_i \in S$, can be divided in three parts: a potential prize $p \in P$, a valuation $\omega_i(c)$ capturing learning, awareness, networking, etc., and a cost $cost_i(s_i)$, giving $u_i(s_i) = p_i + \omega_i(c) - cost_i(s_i)$, given that agents are self interested and therefore $u_i(s_i)$ must be positive, implying $p_i + \omega_i(c) > cost_i(s_i)$, which solves when $cost_i(s_i) \approx 0$ or when the likelihood of winning or the valuation of the challenge is high.

This reasoning is consistent with the results of Lakhani and Jeppesen [2] defining the Innocentive mechanism as broadcasting search, therefore mostly directed at finding new uses for existing solutions, rendering $cost_i(s_i) \approx 0$.

Proposition 3.

The broadcasting search mechanism prevents the recombination of ideas.

Although innovations results from a diversity of sources and mechanisms, a prevalent and very well known one is idea recombination [24] [25]. Idea recombination is a result of interaction, a possibility that many platforms take advantage of. However, Innocentive prevents this possibility by rendering solutions proposed by solvers entirely private.

Brainstorming with ranking

As we discussed in the previous section, Atizo and others propose a platform that ranges from brainstorming to concept development, focusing on the collaboration between a team of experts as the driving force. In terms of mechanism we will centre in this aspect of collaboration in idea generation through brainstorming, commenting and ranking of ideas.

Proposition 4.

The brainstorming with ranking mechanism is not incentive compatible.

It is easily seen that it is not in the best interest of the agents to rank high or provide useful comments to the ideas of competitors.

Given a solution s_i provided by agent i and a solution s_j provided by agent j , if $r(s_j) < r(s_i)$ the opportunities of agent i are maximised, therefore it is in the best interest of agent i rank low the competing ideas of agent j .

Propositions 2 and 3, equally apply to the brainstorming with ranking mechanism.

Proposition 5.

The brainstorming with ranking mechanism takes advantage of recombination.

By keeping ideas public and encouraging comments, brainstorming with ranking tries to take advantage of cross-fertilisation and recombination of ideas. The existing number of comments provides an empirical evidence of this process.

Discussion

In the last sections, we attempted first to characterise the mechanism used by open innovation intermediaries and secondly to approach them from the point of view of mechanism design. Out of this analysis two main axis emerge: the management of monetary incentives and the need for collaboration.

Mechanism Brainstorming with ranking

Input: challenges $c \in C$ — *challenges proposed by seekers*
 payments $p \in P$ — *payments rewarding solvers*
 solvers $a \in A$ — *agents addressing the challenges*
 Output: ranked solutions $s \in S$ — *proposed solutions*
 comments $m_s \in M$ — *comments on solutions*

Mechanism Brainstorming with ranking: $(c,p,a) \rightarrow (s,m)$

repeat

for each $c \in C$

$s_i \leftarrow$ ideas (a_i) — *agents propose solutions*

$m_s \leftarrow$ comments (a_i) — *contribute with comments*

$s_{ranked} \leftarrow$ rank (a, s) — *agents rank solutions*

return s_{ranked}, m — *set of ranked solutions and comments*

end

Monetary incentives look like the obvious choice for providing an adequate reward to solvers in exchange for their contribution. Also, monetary incentives appear, at least at first glance, to fit with the need of spurring and fostering competition among solvers and creating awareness around the proposed challenge. These are probably the reasons behind the fact that all open innovation intermediaries that aim for a concrete result for a product or service use monetary rewards and, more concretely, prizes as the main incentive.

There is however, mounting evidence that this is probably not the most appropriate type of incentive when referring to innovation. In fact, since the seminal Glucksberg candle experiment [26] on the effect of extrinsic motivators on problem-solving, the evidence shows that these types of motivators, such as monetary incentives, not only don't foster innovation but hamper creativity.

In the last decades we have witnessed large-scale examples of group and user collaboration without monetary incentives. User-generated contents such as the case of Wikipedia or YouTube together with the open-source software, are prime examples of this. Particularly in this last case, open-source software, we can also find a strand of research around the motivation factors of the actors involved in it. The conclusions of this research point again in the same direction: the prevalence of intrinsic versus extrinsic motivators [27].

Regarding the business sector, we find that even if the idea that higher rewards lead to higher performance is certainly entrenched, there is evidence coming from research that fails to support it. In fact, in a very well-known and highly publicised [28] study commissioned by the Federal Reserve and conducted by economists from MIT, Carnegie Mellon and the University of Chicago, we can find 'that financial incentives ... can result in a negative overall performance' [29].

One of the more lucid conceptualisations of an explanatory theory that could fit with the evidence presented so far, is due to Teresa Amabile from Harvard Business School, who postulates that the level of creativity needed for completing a task is determinant when choosing motivators. Therefore, in algorithmic tasks, extrinsic motivators will work nicely while in heuristic tasks, the intrinsic motivators will be the ones that will perform better [30] [31]. In her own words: 'Intrinsic motivation is conducive to creativity, extrinsic motivation is detrimental to creativity' [31, p. 119].

However, in the case of open innovation intermediaries whose focus is to pursue and foster creativity and innovation in groups, we still witness how extrinsic and

not intrinsic incentives, normally in the form of monetary prizes, play the main role. Moreover, there is also another aspect where the kind of extrinsic incentives used in the mechanisms discussed, fail in aligning the preferences of the agents with the objectives of the platforms: the necessary engagement of a large quantity of agents.

In proposition 2, we established that the mechanisms used by open innovation intermediaries rely on the availability and engagement of a large number of solvers among whom a solution for the challenge proposed either exists or could be developed. The main incentive for attracting these solvers is, again, a prize, an extrinsic motivator. However, when examining the existing literature on incentives for engaging crowds, we find, once again, that extrinsic motivators not only do not work as expected but produce disengagement [32] [33].

On the other side, the intimate relationship between innovation and collaboration is widely accepted. The recombination of ideas has been portrayed as a key mechanism since Schumpeter [24] by many authors, either in the form of hybridation [25] or as cumulative innovation [34]. Therefore, there is a tension in the mechanisms between monetary incentives and benefiting from collaboration.

Conclusions

In the previous sections, we have examined the mechanisms currently employed by open innovation intermediaries. This analysis revealed both the novelty of some proposals together with the pitfalls and incoherence of this first wave of intermediaries. In fact, through these early years, we have already witnessed a clear evolution towards, many times more mature models. This evolution can be easily observed in the older players and the learning process that is taking place in the industry appearing very visibly when approaching the newer ones.

In our analysis, we did not refer extensively to the mechanisms aiming at connecting instead of at providing novel outcomes, because of its limited interest and evident lack of conflicts. Still, when we analysed the other mechanisms we observed a major problem, lack of incentive compatibility. Thus, in some mechanisms, it is certainly not in the best interest of the experts, to rank high or to contribute to competing proposals. Moreover, understanding the primary mechanism behind each open innovation intermediary provides valid clues on its applicability and limitations when confronted to a real-life challenge.

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Contact

Tuba Bakici
 ESADE Business School
 tuba.bakici@esade.edu

Prof. Dr Esteve Almirall
 ESADE Business School
 esteve.almirall@esade.edu

Prof. Dr Jonathan Wareham
 Director of Research
 ESADE Business School
 Barcelona, Spain
 jonathan.wareham@esade.edu

2.3 The extrapreneurship manifesto — How can large companies and institutions deal successfully with disruption innovation?

The Polaroid case study or why innovative projects should follow their own tracks

Snapshot

Few brands become a common noun: Polaroid did. It's impressive to see all the success this company has experienced for over 40 years. The firm performance has been exceptional, with a 23 % yearly average sales growth, 17 % profit growth and 17 % share price growth between 1948 and 1978. The reason for such impressive profits could lie in their Razor and Blades business model: sell cheap cameras, make the profit with expensive films sold with a 70 % margin.

Polaroid used to be one of the most innovative companies of its time, with massive R&D and a strong vision for the future. It was a very technology-oriented firm: the charismatic founder and first CEO Edwin Land himself held more than 500 patents. Which CEO could boast such a record today? He considered market research useless as Polaroid technology and products were meant to create their own market. In many aspects, Polaroid was the Apple of the 1970s. OK, maybe Apple was the Apple of the 1970s.

The SX-70 camera, for instance, was an iconic object of its age. The revolutionary camera cost more than half a billion dollars in development over an eight-year period: being the first to eject a picture that developed before the customer's eyes, the product was a huge success and still ranks as 'cult' today.

In the 1970s, 1980s and even in the 1990s, everyone had played at least once with a Polaroid camera: the brand was known and appreciated worldwide. Nevertheless, in 2001, Polaroid declared bankruptcy.

Shift happens

The culprit's identity is no secret: digital imaging. Digital imaging was a disruptive technology, according to Clayton Christensen's term, in the sense that it was a different technology offering a different promise to the consumer. It's clear that Polaroid never managed to cope with the disruptive innovation digital imaging is, but it's hard to understand why an entire technology-oriented firm did not see the shift come. Actually, they did see it coming [1].

Polaroid started to work on digital imaging in 1981. In 1989, they had developed a working prototype of a high-resolution, 2 mega-pixel digital camera: this camera was an enormous improvement both in price and quality over other products currently developed by the competition. Technical challenge was in the DNA of the company and they had little difficulty to develop new technologies, even unrelated to their previous hardware.

In spite of this achievement, Polaroid failed to adapt to the radical change that had occurred in the landscape. The reason lies in their Razor and Blades business model, successfully developed and adopted in the traditional imaging business, but inconsistent in a digital world. The senior managers of the company believed until the end that the company could not win any money with hardware. For this reason, they never encouraged the development of a new business model and never let go of the reason why they were successful in the first place.

They also believed that the consumer would always cherish a physical copy of the picture they had taken. But what stood as a strong competitive advantage in the traditional imaging world began to seem irrelevant when every camera you handle allows you instantly to see your last picture on a screen. If you remember your first digital camera, you probably found the experience somehow similar to instant photography.

Lack of autonomy killed Polaroid's digital projects

Technology did not kill Polaroid: inertia did. When the market for digital imaging started to slowly emerge, Polaroid had the best prototype of digital cameras. But it never succeeded in converting the technical advantage into a market advantage.

Disruptive innovations are a complex subject for big companies. Most of the time, the problem is not related to the technology but to the necessity, when change happens, to adopt different strategic beliefs.

Christensen showed that disruptive innovations could hurt successful and well-managed companies, which are responsive to their customers and have excellent research and development, such as Polaroid. These companies tend to ignore the markets that are most likely to harbour

disruptive innovations, because these markets have very tight profit margins and are too small to represent significant growth; also, these markets are often the ones that demand a new set of beliefs.

Our conviction is that, when confronted with a disruptive change, it's not enough to redesign your product or your service: it's necessary to redesign the whole business. What has worked before won't necessarily work after.

Polaroid's difficulties in adapting to a disruptive innovation were mainly determined by the inertia of its corporate executives: when environmental change started making the corporate beliefs obsolete, Polaroid should have prototyped not only its new products but also a new organisation, able to test new ideas for exploring this new environment, both in terms of market and of technology.

A lot of traditional photography companies failed to manage the shift: Polaroid, but also Kodak and Konica never stepped back up to where they once were before. But others did succeed: firms like Canon and Nikon have become leaders of digital imaging.

Should Polaroid have externalised its digital imaging project, the project would have been freed from corporate pressure as to holding the Razor and Blades business model as alpha and omega for any technological project. The project manager could have designed a whole new business and would not have been required to focus exclusively on the technology. Polaroid could have been the first to launch a digital camera, the Poladroid. The Poladroid would have been very usable (after two or three iterations), preserving Polaroid's promise of 'a camera for everybody'.

How extrapreneurship will save incumbents

Entrepreneurship applied to disruptive projects can help large companies and institutions to successfully seize the opportunities of new markets, without endangering the company's need for consistency.

Innovation requires action

To seize opportunities carried by disruption, companies have to reach genuine flexibility, and practice regular and unbiased evaluation of their short- and long-term vision. The true goal of innovation is to convince other actors, from your end-users to your shareholders. We are deeply convinced that **innovation is principally a matter of action**, and that companies should always experiment in order

to gain and confirm valuable insights on emerging markets. Small structures can navigate more easily in an unknown sea, because they don't bear the weight of corporate assumptions and can act more quickly.

Our model acknowledges the failure of intrapreneurship. In most cases, intrapreneurs are insufficiently rewarded for their work. Their success is improbable because their autonomy is very often delusive and this results in a merely futile questioning of the company's strategy. The second problem with intrapreneurship is that it's often a cheap form of entrepreneurship: a start-up entirely financed by a company won't leverage as much passion, ambition and therefore action as a personal project. There is no such thing as a 9 to 5 entrepreneur. Action comes with autonomy and risk.

We think that in order to survive disruptive innovation, your company should give both autonomy and uncertainty to disruptive projects. This is the reason why we have coined the word 'extrapreneur'. An extrapreneur is first and foremost an entrepreneur who works for his own sake, not an employee. An intrapreneur belongs to a company, stays inside its walls and does corporate work; an extrapreneur keeps the independence which will eventually allow him to test new ideas and scenarios.

Innovation requires a vision

Having an executive vision will be fundamental in the success of your disruptive projects, especially when first difficulties arise. This vision should be the responsibility of only one (or two) person(s), call it the CEO or the project manager. At faberNovel, we have accompanied many projects where this vision shaped the project and contributed to its success.



Polaroid with Edwin Land, being one of the most successful companies was the result of a person's foresight. Amazon CEO Jeff Bezos, while reckoning that 'books are the last bastion of analog', has a genuine vision about how the digital era will reshape the book. For him, the Kindle e-reader is not about a device, but a service: 'the vision is



Stéphane Distinguin

that you should be able to get any book — not just any book in print, but any book that's ever been in print — on the Kindle, in less than a minute' [2]. This is perhaps the best example of how companies can successfully take on disruptive innovation: on Amazon, ebooks outsold hardbacks by 180 to 100 in July 2010.

Extrapreneurship is the best way to give birth to an individual's personal vision that can't fit the company's strategy. Adopting a disruptive strategy is in most cases an unacceptable decision for a CEO: rather than adopting a new vision from someone, top management can test it in an environment that keeps the company safe by commissioning a visionary extrapreneur.

A challenger for the unchallengeable

Entrepreneurs have a wealth of virtues that are somewhat absent in most companies. You may even have one of these entrepreneurs in your own company: a sceptical person showing creativity and a strong need for thinking out of the box. To make disruption happen, a company needs such people that will go against the consensus. Keep in mind that if a CEO can take some of his time to think about a disruptive technology coming, an entrepreneur will think 24/7 about their vision.

It is highly probable that disruptive innovation will shake your business to the ground. Consequently, you should let extrapreneurs challenge even the most evident aspect of your strategy.

Admit that the problem is constantly changing: having an instant physical picture was certainly a key promise of Polaroid in the 1980s but became more and more irrelevant while digital cameras emerged. As a consequence, Polaroid should have been humble and let an autonomous project question this (wrong) preconception: this might have led them to realise that the experience from a digital camera with an LCD screen is quite similar to instant photography.

At the same time, there should be at least one common denominator between companies and their extrapreneurial businesses: otherwise companies might as well buy Google stocks. If your extrapreneurial business cannibalises your own sales, your strategy is proving right. You would rather want that than being exited by a competitor.

Manifesto for extrapreneurship

Extrapreneurial businesses need to recreate the conditions of real start-ups.

Extrapreneurs take the helm

Entrepreneurs need to be in command of the project. Everything related to their project should be under their responsibility: from business model to technological choices, from distribution to partnerships, etc. They should even be allowed to partner with your competitors!

In his book *The Design of Business*, Roger Martin shows how McDonalds built up a legendary brand by innovating in many areas [3]. This type of success is made possible by the concentration of all responsibilities and all decisions in the hands of just a few entrepreneurs fostering the project's coherence. One of the reasons why Canon succeeded where Polaroid and others failed lied in Canon's ability to hire people from other backgrounds and create an independent structure. The firm hired engineers and managers from electronic companies. On the contrary, Hasselblad assumed cameras were about precise mechanics, not electronics. They failed to assimilate these new competencies, as lack of autonomy prevented project managers from hiring useful competencies [4].

Start small

There is a paradox in the fact that all large companies seem compelled to develop only large projects, while all projects begin small. At faberNovel, we think on the contrary that disruptive projects should be humble and agile. Instead of one USD 1 million project, you should have 15 USD 30 000 projects. Steve Blank explains how the digital revolution democratised entrepreneurship: short time to market, low cost to first product, fast customer adoption rate ... [5]: it has never been this easy to be successful with a wealth of small projects. Benjamin Bejbaum, founder of Dailymotion, claims that the initial investment in the website has been 'coffee and sushi' before their first roundtable of USD 25 000 [6]. It doesn't cost much to start a start-up these days.

Christensen showed that disruptive innovations initially address niche markets with different needs rather than the mass market. The technology then evolves to finally address the mass market. Canon targeted the photojournalism niche market for its first digital cameras and built up its brand little by little. Companies like Polaroid or Hasselblad dismissed digital projects because they were in a market 'still in its infancy'. The firms believed their brands would make a difference. Both companies never caught up with the technology and eventually faced bankruptcy [6].

Accept differences

Large companies are often plagued with redundant procedures and a slow decision workflow. In most projects

we have backed, we have found that entrepreneurs and larger companies think very differently. A lot of acquisitions fail by misunderstanding this difference. An entrepreneur isn't usually impressed by a high-responsibility job in the company that bought his company, nor do they want to dedicate 50 % of their time to reporting. Lack of agility can kill a very promising project.

Preventing your extrapreneurs from being 100 % on their projects with unnecessary corporate procedures is ultimately counterproductive and will not stop these ventures from being utter failures. Extrapreneurs and larger companies don't speak the same language, but they can have a deep interest in cooperation.

How to use resources without letting internal procedures slow down the project? A client-provider model will allow extrapreneurs to resort to other providers if your company is not quick enough. Ultimately, you should see your company as potting soil for extrapreneurship.

Conclusion: faberNovel, an extrapreneurial platform

In this article, we suggest a new model for large companies willing to survive disruption. We think that extrapreneurship can be successful in hosting these disruptive innovations.

We see ourselves as a provider of extrapreneurial services. faberNovel's role is to accompany companies who face the challenge of innovation in designing both their innovating

businesses and the structure to make them happen. We see ourselves as a platform connected to both corporate and entrepreneurial worlds.

We have developed a three-stage methodology to support companies in their innovation process.

- The first stage of the methodology, *Business Insight*, is all about the disruption. We gain insight by researching the market, emerging technologies and doing field work to understand what is going to be the future of the company and its environment. This stage helps us generate creative ideas for new business. An idea is finally selected, designed and envisioned. This visualisation can then be shared within the company.
- The second stage, *Business Design*, is a prototyping stage. We prototype with the company not only the product or service we designed, but also the business model and the future organisation. If the potential is there, we help the company decide which organisation model is the best for the project. An incremental project should be internalised. A disruptive project should find its extrapreneur to come true.
- The last stage, *Business Setup*, is getting the thing done. We back the project through its development, whether it's an in-house business or an extrapreneurial venture. We foster communication between the two structures and protect the project from the corporate world.

This methodology offers both security and boldness for a company facing a disruptive innovation.

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Contact

Stéphane Distinguin

Founder & CEO

faberNovel

stephane.distinguin@faberNovel.com

2.4 Open innovation: Are there any effects of user involvement in innovation?

Open innovation

“Open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well” [4, p. 43].

In the last few decades, new market conditions, technological advances, shorter product life cycles and customers increasingly unwilling to settle for mass-produced items or services have influenced not only what to develop but also how to develop in collaboration with both suppliers, customers and sometimes with competitors [1]. This complexity of innovation and the rapid speed of innovation within all types of industries have created new types of customers who demand greater responsiveness from companies regarding a dynamic set of various requirements and exposes companies to increased competition around the world [1]. In this scenario, responsiveness may be one of the most important capabilities needed for staying competitive today and hence to collaborate closely with customers and users. But how can companies create this needed agility responsiveness in innovation?

How to manage innovation has been an area of research for decades while industries have been exposed for different types of forces and challenges; the need to adapt quickly to customers' evolving needs and to develop the 'right' products from the very beginning of the R&D process [2]. This challenge in developing new products is emphasised in the theory of Total Innovation Management (TIM) which reinforces innovation in all elements of an organisation's business system [3]. Also, there are several models presented in the literature on project management concerning innovation and new concepts are evolving continually. A concept that is in focus today is 'open innovation' coined by Chesbrough [4]. But the concept does not signify an altogether new phenomenon [5]. Other researchers have also addressed the 'openness' in innovation as the interactive, cross-disciplinary and inter-organisational

nature of innovative learning [6] [7]. In the late 1980s and 1990s, technological alliances with users, suppliers and competitors increased the nonlinear flows by incorporating information generated outside the firm. But it is essential to understand the global innovation system, the nature and stage of the technological regime, and the particular coordination requirements, are necessary pre-conditions for devising and effective innovation strategy, including its level and mode of openness vis-à-vis complementary partners [5].



Adapting quickly to customers' evolving needs by developing new products entails the challenge of 'betting on the right horse' from the very beginning of the R&D process. Shortened innovation cycles, the fusion of industries, and the resultant rapidly changing environment of market players and business models require more effective innovation activities [2].



The changes above have led to an increased interest in the management of innovation and various studies from a number of perspectives have been conducted over the years. Initiators of the product development process have previously been focused on the manufacturer. But this has changed with a growing role for users in the idea generation process [8]. Researchers demonstrated early in the 1980s the importance of user involvement in product development

Innovation and changes

There is a challenge for companies today to adapt quickly to customers' evolving needs by developing new products and putting in efforts on the 'right products' in the beginning of the innovation process [2]. In order to meet shortened innovation cycles, the fusion of industries, and the rapidly changing environment of market players and business models, companies require more effective innovation activities and to understand that innovation capabilities from outside the company must be exploited better. Also, since the early phase of the innovation process can consume up to 85 % of the total cost of new product development (NPD), decisions regarding proper investments must be made as soon as possible to direct the entire value chain of the innovation process towards market needs [2].

processes in different industries as industrial machinery, medical instruments, application software and machine tool [9].

The concept of integrated product development

The importance to integrate customers in the innovation process is by no means new. Over the years, different researchers have shown how various actors must integrate in product development projects. The literature uses various concepts for integrated product development such as Simultaneous Engineering (SE), Concurrent Engineering (CE) and Integrated Product Development (IPD) to describe different approaches of product development [10] [11]. Also, the external cooperation and integration of a company is another aspect that is widely discussed in product development literature. In general, research shows that building bridges between functions to suppliers and customers increases the likelihood of success for the company. These bridges can take the form of cross-functional teams with R&D, manufacturing and marketing integration [12] [13] [14] and R&D and marketing integration [15] [16]. Other forms of collaboration are strategic partnerships [17] with suppliers [18] and customers [19] [20] [21] [22] [23].

However, problems of organising for effective new product development do exist [24]. Sands [24] focused on the question of the 'right' organisation for new-product activities. What is best for one firm might not be best for the other. In actual practice, a range of new-product organisations can be found. To achieve cooperation and integration in the innovation and product development process different techniques and tools can be used. For instance, applying information technology to sales and marketing has meant tighter coordination between sub-functions [25]. Further, understanding customers' wants and needs is closely connected with the disciplines of marketing and R&D. Information gathering and sharing and well-functioning communication links are often stated in the literature as success factors of product development projects [1] [26] [27]. Tidd and Bodley reviewed the range of formal tools and techniques available to support the new product development process [28]. Their study identified the potential mediating effect of project novelty on the process of new product development, and some of the dangers in adopting so-called best practice methodologies without considering context or contingencies.

Innovation models

There are several models presented in the literature on the management of innovation. Historically, the management

of research and development has evolved through four different phases [29]. Briefly, as Rothwell described [6], the first two phases as involved with linear flows of knowledge. From its beginnings in the mid 19th century to the 1950s, the knowledge flow was based on 'coincidence' and somehow isolated from the other functions of the firm. In the 1970s and early 1980s, business development groups appeared within the firm, to coordinate different functions and assure a multidirectional flow of information. In the late 1980s and 1990s, technological alliances with users, suppliers and competitors increase the nonlinear flows by incorporating information generated outside the firm. In this new context, long-term R&D projects have become much more uncertain and risky. During the 2000s, Chesbrough introduced the concept of open innovation to describe that companies have shifted from so-called closed innovation processes towards a more open way of innovating [4]. This much due to that the technological frontier advances much more rapidly today and that the stock of knowledge of any organisation becomes obsolete quickly [29]. Flexible innovation incorporates many of the effective methods of previous stages, like project management techniques, business development groups and hence user involvement in innovation.

The changed competitive environment for companies has enhanced the importance of responsiveness and agility in the innovation process and hence innovation models. The research literature shows the importance of agility and responsiveness in innovation, but the concepts are used inconsistently. But the agility conceptually encompasses two major factors [1]:

1. responding to changes (anticipated and unexpected) in due time; and
2. exploiting and taking advantage of changes as opportunities.

What the two concepts state is that innovation today encompasses the ability to respond quickly and successfully to change, the ability of an organisation to thrive in a constantly changing and unpredictable business environment, the ability to efficiently change operating states in response to uncertain and changing demands placed upon it, and the ability to respond in a timely manner to the needs and wants of its customers [1].

The concept of open innovation

Researchers and practitioners concordantly recommend that, to reduce the risks of failure and target resource spending more precisely, companies must align their key

New Product Development (NPD) activities with actual and potential customer [19] [20] [21] [22] [23]. This integration of customers into the innovation process was discussed to a great extent in the 1980s but gained new recognition during the shift to a new innovation paradigm: open innovation [4]. An open innovation process also enhances the companies' ability to respond quickly to changes in both the environment and the customers' needs.

As stated, there has been a growing attention to the concept of 'open innovation', coined by Chesbrough both in academia as well as in practice [4]. Chesbrough meant that companies have started to look for other ways to increase the efficiency and effectiveness of their innovation processes [4]. For instance, through active search for new technologies and ideas outside of the firm, but also through cooperation with suppliers and competitors, in order to create customer value. Another important aspect of the open innovation process is that companies' further development of an idea, concept or technologies that do not fit the strategy of the company, can be out-licensing to other companies. Chesbrough emphasised that companies have to become aware of the importance of how to open up their innovation process [4]. Because, not all good ideas are developed within the own company, and not all ideas should necessarily be further developed within the own company's boundaries.

But the concept of open innovation does not signify an altogether new phenomenon [5]. Christensen et al. compared the concept to that of 'absorptive capacity' which address the particular competence that companies build in R&D, not only for managing internal innovation but also for being able to access and absorb external ideas, science and other kinds of knowledge inputs to innovation [5]. Von Hippel among others, has also addressed the 'openness' as the interactive, cross-disciplinary and inter-organisational nature of innovative learning [30]. Christensen et al. emphasises that what Chesbrough has developed is more a comprehensive and systematic study of the 'internal' corporate modes of managing such more externally oriented processes of innovation, from an introvert and proprietary to an extrovert and open paradigm [5].

But how common is it that organisations have an open mind concerning innovation today? Lichtenthaler shows in a study that many firms still pursue traditional closed approaches to innovation and that many firms seem to be reluctant to open up their innovation processes [31]. His study shows that firms that are diversified at the product level tend to externally leverage technologies more actively than focused firms. Another major finding in his

study is the insignificance of industry differences across the clusters. That is the openness of the innovation process is not mainly determined by industry characteristics. His study indicates a clear trend towards open innovation, which he states will probably continue or even intensify in the future.

As shown above, research indicates that there is a trend towards an open innovation. But in order to pursue a more open approach to innovation, it is essential to collaborate with customers and users. The next section will discuss customer interaction in innovation and review if there is any research attempt in measuring the effects on bringing customers and/or users in the innovation process.

Customer innovation — user involvement

In open innovation, customers and users are central actors. Several studies have shown that user involvement leads to innovative ideas [32] [33]. The most important and novel products and processes have been developed by users — both user firms and individual end-users. As an example, nearly all the most important innovations in oil refining were developed by user firms (oil refineries) [34]. Further, user involvement is useful for capturing latent needs of consumers that are so important to successful NPD. Kristensson et al. derived two interesting results from their study [32].

1. Customers generate ideas that are more original than the ones generated by the company.
2. Customers generally assess innovative ideas different from the company.

They also emphasised that user involvement in service innovation can contribute to the creativity in the service ideas produced. In respect of the development of new services then, managerial implication of this study suggests that business organisations, attempting to produce innovative and successful products, have a hidden resource in their customers.

Customer co-creation during innovation processes appears to have become increasingly popular in recent years; however, there is a paucity of research on the theory and practice of user involvement during both new product and service development [35]. Kristensson et al. point out that there is a lack of a firm theoretical foundation on which to base an understanding of the strategies (e.g. antecedents and critical processes) which are required for success during the co-creation of services [35]. They found that in terms of research on key strategies during co-creation, only

sparse accounts can be found. It is clearly envisaged that the customer should be active in generating the knowledge, thus participants will not be subject to guidance in the same way as during reactive market orientation.

Kristensson et al. presented some key strategies indicating that user involvement can facilitate the identification of latent needs because users identify their own needs as and when they occur and they enhance the originality and value of ideas for future products and services [35]. In sum, according to Kristensson et al., a user involvement project during NPD should consider the following key strategies [35]:

1. users identifying needs in their own setting of use;
2. users identifying needs in their various roles;
3. providing users with analytical tools;
4. motivating users via apparent benefit to be gained from their involvement;
5. non-reliance on brainstorming when generating ideas;
6. users not having too much knowledge of technology; and
7. the involvement of a heterogeneous group of users to ensure that a diversity of ideas is provided for future services.

The concept of lead users — and their impact on innovation

Measurement and effects of user involvement in innovation is a research field that is still unexplored. One research attempt is achieved by Lettl et al. who explored how lead users develop radical innovations outside of manufacturing firms [36]. Their cases showed that lead users provide a broader spectrum of knowledge and contributions than previously assumed in lead-user projects. Manufacturing firms can use this potential by developing new forms of interaction and integration. Lettl et al. stated that (i) firms can integrate lead users directly and more continuously into their internal R&D process [36]; and (ii) being aware that lead users might contribute to radical innovation projects more often, manufacturing firms should invest in the systematic screening of lead-user activities and in sponsoring the entrepreneurial activities of the lead users

who develop the most promising innovations. One of their initial implications for research is that more insights are required in order to gain an even better understanding of innovative lead users' problem-solving processes and their various roles from invention to commercialisation.

Franke et al. tested and confirmed the basic tenets of leader-user theory [37]. These authors also found that the three components: being ahead of the trend, having high-levels of need, and actual development of innovations, were significantly correlated throughout their sample. Their findings suggested that the variables that will be most effective for identifying commercially attractive user innovation will differ depending on study condition and goals. But the goal of identifying as many user-developed innovation as possible independent of commercial promise can be achieved by adding resource-related variables (technical expertise, community-based resources) with regard to users' technical expertise and availability of support from a user-community to the two lead-user components (high benefit expected, ahead of trend). But, user innovation communities are not a new phenomenon. They existed long before the advent of open-source software and have extended far beyond it [30]. But it is a changeable phenomenon in new contexts. Innovation communities composed of users and for users, communities that according to traditional economic views should not exist, work well enough to create and sustain complex innovations without any manufacturer involvement.

When is it worth engaging lead users in innovation? Lilien et al. compiled a review of marketing literature on techniques and tools used to generate ideas for new products and services makes [38]. They found two major points of difference between methods traditionally used and the lead-user idea-generation method: the kind of respondents from whom information is collected and the type of information that is collected. Ideas from lead users were significantly more novel than ideas generated by non-lead user methods.

Putting value on openness

Companies are always on the search for tools and methods that can assist them in calculating the value of having an open innovation process and involving user in the innovation. Open initiatives may allow for the creation of whole new complementary links in a value chain [39]. Can there be such thing as too much openness? Open initiatives must confront real and serious challenges to their ability to sustain themselves over time. While

building broad communities of motivated individuals can set free creative contribution, these are difficult to sustain over time [39].



Firms that choose to open up their innovation process to include outside actors, despite giving away much of their intellectual property, are valued positively by the market if they choose an appropriate business model for this strategy [41].



Users have proven to be a principal driving force of many innovations in different industries [40]. Raasch et al. examined user innovation over time and contributed to the extension of the existing model of user-driven innovation to a more dynamic setting [40]. They found that the level of user activity does not follow a unidirectional trend, but rather develops depending on a number of contextual factors. This suggests that, given a stimulating setting, user innovation can be sustained over long periods of time. They propose that the activity level of user innovators at any point in time is affected simultaneously by five factors; technology complexity, technology maturity, market concentration, customer satisfaction, innovation barriers. These factors may jointly produce the cyclical pattern of innovative activity and progress.

Another researcher examined the effects of opening up the innovation process on the market value of firms [41]. The author found that market value is strongly influenced by what the business model firms choose for their open innovation efforts. The findings show that value may well be created by firms deciding to open their knowledge in the form of open-source software (OSS) — under the condition that they have a valuable business model for this. Alexy stated that firms announcing open innovation initiatives including a clearly communicated revenue model [41]. The findings also contributed to the research on business models in general as they highlight that the capital market is able to distinguish between differences in the choice of business model and the consequences on value appropriation by the firm.

Innovation and business models

Open innovation is considered to be the third stage in evolving systems for innovation management [42]. As stated above, management of innovation is, in essence, the process of bringing monetary value to technological knowledge and creativity, and as shown, a particular model of doing so has been popularised: open innovation. The essence of open innovation lies in several key elements. One is the notion that it takes a lot of effort to

bring monetary value to technological knowledge, because the knowledge itself has little value in itself. A second is that innovation seems to pay better as a company's own knowledge is combined with that of others.

The purpose to open up the innovation process and utilising users in the innovation process will require other means to do business, which will require new business models. Chesbrough emphasises that when building a new business model, companies must figure out what to do with their existing model [43]. Developing a new business model can inadvertently suggest that the current one is somehow obsolete. Managing the coexistence of a new business model alongside an existing one can be difficult.

User-centric innovation

Corporate innovation management geared to long-term success calls for a strategy to grow innovations into a substantial competitive advantage [44]. This, however, coincides with an enormous failure rate at the market, especially in the field of breakthrough innovations. Companies are trying to alleviate the lack of user-acceptance through opening their innovation processes to external actors, particular customers [44]. Such customer-centric innovation not only harness the voice-of-the-customer but also take the further step beyond the traditional market research by integrating users as problem solvers in various phases of the individual innovation process.

Bilgram et al. point out that the development of user-centric innovation has constantly gained momentum and experienced a tremendous boost in interest, in the wake of the widespread use of the Internet [44]. They used different approaches to integrate users in various stages of the value chain, for instance, toolkits for user innovation, community-based innovation. In contrast to the customer-specific configuration in later phases of the NPD, i.e. mass customisation using toolkits, the lead-user method does not limit the solution space within which users can generate ideas and is designed to integrate users in a face-to-face workshop rather than in an online setting. The non-representative nature is characteristic of the lead-user method that explicitly tries to explore the leading-edge customer's solutions to problems. Whereas traditional customer-oriented approaches concentrate on eliciting customers' representative needs in order to tailor their products to them, the lead-user method aims at users with exceptional qualities.

Another concept implying co-innovation is participatory innovation. An increasing number of corporations engage with co-innovation of products and services. But there are a number of competing perspectives on how best to integrate these understandings into the existing corporate innovation development process [45]. The essential value of user participation in corporate innovation processes is now widely appreciated. User-driven innovation has come of age, at least in academic and research circles. Yet, Buur and Matthews found that industry has been slow to adopt user-centred approaches to product development and innovation [45]. Many well-established development processes in companies retain a traditional structure that inhibits the adoption of user-centred methods of innovation. This is in part because such adoption would necessitate a significant re-prioritisation of how enterprises organise and distribute their resources, particularly with respect to market research.

To make user-driven innovation work as a practicable option for businesses, it is essential to understand not only the contribution that users can make to innovation and how this contribution can best be harnessed, but also to understand the potentials and the constraints that exist within the business organisation and how realistic these approaches may be to implement [45].

Open source

An example of user-centric innovation is open-source initiated by an individual or group of users to satisfy their specific needs. According to the definition provided by the Open Source Initiative [46], open-source software (OSS) allows users to have access to the source code of the software, the freedom to use the software as they see fit, modify the software to create derived works, and redistribute the derivative software free of charge. The users of the derivative software could themselves modify and/or use the software according to their own needs. The open-source approach is considered more efficient than traditional software development because OSS avoids the inefficiencies of a strong intellectual property regime and it implements concurrent design and testing of software modules [47] (Subramaniam et al., 2009).

Subramaniam et al. discussed determinants of open-source software project success. Success in OSS projects is better understood by examining the development environment which is more publicly visible [47]. Researchers have proposed measures such as project activity levels, release of new features, and the time taken to fix software bugs. Since OSS projects rely on voluntary input, the ability of

a project to attract the interest of and contribution from the developers is a key success measure. Increasingly more non-developer users are relying on open-source software for personal and business needs, and the interest shown by these users for open-source software may be an important indicator of the project's success. The interest can be measured by the traffic on the OSS project website and the extent of downloads of the software code.

The study of Subramaniam et al. confirmed the importance of both time-invariant and time-dependent characteristics of an OSS project for its success [47]. They found that the three success measures — develop interest, user interest, and project activity — traditionally used in OSS literature are interrelated. In particular, the interest levels of OSS participants and the project activity in any given time period affect the project success measures in the subsequent time period.

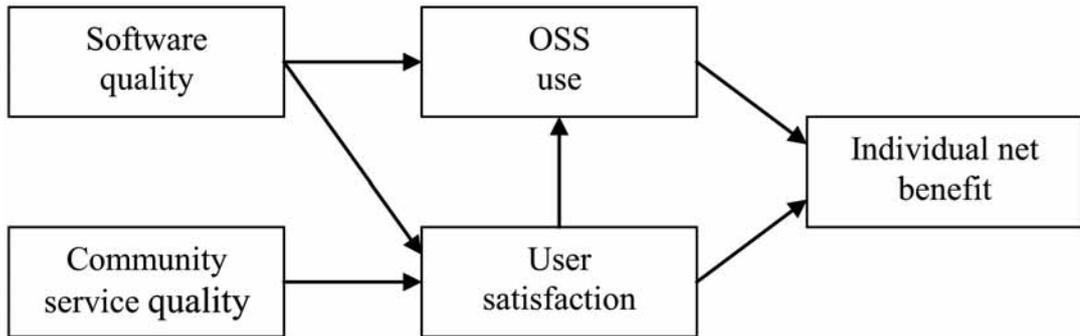
Research on OSS shows different measures to define success of open-source projects. The contributions can be classified into three categories: (i) software use; (ii) size of community and/or its level of activity; and (iii) technical achievements on the project [48]. Some measurements found in a review by Comino et al. deal with output per contributor, number of subscribers associated with a project and network embeddedness (modularities) [48].

Measuring open-source

How exactly are companies measuring innovation? Pentilla described the three most popular metrics [49]: (i) customer satisfaction; (ii) percentages of sales from new products and services; and (iii) overall revenue growth. The problem is that these three metrics may not give the whole picture. Pentilla meant that company leaders are searching for one innovation measurement that will give them the whole picture [49]. Measuring decision-making speed, how much time employees spend on innovation and the time it takes to reach project checkpoints can be easy ways for small firms to see how they are doing [49]. Trying too hard to measure everything, however, gets in the way of innovation.

Still, little is known about how to enhance the success rate of OSS. However, Lee et al. presented one of the first empirical studies to measure OSS success by developing an OSS success model with following determinants [50]: software quality, community service quality (service quality), user satisfaction, OSS use, and individual benefit (Figure 1).

Figure 1. OSS success model [50]



Conclusions

This chapter aims at giving an overview of the field of open innovation and if there exists any research efforts concerning effects of collaboration with customers and/or users in innovation. More specifically, what effects do user involvement brings in a company’s innovation process?

The review shows that there is a growing interest of open innovation and collaboration with customers and users in innovation. However, the review also indicates that there is a lack of research concerning measurement of user involvement in innovation. There is an extensive research that indicates the importance to integrate customers and/or users in the innovation process.

The stated effects of user involvement follow.

1. User involvement leads to innovative ideas [32] [33].
2. Customers generate ideas that are more original than the ones generated by the company [32].

3. Customers generally assess innovative ideas differently from the company [32].
4. An industrial software product concept developed by lead users had greater marketplace appeal than did concepts developed by conventional marketing research methods [7].
5. Ideas from lead users were significantly more novel than ideas generated by non-lead user methods [38].

Raasch et al. examined user innovation over time and contributed to the extension of the existing model of user-driven innovation to a more dynamic setting [40]. They found that the level of user activity does not follow a unidirectional trend, but rather develops depending on a number of contextual factors. Buur and Matthews emphasise that it is essential to understand not only the contribution that users can make to innovation and how this contribution can best be harnessed, but also the potentials and the constraints that exist within the business organisation and how realistic these approaches may be to implement [45].

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Contact

Dr Diana Chronéer

Administration, Technology

and Social Sciences

Luleå University of Technology

Sweden

diana.chroneer@ltu.se

2.5 Identifying, controlling, measuring, and reporting innovative competence

Abstract

Knowledge Society and *Innovative Competence* are popular terms these days, which are used in a broad variety of situations. This paper starts with an explanation from a historical point of view as to how the term *Knowledge Society* came about. Important issues to understanding *Innovative Competence* are the aspects of organisational immaterial assets. They are — here is the consensus — the key drivers for the organisation's problem solving capability and as a causal, for its innovative competence. A detailed review of the *Intellectual Capital* (IC) and the organisational IC management characteristics completes the 'Teaching-Part' of this paper. The paper's 'News-Part' starts with a review of the two currently most popular tools, which are used to work with organisational immaterial assets: the *Balanced Scorecard* and the *Intangibles Reports*. Since both of them show specific limitations, a new approach is introduced: The *Intellectual Capital Management System* (ICMS) allows auditing knowledge-based organisations in a standard approach, regardless of their size, sector and purpose. The ICMS overcomes the mentioned limitation by delivering harmonised reports. Depending on the nature of the individual organisation's knowledge initiatives, the ICMS can be linked to established tools such as the *Knowledge Matrix* (to monitor project workflows) and/or the *Balanced Scorecard* (to control and measure the project status). The resulting modular tool offers support to all aspects of knowledge work, which are in a context to the management of the organisational *Innovative Competence*: Identifying, controlling, measuring and communicating intangible assets can be performed independently or combined according to the organisations preferences.

Fundamentals of the knowledge society

Introduction [1]

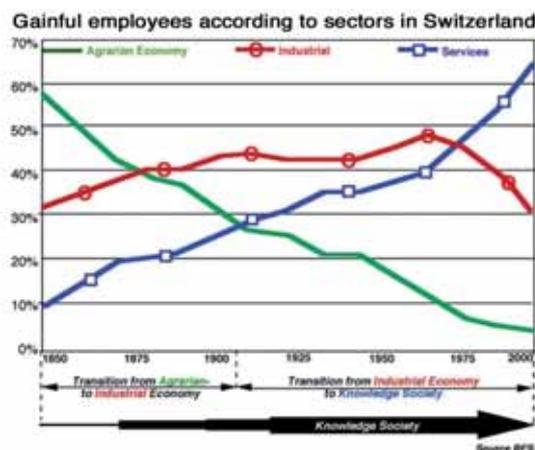
When economic leaders, education experts or politicians discuss the actual challenges of political economics in these days, they use *Knowledge Society* in their standard vocabulary. What is the definition of this term? Does it stand for the sustainable, irreversible and radical change, provoked by the global economics? And which impacts are there having the knowledge towards an encouraging innovation?

Whatever the answers to the above questions will be, the practice shows that this structural change influences the operations of knowledge-based organisations. The problem-solving and innovation competences are increasingly defined more by organisational reproduction logic and less by individual skills. Thus, a *Meta Competence* is required, that allows to extend, distribute, preserve, use and evaluate the existing organisational knowledge and to reflect those processes.

From the agrarian economy to the knowledge society [2]

In the 19th and 20th centuries, changes in the working sectors was a major supposition for the sustainable economic growth. Occupational activities have undergone a complete change since 1850: the dominating position of the agrarian economy and forestry shrunk from 60 % to less than 5 % in 2000 (Graph 1). The industrial sector overtook the agrarian economy in the early 1880s, the service sector at the beginning of the next century. Since then, services have grown faster than both the industrial and agrarian sectors. In 1970, the industrial and service sector had approximately the same number of employees, while today about two out of three receive their income from the third sector.

Graph 1. Switzerland's development history is representative of occupational activities in Western countries



As a conclusion, we observe a transition from an agrarian economy towards industry in the late 19th century, while the industrial society was replaced by a service society in the late

20th century. At that time, the new term *Knowledge Society* was born: organisational knowledge (= *Intellectual Capital* or *Intangibles*) increasingly receives recognition as the key factor for innovation competence and thus as being the most important driver for a sustainable successful economic future.

Information management versus knowledge management [3]

Information can be codified and converted in a systematic language, where IT offers efficient tools: they allow, with sophisticated search machines, access to all released information within a local or decentralised organisation, project teams can act virtually and the workflow can be monitored constantly, data can be navigated and combined at necessity. On the one hand, those are suitable and efficient tools providing the undisputed advantage of high communication speed. On the other hand, IT tools are a source of confusion: they identify, document and transfer *information*, but some individuals call those activities *knowledge* management!

A qualitative difference between information and knowledge is the fact that information is punctual, while knowledge presupposes the understanding of coherence. Knowledge creation requires embedded contexts. Even for that IT offers solutions: expert systems and other artificial intelligence technologies demonstrate amazing results, but they work for specific tasks only and are not (yet) available for polyvalent applications.

The goals to raise, renew or justify actual knowledge require human capital, since only humans own the ability

to develop information up to expertise. This development depends on human perception and skills: *Remember > Recognise > Understand > Combine > Conclude* are human activities of knowledge creation and thus, rather work than ‘managing’: it is individual and organisational working with the *Intellectual Capital*, which adds up to the total of the organisational explicit and tacit knowledge.

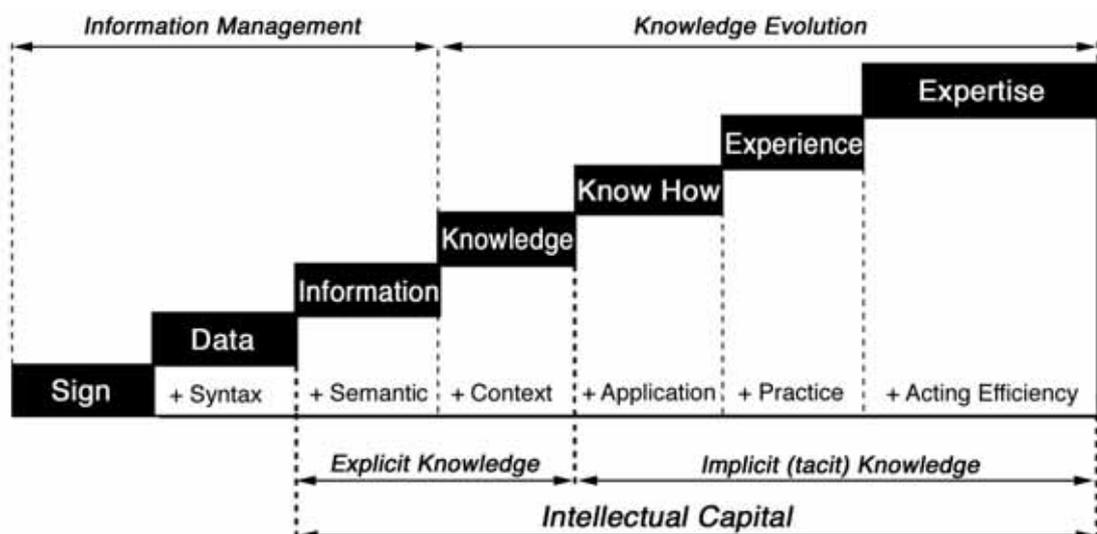
A superior goal of knowledge work is the consolidation and further development of the organisational core competencies, which are mostly based on the staff’s experience and expertise. Consolidation means in this context to retain identified knowledge hosts and to steer the transfer of their tacit knowledge by using innovative organisational process models. Knowledge creation presupposes a ‘high-trust culture’, allowing freedom to act and offer adequate incentives for knowledge sharing.

Conclusion: *Information Management* is a mandatory tool, that allows data to be converted in to information and to store, distribute and re-find information contents, while *Knowledge Management* is strictly human-driven.

Intellectual Capital (IC)

Intellectual Capital is often described as being the difference between the market and the booking value of an enterprise. This formula is somehow questionable, since an organisation showing a market value below booking value, certainly does not have a ‘negative Intellectual Capital’. A better definition might be ‘IC = expected future economic

Graph 2. Uncovering the assumed IT dependence for knowledge creation



“Knowledge has its place between two ears and not between two modems”, quotation by Fredmund Malik

success'. It is undisputed that the Intellectual Capital represents the most important asset of a knowledge-based organisation. Intellectual Capital must be converted into knowledge resources to formulate an Intellectual Capital statement. The most common classifications or types of knowledge resources are technologies, processes, stakeholders and (of course) employees. The three components of IC are interactive: the *Human Capital* raises the *Structural Capital*; both together create the *Relational Capital* (Graph 3). The pure presence of resources is not sufficient to create value: for example, there is no correlation between the number of graduates in an organisation and its innovative competence.

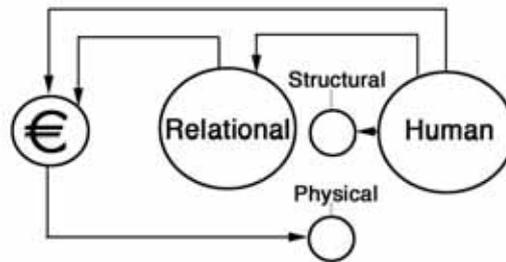
Navigator models revealing value-creating resources [4]

The impact of IC transformations on value creation can be assessed and visualised through the Intellectual Capital approach with a 'Navigator', a model revealing all the value creating resources (tangible and intangible), their transformations and the relative importance of the resources and transformations for value creation. The claim for a standardised IC evaluation as required by financial markets, can be partly fulfilled by reducing the large number of different organisational structures down to two navigator models, which are valid for services (model X) and industry (model Y).

Model X: Human-Centric Navigator [5]

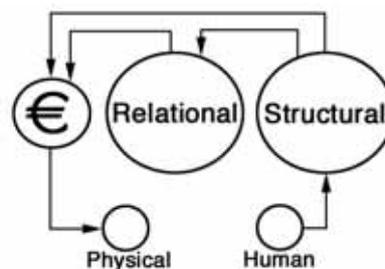
The X navigator shows an organisation that relies heavily on its human and relational resources. It does need some monetary resources, but hardly any physical or structural resources. This is an organisation focused around very knowledgeable and competent individuals who use these

Graph 4. Human-Centric Navigator

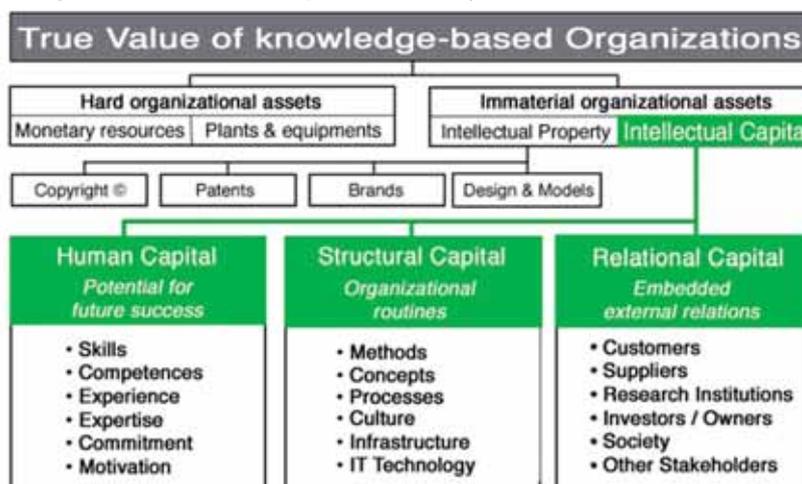


attributes to form personal relationships with their clients and to deliver value. The organisation survives and thrives thanks to low fixed costs and high billing rates and margin. Typical examples are consulting services and providers of individual products (e.g. software). Some of the money that is earned is used to sustain the relationships with clients and some to maintain and develop the competence of the individual. The quality of the products or services delivered may vary according to who is doing the job.

Graph 5. Structural-Centric Navigator



Graph 3. Classical diagram of the Intellectual Capital as commonly used in literature



Model Y: Structural-Centric Navigator [5]

This Y organisation places much more emphasis on its structural resources and is less dependent on bright individuals. This does not mean that people are not important, but their relative importance is lower. The best people are used to develop processes which are ‘activated’ by less skilled employees. There is more codification and there are more rules; the company may have higher fixed costs and lower margins than a people-centric company. Typical here are all kinds of manufacturing, the chemical industry and public services. Product quality is more standardised and therefore a more system-focused approach is evident.

The relative importance of the three IC categories shall be considered. Value creating patents and strong brands, for example, may play a major role in model Y, but have almost no significance for model X organisations. In the human capital of model Y, the identification or retention of the knowledge hosts and the externalisation of their tacit knowledge are a matter of survival. In model X, the knowledge hosts are known per se, while efficient stakeholder communication and collective knowledge development belong to the most important resource transactions. Depending on the type of organisation, different IC aspects dominate. Thus, a generally accepted IC evaluation, as required by the financial markets, cannot be fulfilled or, at best, partly fulfilled.

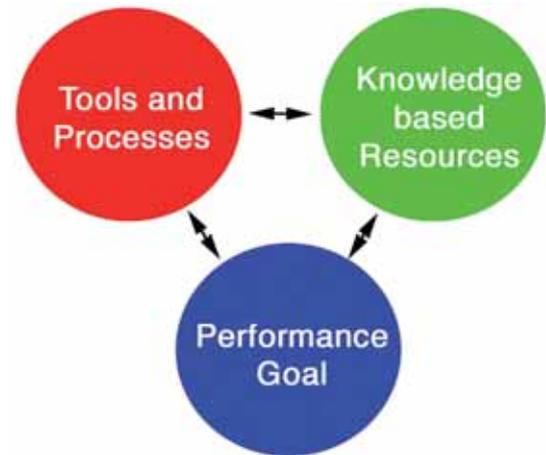
In addition, many organisations refuse to disclose their IC data. They declare it as strategic and secret information, which is reserved for the internal IC management. IC data demonstrate how resource processes contribute to competitive advantage. IC-oriented organisations show (somewhat legitimately) reservations, since the newly realised advantages might be negated by full IC transparency.

Aspects of knowledge-based organisations

Today, more products contain ‘built-in-intelligence’. That means such products are developed, sold and distributed in knowledge-intensive processes. To produce such non-trivial goods, the enterprises transform to knowledge-based organisations. In addition, a meta-competence is required that allows the further development of the existing knowledge. To optimise those processes, the organisations rely on systematic knowledge work. The processes are defined in a manner that collects and systemises the knowledge and know-how of all involved parties. Finally, an adequate development of the human resources assures that the organisations can systematically access all their knowledge potentials to reach the performance goals.

Graph 6 shows the dominating aspects, which characterise knowledge-based organisations. On the one hand, implemented standard processes and tools are the primary

Graph 6. Aspects of knowledge-based Organisations



presupposition for efficient organisational operations. On the other hand, an efficient and sustainable management of the knowledge-based resources optimises the problem-solving capability and thus, the innovative competence. Those aspects interfere reciprocal, what can be monitored and steered by using specific tools.

Graph 7. Action fields knowledge work



Graph 7 shows the coherencies between the performance goal, the available knowledge-based resources and the implemented tools and processes. The overlapping segments represent the action fields of the knowledge work. They can be described as follows:

- Internal process > Where do we need to improve to reach our market goals?
- Innovation > Where do we need to improve our change and growth potentials?

It is worth mentioning that the white area (social-technical competence), is the place where the main part of knowledge work is evident. Depending on the character of a knowledge-based organisation, the other overlapping segments contribute to knowledge work at different intensities. Even the yellow segment should receive adequate attention: in the fast moving knowledge society it is worth being prepared for new challenges, full transparency about all available knowledge resources may avoid huge time losses, if new knowledge is instantly needed.

All knowledge-based organisations are faced with the challenge of maintaining their immaterial assets in a systematic manner to ensure that the relevant knowledge is identified, preserved, accessible and distributable and new knowledge can be acquired and/or developed.

Actual IC-Management Standards

Balanced Scorecard (BSC)

The value of intangibles can be several times those of physical capital (monetary resources). In addition, the sustainable treatment of this Intellectual Capital (IC) has become the acknowledged key driver for innovation efficiency and thus, for the long-term survival.

Several tools have been developed to control and measure the knowledge initiatives, whereas the Balanced Scorecard (BSC) has become the widest acceptance. The BSC covers the demand to use perspective parameters instead of relying on past financial reports when an organisation has to be evaluated. It is a steering and controlling system combining strategic and operative planning. It allows an organisation to be judged from the view of the most important perspectives. Strategic and operative goals and their derivative key performance indicators (KPIs) describe these perspectives. Norton and Kaplan define four original BSC four perspectives:

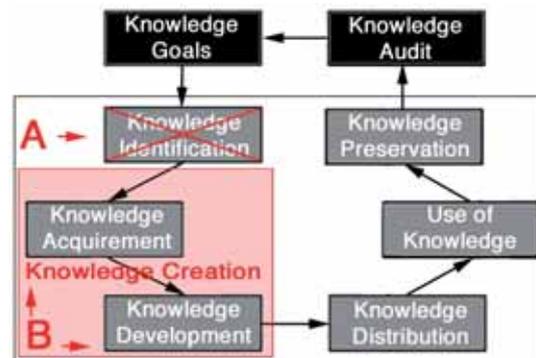
- Financial perspective > Behaviour to stakeholders to aim future financial success?
- Customer perspective > Behaviour to customers to realise our visions?

To adapt the BSC for specific inquiries, the original four perspectives can be changed and extended according to the defined subject. The flexible architecture makes the BSC to an attractive and versatile tool.

Architecture of a Balanced Scorecard for IC Management [*3]

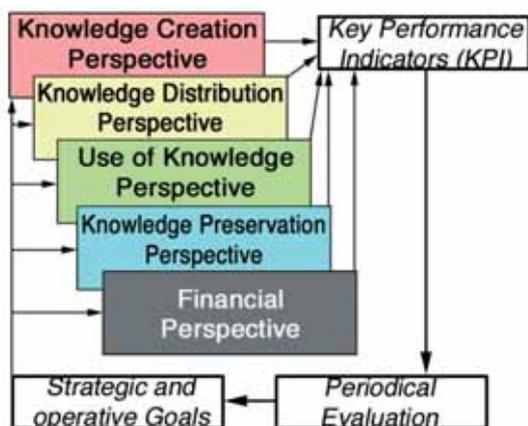
Using the BSC for knowledge management applications requires an adaptation of the perspectives (Graph 8).

Graph 8. Modified knowledge management model



Knowledge perspectives are defined according to the knowledge management model introduced by Probst et al. [*6]. This model puts six operative core processes into a coordinating frame. On the strategic level this model includes two additional processes: *Knowledge Goals* and *Knowledge Audit*, essential for the BSC application. Strategic goals are the basis for each knowledge perspective. Auditing knowledge is (besides steering) the main reason for the BSC invention. The strategic goals of knowledge work need to be defined for each perspective individually. Each organisation has to define its own knowledge strategies, which are products of the superior economic goals. The core process *Knowledge Identification* (A) is not foreseen to act as a perspective, since knowledge transparency is expected as to be at hand in a BSC-based management process. The core processes *Knowledge Acquisition* and *Knowledge Development* are linked resulting in the *Knowledge Creation* perspective (B). Since all knowledge work activities will impact the success, a financial perspective is added to the knowledge perspectives. Thus, the BSC for knowledge work consists of five perspectives (Graph 9).

Graph 9. BSC for Knowledge Management



The four remaining knowledge perspectives are described hereafter.

- *Knowledge Creation Perspective*
 Knowledge Creation is focused on Knowledge Acquisition and Knowledge Development. This perspective aims at the set up and/or expansion of the organisational knowledge base. Strategies of this perspective deal with the acquirement of external knowledge and the development of the organisational knowledge. Goals of knowledge creation could be the extension of R&D, research cooperations and lesson-learned programmes. Optimising the structure of organisational learning (Think Tanks, Learning Arenas) belongs to this perspective too.
- *Knowledge Distribution Perspective*
 This perspective deals with the optimal knowledge distribution and the procedures assuring the distribution. Besides adequate tools like Intranet and/or GroupWare, transfer of best practices, incentive systems and the individual's skills management belong to this perspective.
- *Use of Knowledge Perspective*
 This perspective deals with a productive use of organisational knowledge. Strategies of this perspective focus on access to expert knowledge by using knowledge maps, yellow pages or expert directories. In addition methods and processes will be developed which support the use of new knowledge. Tools such as incentive programmes or an optimised infrastructure allow an exchange of ideas and experiences.
- *Knowledge Preservation Perspective*
 Knowledge Preservation means durable memorisation of the relevant knowledge. Goals in this perspective are electronic data acquisition, the indication and categorisation-

tion of available knowledge as well as the separation of obsolete knowledge. Knowledge preservation is especially laborious when dealing with tacit knowledge, which is a human property. In this context, knowledge preservation requires to isolate tacit expertise from individuals, as long as they are available.

Definition of knowledge goals: determining strategies

The deciding step to run a BSC application is the serious determination of knowledge goals. This gives a direction to the learning processes and makes it possible to measure success and/or failure of knowledge work. Knowledge goals are deviated from the overall organisational goals and cannot be evaluated for themselves: rather they are a deliberate supplement to the common planning activities. Thus, the organisational strategic goals lead to normative, strategic and operative knowledge goals, where the strategic and operative knowledge goals are essential for the BSC.

Indicators of the knowledge perspectives

The knowledge goals serve to define key performance indicators (KPIs). KPIs include metric sizes, measuring intervals, owners, sources of data, etc. In the phase of goal setting, the focus is typically concentrated on a single KPI and therefore isolated from the entire coherence. This requires, that after completing a single KPI's definition, the dependencies of all KPIs need to be evaluated: causes and effects, interferences, etc., are subjects to be investigated.

Balanced Scorecard for knowledge initiatives: Quo vadis?

The BSC derivate for KM is an excellent tool to steer, control and measure knowledge initiatives. Since its use is extremely specific for the applying organisation, it is — and will remain to be — an internal instrument that cannot be used for other purposes such as intangibles reports and other stakeholder communications.

Intangibles reports [6]

For about 15 years, embedded relational stakeholder groups have asked increasingly for information about the set-up of the Intellectual Capital (divided into human, structural and relational resources) and about the initiatives to maintain the IC in a sustainable manner. For scientific organisations, the subject of interest is the ratio between public investments and the resulting research performances, while for profit-oriented organisations, the insight in the development of future-securing initiatives and consequently, the innovative ability is the subject of interest.

These requirements are answered by *Intangibles Reports*. On the one hand, they show the relations between organisational goals, processes, the Intellectual Capital and the success of knowledge-based organisations. On the other hand, *Intangibles Reports* generate, in addition, key figures for strategic decisions. These indicators often include sensitive information. Thus, they are mainly reserved for internal use.

The target groups of *Intangibles Reports* can be separated in to internal and external groups. Internally, this covers mainly the strategic management, while the *Intangibles Reports* for external communications aim toward carriers of scientific institutions, owners and investors, potential employees, suppliers, customers and partners.

The pioneer of *Intangibles Reports* was the Swedish financial firm Skandia. In 1995, this company started to add, to its conventional annual reports, an *Intangibles Report*, which became famous with the name *Skandia Navigator*. In Germany, the ministry of economy and labour (BMWA) launched an initiative to promote *Intangibles Reports* as a strategic tool to acquire, measure and present immaterial assets for German middle-class organisations. In Austria, a new law obliges all universities to publish annual *Intangibles Reports*. Even national and international accounting standards (IAS 38, DRS 12, IFRS, Basle II) recommend annexing immaterial assets to conventional annual reports.

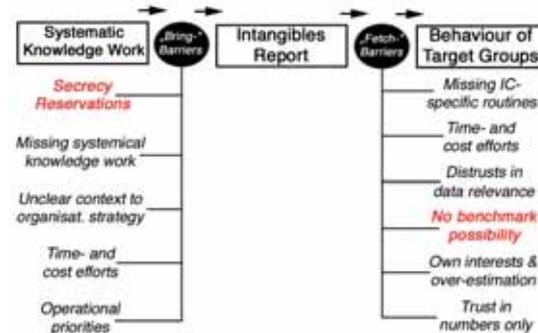
Nevertheless, the Intangibles Report is actually no more than a good intention

Between its indisputable potential and its effective impact, there is a significant gap! The reason for this is a missing standardisation that allows benchmark capability. Even the question ‘Which qualitative criteria contain substantial information?’, cannot be answered in general due to the different knowledge processes: each organisation has to define for itself what their equitable knowledge resources are, which should be developed and maintained in a sustainable manner. Therefore, interpreting non-standardised *Intangibles Reports* requires a deep understanding of the management of the immaterial assets and this is extremely time-consuming.

Typical barriers in intangibles report projects [7] [8]

Considering the reporting organisation as being a supplier of information and the target groups as being information receiver, we can observe typical barriers on both sides (Graph 10). They even show reciprocal influence.

Graph 10. Typical Barriers in Intangibles Report Projects



Bring-Barriers: On the ‘bring-side’ the four barriers from bottom up are typical for a poor or non-existing knowledge-based organisational culture, while *Secrecy Reservations* is a true barrier: many organisations refuse to disclose their IC data. They declare it as strategic and secret information, which is reserved for the internal IC management. IC data demonstrates how resource processes contribute to competitive advantage. IC-oriented organisations show (somewhat legitimately) reservations, since the newly realised advantages might be negated by full IC transparency.

Fetch-Barriers: On the ‘fetch-side’ all barriers (except the missing benchmark capability) are influenced by the *Not-Invented-Here-Syndrome* and could be resolved, if the receiver acknowledges the value of systematic knowledge work and acts accordingly. *No benchmark capability* is not a true barrier, either, since depending on the type of organisational knowledge work, different IC aspects dominate. Thus, a generally accepted IC evaluation, as required by the financial markets, cannot be fulfilled or, at best, can only be partly fulfilled: the impossibility of comparing IC data in a standardised and benchmarked manner requires an alternative IC evaluation.

Intangibles reports: Quo vadis?

The breakthrough of *Intangibles Reports* depends on the elimination of the listed barriers. The presupposition to reach this is the acceptance of the knowledge society’s challenges. First of all, a knowledge-based culture is mandatory. Here, the top management is obliged to translate normative knowledge goals into action. The acceptance of external target groups (especially investors) depends mainly on the comparability of the report’s contents. Thus, the architecture of an *Intangibles Report* needs to be the same for each type of reporting organisation, regardless of

their scientific, profit- or non-profit goals. Accurate external benchmarking (Systematic comparison of one's own abilities with the competition's performance) fails due to the variety of organisational structures, with their corresponding variety of knowledge work and their refusal to publish sensitive IC data.

Therefore, a measurement and communication tool is required, which enables a high degree of standardisation and maintains the necessary privacy. New thinking is needed and new processes must be adopted to define standardised IC measurements and its communication.

Thinking differently: the Intellectual Capital Management System [7]

Learning from history

Like others, the author of this paper also believed, some time ago, that an overall valid indicator metrics might be possible for Intangibles Reports. After a classical lesson learned, he finally found an alternative, but practicable solution.

In the early 1990s, a group of leading quality managers, representing multinational firms, tried to figure out how product quality could be measured and benchmarked. After days of discussions they realised that this was a non-realistic goal. The conclusion was that a meaningful standardised indicator metric catalogue for product quality couldn't be raised, not even for comparable organisations. On the one hand, the reporting organisations might lose competitive advantages by disclosing sensitive data; on the other hand it is obvious, that a necessary and sufficient product quality cannot be standardised for the wide range of products and services.

The quality managers were looking for an alternative solution and they found a different approach: not the resulting product quality (WHAT is the output), but the way to get quality (HOW it's done) should be evaluated. In other words, quality assurance is measured by assessing the instruments, processes and procedures implemented

to reach quality. This was the birth of the now established ISO 9000.

Architecture of the Intellectual Capital Management System (ICMS-15649)

What works for quality assurance, should be fine for intellectual capital management too. The impossibility of comparing IC data in a standardised and benchmarked manner requires an alternative IC evaluation. An *Intellectual Capital Management System* (ICMS-15649) covering all components of the Intellectual Capital. The ICMS evaluates processes and tools according to a defined framework that includes all components of Intellectual Capital (Graph 11).

The IC audit comprises human, instrumental and organisational aspects, described in 58 concrete requirements. Counter to ISO 9000, ICMS-15649 uses a different reporting form: instead of a 'digital judgement' (requirement fulfilled YES/NO?), the ICMS looks at how well the requirements are fulfilled. A taxonomy, that uses 'best possible fulfilment' as a reference, allows for harmonised comparisons of knowledge-based organisations, regardless of their sizes and the sectors. The idea behind the ICMS approach is to offer objective comparisons, how well the audited organisations are prepared for the challenges offered by the knowledge society. The reporting forms don't show the outcome of knowledge initiatives; they reflect the 'organisational fitness' for problem-solving, innovative ability — and as a causal — for economic survival.

Framework of IC Management, evaluated by ICMS-15649

For the three IC categories and IC management, a total of 58 requirements are derived from the organisational knowledge work. In general, each reporting organisation is asked to respond to all requirements, since every knowledge-based organisation already does something in each of the IC components, even when this doesn't figure under the knowledge management label. However, it is conceivable that specific requirements have no relevance in fact. In such a case, the reporting organisation is asked to conclusively show and explain the non-relevance. This proceeding has the added value that it becomes visible indicating which knowledge-based initiatives are subjects to be optimised and/or need to be managed in a more systematic approach.

IC audit procedure

The organisation to be audited receives guidance, containing all 58 requirements, five days before the audit date. Where specific terms might lead to misunderstandings, the requirements are discussed by presenting a range of possible answers.

As a countermove, the auditor receives a company profile containing the performance goal(s), an organisational chart and documented operation procedures. Facts about the headcount and the staff age distribution complete the necessary information for the auditor’s preparation. The presence of a member of staff familiar with the organisational operations is required for the 4–6 hours of the audit. Where necessary, specialised staff (HRM, IT, organisational development) are involved too.

The quality claim of the audit requires, that the statements — wherever possible — can be verified by sight of the appropriate documentation. Generally, the audited organisation is obliged to respond to all of the 58 require-

ments. Of course, it is possible that specific requirements do not show any relevance for the audited organisation: in such cases, the organisation is asked to give valid reasons. For example, it makes sense that in an IT company with an age distribution of 21–42 years, a possible knowledge loss due to the demographic facts (babyboomers effect) has no relevance.

After the audit (Graph 13), the auditor raises a detailed report within 72 hours. This report describes the status quo, where the organisation is with its maintenance of the so-called most important resource stands. Disclosed weak points, standing in opposition to the performance goals, are discussed in detail. The report is supplemented by a summary, showing the audit key information on one single page.

At the handover of the report, the audit results are presented on-site. Disclosed weak points are discussed and proposals for their remedy are presented. It is then the management’s decision whether remedial actions will be taken or not.

Graph 11. Architecture of ICMS-15649

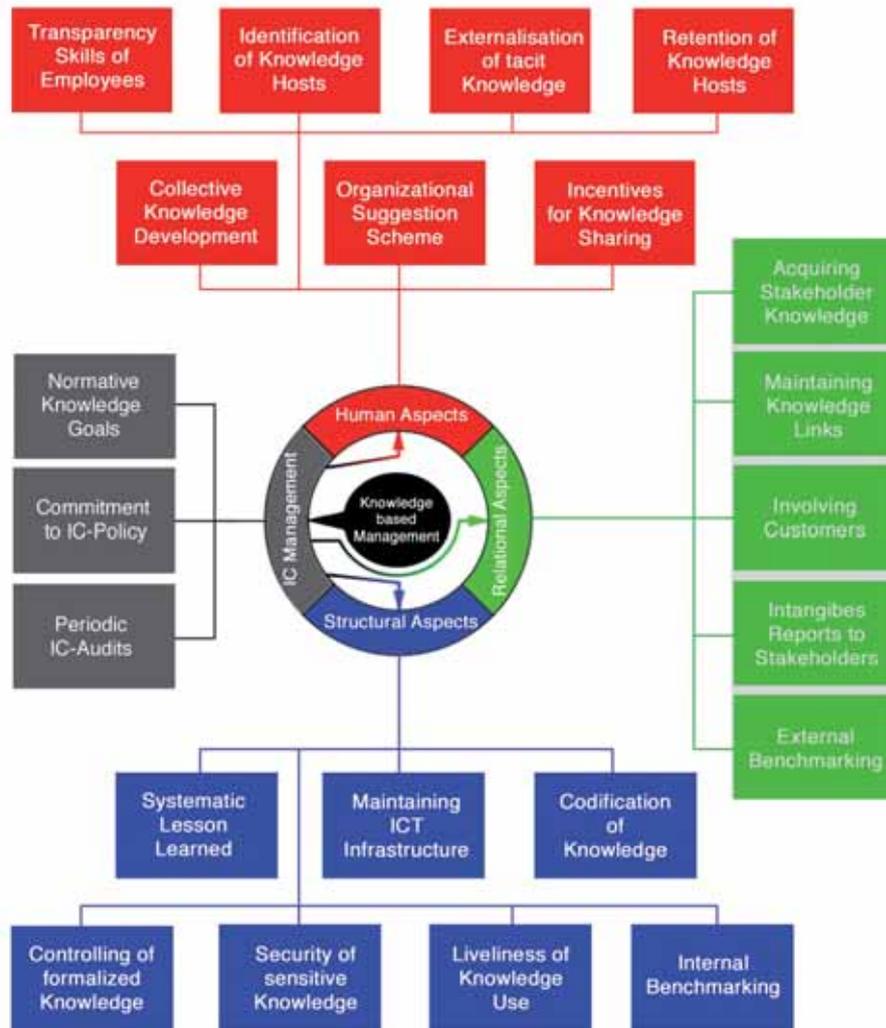
IC-Management: Formulation of normative knowledge goals, declaration of a knowledge policy and performing IC-Audits		
<p>Human Capital Evaluation of implemented tools and processes for the sustainable treatment of human resources:</p> <ul style="list-style-type: none"> • Skills • Competencies • Experience • Expertise • Commitment • Motivation 	<p>Structural Capital Evaluation of implemented tools and processes for the sustainable treatment of structural resources:</p> <ul style="list-style-type: none"> • Methods • Concepts • Processes • Culture • Infrastructure • Info-Technology 	<p>Relational Capital Evaluation of implemented tools and processes for the sustainable treatment of relational resources:</p> <ul style="list-style-type: none"> • Customers • Suppliers • Research Institutions • Investors • Society • Other Stakeholder

Final report and taxonomy [9]

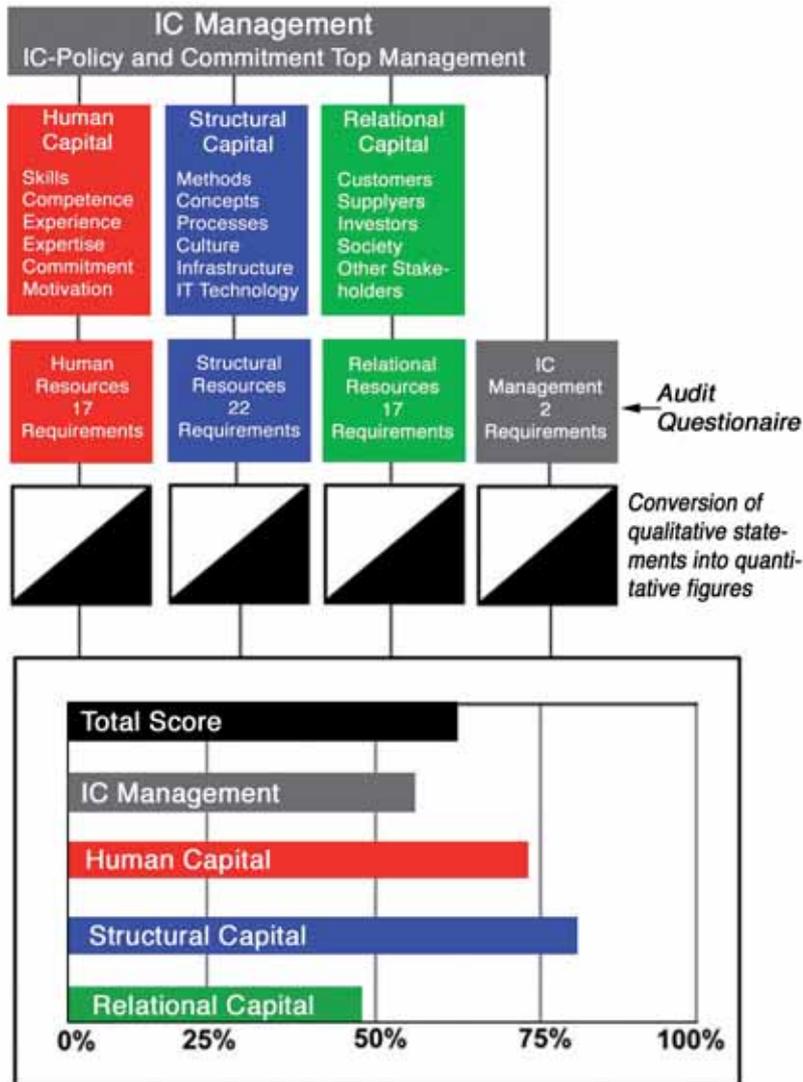
The final report includes all ICMS requirements, where provable non-relevant items are not subjects of the evaluation. The report shows separately the individual scores of the three IC categories and of IC management. They are weighted according to the organisation's structure and performance goal(s), allowing the calculation of a total

score. The results are shown in bar diagrams, which are used as a benchmark in reference to the optimal reachable score (Graph 14). To ensure transparency (how the results were obtained), the individual results of the IC categories and the IC management are shown individually. This allows disclosure of which IC category significant deficits in knowledge work are evident.

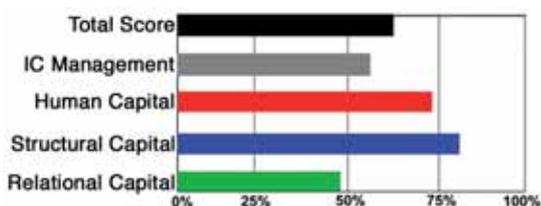
Graph 12. IC Management Framework



Graph 13. IC audit procedure



Graph 14. Quantified Scores for all IC Categories



Such quantified score graphs allow overall benchmark comparisons between audited organisations, but they don't reflect how the results came about. To achieve this, the replies to each of the 58 requirements are commented on separately. All disclosed weak points are discussed individually and recommendations are given to correct them (Box 1).

Box 1. Sample of a detailed weak point statement• *Requirement 2:*

The organisation secures the implementation of LL in project procedures

• *Statement of the audited organisation:*

At the weekly management meetings, disagreeable surprises in project procedures are discussed and entered in the minutes.

• *Recommendation for weak point correction:*

Integration of an institutionalised lesson learned into the project organisation guidelines: documentation according to the sequence ‘What did we expect?’ > ‘What happens in reality?’ > ‘How did we solve the problem?’. Those findings, including the names of the involved employees, shall be stored in the organisational content system. In future projects, such information might prevent huge time losses, even before the project starts.

A by-product of the audits is the internal *best practice disclosure*, which allows transparency of isolated solutions that are worth being implemented by the whole organisation. This is an additional benefit, especially for decentralised or multi-divisional organisations.

The ICMS: Quo vadis?

It is indisputable that an efficient IC management supports an organisation’s innovative competence and it generates and preserves market advantages, which are hard to copy. Another fact is that stakeholders (especially investors), have discovered the intellectual capital as valuation criteria. They ask for an external tool that allows the comparison of knowledge-based organisations, regardless of their size or sector. Indicator-driven tools don’t fulfil this requirement, since they are too specific for the reporting organisations. In other words, classical tools like the BSC and Intangibles Reports are useful for internal IC management. But it’s impossible to define an indicator set, which is suitable for all knowledge-based organisations.

The ICMS delivers harmonised results allowing benchmark comparisons that one can interpret with a moderate understanding of immaterial resource processes. The limitation of the ICMS approach is its usability as a tool to analyse a systematic knowledge work and to report the findings. But, in contrast to the above mentioned classical

tools, it doesn’t deliver indicators serving as steering factors for the internal IC management.

To combine internal IC management (identification, steering and measuring IC) with stakeholder communication, a modular system is required, which offers adapted solutions to individual priorities in knowledge work. The next paragraph describes such a modular configuration.

Looking for the Egg of Columbus: a modular framework, adaptable to individual needs

Working with (or managing of) the resource knowledge is full of facets. Depending on what the main goals of knowledge initiatives are, an individual stand-alone tool may be sufficient, or a combined application of several tools can be a necessity. A systematic approach, that embraces identifying, controlling, measuring and reporting intellectual capital, requires a modular framework, which offers single or combined use of the different tools.

The Knowledge Matrix [9]

A matrix is the centrepiece of the modular system. It ties the components of the Intellectual Capital with the operative components of Probst’s knowledge management model (Graph 15).

Launched knowledge initiatives are described in the intersections of the involved IC resource and the activated operative component. Example: customer knowledge shall be collected systematically. The intersection will be between the ‘IC resource customers’ (Relational Capital) and the operative component *knowledge acquirement*. Depending on the complexity of knowledge-based initiatives, it may be conceivable that several resources and operative processes are involved. In the example above, it might be conceivable that the operative component *knowledge identification* is also involved. The content of the corresponding intersection fields embraces the nature and the goal of the knowledge initiative, its actual status, the project owner, remarks and, where appropriate, the dedicated indicators.

The modular framework

Graph 16 shows different IC tools, which can be applied either separately or in a linked configuration, depending on the purpose of knowledge work and/or on the aspired degree of detailed information in the intangibles report.

Each of the above tools can run alone, systemising the knowledge-based processes. Or, the tools can be linked according to the goals and the desired reporting form of

the organisational knowledge initiatives. The modular system offers the following combinations with the accordingly different characteristics.

▪ *Knowledge Matrix + BSC*

An efficient approach to identify, control and measure knowledge initiatives, but limited to internal use only.
> No stakeholder communication suitability.

▪ *Knowledge Matrix + Intangibles Report*

'Light version' of an intangibles report: generates extremely organisation-specific content, which is hard to interpret.
> No benchmark ability.

▪ *Knowledge Matrix + BSC + Intangibles Report*

Architecture of most of the actual published intangibles reports. Characteristics and limitations of this approach are described in paragraph 2.2. Intangibles Report.
> Its main disadvantage is the very limited benchmark ability.

▪ *Knowledge Matrix + BSC + ICMS + Intangibles Report*

Complete tool set for a sustainable knowledge work and its reporting to internal and external stakeholders.
> Harmonised ICMS results allow a benchmarking of different organisations.

▪ *Knowledge Matrix + ICMS*

Complete IC audit tool that allows long-term monitoring of the knowledge work. Recommended for decentralised or multi-divisional organisations in order to perform a meaningful internal benchmarking and/or best practices studies.

> Harmonised ICMS results offer benchmark ability.

Reporting the outcome of knowledge initiatives [7]

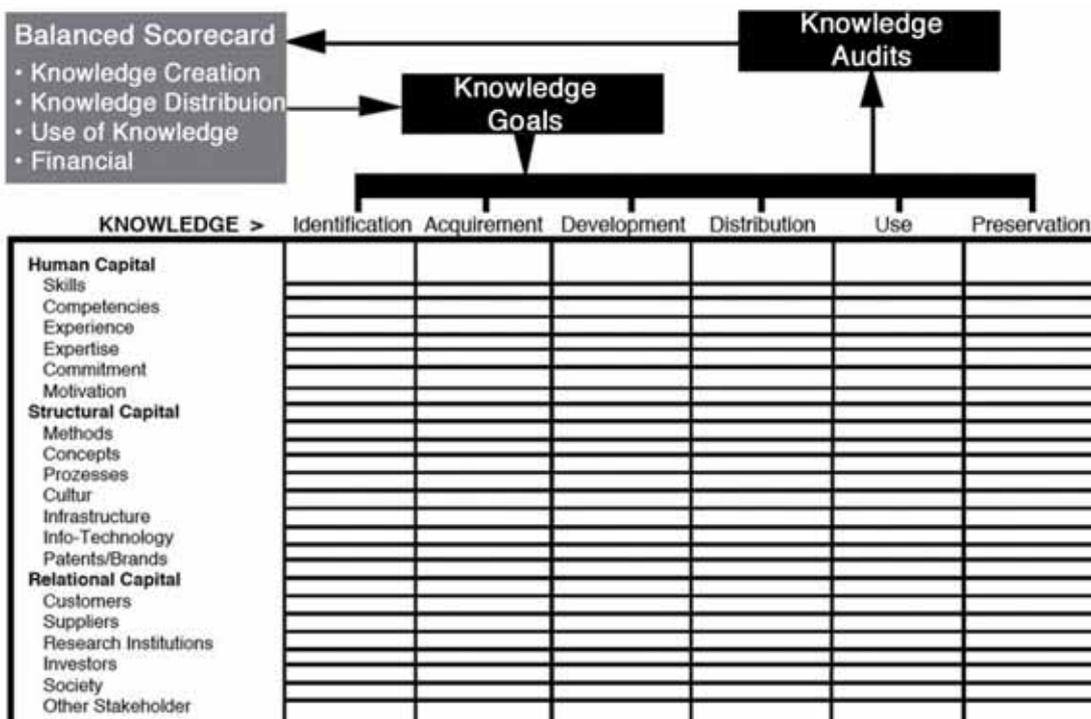
As mentioned earlier, *Intangibles Reports* serve external and internal target groups. Here it is worth demarcating the content of information for the different target groups. That means the reporting organisation has to consider the degree of detailed information in the context of the claim of target groups:

Is our communication aiming towards our target groups?

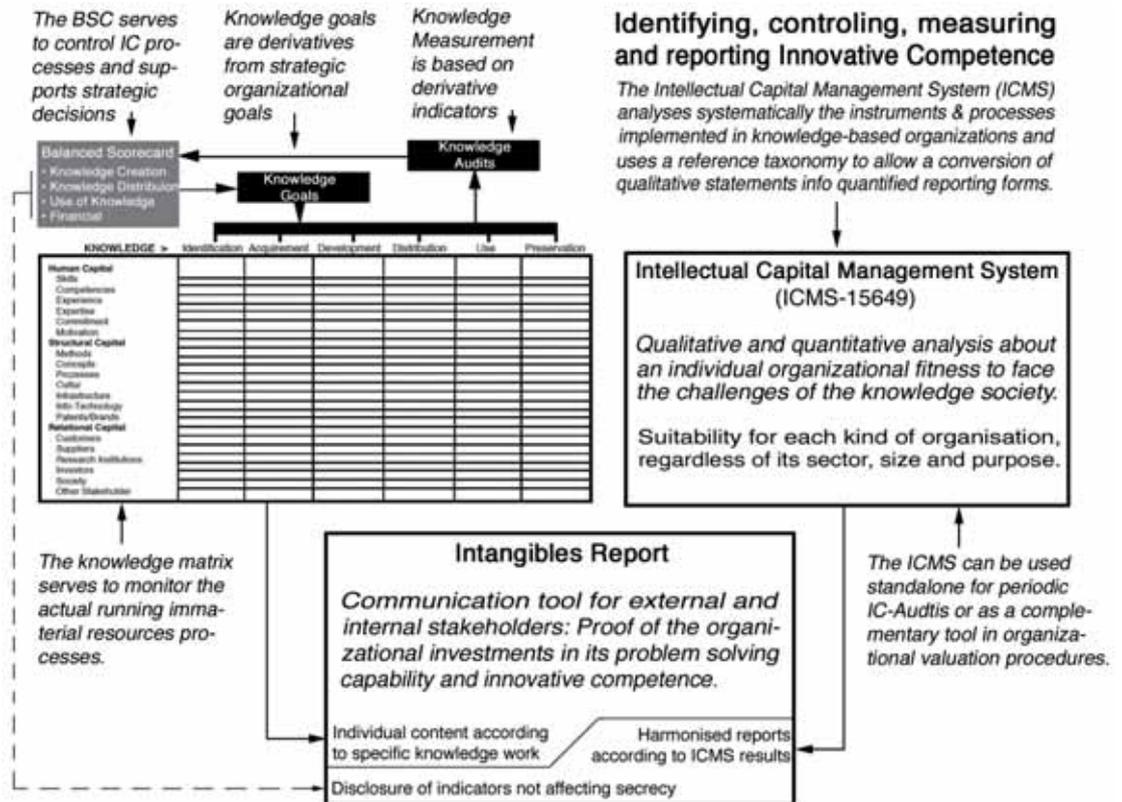
What do we intend to show?

How much internal information can we disclose without cannibalising our market advantages?

Graph 15. Knowledge Matrix



Graph 16. Framework of IC tools



Graph 17 shows the intangibles report's information content for both, the external and internal target groups. Simply put, external groups receive an impression, WHAT (knowledge matrix content and ICMS findings) is done, while internal groups get additional information about the HOW (insight in BSC data and used key performance indicators). Of course it's conceivable that selected external target groups (e.g. investors, owners) can access this sensitive data too.

Graph 17. Content of information for target groups



It is undisputed that there is an increasing interest in intangibles by stakeholders (especially by financial analysts). They are asking for a standardised IC benchmark tool. This produces a conflict of interest: *Secrecy of IC Data v Stakeholder Communication* and the challenge to set up a *standardised benchmark for different knowledge work*. This requires a conjoint measurement system that fulfils the demands of all concerned parties. These challenges answer the introduced reporting form: external target groups get an insight in actual, running knowledge initiatives and their proceedings (content of knowledge matrix), while the requirements of an Intellectual Capital

Management System disclose, which established processes and tools are implemented for the sustainable treatment of intangibles. The plausibility of the statements can be judged by their reciprocal correlation. For internal target groups, the generated indicators are embedded in the value-adding chain, serving as steering parameters for strategic decisions. This is an additional benefit for reporting organisations. The systematic management of intangibles depends on its periodic measurement: other-wise the future development of the most important resource is a product of hazard and/or depends on the good intention of individuals.

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NOTE: Papers marked with an 'E' are available from http://www.hrm-auer.ch/english_docs.php



Contact

Thomas Auer

Auer Consulting & Partner

auer@hrm-auer.ch

www.hrm-auer.ch

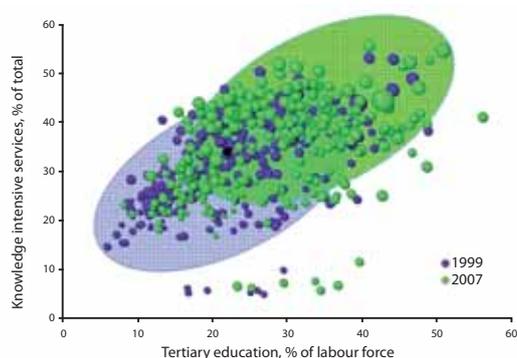
2.6 Smarter cities: why open innovation by cities is key for smarter growth

More than ever before, the traditional 'bricks-and-mortar' drivers of prosperity are giving way to an economy based on 'brains and creativity.' As a result, the diverse skills, aptitude, knowledge, creativity and innovation of a workforce — which collectively can be viewed as the talent pool of the economy — have become increasingly important drivers of economic growth and activity. To compete in this new economic environment, cities need to apply, open, innovate and leverage the advanced information technology and analytics available externally to address the challenges they face in their core systems and to develop a more citizen-centric approach to services. By doing so, they can better attract and retain the talent necessary to drive growth and prosperity.

Human capital is becoming an increasingly important economic force

Over the past decade, a new economic age has started to emerge in which human capital is rapidly becoming an increasingly important driver of economic growth and activity at urban and regional level. Between 1999 and 2008, there has been a marked increase in the impact of human capital on growth in income. This reflects a rise in the contribution of knowledge-intensive and human capital-intensive sectors to urban and regional economic activity (Figure 1).

Figure 1. Growth in skills and knowledge is driving growth in urban and regional income



Source: IBV analysis of OECD Regional Statistics Database, 2010

The links between human capital and innovation are strengthening

The new trend toward a human capital-intensive economy also reflects the strengthening of the links between higher quality human capital and innovation (both technological and creative). In the 1990s, the relationship between human capital and physical capital, was characterised by the rising substitutability of labour and physical and technological

capital. Since then, there has been increasing complementarity between labour and technological innovation and this growing link between human capital and innovation is already underway in modern industries. The correlation between growth in economic value added and human capital and technological innovation has risen from strongly negative in the 1990s to positive in 2000–07; this correlation is forecast to rise by over 70 % by the end of the current decade [1]. Thus, this trend will continue to gather momentum, with human capital-driven growth becoming more reliant on an ever-closer merger of creativity, technology and innovation. In addition, highly skilled human capital is important for knowledge intensive activities — there is a strong positive correlation between improved knowledge competitiveness, which includes quality of human capital, and growth in the knowledge intensity of regional and urban economies around the world [2].

Demand for higher quality workers is increasing

The increasing importance of education, skills, creativity, aptitude, and innovation capacity of the workforce in driving economic growth means demand for talent and skills is expected to accelerate dramatically over the next 10–20 years. In the EU-27 for example, growth in demand for higher skilled workers is expected to double from 10.1 million in 2007 to 20.1 million in 2020. At the same time, demand for lower skilled workers is expected to contract by 28.3 million by 2020 having contracted by 8.5 million in 2007 [3]. At the same time, the mobility of talent will increase as the number of highly educated international migrants around the world is expected to more than triple, from 29.5 million workers in the 1990s to almost 99 million in the next decade [4].

Cities are focal points for this transformation

While efforts at national level are obviously critical for driving growth, it is also important to highlight the potential for action at city level to influence growth and prosperity.

Cities, as hubs of the global economy, are the focal points for the transformation to talent and innovation-intensive growth as outlined above. Globally, leading cities have GDP shares of their national economies that are up to five times higher than their share of national populations. For example, Seoul accounts for almost half of South Korea's GDP; Budapest (Hungary) and Brussels (Belgium) each for approximately 45 % of total economic activity in their respective countries [5]. The top 100 cities worldwide accounted for roughly 25 % of the world's GDP in 2005 — by 2008 this had increased to over 30 % [6]. Economists and urban planners know that urban density acts as a platform for the spread of knowledge [7]. Furthermore, in the immediate future, three interconnected factors will place even more emphasis on the role of cities in talent-based economic development.

- The world is at an unprecedented level of urbanisation. In 2008, for the first time ever, more people lived in cities than not [8].
- Cities contain an increasingly large share of the world's highly skilled, educated, creative and entrepreneurial population, giving rise to highly concentrated and diverse pools of knowledge and knowledge-creation networks [9].
- Cities can support large-scale business and investment networks that create economies of scale in absorbing and extending innovation [10].

Cities are facing intensifying competition for talent

The importance of cities for economic activity and growth means that cities must attract and retain the talent necessary to drive this growth. Given the increasing demand for skilled workers highlighted above, this means that cities are facing intensifying competition to attract and retain the right mix of skills and knowledge. Those cities that are competing in terms of establishing innovation-intensive activities and a viable knowledge economy are facing even stronger competition for human capital.

Individuals have become very proactive in choosing between many possible locations, so cities are engaged in a 'battle for talent' [11]. The ability of a city to compete for the skilled labour and innovative businesses necessary to drive growth is determined by a range of factors including the job and career opportunities available to people, the quality of natural amenities, lifestyle amenities and the overall environment. While wages are an important factor that influences the decision to stay or leave, a location

research from the World Bank has found that reasons for leaving a location also include poor public-service delivery, public safety issues or unemployment [12]. In fact, living conditions have such a critical influence on the attractiveness of a location that migration to locations with more attractive living conditions can occur even if earnings in a destination are lower [13]. The core systems of a city that affect these living conditions are thus of critical importance for driving growth via their impact on attracting and retaining human capital.

Cities are based on a number of key essential systems

Cities are fundamentally based on a number of different systems — infrastructures, networks and environments — central to their functioning, operation, economic prosperity and development.

- **Transport:** The transport system includes all aspects of its road network, its public transport network and its sea and air ports, from provision to pricing.
- **Water:** The water system is an essential utility that includes the entire water cycle, water supply and sanitation.
- **Energy:** The energy system includes its power generation and transmission infrastructure.
- **Telecommunications:** The communication system includes its telecommunications infrastructure, including telephony, broadband and wireless. The ability to access and communicate information is central in a modern economy and key to a smarter city.
- **People:** The people system refers to its human and social networks. These include health and education systems and networks as well as public safety infrastructure (fire, police, and disaster recovery).

These core systems are essential for prosperity

As well as being of importance for quality of life and attracting human capital, each of these core systems also underpins prosperity. Efficient management of the water system contributes to well-being and prosperity [14]. Good management of water resources brings more certainty and efficiency in productivity across economic sectors and contributes to the health of the ecosystem. For example, there is a strong link between access to clean water and

improvement in health — the higher the proportion of a population with access to clean water, the higher the life expectancy of that population [15]. A secure and efficient energy system is critical for economic activity and raises the standard of living [16]. The lack of a reliable energy supply acts as a key constraint for business activity and value creation, and likewise there is a clear positive correlation between a secure energy supply and prosperity [17]. A safe and well-functioning transport system is critical for economic growth. For example, a reduction in travel time for all business travel on the road network can generate cost savings for business [18]. These reduced costs, coupled with opportunities to exploit economies of scale and gain easier access to markets can also encourage greater levels of investment [19] — an important driver of growth and prosperity. A modern and integrated communication system creates economic opportunities and builds social cohesion by connecting people without the need to be in the same physical location. Improved communication systems have generated vast productivity gains and improvements in business processes across economies, particularly when combined with other advances in technology that have boosted the capacity to process information [20]. An effective people system that improves citizens' capabilities, well-being, and quality of life is central to achieving sustainable prosperity. Educated and healthy people are more productive, innovative and better able to adopt new technologies and processes and so have a positive impact on growth and prosperity [21]. So, directly and indirectly, improvements to core systems can drive growth and prosperity. Yet all of these systems face a number of pressing challenges and constraints that affect the quality of the core services cities are providing to skilled citizens and innovative businesses.

Cities face numerous challenges in core systems

Transportation costs are one of the major factors of individual choice that cannot be traded and therefore will vary among cities and regions, affecting people's willingness to live in a location. Urbanisation and globalisation create more commuters and more freight traffic and congestion is considered to be one of the main urban transportation problems [22]. Every day, more than 7 500 kilometres of European roads are blocked by traffic jams [23]. The congestion faced by cities' transport systems incurs significant costs and a number of estimates suggest that congestion costs — in developed and developing cities — are between 1 and 4 % of GDP [24]. These costs are generated from wasted fuel and lost productivity as urban productivity is

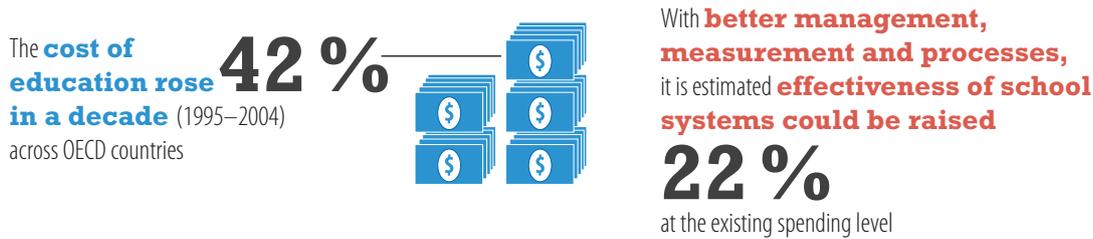
highly dependent on the efficiency of its transport system to move labour, consumers and freight between multiple origins and destinations. These transport inefficiencies and costs are likely to get significantly worse without action.

Problems with water efficiency, leakage, quality and the threat of flooding pose a significant threat to sustainability. Water is fundamental for sustaining human life. Every economic exchange involves a virtual exchange of water. Globally, less than half of water supplies are accounted for (leakage rates often represent up to 60 % of water supplied) costing water utilities worldwide USD 14 billion every year [25]. Currently, 2.8 billion people, or 44 % of the world's population, live in areas of high water stress and present trends suggest that this will rise to almost four billion by 2030 [26]. Water leakages from distribution networks vary across Europe — while leakage rates in Germany for example are very low, some Italian cities have up to 70 % leakage rates and London up to 35 % [27].

Current energy systems are insecure, inefficient and unsustainable. Global emissions of CO₂, the principal greenhouse gas, is expected to have increased by more than 45 % between 1990 and 2010, driven largely by the growth of cities [28]. As a result, cities are under growing pressure — from citizens and from investors — to incorporate into their policymaking environmental sustainability in general and greenhouse gas emissions in particular. Cities are starting to rise to this threat to their sustainability, with the mayors of 400 European cities, for example, pledging in February 2009 to make 'drastic' cuts in CO₂ emissions by 2020 [29].

Countries are facing ever greater demands for connectivity. The last 20 years have seen a revolution in how we communicate and inform ourselves, in particular the ability to share information through the World Wide Web. The online population has grown by over 440 % since 2000 [30]. While EU members occupy the first four positions for connectivity and technology infrastructure in the Economist Intelligence Unit Digital Economy rankings, there are only five other EU countries in the top 20 indicating that there is substantial room for improvement in this area [31].

School and higher education systems are straining under rising costs at a time when budgets are static or shrinking in many cities around the world (Figure 2). Yet, paradoxically, demand for knowledge workers with specialised skills is growing by 11 % a year. Moreover, many jobs will require lifelong training and continuous updating of skills [32]. Ageing populations in Europe due to demographic

Figure 2. Education systems are straining under rising costs

changes are impacting the health service and leading to growing health challenges. Consequently, this will add further strain to the fiscal sustainability of health systems. Projections indicate that the ageing populations will lead to an increase in public spending on health of up to 4 % of GDP in Member States, with the largest increases projected to take place between 2010 and 2030 [33]. Responding to these demographic changes poses a major challenge for the health service.

Cities are under pressure to act and address these challenges

Cities must address these challenges, innovate, and improve the quality of the core services they are providing to citizens and businesses to attract and retain the talent necessary to drive growth. By improving their core systems cities can create a virtuous circle between attracting and retaining skilled and creative workers and innovative businesses. As skilled, creative and diversified workers are attracted to or stay in a location, this positively affects the attraction and retention of innovative businesses. The relocation of firms, the establishment of new businesses and the improved functioning of existing enterprises can collectively act as an engine of growth, lead to an increase in employment and incentivise workers to further enhance their skills. Conversely, cities can find themselves in a vicious circle where lack of skilled and creative workers discourages the attraction or retention of businesses and this in turn depresses demand for skills [34].

Traditionally, the approach taken at national, regional and city level to address these types of challenges has been to expand the systems, devoting ever larger resources and expenses to enhancing and maintaining them. However, the scale, nature, and immediacy of the challenges across these core systems, coupled with new economic, social and environmental constraints, mean that this business-as-usual approach is no longer an option. This means cities must take an innovative

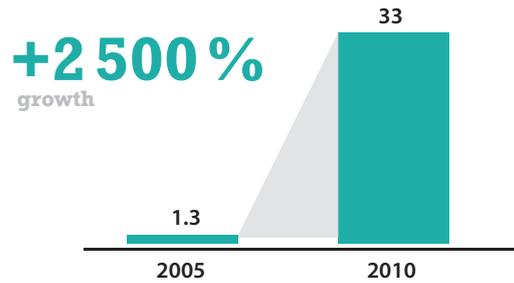
approach and shift away from focusing on standardised services. Instead, they need to focus on providing services that are more citizen-centric: tailored and individualised to reflect tastes and work preferences, green and clean in line with the demands of the internationally mobile highly skilled employees. This shift places new demands and pressures on a city's infrastructure and services delivery.

The good news is that cities can leverage open innovation to address these issues and try and create this virtuous circle. As the world becomes increasingly instrumented, interconnected and intelligent in nature, cities have the chance to accelerate their journey towards sustainable prosperity by making use of new 'smart' solutions and management practices that are already available to enable innovation and improvement in the quality of their core services. Greater instrumentation, interconnection and intelligence in developing city infrastructures can help better manage resources and alleviate the demand for new investment.

Smart solutions are instrumented, integrated and intelligent

Instrumentation enables cities to gather more data, and better quality data, in a more effective and timely manner than ever before. The pervasiveness and low cost of existing devices and sensors offer the ability to measure, sense and see the exact condition of everything. The transistor, invented 60 years ago, is the basic building block of the digital age. This year, 2010, there are estimated to be a billion transistors per human [35]. The myriad of devices capable of collecting data includes those devices not originally designed specifically for this purpose, for example, mobile phones and 2008 saw a historic milestone being achieved with mobile phone users passing the four billion mark [36]. New sensors and devices offer further data gathering possibilities. In 2005, there were 1.3 billion RFID tags in circulation and by 2010 there will

Figure 3. Unparalleled data-gathering possibilities: number of RFID tags in circulation, billions, 2005 and 2010



Source: Instat, Explosive growth projected in next five years for RFID tags, 2008

be 33 billion, a phenomenal increase (Figure 3) [37]. These existing and new sensors and devices can be embedded across the key systems on which cities are based as a first step in addressing and solving the challenges cities face by allowing cities to gather more and better quality data from their core systems.

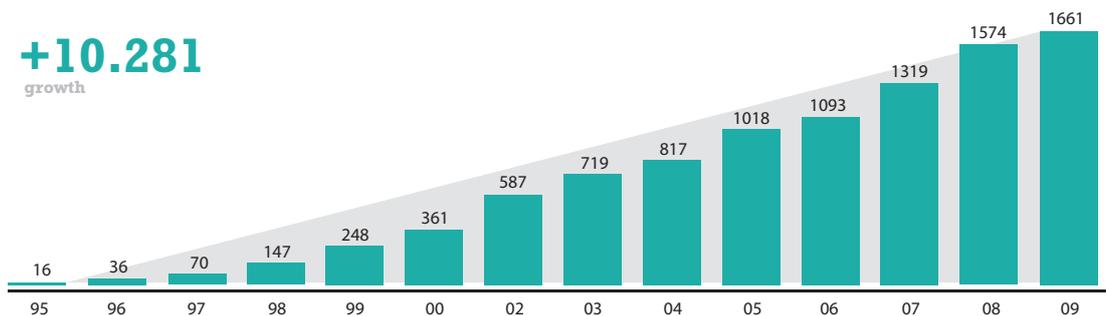
Interconnection enables cities to link data, systems and people in entirely new ways that were not previously possible. In 2009, there were over 1.6 billion people using the Internet [38] and soon there will be a trillion connected and intelligent things [39] such as cars, appliances, cameras, roadways and pipelines (Figure 4). Cities can prioritise the interconnection of systems on the basis of their most pressing challenges but given the interconnected nature of these challenges, they must adopt a system of systems approach. This requires cities to interconnect the sensors and devices not just within a particular system, but between that system and the other key systems on which the city is based.

Intelligence — in the form of new computing models — enables cities to use predictive insights for informed decision making and action. These new computing models can handle the interconnections between the proliferation of

end-user devices and sensors. Combined with advanced analytics, these new computing models can turn the mountains of data generated into intelligence to generate knowledge as a basis for actions that can make systems, processes and infrastructures more efficient, productive and responsive than ever before.

Countries, regions and cities can practice open innovation by leveraging this externally available new technology with advanced capabilities and combine it with internal innovation such as organisational, business model and strategy changes to achieve the step change in the quality of core services and make them ‘smarter’. We investigate in the next section how cities can leverage these new technologies to innovate and provide better quality, ‘smarter’ core services for skilled citizens and innovative businesses.

Figure 4. Unparalleled interconnection: Internet users, millions, 1995–2009



Source: Internet World Stats, 2010

Smart solutions help cities address their constraints and challenges and accelerate the path to sustainable prosperity

Smarter transport systems bring new capabilities to cities that can help to address these challenges and pressures. Developing citizen-centric public transport can help to reduce congestion by encouraging increased use of public transport. For example, real-time road pricing to address congestion issues leads to a reduction in resources required to run private and public transport, as well as less pollution/emissions. Singapore has successfully attracted its citizens to use public transport and minimised congestion by leveraging smart technology [40]. Smarter transport can also help to improve safety as vehicle failure can be predicted and avoided, as well as reducing accidents and congestion by balancing traffic across routes or modes [41]. Because smarter transport can make the area more attractive and accessible to firms and workers it can lead to the relocation of jobs [42]. In turn, this can make a city more attractive to skilled workers as employment prospects are improved.

Smarter energy systems provide a means for cities to achieve a more reliable, secure and less polluting energy supply. By fitting sensors to gather data on usage across the energy system and interconnecting devices between energy consumers and providers, cities can optimise the use of the system and balance use across time. This helps cities to utilise more efficient, less polluting energy systems which can thus improve quality of life, as well as providing increased certainty of supply to support human capital in generating economic activity and growth.

Smarter water systems allow cities to leverage technology to gather data for water quality monitoring, interconnect users of water, such as businesses, ports and energy users, and derive insight from the information collected to provide real-time quality, drought, and flood control. Galway city in Ireland is one example of a city that is leveraging the power of smart technology to address water challenges [43].

Smarter education provides a means to improve the quality of education, increase access and reduce costs. Innovative administration of education can help institutions improve performance and operational outcomes in a meaningful,

efficient, and transparent way. Smarter education means learning services and resources will become more interconnected and seamless. Information about student needs and skill gaps will become more instrumented and non-intrusive to the teaching process. Decision-making will be informed by intelligent insights based on an integrated view of learning.

Smarter healthcare systems provide a means to integrate various aspects of health systems, make use of electronic patient records, streamline processes and improve access. These elements of smarter healthcare can lead to improved quality of life by reducing the risks to health and well-being, provide improved compatibility with international standards to support international mobility and overall provide more citizen-centric services tailored to the needs of individuals. The Xicheng district in Beijing, China is one example of where smart technology has been leveraged to improve the quality of healthcare services provided to citizens [44].

Overall then, there are several benefits to be realised from smart infrastructure and technologies. They can facilitate less costly and more resource efficient ways of doing things. In addition, the feedback and information created in real-time by smart solutions improve responsiveness to customer and citizen needs and effectiveness in decision-making.

Furthermore, smart infrastructures and technologies can open up interesting opportunities for developing new products and services. For example, improving the sustainability of energy and utilities can support the development of skills, expertise and industries in new areas. Smarter transport systems can create new ways of offering logistics and car lease. Smart technology can facilitate the introduction of innovative pricing mechanisms — for example, ‘time of use tariffs’ can be introduced in water and energy systems. The real-time analytic capabilities of smart technology also means that the time required to create value and generating growth can be drastically reduced, and smart solutions can thus accelerate a city’s path to sustainable prosperity. Smart technologies can open up new avenues for consumer satisfaction, create new revenue streams and define new business models. Existing organisational strengths and new capabilities to be developed can form the basis for a broad menu of innovative new products and services that providers can offer [45].

Cities must act now and leverage Smart technology through open innovation

Many cities have already realised the critical importance of core systems and are focusing on improving and optimising them — other cities can leverage the valuable lessons learned by these forward looking cities. In addition to this, there is the possibility of cities in EU Member States getting assistance to fund smart improvements as they are consistent with the priorities and objectives the

EU has set out in the Digital Agenda and the EU's 'Europe 2020: A European strategy for smart, sustainable and inclusive growth'[46]. Cities now have an opportunity to use smart technology through open innovation to generate significant and measurable benefits. By fully leveraging the valuable advantage of smart technology and implementing innovative solutions to address challenges in core systems, cities can substantially improve the chances of economic success and prosperity. Cities must seize this opportunity now and lead by example.

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Contact

Dr Mary Keeling

Manager

Global Centre for Economic

Development

IBM Institute for Business Value

IBM Ireland

mary.keeling@ie.ibm.com



3.1 SII — Service Innovation and ICT

About SII

SII is an independent identity that manages the Dutch programmes for ICT-related service innovation. SII is an abbreviation and stands for Service Innovation and ICT. Services innovation, a phenomenon that cuts horizontally across the whole economy and has developed in all industries: from the service sector to traditional manufacturing sectors. The SII programme focuses especially on the creative industry and financial logistics. It is a programme that runs for at least two years (2010–11) and is supported by a EUR 12.5 million subsidy from the Ministry of Economic Affairs.

The SII logo



Why this support?

Services innovation can create new business opportunities for companies from very different backgrounds and can therefore facilitate the transformation and renewal of industries, networks and clusters as a whole. The integration of services and ICT is important for the development of services innovation, but the driver for innovation is not the technological solution as such, but rather the value it can create both for the service provider and the customer.

The services sector is extremely important for the Dutch economy. Approximately 70 % of the country's gross national product and 80 % of its employment comes from this sector. The services sector presents major opportunities for growth, given the increasing trend towards the liberalisation of services on a global level. New innovative service concepts on the basis of ICT can be duplicated in a relatively simple way and then exported. The focus here is on those service sectors that are prominent internationally in terms of both technology and market potential.

Partnership

Companies and organisations operating in the all-important creative and financial industries (including Philips, Logica, IBM, ING ABN/AMRO, Rabobank) have

joined forces in this innovation programme to integrate their ambitions with respect to service innovation and ICT. Although supported by the Dutch Government, the board of directors and supervisory board consists of representatives of large companies, SMEs and knowledge institutions acting and innovating in the field of service innovation itself. More than half of the funding of each project which runs under the SII programme is taken care of by market companies.

Each individual project will have to contribute to one or more of the ambitions of the SII programme. On a strategic level, these ambitions aim at the Netherlands becoming the European hub for smart services, the European knowledge centre for financial logistics.

Creative industry

The industry is looking to implement invisible and intuitive technology in products and services, which will be centred around information, communication and media. As today's consumers are fickle, interaction and customised, personalised services are vital to meeting their needs and requirements. Another key industry challenge is to connect three 'worlds' that are currently still too separate: small and medium-sized businesses operating in the creative industry; the creative production industry; and first-rate educational and research institutions. Bringing these worlds together will create opportunities for economic growth and innovation.

To achieve this objective, three interrelated growth areas have been designated: Content, Experience and Connectedness.

Financial logistics

The financial industry has similarly put the creation of a hub at the top of Holland Financial Centre's innovation agenda. The objective is to turn the Netherlands into an international centre of excellence in financial logistics, to establish the most efficient processing system for value data of any country, and to achieve an internationally leading position in value-added services related to financial logistics.

Financial logistics is a rapidly growing market, with many challenges such as the Single Euro Payment Area (SEPA)

that calls for precompetitive collaboration between stakeholders. In addition to the challenges of SEPA, there are the more technology-driven innovations, like mobile banking and mobile payments which have a major impact on the market for payments services. Successful innovations on micropayment services are still very scarce but needed in order to facilitate the growth in online service innovations.

However, the opportunities and challenges are not limited to the market for payment processing: financial logistics services are set to become tradable goods, thereby creating significant opportunities for innovative, high value-added services aimed at the entire chain of financial companies. This requires effective cooperation, a common approach within Europe, standardisation and the ability to benefit from the innovative power of the challengers in the industry.

Main elements of the programme

1. Innovation tender: R&D support: 25–50 % of R&D costs

The first innovation tender related to the following issues: content, connectedness, e-invoicing, e-payments, micro-paid micro-experiences. Eight proposals have been awarded public funding.

The second innovation tender deals with issues like lifestyle and e-files.

2. Scientific research on service innovation and engineering and on e-identity and e-profiling
3. Platform projects: Virtual Creative Collaboration Platform, e-Invoicing platform, Dutch Valley
4. Human Capital and dissemination of results and knowledge valorisation: academic exchange programme, conferences, publications.



Contact

Carlien Roodink
Program Director, SII
carlien.roodink@si-i.nl
www.si-i.nl

3.2 Measuring the impact of open innovation at Philips Research

Since its introduction more than a decade ago, many organisations have considered ways to measure the success of open innovation. Philips Research conducted a study on the effectiveness of open innovation. The study was rooted in a number of success factors obtained from alliance management and on some well-known elements from knowledge management. We looked at open innovation from a process perspective and developed a so-called maturity model to indicate how rich and effective a process is. Such a model helps organisations to assess their open innovation process and to determine points of improvements. In this way, the model provides guidance to organisations and offers also an opportunity to benchmark their own maturity level against that of their competitors (Table 1).

Our research revealed three important elements in the creation of an open innovation process: (i) *innovation climate*; (ii) *partnership capabilities*; and (iii) *internal processes*.

The innovation climate inside the organisation is the first important element in the creation of an open innovation process. Such a climate can enable employees to strive for

high performance and stimulate them to be innovative and entrepreneurial. Management plays a central role here in formulating and demonstrating a clear ‘open innovation’ oriented strategy. Success stories need to be communicated to stimulate employees to have an open mind towards open innovation. An incentive system, consisting of smart targets, could assist management to activate and change the mindset of employees.

The second element in the open innovation process is partnership capabilities. These capabilities are essential in cooperating with external parties in an open innovation setting. Organisations with professionalised partnering capabilities, on average, get more value out of their open innovation initiatives. Having the reputation for being a good and responsible partner will increase the possibility of connecting to the right companies and universities. An organisation’s reputation, however, is not the only factor that determines the success of getting connected to the right partner. A network of possible and existing partners supports the selection of partners, which is an important condition for the success of collaborations.

The third element in the facilitation of open innovation projects are internal processes. Especially in large organisations, duplication of efforts and missed opportunities can happen frequently. Having a structured system for information gathering and communication increases the efficiency of open innovation. Knowledge management ensures that lessons are being captured and inputs and outputs can be monitored. Adequate absorption and transfer of these lessons throughout the organisation may turn open innovation into a competitive advantage. Finally, the legal and IP departments play a role in becoming effective in open innovation as an organisation. Without the proper support from these departments, it will be hard to create effective open innovation partnerships. These departments need to focus on creating win-win agreements, in addition to protecting the IP of their own organisation.

For Philips Research, the High Tech Campus Eindhoven proves to be a natural environment in which open innovation projects are initiated. This campus enables the execution of cooperative projects due to the co-location of companies. Based on the collected data, it was suggested that there is an order in the elements of open innovation maturity. Creating a climate for innovation should happen before partnership capabilities and internal processes are developed. With these elements and characteristics of open innovation, a framework was defined that can help organisations to assess their open innovation effectiveness. If this framework is used by a larger group of organisations, it can also serve as a benchmarking instrument.

Table 1. Benchmarking maturity level

Elements			
Maturity level	Innovation climate	Partnership capabilities	Internal processes
1. Initial/arbitrary	little initiative taking; accidental opportunity spotting	affection-based collaboration; arbitrary, one-off partnering, individual initiatives	informal communication of initiatives; protective legal and IP system
2. Repeatable	verbal management support; targets at lower levels; individual initiatives	few, informal, repeating partnerships; satisfy own organisation; affection-based selection	limited sharing of facilities; knowledge and information informally shared in team; strict IP and legal conditions
3. Defined	written OI strategy; targets based on strategy; screening by champions	formal, short duration partnerships; behavioural guidelines; selection based on network experience	opening facilities; irregular inter department knowledge sharing; trust-based IP and legal attitude
4. Managed	strategy stimulated by management; targets set and communicated; champions stimulate initiative taking	intensity, focus in partnerships; partnering tools used; management stimulates satisfying partners; strategy-based selection	start-up shared facilities; structural budget; long term view of legal and IP
5. Optimising	management 'walks the talk'; continuous adjustment of targets; initiative taking in whole organisation	satisfied partners monitored; diversity in partners along value chain; selection criteria based on proactive strategy	network facilities; OI integrated in budget; knowledge accessible in database; win-win contracts

 **Contact**
Hannah Kerklaan
Philips Research
 hannah.kerklaan@philips.com

Emile Aarts
Vice-President and Scientific and Program Manager
Philips Research
 emile.aarts@philips.com

John Bell
Philips Research
 j.bell@philips.com

3.3 The usage and benefits of internal and external crowdsourcing

Introduction

Approximately two thirds of organisational value consists of intellectual capital [1], so it is unsurprising that many studies also recognise the growing importance of innovation management initiatives [2] [3] [4] [5]. On the one hand, innovation has become essential for companies to remain competitive in the knowledge economy. However, on the other hand, innovation failure rates have reached as much as 86 %, [6] 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 [7].

The increasing demand for new thoughts and the lack of user acceptance have forced companies to look for new sources of ideas [8]. Collective thinking has become more effective than the innovation of separate users [10] and involving consumers in the ideation process, besides being cost effective, offers valuable insight into customers' thoughts, wishes and preferences [9]. It can also facilitate the consumers' adoption of the innovation [9] because their opinions have been listened to.

In the 1960s, studies showed the importance of external resources in the ideation processes [12]. Over time, it has been discovered that firstly, most ideation happens when different knowledge domains are crossed [13] [14] and secondly, ideas are more likely to arise in teams that consist of people with different personalities, knowledge, skills and backgrounds [15].

Improvements in computer and communications technology have enabled users to participate in new product and service developments. Nowadays, users can

freely share their ideas with others, creating rich intellectual communities [11]. Ideation marketplaces, enabled by social media tools and the wisdom of the crowd combined with artificial intelligence, can act as mediators between mentioned actors [9]. Porta et al. [16] claim that 50 % of large enterprises and 47 % of startups are already using network intelligence for value creation.

This whole phenomenon is known as 'crowdsourcing'.

What is crowdsourcing?

Crowdsourcing is defined as 'the act of outsourcing tasks, traditionally performed by an employee or contractor, to an undefined, large group of people or community (a crowd), through an open call' [17]. However, for Nokia, crowdsourcing is the junction of open innovation and social media (Figure 1).

The open innovation paradigm by Henry Chesbrough [18] is undoubtedly familiar to all readers. However, for those not so familiar, Chesbrough states that:

'Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology.'

Social media has been defined by Andreas Kaplan and Michael Haenlein as 'a group of Internet-based applications that build on the ideological and technological foundations

Figure 1. Nokia's definition of crowdsourcing



of Web 2.0, which allow the creation and exchange of user-generated content' [19]. In other words, we can say that, crowdsourcing is a social media activity used as a channel to bring people together to innovate and develop ideas.

Crowdsourcing at Nokia

Nokia uses crowdsourcing for several internal and external initiatives. Nokia's internal crowd of 63 000 employees has remarkable crowdsourcing potential which could be used to aid mobile device development. Nokia currently has over 50 internal innovation channels that gather people together to use the wisdom of crowds in different phases of the product development process. To date, crowdsourcing has been used primarily for ideation and marketing although the aim is to expand crowdsourcing techniques to other phases of development.

Nokia's external audiences such as consumers, users, lead users, developers, universities and partners are also invited to participate in different phases of the innovation process. The IdeasProject, Nokia Beta Labs, Calling All Innovators, Make My N8, Innovate Afrique [20] and other initiatives were all developed for different purposes, but are also all based on crowdsourcing.

The IdeasProject website brings together leading thinkers on the mobile Internet. These are people from all walks of life with great ideas that will impact the future of communications. Nokia Beta Labs is a space to share new applications and services with a vibrant community of active users, either prior to commercial release or for experimental research. The feedback and comments from the Nokia Beta Labs community is crucial to understanding and improving the applications in real-life situations. Calling All Innovators is a global developer competition designed to inspire creativity by challenging developers to create applications and services for Nokia mobile devices. Category topics ranged from entertainment to life improvement. In the Make My

App competition, Nokia connected the best application ideas generated by consumers with top developers from all over the world. Out of the 7 691 total shared ideas, the best 13 were developed into real apps for the new Nokia N8 at the Nokia World Developers' Summit 2010 and competed for the main prize of USD 100 000.

Lately, Nokia together with World Bank, InfoDev and Capgemini organised the Open Innovation Africa Summit, where crowdsourcing was used before the summit to identify key ideas and topics for discussion at the event around creating a sustainable innovation ecosystem in Africa. People were invited to submit ideas related to the four key conference themes and eight contributors were chosen to attend the summit to share their ideas with the audience of different innovation ecosystem players in Africa.

The future of crowdsourcing at Nokia

Nokia launched an internal 'ideas marketplace' pilot early in 2008 which included educational and strategy sharing goals with Web 2.0 like features. After 18 months in use, the concept of creating educational content was left behind. However, experience of sharing ideas online reinforced the engagement strategy and opened a space for employee dialogue. As a result, the user experience of 'Nokia Sphere' as the internal service was called, was renewed and now includes improved social media, idea harvesting and collaboration capabilities.

In the near future, crowdsourcing at Nokia will become an ecosystem enabler, for example by bringing developers closer to consumers. Nokia's aim is to build a systematic crowdsourcing capability that will facilitate and generate new and exciting ideas. When harvesting the masses of ideas we take the advantage of statistic methods and cloud computing, for example regression analysis with text mining and neural networks.

Table 1. Benefits of crowdsourcing from Nokia's point of view

For consumers	For Nokia innovators (Nokia's employees and ecosystem)	For Nokia
Getting new products and services that are more usable and even more fun	Instant feedback	Brand loyalty
Seeing their ideas matter	Direct consumer access	Increased innovation capacity
Being heard and understood	Inspiration	Nokia innovators and consumers can be inspired, live and work together
Being proud of their digital identity artifact	Co-creation	
	Finding others to work with	

While working with ideas is inspiring, it may also feel like looking for a needle in a haystack. Using techniques such as crowdsourcing offers us the opportunity to create a place for ‘lucky accidents’ to happen, to give a chance to our dreams and to face challenges head on. Bringing people together to combine ideas also offers the possibility for a basic or ‘medieval’ idea to become a

shining idea — thanks to the contribution of the crowd. When crowdsourcing, there is always a chance of success and a risk of failure. We are on a learning path and, as an active practitioner of crowdsourcing, topics like crowdsourcing and a better usage of artificial intelligence are something we are currently studying.

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Contact

Pia Erkinheimo-Mennander
 Head of Innovation Crowdsourcing
 Nokia
pia.erkinheimo@nokia.com

Karoliina Harjanne
 Social Media Trainee
 Nokia
karoliina.harjanne@nokia.com

3.4 The need to innovate: Open innovation and Smart Cities

Smart Cities as a concept was born around the need and the opportunity to reinvent cities by building on the developments in information and telecommunication technologies. However, this need heavily contrasts with the realities of city management and especially innovation management, still based on the old command-and-control models of industrial age enterprises.

This prevalent model of management has been caricaturised by Donald Kettl [1] as vending machine government. A system where we pay our taxes and we expect services from a full menu predefined beforehand and where a small number of authorised vendors previously scrutinised act as the sole suppliers.

However, these two characteristics of (a) well-known needs and previously defined services and (b) the existence of a pool of experienced vendors ready to provide the services that could cover these needs, is precisely what is absent in the endeavour towards Smart Cities.

Smart Cities aiming at reinventing cities and therefore the city space and our relation with it are naturally an exploratory process where services are yet to be defined. Also, most likely, this process of reinvention will not be circumscribed only to the services that cities will provide, but as we will argue, to the way these services are managed and elucidated.

However, we can find increasing insights pointing to the replacement of the so-called slot machine government by government as a participatory platform where services are provided not only by the Cities themselves but also by a combination of private and public-private agents interacting at the same level [2].

Hence, the role of government changes radically from being a service provider to becoming a platform manager. And hence, changing the objectives behind these two different roles, from efficiency in the management to encouraging competition and innovation.

In fact, we have some early examples that show not only the feasibility of the concept but its potential.

In 2008, Vivek Kundra, then the CTO of the District of Columbia, announced a challenge called 'Apps for Democracy' [3]. Software developers were asked to build and submit applications based on open data made

available by the municipality. Winners would receive a prize of USD 10 000. However, the term was pretty narrow, only 30 days.

Forty-seven applications were submitted in spite of such a narrow window. The two winners featured historic walking tours around the DC area and showcased demographic information for residents thinking of moving to a new neighbourhood. A wide range of categories was addressed by the participants, ranging from guides for city bikers to tracking government expenses or even finding the safest way home for inebriated users.

Apps for democracy cost of USD 50 000. However, the resulting applications were valued at USD 2 million and it would have taken a year to build them if traditional methods had been used.

Apps for democracy is an exemplary case of why reinventing cities implies reinventing innovation management in cities and hence the role of the government.

However, this need of reinventing innovation management is not new. Open innovation [4] draws on the same need to address a world where competition is no longer established in terms of efficiency but also on innovation. And open innovation draws too on the same insight that in a world where knowledge is widely distributed and readily available, the best solutions are not likely to be found inside the firm but outside of it.

Furthermore, there are many similarities in the elements that triggered the change towards open innovation and the challenges that cities are encountering in the road to become Smart Cities. These similarities encourage us to believe that the open innovation framework that has been developed over the past years can be successfully translated to the public sector and in particular to Smart Cities.

To explore the main elements of this translation is the objective of the present work.

Open innovation intermediaries in the public sector

Open innovation is characterised as the purposeful management of knowledge inflows and outflows in the innovation process.

By increasing the flow of knowledge inputs in the firm, open innovation solves the problem of the scarcity of innovative ideas. However, by doing that it stumbles into another problem, not insignificant: How to locate and chose the very best among a large number of disperse potential solutions?

Open innovation intermediaries such as Innocentive or NineSigma appeared to help in solving this newly created problem. They addressed it by creating marketplaces for innovation where new ideas and solutions are traded.

The existence and relevance of these intermediaries is undoubtedly one of the most salient characteristics of open innovation when compared with other approaches.

However, many classifications of open innovation intermediaries exist, we find enlightening for the purpose of translating open innovation to the public sector to group the ‘outside-in’ category of intermediaries by the constituency that they address (Table 1).

Table 1. Open innovation intermediaries by addressed constituency

Constituency	Intermediary
Users	User-Experience consultants
	Crowdsourcing
	Living Labs
Experts / Innovative Companies	Marketplaces (Innocentive, etc.)
	Personalised search intermediaries (NineSigma, etc.)
University – Research Organisation	Science Parks
	Collaborative Projects

Albeit that many exercises in crowdsourcing exist and the popularity of Living Labs is increasing, the dominant constituency is by far experts and innovative companies together with universities and research organisations.

There are no reasons to doubt that regarding innovation management, many points in common exist between the private and the public sector: there are however some distinctive characteristics that put them apart.

Probably the most salient of them is the purpose of innovation. In the private sector, we often encounter the goal of producing the next breakthrough product. However, in the public sector, efforts are directed to find the best way to meet the needs of citizens. And these needs are normally not expressed solely in terms of functionalities and efficiency but also in terms of values and collective

objectives that many times moderate or even surpass other criteria such as efficiency or even economic soundness.

Taking into account these differences in objectives, it then seems relatively straightforward to conclude that crowdsourcing, Living Labs and, in general, exercises aimed at capturing the user experience, user-feedback and building on them by means of co-creation, should have a significant importance or at least a promising future, in the public sector.

The recent experiences in this line of the Obama Administration, such as challenge.gov [5] powered by the IdeaScale [6] platform or the crowdsourcing exercises in Amsterdam [7] and other places in Europe, certainly point to this direction.

Platforms in the public sector

In the last decade, we have witnessed the surge of platforms not only as coordination mechanisms between agents but also acting as a driver for innovation. Even if the most popular ones are situated around the offers of mobile vendors, platforms have a long standing in the computer industry with examples such as Wintel (Windows and Intel), etc., and outside it with offerings such as 4/3 or micro 4/3 in cameras.

Platforms provide a combination of constraints, value propositions and revenue-sharing mechanisms aimed at maximising network effects and creating a virtuous cycle.

Regarding open innovation, platforms represent a different way to coordinate ideas and proposals coming from a diversity of companies. Their collaboration doesn't result in a new product or service but in a process of cross-fertilisation among the participants that enriches them all.

In a platform, the offering to consumers in terms of value proposition is no longer a single product or service but the combined value of the platform itself.

Despite the extraordinary success and popularity of platforms, the public sector has been very slow in translating this concept and implementations are limited to a few experiments or to participation in existing global platforms such as Google Maps, iPhone or Android.

There are, however, clear signs that platforms promoted from the public sector are a good way to convey the growth of advanced IT services.

Among them, open data looks as the most promising and well-developed concept.

Open data is hardly a new concept; its origins can be easily traced to open science data, a fairly common practice among scientists. Nevertheless, its translation to governmental data is credited to Edd Dumbill in the 2005 XTech conference. This idea was supported by Tim Bray and Tim O'Reilly in 2006 [8] and acknowledged by the OECD [9].

However, were the apps contests, modelled after the 2008 Kundra initiative and especially after the endorsement of highly regarded public institutions such as the Obama administration and the City of New York, the ones that popularised the mechanism of open data as a way to provide advanced information services?

Open data relies on transforming public data into a public good situated in a commons and using this commons to trigger the emergence of services provided by private agents.

Data is by nature a non-rivalrous product, making this data available through a public website endowed with mechanisms that allow easy access to this data through programmatic interfaces, and transforming it into a public good situated in a platform that acts as commons.

However, open data is not the only good that can be translated into a commons and used as a trigger to spur applications. A recently approved European Project, Open Cities [10], proposes to use the same principle on data coming from Sensor Networks by opening Fiber-to-the-Home platforms and using it to spark new services.

Nevertheless, these mechanisms still lack the governance structure, the value-added proposition and the means for value capturing that could characterise them as platforms.

Moreover, it is also unlikely that single cities alone, even if big, could generate a value proposition powerful enough to attract a large number of users and developers. Therefore, some kind of aggregation mechanism is needed in order to render them viable and competitive.

Conclusion

Innovation and Cities are two concepts that have always come together. Geoffrey West [11], for many years director of the well-known Santa Fe Institute, described a positive

power-law between city size and innovation capacity, finding that a city that was 10 times larger was 17 times more innovative, but one that was 50 times larger was 130 times more innovative.

Big cities have also been portrayed as the locus of subcultures and unconventional residents [12] and of the creative class [13].

In this article, we argued that although cities have conveyed innovation in many ways through history, city management still follows a model of provision of predefined services that don't provide an adequate path for the reinvention of cities into Smart Cities [14].

The reinvention of cities leading to Smart Cities inevitably requires the reinvention of City Management and more specifically of Innovation Management. This is even clearer when looking at cities as entities competing for talent and creativity [15] in a world where competition is increasingly driven by innovation and not solely by productivity or efficiency.

Open innovation can certainly provide some clues on how to address these challenges. Through this article, we discussed some of the most salient aspects of open innovation that can be applied to Innovation Management in the public sector.

The first was the role of Innovation Intermediaries and particularly the ones addressing a particular constituency: citizens. The second was the power of platforms not only as locus of innovation but as a way to provide advanced services far beyond the capacity of municipalities or even governments.

Both aspects are not just examples or opportunities but what we believe is a pressing need to apply the principles of open innovation to the public sector. Smart Cities are not going to become a reality by the application of new technologies alone: radical change in the way that cities, and particularly innovation in cities, is managed is needed.

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Contact

Prof. Dr Jonathan Wareham
 Director of Research
 ESADE Business School
jonathan.wareham@esade.edu

Prof. Dr Esteve Almirall
 ESADE Business School
esteve.almirall@esade.edu

3.5 Implementation of user-driven open innovation in a public sector organisation

Tools in the hands of users can result in innovative solutions so the goal is to make available services like building blocks that can be combined to create custom applications tailored to people's needs.



If you want different results, do not do the same thing.

Albert Einstein

The year 2010 has been crucial in the evolution of Europe. With a staggering economic crisis shaking the foundations of Europe, it has become apparent in all sectors of society that is necessary to address the challenges differently.

Returning Europe to the top in innovation has been an institutional objective of the last 20 years. Now, in addition, it is a necessity to guarantee the standard of living in the new changing economic scenario.



In this context, the Europe 2020 strategy has been published and, specifically, the 2020 Digital Agenda was published in the spring of 2010. A clear and compelling objective of the Digital Agenda is to ensure the effective implementation of the Digital Single Market through the enhancement of services and solutions.

The Digital Agenda outlines the actions to be developed in coming years at European level to maximise the potential of information technologies in social and economic development and prepare the EU economy to better withstand economic jolts.



One example is the problem of an ageing European population. Recent studies show that it will double in a few years and technology will be the only way to meet this challenge and that health systems, as they are designed now, will not be able to meet the needs arising from the growing ageing population. Telemedicine is the advanced technological answer to this challenge.

Moreover, one of the specific actions to be taken is to work with stakeholders to develop a new generation of web-based applications and services, including multilingual content and services through support for open standards and platforms through programmes funded by the EU.

The new services

The new services, those which make a difference to the current way of doing things and get different results will be focused and directed to the user.

The theory of user-driven open innovation is a new model that is supported by the following facts.

- Internet services development with a richer offer both in number of services and the capacity to interact with the mechanisms that have been called Web 2.0 and a high degree of customisation.
- A new academic discipline called Service Science is evidence of the change. The emergence of services that reach us from the Internet requires a discipline that analyses, studies and orders them. Science Services is a multidisciplinary approach (engineering, psychology, business strategy, operations delivery, etc.) for a better understanding of the benefits that should offer and how.
- New innovation ecosystems fall within the open innovation model coined by Chesbrough [2], where the process of creation includes external actors within it. In other words: don't limit research and development to the boundaries of the organisation but use the potential of all stakeholders: partners, customers, partners, etc.

—Focus on Innovation 'user-driven,' is not only considered in the initial stages of the process of creation, but is a necessary participant throughout the process and in particular the origin of demand. This last point is particularly interesting because, as has been seen in 'The European Network of Living Lab' [1] users, when they are involved and contribute to the creation process, create services that best suit their needs.

—The convergence of services is bringing futuristic scenarios as we have seen. The new wave is now a



The user-centric services meet better the real needs of the world we live in and benefit from the potential and diversity of the entire European population.

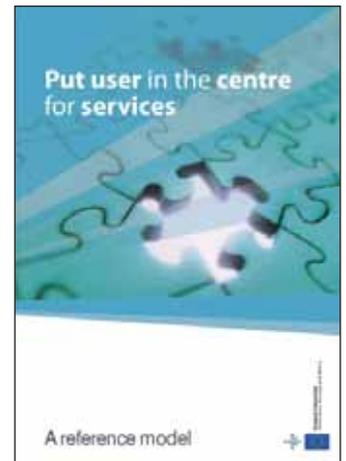


combination of Internet, mobile and contextual information. Some examples follow.

- A mobile adjusting its sound setting (high, low, vibration) depending on where you are (car, office, home, etc.).
- Advanced Directories cross-referencing contextual information such as one's location with data from one's personal agenda to show location and current activity.

In this unit, the evolution model of open innovation and user-driven innovation is taking place, driven by the skill of the people who work in the unit. Their technical skills are very high but what is even more relevant is their understanding of trends in innovation.

In fact, there have been small steps that can be framed in sections of open innovation and user-driven innovation.



Open innovation

Decisions on the architecture of the applications being developed in the unit were made by consensus of the group's software architects. Currently open innovation philosophy is followed and regularly the challenges of architecture are discussed within the entire group to receive contributions at all levels.

Moreover, with the idea that innovation and development does not occur only within our organisation, we have asked outside companies that assist the unit to propose ideas and solutions that apply in our field.

The two previous measures have already given some interesting results.

We have also adopted crowd models to solve problems such as updating the data of 12 000 employees. The model of a manager who was responsible for gathering information, offices, telephones, etc., did not work so the responsibility of updating the directory of the organisation has been delegated to the mass and with rather more success.

User-driven innovation

Experience in developing applications for users has made us think that often the products generated with great effort and cost are not of the desired usefulness and do not meet the expectations of users, even though we have worked with them from the beginning of the life cycle of the application.

As an experiment, the user has been asked to outline what tools need to work and we have realised that user needs differ from the traditional conception of the applications we were developing. Users want:

- fewer applications
- easily found applications on the desktop
- applications must be very simple to use
- applications can be combined.

Architectures that support new services

Tools in the hands of users can result in innovative solutions, so the goal is to make available services like building blocks that can be combined to create custom applications tailored to their needs.

Mashups let you drag different widgets containing pieces of information to the same page so that you get all the selected information displayed on

the same page. These widgets are primarily information containers and non-featured and if you want to combine them you need programming tools and, therefore, a technical background.

If the user, instead of combining widgets, can combine services and make them interact (and all this without a technical background, just by dragging boxes and connecting them), we will be giving the user driven tools for innovation.

It is with this philosophy in mind, that the report *Putting the User at the Centre of Innovation Services — a Reference Model* was written [3]. It is the academic exercise of sketching an architecture of building blocks that, offered to the users, could be used to compose services suited to their needs, all raised from the perspective of public services.

Application in our unit

The Directorate-General of Information Technologies and Communications of the Ministry of Economy and Finance is dedicated to designing and developing applications for use by the 12 000 employees of the Ministry.



Make sure your new product or service meets an existing user need — and that they understand it.



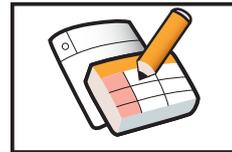
Desktop icons (icons from Google)



Descargar



Descargar



Descargar



Descargar

APLICACIONES DE USUARIO

These user desires do not match the user interface based on the desktop metaphor, which still requires training for many people because the idea of folders and windows is not intuitive at all.

Moreover, the desktop metaphor is far from simplified, further complicated by the amount of digital files that we use, so that there is information overload on the intranets of organisations.

An iPhone-like interface consisting of icons and gadgets seems to be closer to the users' needs.

So, we are working to guide our developments in this way. We aim to provide a very simple toolbar where each person can drag to his/her desktop those that he/she finds useful.

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Contact

Myriam Corral
*Jefe de Área de Desarrollo de la
 Subdirección General de Tecnologías
 de la Información y las
 Comunicaciones (S.G.T.I.C)
 Ministerio de Economía y
 Hacienda (MEH)
 myriam.corral@meh.es*

3.6 Openness and collaboration for competitiveness and well-being in Finland

Openness and collaboration in Finland

Finland, as a society and economy, prioritises openness and collaboration. The overall dynamism, creativity, innovativeness, trust and social harmony as well as quality of life and international competitiveness * [1] all seem to benefit from the development of open society. Finland may also be the very first country in the world that has a conscious country brand strategy that encourages even individuals to creative openness and collaboration side by side with firms, academia, cities and public agencies; the idea is to experiment together for the better future of humanity [2].

Finland promotes open-society **-based collaboration that mobilises the capabilities and enthusiasm of people, firms and other actors to solve local and global wicked problems such as climate change, energy efficiency, green development, ageing, well-being and social and economic structural change. The focus is especially on solving problems that call for collective competences of societal and systemic nature; Finland aims at becoming the Silicon Valley of Social Innovation by 2030 [2].

In the same spirit, the Finnish information society 2020 [3] strategy aims at human-centric societal development including services and technologies that are all-inclusive; meaningful, safe and accessible for everyone. According to the strategy, the ease of use ensures that the digitised culture includes all citizens. The further argument is that solving the wicked problems — such as climate change — calls for mobilisation of people, social networks and wide use of ICT; this makes modern electronic services very important; it pays to prefer bits to atoms. The strategy also promotes open innovation, public-private collaboration and engagement of citizens in co-creation and co-innovation.

* Finland is No 1 in the Newsweek (2010) study: The World's Best Countries. A Newsweek study of health, education, economy, and politics (<http://www.newsweek.com/feature/2010/the-world-s-best-countries.html>).

** In open societies, government is responsive and tolerant, and political mechanisms are transparent and flexible. The state keeps no secrets from itself in the public sense; it is a non-authoritarian society in which all are trusted with the knowledge of all. Political freedoms and human rights are the foundation of an open society (Wikipedia).

The Finnish National Innovation Strategy [4] emphasises demand and user-driven innovation in parallel with technology-driven innovations (supply-side) ***. The implementation plan of the demand and user-driven innovation policy (16 February 2010) views that the contemporary societal challenges are often both local and global by nature. Solving local problems in innovative ways may provide scalable solutions for wider use in the world. However, there is a need for competence that helps to turn the responses to challenges into innovations and businesses locally and globally.

The core of the implementation plan of the Finnish demand and user-driven innovation policy is to develop ways and means for engaging citizens, active users and developer communities in research, development and innovation (RDI). RDI can be also brought away from closed corporate or university laboratories to people's everyday life; the solutions of problems can be experimented, prototyped, tested and validated in real-life contexts and places of usage and real action. The Finnish Ministry of Employment and the Economy promotes open and user-centric ecosystems of RDI such as Living Labs. The ministry views that this approach has a strong potential even in renewal of industry and public services.

The Finnish policies reflect the major societal challenge: What is Finland's competitive future in a global economy as an open, small, human-centric welfare society? There is a need for both structural renewal in the public sector for productivity gains and private sector for renewal of the eroding industrial base. The Finnish policies aim to tackle both of these renewal processes even through open RDI activities that involve citizens.

Finland's experience shows that the good education system, efficient RDI-system and internationally competitive firms are not enough. The whole society and economy needs dynamic qualities of transparency, openness and collaboration in order to promote entrepreneurial risk-taking and boldness in shared visioning and action. However, the openness and collaboration-based development of competitiveness and well-being may bring about major socio-techno-economic and institutional changes that extend the domain of participative democracy, collective

*** The Finnish innovation policy is further discussed in Evaluation of the Finnish National Innovation System (2009) (<http://www.evaluation.fi>) [5].

action [6] and collaborative governance; we may have a good reason to discuss even of co-governance.

An open society with high-level of public participation contributes to modernising the practice of representative democracy within established constitutional frameworks. In a democracy, public participation has intrinsic value by increasing accountability, broadening the sphere in which citizens can make or influence decisions and building civic capacity. It also offers instrumental value by strengthening the evidence base for policymaking, reducing the implementation costs and tapping greater reservoirs of experience and creativity in the design and delivery of public services [7].

Finland provides an example where not only the public sector and industrial renewal but even a wider societal renewal may be experimented; new operation modes and methodologies of open society-based collaboration and experimentation.

Dynamic trinity of people, ICT, and places of life

Since the 1990s, the science, technology or corporate-driven innovation paradigm has been challenged by a new open, human and ecosystem-based collaborative innovation paradigm where the knowledge creation and innovation brings about — not only new technologies or products (supply-side innovations) — but rather new production and consumption patterns (systemic transformations) that renew both local and global services, markets and industries through new sustainable ways of operating and providing value for quality of life [8]. The demand-side, i.e. people as citizens, users and customers, cities as places of life, public services, social networks and other 'players', are viewed as sources and contexts for knowledge creation and innovation.

This is argued to be a worldwide golden opportunity for a new Renaissance that deploys the dynamic Trinity of: (i) empowered people and social networks; (ii) modern ICT; and (iii) places of life — be they cities or rural areas. The modern ICT is compared with Gutenberg's discovery of printing technology and the communities and networks of people are compared with artists, inventors and discoverers of the Renaissance. The places of life, in turn, are the very contexts where many of the contemporary problems of humanity may be met and solved. The modern usage of ICT for collaboration of people, firms, cities and public agencies may contribute to problem-solving in well-being and quality of life of people, communities and the nature.

This includes creation of solutions for public governance, eDemocracy, social and participative media, sustainable construction, smart and sustainable urban and rural development as well as renewal of social and economic structures and processes.

These developments challenge our fundamental assumptions regarding the welfare state and quality of life. However, the open society development provides new opportunities for collaborative problem-solving that involves public and private sectors alike and mobilises people to participate in co-creation and co-innovation. However, within open society development, people expect new levels of transparency and openness in public sector leadership and governance, and are willing to actively contribute to the development of new structures and collaborative processes for open governments [9].

The business sector can have an important and instrumental role in this development. It has widely acknowledged this paradigm shift and recognises that the autonomous activities of single organisations cannot produce the much needed radical, cross-disciplinary and architectural innovations required for structural changes [10]. A more collaborative, open and human-centric approach to development is needed.

The public sector should find a more proactive and dynamic role in promoting this development.

Enabling ICT technologies

Open society needs open innovation and communication technologies (ICT), since democracy requires access to information and dialogue [11]. Increased use of ICT in democratic processes is expected to increase transparency and pluralism, and thus to contribute to the overall democratisation of societies. Developed information and communication technologies have enabled users to demonstrate increased power and influence over the content of products and services [12].

ICT enables more transparent and efficient society with increasing digital social capital and participation. However, the first generation of eGovernment tools focused on improvements in productivity and administrative-burden reduction within the existing governmental processes and structures rather than on structural reforms, innovative engagement processes and management models.

The role of ICT may be instrumental in public and private structural renewal.

Firms' role in changing society: the opportunities offered by a collaborative, participative and open society

Recently, we have witnessed the innovation failure of big corporations alone to tackle the challenges — or opportunities — of wicked problems. The innovation failure is even greater in the case of productivity improvement or systemic renewal of public (or private) services such as clean and green energy production and distribution, traffic and transportation. Some new innovations may have their very origin in human communities, social networks and other 'walks of life'. Some innovations and forms of social entrepreneurship may only emerge from RDI and the renewal of public services, governance and administration.

The OECD and EU are promoting the development of participative and open society as well as opening up public sector RDI*; this is done to promote all-inclusive socioeconomic development and the creation of jobs and growth. The EU even promotes economic dynamism that is based on the social market mechanism and new patterns of balanced socioeconomic development (EU 2020, Digital Agenda).

These are proper frameworks for firms considering collaboration with people, SMEs, cities and other public agencies for collaborative and participative open society development — and especially for jobs and growth. However, from the viewpoint of a firm, the major benefit of entering an open collaboration may lay in experimentation for new open service and technology architectures, or when there is a need for changing the business model or value creation model of the industry. The open collaboration may be considered also in cases where the change from a very centralised production and delivery patterns towards more distributed ones is needed for, or in cases where hierarchical vertical structures should be changed towards more non-hierarchical, horizontal, partnership- and network-based collaborative structures. This often implies a renewal of production, delivery and consumption patterns based on ongoing societal and economic trends such as globalisation, sustainable development, and ageing population. This may lead to new services, business and market creation. This includes new socioeconomic activities, social entrepreneurship and even new industry creation [13] [14].

* EU Policy on Opening of Pre-commercial Public Procurement.

Public sector innovation

Finland has some important building blocks in place to face the major challenges of the structural renewal of public services and administration. However, implementing this 'strategic intent' may require much more.

The core problem of our current service provisioning system is that it consists of two separate 'top-down verticals'; one providing public sector services and the other providing private sector services — without collaboration with each other or citizens or third party involvement. Furthermore, the public sector services are developed and delivered in various national and local 'silos' without any transparency — and with huge duplication of resources.

Innovation solutions: focus on the customer centricity and systemic efficiency

The only way out of this 'systemic inefficiency' is to put human beings — or customers — at the centre and start developing solutions together. This may even mean that the service is designed and the delivery system organised around people or citizens. The service system needs to be reliable and efficient — not only from the viewpoint of provider — but also from the viewpoint of receiver: a citizen. This arises many issues of personification, user-centric service profiling, identity management, trust, security and confidentiality. It also brings about the question: Who owns the information? This, again, calls for a 'new deal,' or governance innovation, among the public, private and third sectors — together with the citizens.

According to Finnish law, the public sector is responsible for arranging basic public services — but it doesn't need to develop and run all of them. Instead, the public sector should first and foremost concentrate on providing the basic architectural standards, guidelines and quality controls for the private and third sector service provision — in addition to providing those public services not economically viable for the private sector.

By enforcing open interfaces and by allowing easy access to public data, the public sector could speed up and improve the quality of new service creation enormously. Besides improving the well-being of citizens and productivity of the public sector, these new principles would open up a whole new market for innovative businesses.

Helsinki Metropolitan Region has an ongoing bold exercise that aims to open up public data. The public data includes a wide variety of statistical data, geographical data or

information of public services and economic activities of the region or of international investments, RDI and tourism in the region, etc. Open public data is available for free for wide educational, research, media, content or any other service or industrial use. The significance of open data has been realised worldwide. Numerous initiatives have been taken both at city and national as well as at European level. These initiatives have been often closely related to open government initiatives, public procurement policies, knowledge society development or even digital library initiatives.

There are already also many other excellent examples of new Internet and social media-based services — for instance for the elderly people — developed by the private sector, third sector and citizens together. For example, the CareTV* for elderly people brings benefits of connected interactive TV, social media and the healthcare data of people and their doctors at local hospitals or care homes.

The EU-funded SAVE ENERGY project** deploys collaborative cross-border and ecosystem-based Living Lab methodology for open RDI of energy efficiency in public buildings of Helsinki, Luleå, Leiden, Manchester and Lisbon. The project experiments with citizens monitoring energy consumption patterns and energy management systems that reduce energy consumption. The project has developed serious gaming and social media tools for experimenting with people across borders on different energy consumption patterns. Based on wide technical sensory data as well as on wide human and social behavioural data, the major changes in consumption and delivery patterns of energy have already been found. For instance, the City of Helsinki — that piloted with two public schools — has already decided to scale up the information learned, into wider use in its schools. The project has helped the SMEs involved to grow rapidly in internationalisation of their products and services.

The Finnish Innovation Fund (Sitra) has a strategic task to develop open society collaboration and partnership models; how to co-create and co-innovate, how to co-finance, how to co-manage, co-organise and co-govern complex and dynamic network and partnership operations, and how to conduct open RDI: experiment, validate and scale up

* The careTV concept was developed together by elderly people at their home and their doctors and nurses. The RDI was conducted by the Laurea University of Applied Sciences in Helsinki. The concept and activities was later bought and further developed by Phillips Corporation.

** From Finland, the City of Helsinki, Metropolitan University of Applied Sciences, Green Net, the Center for Knowledge and Innovation Research (CKIR) of Aalto University School of Economics and Process Vision are participating in the project. The Prime Contractor is Alfamicro from Portugal.

through wide networks and partnership operations. The question is about development of workable design rules and methods for major societal change projects.

Sitra develops, with around 20 Finnish cities and their service providers and citizens, shared ICT services for public administration and services. This implies changes in the operational processes of cities, including shared architectural solutions and standards and even shared ICT capacity. Traditionally, all the cities and communes in Finland have had their own ICT policies, solutions, capacities, services and processes. The joint operation is a major transformation in the ways of how the public services are produced and delivered. It brings about major efficiency and productivity gains — however, it seems also to inspire new service innovations and structural renewal, i.e. the systemic innovation is in place.

Recently, Sitra has developed shared IT services architecture for micro-entrepreneurs. It has also organised a design competition and process for the construction of a new harbour city part of Helsinki: Jätkäsaari. The Jätkäsaari project has benefited from the experiences derived from two other city districts, Arabianranta and Kalasatama, that Helsinki has purpose-built to be housing environments with wide and deep citizen-participation in RDI of everyday life. The cases have involved people such as entrepreneurs, citizens, students, people from SMEs and big firms, people from Helsinki public administration, etc.

The experiences so far promote the need to encourage and mobilise large-scale dialogue, experimentation, piloting and risk-taking across the system; i.e. there is a need for a conscious systemic change in RDI that involves all the relevant players needed for public services and administration renewal.

Some cases indicate that the structural challenges have already grown to such a level that they have moved on from the pilot phase to large-scale implementation.

Industrial reform

Finland has traditionally been reliant on export-oriented, raw material and resource-intensive industrial production. With globalisation, the paradigm shift towards more knowledge and less labour-intensive sectors has become inevitable.

The Finnish innovation policy promotes major industrial reforms through parallel demand and supply-driven innovation

strategies. The idea is that the new market creation — even new industry creation — may benefit from open, demand and user-centric, ecosystem-based dynamism that brings together all the relevant players for future services and manufacturing. The underlying assumption is that the innovation cycle of new services, businesses and technologies — even markets and industries — can become ‘compressed’ and short if the RDI collaboration involves all the necessary partners of the emerging ‘value constellation’.

According to Finnish innovation policy, the Finnish Funding Agency for Technology and Innovation (Tekes) has created six Strategic Centres of Excellence for Science, Technology and Innovation (SHOK) that are to update industries such as information and communication technologies and services (ICT), metal products and mechanical engineering, forest, construction, health and well-being as well as energy and environment. SHOKs are collaborative public-private consortiums of firms and academia that run together strategic RDI programs that aim at major reforms and global breakthrough innovations within the industry. The programmes include elements of demand and user-driven RDI. The instrument is quite new — only two years old. It is too early to assess if the SHOKs will succeed in the major long-term strategic reform of industries or if they remain instruments for a shorter or medium-term business or technology innovation.

Since the challenges are ‘burning’ and systemic, they call for efficient collaboration modes for systemic innovation. This implies participation of relevant players, even customers and citizens. This may also lead to new forms of social entrepreneurship that ‘kicks out’ new types of start-ups and spin-offs.

As a small, well-educated, tech-savvy and collaborative country, Finland could take a leading role in addressing some of the ‘wicked problems’ facing the world, and create lead markets for new types of sustainable networked innovations and development platforms.

Consequently, promising new approaches are being experimented in private, public and civic sectors. These include the increasing participation of users and citizens in product and service development, the use of foresight in strategy and policymaking processes, Internet-based open innovation and problem-solving ‘jams’, participatory development of shared visions, strategies and values, cross-sector cooperative networks, Private-Public-People-Partnerships, etc. However, these new solutions cannot be fully deployed until the old governance structures and institutions give in [15].

Governance structures and new leadership

Finland has the strength of consensus-driven top-down policymaking that is based on wide informal dialogue through horizontal networks across the sectors and institutional boundaries. In rapidly rising global challenges, this is a good asset but needs further improvement. Finland as a small country, should, and can, be mobilised — even with the help of ICT and new forms of interactive social media — to live up to the open society principles in solving the problems for the future development in Finland — and even for the world.

However, the Finnish thinking used to be institution-based. The welfare state established many institutions. But current cost structures, efficiency and the agility to respond to individual needs causes challenges. Therefore, we should redesign our society from a human-centred point of view. In order to succeed in the huge paradigm change needed, we need more diversity, distributed production and interaction efficiency to apply the wisdom of crowds more effectively.

An example of new co-governance culture is the city of Oulu. The Municipal Public authority for building permits changed their approach from a control-driven process to a pro-active consultation with citizens and businesses. They started to organise briefings for those who were about to start building their own house. With very simple models, they help people to plan for long-term energy efficiency, already in the planning phase. For companies, they organised workshops to develop the ecosystem. As a consequence, more innovative solutions evolved and overall energy efficiency rose by, for example, 37.4 % in single family houses and quality improved in the process and in subject domain. This would mean, if applied to national level, more energy savings than the total nuclear energy production, i.e. 2 400 GWh in 2009. This is a prime example of a systemic change which covered all elements (public sector as enabler, citizens, industry) of the system in order to put knowledge to work for society.

The governance structures and steering mechanisms developed for the 19th and 20th century organisations and societies do not suffice anymore in our world of increasingly



Finland is already quite transparent and for us to move citizen-centric architectures with open data principles and collaborative applications is quite a challenge, but doable with our technology-savvy population. In order to accomplish this, parties, public, private and education sectors must evolve their roles and start build up a sustainable human-centered world. Finland's success will surely continue to rely on its age-tested cultural values of self-honesty, common sense and a deep appreciation for rational, considerate and steadfast civilisation that thrives in intimate relationship with nature.



fast change and complexity. We know that traditional hierarchies cannot cope well with the complexity and fast change of our time, thus we need to adopt new organisations. But what else do we need?

We certainly need more strategic agility at the societal level both in Finland and globally — if and when we want to cope with the forthcoming challenges. The other reorganisational alternatives cannot meet the challenge for the following reasons.

- The model of continuous improvement/operational excellence only works well with a slow-changing, simple environment.
- Conventional strategic planning can deal with complexity in stable conditions but not in today's dynamic environment.
- 'Bringing Silicon Valley inside the company' — alternative works fine in a dynamic environment without interdependences and synergy opportunities.

Strategic agility is not only a challenge for countries and organisations but also a major opportunity for a smart, quick and committed actor — such as Finland as a country.

With newly modified, more integrated, and open governance principles we could simultaneously improve our public sector productivity and create new growth areas for business.

Do we need a new agreement between individuals, communities and government — new ways for people to get involved in determining their lives in a meaningful way? This could support a human-centric systemic change enabling people to flourish and bring their dreams alive. Leaders could become involved in this dialogue through social media for openness' sake and to gain an understanding of how to develop in a way that enhances our competitiveness. Openness gives the opportunity to collect partially formed notions which would never be commonly accepted as formal ideas. For a business of this type, customer collaboration is vital. Social media has proven a fantastic way of creating openness between customers and companies. Citizens and their governments could reap the same benefits.

But implementing this 'new vision and governance model' requires also a new leadership approach. Henry Mintzberg [16] proposed that we should replace the concepts of leadership and management with something he calls 'community-ship'. In his words, 'community-ship'

certainly makes use of leadership, but not the egocentric, heroic king that has become so prevalent in the business world. We make a great fuss these days about the evils of micromanagement but far more serious is 'macro-leading': the exercise of top-down authority by 'out of touch' leaders. Community-ship requires a more modest form of leadership that might be called engaged or distributed management. A community leader is personally engaged in order to engage others, so that anyone and everyone can exercise initiative.

Europe-wide engagement of people as citizens of an open society

By exploiting the potential of advanced ICT technologies and community-based social production by self-organised social communities, Europe can transform public policy-making and service creation environment to a democratic citizen-driven, open innovation. This, however, would require maximising synergies between the various stakeholders in explorative cross-border collaboration in the development and provision of the next generation citizen-centric services as well as related development platforms for improved competitiveness, openness and well-being.

The EU's i2010 policy (2005) did boost single and lead market development through research and innovation in ICT towards a more inclusive society where people do participate in new services, media, business and technology developments that provide easy access to information, communication and related services for everybody at any time from any place. The i2010 policy did emphasise new waves of innovation in networks and the Internet as well as more comprehensive user involvement in innovation [17]. However, the implementation of this policy remained very slow.

In the framework of the new EU 2020 strategy and Digital Agenda, these goals are even more valid. The EU 2020 strategy and Digital Agenda include the idea of social market mechanisms and balanced socioeconomic development. In this spirit, Europe should aim at having a leading edge in the global service, market and industry creation that is based on social market mechanism and open and collaborative society and economy development. Europe should find the ways to be bolder in its implementation of strategies and avoid the tendency of having good strategic initiatives but lacking in implementation. We wish that Europe lives up to the opportunity to take the forerunner position in this race for the most open society, revitalising democracy with economic prosperity, cultural diversity and democratic heritage.

The United States of America and China are also taking interesting steps in their renewal process. The United States and China are engaging citizens with different strategies. Top-down strategies are supported by bottom-up participation. In China *the emancipation of the minds* principle releases people's energy and strengthens their self-esteem. In the United States, Obama's administration has encouraged the wide use and development of Internet-based services, including public services. In both cases, people will stand on their own feet to contribute to the process of transforming the country. Also, the governance system engages both the leadership and citizens in creating interplay between top-down principles and bottom-up demands — they seem to work together to strengthen the whole.

However, Finland with its bold new brand strategy, offers — even to itself — a fresh picture of a People-driven New

Society that acts like a dynamic networked 'front' of people hand in hand. All are citizens and people — even though having different tasks and duties in time. The main organising principle is the problem, issue or task at hand; How to manage the task and problem-solving in the most efficient and fruitful way together? This bottom-up people-driven society does not shy away from problems but rather mobilises itself around them. This is a vision of a society that is very pragmatic but value and future-driven. This vision of a society throws out the mechanistic view of a society where rigid hierarchical, organisational and institutional structures subordinate people and their creativity and make them serve the system. Finland offers a vision of the society where the system serves the people; institutional, organisational and technological structures and processes of the society are dynamic, purpose-built and flexible; they are enabling the processes of creation for Life.

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Contact

PhD (Econ) Seija Kulkki
 Director
 Center for Knowledge and Innovation
 Research (CKIR)
 Aalto University School of Economics
 seija.kulkki@aalto.fi

Ossi Kuittinen
 Director
 ISTAG member Finnish Innovation
 Fund Sitra
 ossi.kuittinen@sitra.fi

Ph. D (Tech) Petra Turkama
 Director of Research
 Center for Knowledge
 and Innovation Research (CKIR)
 Aalto University School of Economics
 petra.turkama@hse.fi

3.7 Open innovation and the IT profession — an IT Capability Maturity Approach

Information technology is emerging as one of the most dominant forces changing business and, indeed, society today. Increasingly, we are seeing the collision of Moore's law with all types of business producing great entrepreneurial and business opportunities. Although technology, driven by Moore's law, is advancing at a very fast rate, the management practices used to manage and apply IT appear to be lagging significantly. Despite Nicholas Carr's assertion that 'IT doesn't matter', many firms are increasingly using IT to create and sustain competitive advantage. However, the challenges of technology complexity, demand growth, security, budget and many others make the use and conversion of technology into value unpredictable and risky. This paper introduces the IT Capability Maturity Framework (IT-CMF) and how it can be used as a design pattern, i.e. a generally reusable solution to these commonly recurring problems.

IT Management and value issues

The IT profession is in a catch-22 scenario at present. Some IT departments are underperforming and company management is often unwilling to fund IT appropriately. CEOs invest in those areas of the business that contribute to the core objectives of the business, typically looking for growth and margin, or developing new successful products and services. IT departments consume so much of their available resource just keeping the current levels of performance (and not always succeeding) in play, that there is little capacity for investing in innovation. This can continue to be a constantly downward spiral, unless IT can do more from a reactive to proactive posture.

The core issue is that IT management processes are fundamentally undefined at an international, inter-company and profession level. ICT departments have developed their own processes to deliver their responsibilities. They use best practice, but still point solutions, like the excellent CMMI and ITIL, into some process areas, but often depend on the intelligence, background experience and heroic deeds of their management and the best people to keep up an acceptable level of service and performance.

As the IT industry matures it needs to standardise on what is expected of IT executives, professionals and, indeed, users of IT. The absence of a clear European-wide e-Skills

competency framework is leading to inefficiencies in the growth and utilisation of both the potential of Information Technology AND the IT talent pool. Given that there is a global shortage of such talent, Europe cannot afford to allow this inefficiency to continue. Thus a competency framework coupled to a maturity framework is required. This will enable schools, tertiary education establishments, employers, training companies and recruitment agencies to operate in a more joined up manner.

Despite the complexities of IT, in some ways the formula for success is quite simple. The core competencies required to deliver across the spectrum of IT management need to be understood and practised by the IT department. The IT team members need to be trained and capable of executing these IT management processes.

For any IT organisation to demonstrate its capacity to deliver business value and use IT to build innovative business-wide creativity, it must establish a foundation of solid compliance and effective delivery [1]. A mandatory level of performance from IT exists that must be satisfied constantly before IT can move up that value ladder within the organisation. For IT to achieve at the CEO level, and add the value to the business that should be expected for the proportional cost it incurs, IT must operate at the highest levels of performance. Both IT professionals and IT departments can capitalise on the available knowledge provided through the Innovation Value Institute's (IVI) IT-CMF.

The Innovation Value Institute (IVI), based in Ireland, is introducing a unifying approach and framework, called the IT Capability Maturity Framework (IT-CMF) [2] to help organisations systematically manage IT for business value and innovate more predictably and profitably with IT [3]. IVI is targeting a key current gap in the IT Management Profession Landscape, that of the inexistence of a unifying body of knowledge (BOK) which is well structured and can be maintained as the technology and profession moves forward. The IVI established a unique consortium of six different communities to create this BOK and associated framework using an open innovation and design science research approach. Creation of the IVI BOK has been mostly a process of social production with IT executives from more than 30 companies contributing their knowledge voluntarily to collectively develop the first version of the

IT-CMF. In parallel, Design Science is an emerging research paradigm which creates artifacts that are useful to executives and this was used as the core research paradigm. The output of Design Science research is often a design pattern, a generally reusable solution to a commonly reoccurring problem and this is what the IT-CMF hopes to be — a tool that helps the CIO (Chief Innovation Officer) get more value from IT whilst wrestling with many challenges such as pressure for cost reduction and innovation, increasing complexity and rate of technology and business change, etc.

Use of the IT-CMF to help improve IT capability can help IT Organisations and professionals move from being reactive to proactive. Using the open innovation paradigm, IVI has developed a process to help find and document novel, emergent, good, the best and, indeed, the next practice for IT professionals. In the development of the IT-CMF, industry executives working with academics contributed their knowledge of best practices which were organised using a common taxonomy and vocabulary to ensure consistent ease of use of the knowledge collected.

The IT-CMF presents a framework that helps IT to be used as an Innovation resource and enables a CIO to be perceived as a chief innovation officer and helps improve the probability, predictability and profitability of IT-enabled

Innovations. The IT-CMF describes five different maturity levels and four interrelated macro-processes which can be used to help better use information technology for value. Using the IT-CMF as a design pattern (Figure 1), CIOs can help drive four different types of improvement shifts for the IT capability:

- move the business model of the IT capability from a cost centre to a value centre;
- move the IT Budget from a runaway scenario to a sustainable economic model;
- move the value focus from purely measuring total cost of ownership to demonstrating optimised value;
- move the perception of IT from being perceived as a supplier to that of a core competency.

In the past century, many of the leading innovations were enabled by electrification and relied on the delivery of relatively inexpensive power. In this century, many of the leading innovations will likely be enabled by knowledge-fication, the flow of cheap knowledge [5]. It is likely that information technology and the information and knowledge flows that it enables will be critically important in this century. Faced with many global challenges like climate change, energy diversification and efficiency and an ageing society, the application of information technology

Figure 1. The IT Capability Maturity Framework [4]

IT-CMF				
Maturity Levels	Managing the IT Budget	Managing the IT Capability	Managing IT for Business Value	Managing IT like a Business
5. Optimising	Sustainable Economic Model	Corporate Core Competency	Optimised Value	Value Centre
4. Advanced	Amplified Funding	Strategic Business Partner	Options and Portfolio Management	Investment Centre
3. Intermediate	Systemic Cost Reduction	Technology Expert	ROI & Business Case	Service Centre
2. Basic	Predictable Performance	Technology Supplier	TCO	Cost Centre
1. Ad Hoc		← Beginning →		

offers many potential solutions through replacing atoms by bits, for example the reduction of the energy intensity of everyday activities such as a teleconference meeting replacing a meeting which requires a physical journey. In order to fully reap the benefits that IT promises, we need a workforce that can skilfully apply IT to seize opportunities and solve problems while reliably operating these solutions and a broader user community, or even society, that has a high-level of digital literacy. Whilst companies such as Apple, which deliver highly intuitive user interfaces, lower the skill level required to interface with solutions, a basic level of digital literacy and competency will be required.

The role of the CIO is of pivotal importance. Both the business community and the company internal IT community look for leadership to direct IT to that elusive high performance contribution. The absence of an acknowledged educational and experiential progression path makes the capability development for senior IT managers somewhat adhoc. Other professions are so much better supported, with consistent role and responsibility definitions, and well-engineered educational and certification programmes. This scenario has greatly contributed to an industry-wide under achievement report for IT. The key for longer term sustained and industry-wide improvement is in the maturing of IT skills.

IT, as a discipline, is still in early stages of maturity, and yet as we see the pace of technology evolution, change and acceleration, we can observe an increasing gap between the potential of IT and our collective ability to turn this rapidly evolving technology into value. The absence of real-value measures around IT solutions and services deployments causes a credibility gap and also leads to a gap in improvement efforts as no baseline exists. In addressing the value deficit, a key action is to take an overarching managing IT for business value approach [4]. By taking a process and competency improvement approach, organisations can move from being reactive to proactive and deliver IT innovations which are probably more predictable, and ultimately profitable. As the half-life of IT Management knowledge is short due to the fast pace of IT change, a concerted effort will be needed to keep the body of knowledge fresh and current.

Industry and government has a growing dependency on IT and is a serious competitive variable for companies and countries. It is also a major competitive variable at the European Union level. Research into the demand for IT skills in the coming five years clearly points to a shortfall.

Bonn, Milan, Brussels, 3 December 2009 — *empirica and IDC EMEA Government Insights anticipate that the EU labour market may face an excess demand of 384 000 ICT practitioners by 2015. The number of ICT professionals in Europe was 4.7 million in 2007 and is forecast to be between 4.95 and 5.26 million in 2015 depending on five foresight scenarios. Accordingly, the eSkills gap, or unfilled vacancies, will amount to between 1.7 % and 13 % of the existing occupations by 2015* [6].

Key European-wide actions which have been summarised in the EU eSkills Manifesto [7] could include the following.

- Train IT leaders to be business leaders — this means that IT leaders need to learn, acquire and demonstrate business acumen so that IT investments deliver real value to the end-user and customers. The Innovation Value Institute (<http://www.IVI.ie>) has developed several professional diplomas around Managing and Measuring the Business Value of IT and has begun pilot collaboration with EFMD (European Foundation for Management Development) to diffuse these courses to European business schools.
- Application of a maturity model approach (such as the IT-CMF) to stabilise and control the processes to deliver and operate leading edge IT solutions. Such approaches as the IT Capability Maturity Framework removes the need for IT firefighters and replaces this with a need for skilled IT professionals who operate in a rigorous, disciplined and professional way.
- As the IT Profession matures, more opportunities will arise to move IT from the backroom to the boardroom and as IT has a horizontal view of all functions in a business, we should see more opportunities for CIOs to function at board level. In fact, the profession needs 'celebrity' CIOs who actively promote and advance the brand of the IT profession through their demonstrable acumen and influence.
- In IT, we, of course, need lots of skilled professionals and managers who can solve problems and deliver solutions using IT but as importantly, we need IT leaders who can identify what problems should be solved and what opportunities should be seized using IT. It is in appropriately training IT leaders, producing professionals who have the appropriate mix of technology, business, interpersonal and communications skills that will lift the quality of the profession and lift the quality and value of the solutions delivered.

- The EU, and the IT profession, needs greater structure and organisation to deliver the increased capability needed. The EU can be a leader and innovator in playing a significant coordinating and brokering role, including a push for standardisation. The IVI can be a key source of knowledge, and be a key player within this model.
- The Innovation Value Institute have developed the process maturity tools over the past four years through their International Consortium, using a design science approach and a collaborative effort between IT practitioners and Academics. This body of knowledge spans the full and broad range of IT management processes and has incorporated existing best practice guidelines and standards.
- An IT organisation can leverage the IT-CMF through developing the skills of its practitioners, and they in turn implement the processes, and continue to ratchet up the maturity of the IT processes. This competency development of the IT team is essential to sustain improvements. The IT personnel can grow and develop through this knowledge acquisition in a systemic and measured manner.
- The establishment of repetitive, documented, practiced, and competency-based processes are delivered through IT-CMF. The IVI have structured their 32 Core Processes to be delivered in a consistent and readily applied format. Online assessments immediately determine existing maturity levels and pinpoint where improvement attention is needed. The IT personnel responsible for these processes can quickly attain the specific knowledge needed for the processes most urgently in need of focus.
- The IT professional needs specific capability development. Ideally, this dovetails with the company's need for his competency development. However, the effort to personally develop needs to be motivated and rewarded through recognised academic achievement. The university infrastructure needs to be a component of an overall EU IT professionalism solution design.

Looking forward, IT will become more and more pervasive with countries (e.g. Denmark) even publishing public IT plans to drive down cost and deliver better public services. In order to be able to do this efficiently and effectively, companies and governments will need to adopt process and capability maturity models such as the IT-CMF. While the IT-CMF has many of the characteristics needed to become a standard [8], ultimately its success as an open innovation will be judged by whether it is widely adopted and whether it consistently delivers value to adopters. While early results are promising at companies such as Intel, BP, Chevron and SAP, only time will tell. No one consortium has or can have a monopoly on IT knowledge and wisdom but one thing is certain: the road to broad improvement in IT capability and value will be paved with open innovation.

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Contact

Prof. Martin Curley
National University of Ireland,
Maynooth
Director, Intel Labs Europe
martin.g.curley@intel.com

Martin Delaney
Technology Leader
Innovation Value Institute
martin.delaney@nuim.ie

3.8 Open innovation: The case of the innovation Value Institute

Introduction

Over the last decade, significant research has emerged in two areas related to innovation: firstly at the macroeconomic level with the debate on the role and composition of national innovation systems (NIS) and secondly at the operations level with the argument that enterprises must move from 'closed innovation' to 'open innovation' models. The aim of this paper is to examine a case of the practical implementation of open innovation, i.e. the Innovation Value Institute (IVI). Furthermore, the IVI is a 'triple-helix' collaboration between actors drawn from academic, industrial and public service sectors with a focus on one important technology for practitioners and for the region; the management of Information Technology. The paper now proceeds as follows. Firstly, the research context is outlined in terms of the evolving Irish economy. A literature review is then presented from the areas of enterprise innovation models, national innovation systems (NIS) and information technology (IT) governance. Finally, the conclusions, implications for practice, policy and research are outlined together with suggestions for future work.

Background

This section will provide the background to this study by reviewing the changing nature of the Irish economy, the regional context in which the industrial case study is based and the influence of government on the development of the ICT industry.

National and regional context

Over the last 40 years, Ireland has leapfrogged from a traditional agrarian economy to a deliberately created information economy [1]. The initial impetus was fuelled by foreign direct investment (FDI) from North American multinational corporations (MNCs) setting up offshore manufacturing facilities to avail of low tax incentives, a young educated workforce and proximity to their growing number of European customers. However, this initially successful model is increasingly being threatened by the low cost economies of Eastern Europe, India and China. Irish enterprises rapidly need to build new sources of competitive advantage to sustain employment and standards of living. An important national study undertaken in 2004

highlights this situation. The Enterprise Strategy Group's report 'Staying Ahead of the Curve' states that the application of research and development (R&D) and technology to the 'creation of new products and services, now require comprehensive and intensive development and will mark the decisive new orientation of Irish enterprise policy' (Enterprise Strategy Group, 2004). The first strategic focus is to build capabilities and capacity in the following areas where there is currently a deficit:

- expertise in international markets to promote sales growth,
- R&D to drive the development of high-value products and services.

The second area of focus aims to ensure that high-value manufacturing and supply chain operations continue to be an essential component of the country's business environment. Furthermore, the growing importance of services in the knowledge economy and the resulting value chain realignment from selling product to providing integrated customer solutions is being recognised [2].

This report highlighted the present low level of:

- product development and patenting,
- linkage with research bodies.

The continuing slide of the Irish economy in world competitiveness rankings is another reason to make innovation a priority. Ireland is now entering a new era which, according to Porter [3], requires a transition to an innovation economy. However, some commentators are concerned at the tendency to overstate the threat from the low-cost economies given Ireland's commitment to developing a knowledge-based economy [4]. Ireland still punches way above its weight internationally attracting 2 % of total global foreign direct investment (FDI) in 2008 which amounted to circa EUR 2 billion [5]. Manufacturing is the bedrock on which Ireland's FDI was built and over the last three years more than EUR 5 billion of manufacturing projects were approved by the IDA. The present focus is on jobs which are 'capital and skills intensive' where 'labour cost is not a significant competence in demand fulfilment management' [6]. Furthermore, these manufacturing investments increasingly include product or process development activities [7].

Role of government

Having looked at the national and regional context, we will now examine the role of government in the development of the ICT industry. In general, governments have contributed to the development of the ICT industry in three areas: procurement programmes specifications for high-performance computing, and its regulatory role. Most of the early computers went to government agencies. The commercial market did not provide an effective demand for electronic digital computer until the US government indicated its preferences among industrial firms. IBM's success in meeting government specifications translated into success in the commercial marketplace. The emergence of the computing industry under government patronage created an environment that favoured the development of the minicomputer and of microcomputers that gradually replaced the mainframe that embellished the giant government computer facilities. The Internet and the World Wide Web provided a rapidly growing communications environment within which the PC flourished and it can be argued that the ICT industry would not have emerged without the intervention of the government which provided the market to enable its development.

Literature review

Changing innovation paradigms

For this study we will view innovation models through two lenses. The first examines the phenomenon in terms of the design and development methodologies carried out within enterprises. The second lens deals with the economic, institutional and social context of innovation dynamics.

The process of product design has been well road-mapped [8] [9] as has product development methodologies [10] [11] [12]. A number of theses in this area have proposed an integrated approach to the management of the innovation process such as systems innovation management (SIM) [13] and a product innovation management (PIM) framework for networked organisations [14]. The practice of innovation is also taking place within radical redesign of business processes [15] and the change from 'task-based organisations' to 'process-centred organisations' [16]. World-class companies have been found to specialise or excel in one of three core value disciplines, namely operational efficiency, product development or customer intimacy [17]. The innovation-development process as defined by Rogers [18] consists of six steps

(Figure 1), that encompass 'all the decisions, activities and their impact' from the initial recognition of a need, research, development and commercialisation through to diffusion and evaluation of the consequences.

Figure 1. Rogers' Innovation-Decision Process adapted [18]

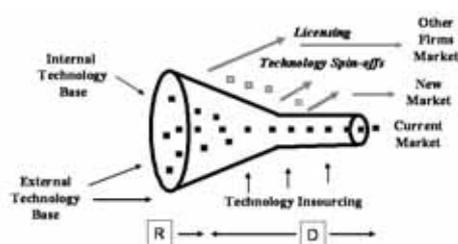


Chesbrough [19] argues that in many industries the centralised approach to R&D which he terms 'closed innovation' has become obsolete. This paradigm, he contends, must be replaced by 'open innovation' which adopts external ideas and knowledge in conjunction with the internal process. A number of factors are influencing this change such as the mobility of skilled people, the increasing presence of venture capital, emergent high-tech startups and the significant role of university research. One of his principles is that 'not all the smart people work for us' and he advocates that the smart people within an organisation connect with the smart people outside. Embracing the ideas and inspiration in these external links, he contends, will actually multiply the advantage of internal efforts. However, connecting external innovation to internal innovation requires a new business model with the following six functions:

- articulate the value proposition
- identify a market segment
- define structure of your value chain
- specify revenue generation mechanisms and estimate cost structure and target margins
- describe firms position in value network of suppliers and customers
- formulate the competitive strategy.

Implementation of the business model can be greatly accelerated by buying and selling intellectual property (IP). However, there always remains the hard work of converting research ideas into products and services that solve customer's problems. Interestingly he states that the presence of manufacturing, distribution and brand are assets that help the firm retain some of the value it creates. Figure 2 shows an innovation funnel adapted to illustrate an open innovation model.

Figure 2. An open innovation model — adapted from Chesbrough [19]



Vanhaverbeke and Cloudt [20] suggest that emerging forms of value networks must be examined at the level of different nested layers. These diverse layers span the spectrum from the individual, to firms-organisations, through Dyadss and on to inter-organisational networks and ultimately reaching national/regional innovation systems. Von Hippel [21] speaks about the democratisation of innovation where products and services users increasingly have the ability to innovate for themselves with the resulting move from manufacturing-centric to user-centric innovation processes.

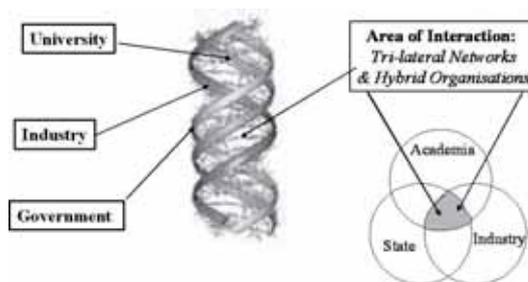
Another feature highlighted by Christensen et al. [22] in their studies of the semiconductor industry is the problem of 'performance overshoot' with the realisation that Moore's Law is no longer the dominant paradigm for analysing this sector. They predict from looking 'through the lenses of the theories of innovation' that the future of the industry will be 'very different than the past'. Customers are less concerned about performance factors such as clock speed and more focused on new parameters such as 'convenience and customisation'. Furthermore, they contend that new 'specialised non-integrated firms' will provide a serious threat to the incumbents and have proposed 'disruptive-innovation' and 'value-migration' frameworks to assist the semiconductor industry to manage these transitions. Avgerou and La Rovere [23], have challenged the IS community to rethink 'long-established disciplinary divisions and conceptual categories' (p. 206). Furthermore, they propose that IS studies must place the internal organisational processes within the wider socioeconomic context.

Inter-organisational systems and the triple helix

According to Kumar and van Dissel, interorganisational systems exist to support and implement cooperation and strategic alliances between two or more [24]. Furthermore, for quite some time, the dramatic growth of inter-organisational systems (IOS) have altered the way organisations conduct business and relate to each

other [25]. As this is a very broad area, this section will look at the implications for inter-organisational systems from the increased cooperation between academia, industry and government. Then an important innovation, that of self-service technology, will be briefly reviewed as it is having an increased influence on how IOS operate. The ever more important role of academia in supporting innovation in knowledge-based societies has led to the development of a number of models from national systems of innovation [26] to the Triple-Helix model of university-industry-government relation [27]. The latter is illustrated in Figure 3 which shows a helix with three layers: university, industry and government. It also shows areas of direct interaction between the two: for example, a technology transfer office (TTO) could be seen as an interface between the academic and business environments. With regard to the level of societal influences on innovation, Florida's 3-T model of technology, tolerance and talent argues that the rise of the 'creative class' is a key factor in the new economy [28].

Figure 3. Triple helix: adapted from Etzkowitz and Leydesdorf [27]

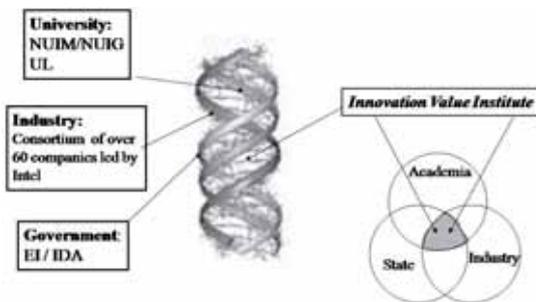


The increasing importance of the triple helix of academia-enterprise-government would argue that companies need to expand present inward-focused methodologies in order to engage with external actors. A triple helix representation of the Innovation Value Institute is shown in Figure 4 [29].

However, while the reality of the growing association between academia and enterprises is widely accepted, the nature of the involvement is still a matter of lively debate. Manimala [30] questions the emerging models of interaction that 'assigns a direct and active role' for higher education institutions (HEIs) in the 'commercialisation of their research or in the promotion of enterprises' (p. 111). Consequently, he proposes that a new paradigm is required where the focus of the HEI is on the general entrepreneurial environment. To support this view, he

formulated a set of new assumptions which, among other points, proposed that the primary objective of the HEI sector is 'creating and disseminating knowledge' and that academics are generally not really interested in becoming entrepreneurs and when they try, performance is normally 'poorer' than non-academics. It is significant that this thesis is supported by Mowery and Sampat's [31] comprehensive analysis of cross-national data on the impact of universities on National Innovation Systems (NIS) which challenges the conventional wisdom that HEIs must become major technology transfer (TT) engines in the economy. Their conclusion that the current emphasis on the 'countable' rather than the 'more important aspects' of the university-industry relationship could have 'unfortunate consequences for innovation policy in the industrial and industrialising world' [31].

Figure 4. The IVI triple helix



Self-Service Innovation

Another phenomenon worth noting here is the growth in automated inter-organisational systems. The increased deployment of self-service technology (SST) in business to customer (B2C) transactions is being driven by the diffusion of information and communications technology (ICT) and the demand to move from high-cost manual transactions to low-cost automated self-service in enterprises and the public service. According to the Gartner Group, 70 % of customer service contacts for information and remote transactions were automated by the end of 2005 with an associated increase in investment in Web SST [32]. These services are becoming increasingly critical for enterprises challenged with providing eCommerce solutions and building relationships in a world where customer and vendor do not meet face-to-face [33]. Among SST interfaces, the use of speech is regarded as ideal because it is the most 'natural, flexible, efficient and economic form of human-machine communication' [34]. However, creating conversational automated agents with responsibility for service levels and maintaining customer relationships is a complex challenge. Providing speech-enabled services

requires capability in speech communication technologies, applications programming and professional services developed in the environment of customer psychology and culture. Consequently, it is proposed that the implementation of such solutions brings together many features (cognitive, emotional, relational and structural) which are relevant for the debate on the future direction of research in IT innovations. It is also argued that self-service business systems are a recent and increasingly important extension of the customer service functions in organisations and, by extension, must be included in the typology of information systems (IS). A more detailed discussion of this topic is available in reference [35].

IT project governance: managing the change

Having reviewed the changes in innovation literature that have implications for Rogers' diffusion theory, we will now consider the implications of the changing innovation environment for IT project governance. Mahrings [36] describes IT project governance as 'the organisational control of an IT project'. According to various authors, the management of information technology projects has been an important and difficult problem for many years for both members of the academic community and practitioners [37] [38]. Information technology is increasingly becoming a more important part of an organisation but the failure rate of IT projects, according to Cole [38] remains high. This high failure rate results in IT projects which are either not used or which do not attain the desired effects [39]. Most companies are now very dependent on their IT capability for day-to-day operations and for maintaining market share and competitiveness. Characteristics of present-day organisational life itself and the constant flow of events in an organisation's environment create the uncertainty and fluidity of management [40] [41]. Managers can only achieve 'temporary coordination of heterogeneous individuals' [42] and, therefore, influencing thus becomes a combination of hierarchy and various types of interactions in social networks [43]. This was described by Perrow [44] as 'managing sensibly what you do not quite understand'. IT Projects, are not only concerned with task knowledge, but also with the constant pressures of reacting to, and acting upon a large number of issues at any given point and time.

A particular challenge facing IT Managers is how to evaluate the value of IT investments. Bannister's [45] review of approaches to IT evaluation identifies three strands in the literature.

- Studies that focus on the long-term historical economic impact of investments in IT. Examples include

Brynjolfsson and Hitt [46] who explored the so-called productivity paradox and the cumulative effect of investments in IS on organisations and Strassmann [47] who has argued that such effects are only really assessable over long periods, maybe as long as half a century.

- Studies on whether specific investments made over shorter periods have yielded value. These vary from the application of innovative methods to measure value realised to the use of well-established methodologies such as return on investment, comparison of how different metrics report or combinations of measures (such as the balanced scorecard [48] or the Prudential Appraisal Method [49]).
- Studies assessing whether or not a potential investment in IT is worthwhile. The time horizon here is typically fairly short, usually 5 to 10 years though, from time to time, studies will contemplate a more distant time horizon. Almost all such studies are at the level of the organisation, be it a firm or a public sector body.

A recent novel approach to IT innovation effectiveness realisation has been proposed by Peppard, Ward and Daniel [50]. The 'IT benefits management' approach advocated by the authors is defined as 'the process of organising and managing so that the potential benefits from using IT are actually realised' where 'benefits management' emphasises that benefits arise only from changes made by individual users or groups of users, and these changes must be identified and managed successfully. 'Benefits realisation' and 'change management' are therefore inextricably linked. This is the case when the project is explicitly an IT-enabled or 'techno-change' programme. A noteworthy aspect of the benefits management approach is the application of a Benefits Dependency Network (BDN). The BDN provides the framework for explicitly linking the overall investment objectives and required benefits with the business changes necessary to deliver those benefits and the essential IT capabilities that enable these changes. This approach is an example of a general trend towards a 'capability-oriented' view of IT as opposed to the 'resourced-based' view described in Section 2 above [51].

The IT Innovation Capability Maturity Framework (CMF)

The goal of the innovative IT manager is to define and identify desired innovations, and to establish activities responsible and causal to IT innovations. In the absence of a unified approach to the manageability of IT innovations, IT managers must confront either that most innovations beneficial to the firm are directly manageable, or that desired

innovations will result as a by-product of otherwise unmanageable activities. Clearly, a modern IT innovation framework must address these two seemingly conflicting and disparate perspectives within a single approach.

Introduction to the IT Innovation Capability Maturity Framework (IT-CMF)

The IT Innovation Capability Maturity Framework extends directly the approach proposed by the Information Technology Capability Maturity Framework (IT-CMF) introduced previously [52] [53] [54]. The IT-CMF proposes a high-level process capability maturity framework for managing the IT function within an organisation. The framework identifies a number of critical IT processes, and describes an approach to designing maturity frameworks for each process. By comparison, other IT process frameworks including COBIT, ITIL, and CMMI do not explicitly provide a mechanism to address the topic of IT innovation. A subgroup of the Innovation Value Institute has been concerned with building and testing the CMF for the IT Innovation critical process. In the sections to follow, we present some novel findings of that work.

The IT Innovation Capability Maturity Framework accepts that innovations arising from both linear sequential processes and complex social processes coexist within the same firm. The framework unifies a single approach to address the manageability of both classifications of IT innovation. For linear sequential processes, the innovation capability describes the ability or capacity to execute in a manner that increases the probability of an IT innovation positive outcome. For complex social processes, and non-sequential activities, the innovation capability describes the pre-conditions required to increase the probability of innovation outcomes.

Broadly defined, the innovation capability is a set of actions undertaken to prepare an organisation to be more innovative. This is achieved by increasing the organisation's ability to enact defined innovation processes, and by increasing the effectiveness and relevance of non-linear activities on innovative outcomes. Preparation in the linear sequential sense involves the creation of tools and artifacts within the firm. Artifacts may be tangible, such as systems, devices, and templates, or intangible, such as activities, roles, processes, and methodologies. Preparation in the complex social sense involves affecting change on the environmental context of the firm to increase the probability of an organisation to innovate.

Specifically defined, the innovation capability consists of a description of the core capability and its primary

characteristics. Each characteristic is described by observable attributes exhibited by the firm, measurable metrics of attribute existence and performance, and expected impact on the firm’s ability to increase the probability of innovative outcomes.

Background to the Capability Maturity Approach

The IT Innovation Capability Maturity Framework describes the IT innovation capability through a five-level capability maturity framework. The maturity approach has been used successfully in the IT industry to describe specific stages of progression to an optimal mode of operation.

Potential advantages of the capability maturity approach include its ability to present a structured, sequential step-wise function. Due to the simplicity of the model, maturity frameworks have seen wide adoption in the IT industry by large organisations (e.g. CMM), and have strong uptake amongst the community of practitioners. The approach is useful in describing a manageable approach to improvement, and therefore preserves the simplicity and direct-acting approaches presented by the linear sequential process innovation frameworks. Each level of the capability maturity framework also describes a set of contextual descriptions, and therefore preserves the approach presented by the nonlinear school of frameworks.

Potential disadvantages of the capability maturity approach include its tendency to adopt a somewhat instrumental, doctrinaire and mechanical approach to problems that may be quite complex. The IS Innovation CMF addresses this shortcoming in two ways. Firstly, the maturity framework is augmented with additional dimensions for each of the five levels. The maturity approach chosen introduces a set of innovation capabilities at each level. Each capability

is assigned characteristics, attributes, and descriptions of representative outcomes on an organisation. Secondly, the IT Innovation CMF is augmented by linking the maturity levels to a supplementary overarching IT capability maturity framework (IT-CMF) — as described in [52] [53] [54]. Therefore, the IT innovation CMF is divided into four strategies, mirroring directly the strategies of the IT-CMF. These strategies describe the four primary activities associated with managing innovation, funding innovation activities, executing the innovation capability, and assessing the value of innovations.

Overview of the IT Innovation Capability Maturity Framework

The IT Innovation CMF is shown in Table 1. The first maturity level describes the IT innovation capability in its most immature form. The capability is initial, linear processes are unmanaged, and there is a poor understanding of the non-linear capabilities and social processes. In practice, there will be a limited adoption of new technologies, and IS managers are, in general, unaware of the potential or existing benefits of IT innovations

The second maturity level describes a sporadically managed innovation capability. An emerging capability is characterised by a small group of IT managers who recognise the value of IT innovation and act in an uncoordinated manner to increase IT innovations. In practice, IT managers will deploy innovation processes, tools, and templates within IT projects.

The third maturity level describes a defined innovation capability with a high degree of coordination. Linear processes are defined, and are executed upon to increase levels of innovation. Nonlinear activities are encouraged through contextual investments. In practice, IS managers identify dedicated IT innovation skills, participate in coordinated

Table 1. The IT Innovation CMF

	Managing IS innovation	Funding the innovation portfolio	Executing the IS innovation capability	Assessing the value of IS innovation
5. Systemic innovation	Business transformation and agility	Self-sustaining	Culture drives continuous business innovation	Confidence in value return
4. Managed innovation	Aligned to strategic business needs	Co-funded with business	Routinely delivers innovative operational improvements	Reliable, consistent measurement
3. Defined innovation	Defined IS innovation strategy	Justified business spend	Tools, processes, organisation supports value chain innovations	Defined value assessment
2. Sporadic innovation	Emerging innovation strategy	One-time spend	Occasional product improvements	Informal value measurement
1. Initial/ad hoc innovation	Undefined innovation strategy	Not explicitly budgeted	Limited impact and scope of innovations	No recognised value

innovation, and quantify the impact of IS innovations on the firm.

The fourth maturity level describes an actively managed innovation capability. IT and executive managers promote and coordinate innovation across the enterprise. In practice, IT projects, to address innovation, are managed through portfolio methods.

The fifth maturity level describes a systemic innovation capability. IT innovations are recognised by the firm contributing value to the enterprise, and the organisation is active in encouraging innovation. In practice, IT innovation is identified by senior management as a component of the business strategy and strategic plan.

Summary and conclusions

This paper reviewed trends in open innovation and focused on one particular new development in this area — the IT Innovation Capability Maturity Framework (CMF). The IT Innovation CMF has been developed as a result of an open innovation initiative and has proved to be a novel and practical mechanism for structuring the set of IT innovation activities within a firm. The framework has been found to simplify otherwise divergent and complex activities into a unified view that addresses primarily the needs of the CIO and IT manager. The practical usefulness of the framework was found to lie in its potential to organise and structure a complex portfolio of IT innovation activities in a manner that enables continuous improvement.

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Contact

Prof. Brian Donnellan

Chair of Information Systems Innovation
Co-Director, Innovation Value Institute
National University of Ireland, Maynooth
Co. Kildare, Ireland
brian.donnellan@nuim.ie

Dr Gabriel J. Costello

Galway-Mayo Institute of Technology
Galway, Ireland
Gabrielj.Costello@gmit.ie

3.9 Mapping the intellectual capital of nations

What is happening in the economics of old nations?

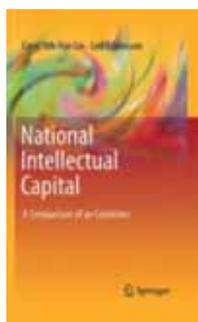
We notice the dramatic articles from Greece, Ireland and Portugal. We notice in the same way the dramatic articles from earlier banking collapses of Lehman Brothers, Northern Rock, etc. How do we make an intelligent interpretation of these crises signals, on national level as well as enterprise level? Is the concept of Wealth, both for nations as well as enterprise undergoing some kind of critical transformation? Is it a global or purely a Western phenomenon?

The concept of Intellectual Capital (IC)

The deeper simplistic meaning of the concept of IC is *roots* for the fruit. A more refined distinction is the *derived insights of head value/meaning*, as capital has its roots in Latin, meaning head. Yet another one is the *future earnings capabilities* or potential. Given these distinctions, we need to look at the systemic view of the so-called crises, especially in the Western economies. Could it be that the navigation for Wealth creation has lost its bearings? For IC, it is essential to have a focus on the future as well as the intangible drivers for value creation and Innovation.

In the taxonomy of IC there are the following three major drivers: *Human Capital, Relational Capital and Organisational Capital* [1]. These components can, for the purpose of National IC, be visualised in this emerging model as statistics for *Human Capital, Market Capital, Process Capital and Renewal Capital*, as well as Financial Capital, as depicted in the recently published book (Figure 1) [2].

Figure 1. This book is about learning from the past to prepare for the future. It shows the early signs of trouble in some European countries from almost 10 years ago. It also offers some insights from the co-development of some Asian countries.



It is an investigation of the development of these intangible dimensions shaping Financial Capital between 1995 to 2008, in 40 countries, by looking into 28 indicators, seven for each category.

Some evolutionary IC maps

By looking at this unique database shaped by Dr Carol Yeh-Yun Lin, at the Taiwan IC Research Center, we can develop the following scatter plots (Figures 2–7). As all navigation is about position, direction and speed, we can now start to see patterns of IC developments. This research is an invitation to ask deeper, powerful questions for the Renewal and Societal Innovation of IC of Nations, to the benefit of future Wealth and Well-being of its citizens.

These plots show the navigation of the overall IC of the country, as an evolutionary map. Not only does it show a position it also shows the comparative level of IC as a scale.

The overall positions for these countries show that the following countries occupied the top 10 positions in 2008:

- Finland
- Sweden
- Switzerland
- Denmark
- USA
- Singapore
- Iceland
- Netherlands
- Norway

But what might be of more interest than the position is the relative position versus other countries as well as the long-term/longitude development of IC.

So let us look at some cases from Europe such as Greece, Portugal, Germany and Finland. The scatter plot for these countries regarding two categories, Market Capital versus Process Capital and human Capital versus Renewal Capital can be seen in the following figures. The first category indicates the capability to generate currency for its evolution.

Figure 2.

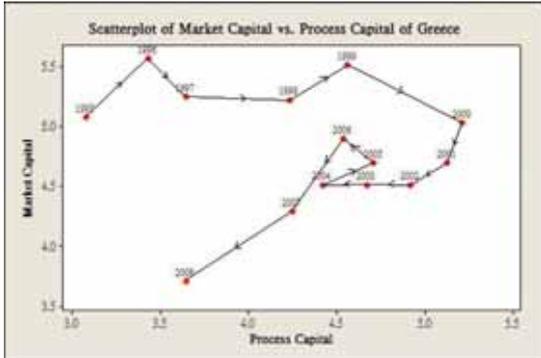


Figure 4.

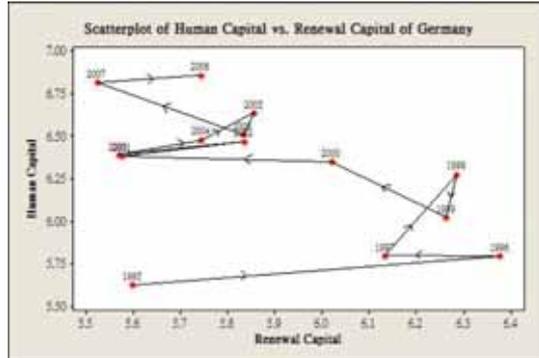


Figure 3.

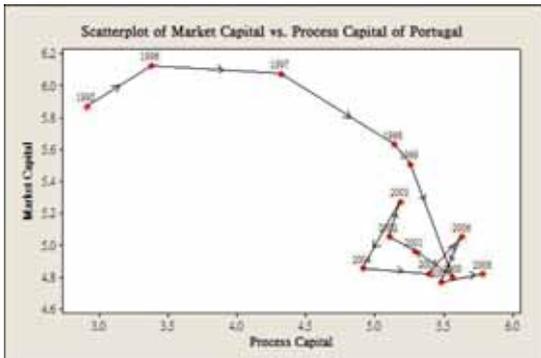
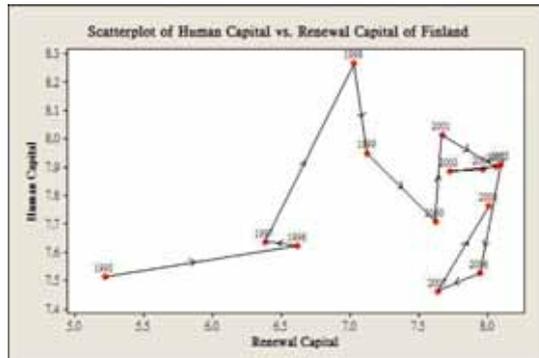


Figure 5.



Of course, these graphs do not show a very positive evolutionary path. The path had already started to deteriorate by 1998, i.e. 12 years before the crises hit the headlines of the news media. They also show that with a more proactive understanding of IC there has been plenty of time and space for Innovation and Renewal. The level of IC is also different between these two countries, where the IC in Portugal goes down from a level of 62 to around 48, while in Greece it went down from 55 to around 37. In other words, Greece ends up on a lower level with a severe backwards sloping trend. This raises the question of whether there is a need for more refined economics navigation for Societal Development.

The second category of scatter plots indicates the capability to Renew or, in other words, Innovation. For Germany, as the largest economy in Europe, the pattern of renewal below indicates an improved, i.e. higher position for its Human Capital, after 14 years, but not a very straightforward path and mainly a backwards slope for Renewal Capital from 1996. For Finland, being the overall No 1 on IC, the path indicates an improved Renewal Capital but not such an impressive development on Human Capital.

Now let us use a very special dynamic software for statistical mapping, called Gapminder: to see more of it look online (<http://www.NIC4o.org>). It highlights the evolutionary pattern (Figure 6).

Now let us expand the perspective to also include some Asian countries. One of the patterns we see is the top position of Singapore. It is also well known for its long-time work on Social Service Renewal. We also see that, so far, most Asian countries operate from a lower level of creating wealth. However, with the volume of Human Capital we can expect this to change and thereby amplify the seriousness and need for Societal Innovation of the above illustrated curves of European economies.

These scatter plots are both illustrative and indicative. They might lead to the question of navigational leadership for Societal Innovation and Societal intelligence. What is happening in our economies, and can we react earlier and in a much more informed way for sustainable Wealth Creation? How do we develop Innovation Systems not only for Enterprise level but also for Societal Innovation?

Figure 6.

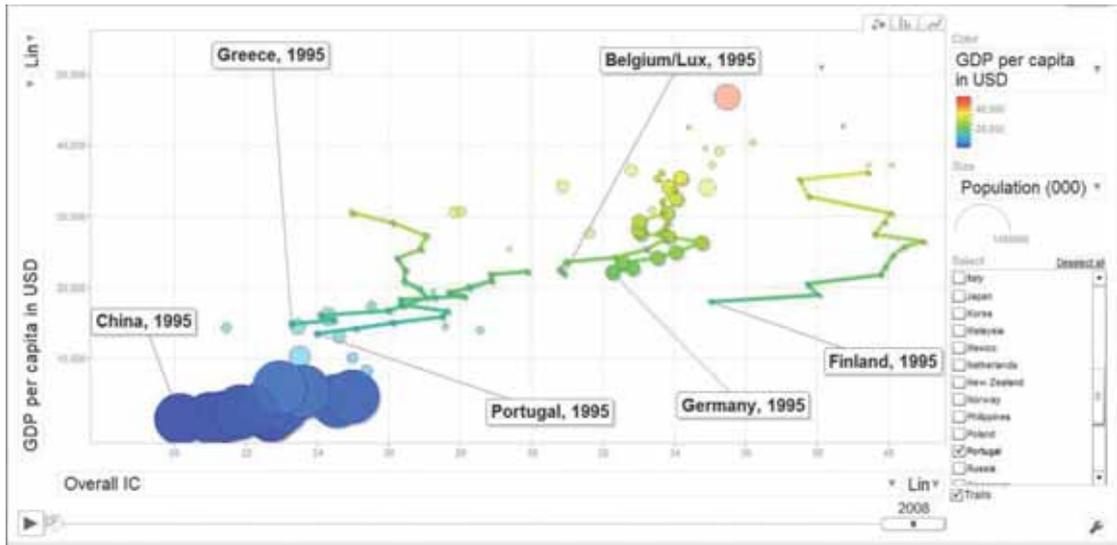
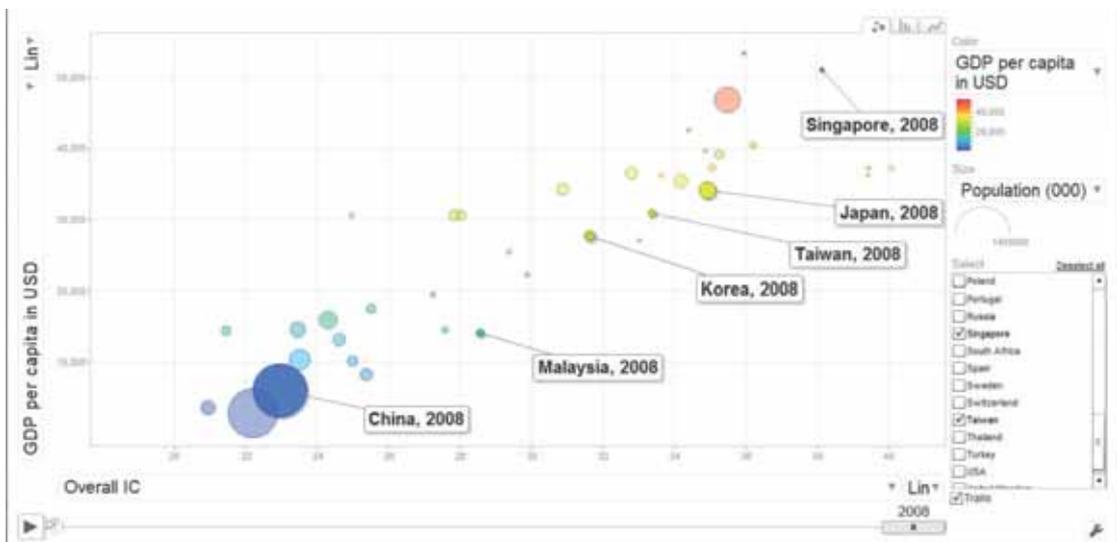


Figure 7.



New Club of Paris

From the scatter plots, we start to see the strong and growing need for Renewal at societal level or Societal Innovation. Societal Innovation can be seen as the renewal of context in a society, for the space of Social Service innovation and development.

To address these issues of developing the intelligence as well as leadership of the Knowledge Economy, the New Club of Paris has been shaped [3].

This organisation is focused on:

- support in setting the **knowledge agenda** for nations, regions and cities in the knowledge economy;
- activation in the **cultivation** of societal and political entrepreneurship;
- participation in project and platform development for creating **societal innovation** globally.

Therefore, in Finland, the Aalto Innovation University has initiated the Worlds' First Training Camp on Societal

Innovation together with the New Club of Paris. The first prototype camp took place in July 2010, with more than 100 participants from different countries which focused on three theme areas: Urban planning, Educational service development and Service development with the Silver Potential (Elderly) [4]. The next camp will be at the end of August 2011. It is a good illustration of Open Service Innovation across national borders, disciplinary borders as well as generational borders.

Funding for renewal

For the future of Science, Research and Service Innovation, the need for funding is absolutely critical. It is hard to fund 'soft' investments going against a lot of traditional accounting procedures. But such fund-raising is also challenging given the above overall economical situation. Nonetheless, we still know that society needs to renew, and for this we need new funding. The future budgeting of the service innovation and knowledge innovation cannot be based on a traditional cost-cutting logic. Every Innovation input needs Intellectual Capital logic for cultivation of the roots for the future fruits.

Therefore, one new approach by using mobile technology, in the process of being prototyped, is the so-called *Crowd Funding*. It is built on attracting the individual citizen to volunteer financial contributions to attractive projects or

societal initiatives. It is about attracting many small contributions in a very simple way, by using mobile technology. In Sweden, one such pioneering project is Fund of You® [5]. It is an illustration of the emerging use of mobile interactive technologies for service innovation. In this case, it is also the development of new digital currencies, based on relational capital and networking, from the theory of Intellectual Capital.

For the future funding of science development, service innovation or philanthropically oriented projects, this might indicate New Open Service Innovation in a very tangible technological way as well as administratively most efficient way.

Future wealth of nations

The Wealth of Nations is more and more interconnected by technologies across the seamless globe. The speed of the technology innovation is very high. The speed of Renewal of Society Service functions do not evolve as rapidly. However, the understanding of drivers as well as evolution and cultivation of Societal Innovation will be one of the key differentiators for the attractive society of tomorrow. This might then become visualised as a ratio between current positions of IC of Nation v potential IC of Nation. This new ratio is highlighting an IC agenda of our responsibility to address already today.

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Contact

Prof. Leif Edvinsson
 Universal Networking
 Intellectual Capital
 Norrtälje, Sweden
 leif.edvinsson@unic.net

Dr Carol Yeh-Yun Lin
 National Chengchi University
 Taipei, Taiwan
 yehyunln@nccu.edu.tw

3.10 A new approach to openly solving advanced R&D problems with crowdsourcing

Abstract

The first part of this article explains the main approaches to crowdsourcing for open problem-solving, focusing on an approach that combines expert identification and problem-broadcast as practiced by hypios. The findings are illustrated by two short case studies.

The second part gives a more detailed account of the technologies that can be used for expert-identification and of the open challenges that have to be solved in the next years for expert-identification online to become even more efficient.

Introduction

The Web has connected people in ways that were unimaginable just a few years ago. In particular, the remarkable rise of social networks has increased the possibility of staying in contact with family, friends, colleagues and even bare acquaintances. It has created an environment for collaborative working. Real-time Web has allowed us to experience the presence of others while online and allows us to share aspects of our lives with them. Most importantly, the Web has integrated itself in our everyday activities. We communicate, we buy, we publish, we read, we give presentations, we organise content, we rate, we mate ... on the Web.

hypios, a young marketplace for solutions, wants to push the boundaries on the ways the Web can help us innovate and solve problems. hypios wants to bring ideas and solutions — whose full extension and applicability had not yet been discovered — out of their obscure hiding places and help them shine in the light of their utility. This is a story about our progress on this mission and the use of Semantic Web technologies to help get us there.

After a short introduction to the hypios approach, we will briefly look at other models to find Research and Development solutions on the Internet. We will not talk about partnerships between companies or between companies and public research institutions, which are not innovative and have frequently been discussed elsewhere. We will also exclude ways to identify existing solutions, rather than 'solution-owners' or experts.

The initial intention and the start

hypios was founded in 2008 by a diverse team of researchers, engineers and young business professionals to create a global market for solutions: a place where the smartest people would solve the toughest problems.

Applying advanced Semantic Web and Machine-Learning technologies, hypios identifies problem-solvers (Solvers) based on publicly available data on the Internet. It then invites these Solvers to compete in solving specific Research & Development (R&D) challenges in their area of expertise on hypios.com.

Within a couple of weeks of launching hypios.com online, hypios had convinced the first Fortune 500 to post a problem on the platform. Others quickly followed suit. Within a year, hypios solved R&D problems in the naval industry, aeronautical engineering, food processing, HR Management, Imaging Technologies, and in many other industry sectors.

More information about hypios can be found on (<http://products.hypios.com/>).

The point of a marketplace for solutions

hypios is a marketplace for solutions. Companies facing R&D problems use hypios to externalise their problems and broadcast them to a larger research audience, which then finds innovative and unexpected solutions to these problems. Karim Lakhani from Harvard Business School calls this method 'problem-broadcast'. R&D departments usually have expertise in a certain domain, and approach problems from a certain perspective. But it's logical to expect that somewhere on the Web there are people with different perspectives who can approach the problems differently and come up with something unexpected. The goal of a problem marketplace is to ensure that R&D problems reach the right people on the Web. One of the initial observations when we founded hypios was that companies constantly reinvented the wheel, simply because they didn't know where to look for existing plans for wheels — or because they were too scared that their competitors could find out that they were working on the wheel. The truth is that most of their competitors also work on

the wheel. As Kevin McFarthing — who implemented open innovation at Reckitt Benckiser — states, ‘R&D problems that would surprise your competitors are very rare.’

The people-centric approach as practiced by hypios makes it possible to identify explicit solutions (as, for example, contained in publications or patents) as well as ‘incorporated solutions’, solutions that are not made explicit publicly, but that people can provide if you ask them. The ability to find this kind of sticky and implicit knowledge is the great advantage of identifying people rather than looking for solutions already made explicit.

Different ways to go open with crowdsourcing

Crowdsourcing is an approach where the Internet is used to attribute tasks to a large crowd that were traditionally executed by one person or small teams. Crowdsourcing can either be a way to combine many small efforts or a way to identify exceptional individuals that are hard to find in other ways. In idea-generation and for micro-tasks this approach is very popular. But there are also some companies that begin to use it for R&D.

Obviously, using platforms like hypios is not the only way to use the Internet to find R&D solutions outside the company. There are many other approaches. Here are those we’ve identified as being dominant.

1. Branded platforms with corporate needs

Probably the most famous example of such a platform is Procter & Gamble’s (P&G) Connect & Develop site. The company will formulate certain needs and post them to the website in order to invite innovators and researchers to submit potential solutions. One such need on P&G’s platform is the need for a lipstick that will glow for more than four hours, much longer than today’s standard lipsticks. While this is not a problem that anyone in cosmetics would find surprising, the company which finds a solution to this problem first, would gain an essential edge over their competitors. Cases like this — where it’s precisely the high impact that a solution would have — that makes them non-confidential are very frequent and exist in all industries, which means that refraining from open solution search because of confidentiality issues is often irrational.

2. Corporate communities for discussion of questions and needs

Another approach is the one taken by Clorox with Clorox Connect: building a platform where innovators and research-

ers can sign up and discuss questions among themselves and with employees of the company, as in a forum, lead by a corporate community manager. The problem with this kind of platform is that they compete with specialised science wikis and forums as well as research-focused social networks like Research Gate, Academia, and generalists like LinkedIn, even Twitter, Facebook, as well as infra-institutional networks like Max Net (for the Max Planck Institutes) or university intranets. Given their limited scope combined with the natural resistance of researchers to anything that seems marketing-led, makes it very difficult to endow this kind of corporate platforms with an added value compared to existing social networks.

3. Communities for customer co-creation

As opposed to the situation in point 2, this kind of platform addresses customers or fans of a company’s products. A very successful initiative of this kind is Lego Mindstorms. It has led to several very successful innovations for Lego that have then been commercialised by the company. While this kind of initiative tends to lead to highly motivated and (nearly) self-driven communities, it’s not something every company can aim for. First of all, Lego builds products with high potential for fan-ship. This is not the case with a company that builds, say, heaters. Furthermore, fans of Lego usually like to build and invent things, they are technical people. This is not the case with fans of, say, L’Oréal.

4. Corporate idea boxes

Shell’s GameChanger is a good example of this kind. While it’s rather successful, all ideas that have led to products and process improvements have come from inside the company. Although it’s formally declared to be open towards the external world, most of the ideas submitted to the programme do, in fact, come from inside Shell rather than outside innovators.

5. hypios approach: a platform that centralises open problems

As opposed to the corporate platforms, hypios’ platform does not only list problems by one company, but by many different companies. It’s thus a place where people generally interested in solving problems, wherever they may arise, can sign up. For a researcher who wants to maximise the chances of finding a problem that is interesting to them, it’s generally more attractive to go to a place like hypios.

The intervention of a third party in the transaction helps build trust with Solvers, who often refrain from submitting ideas to corporate platforms because they are afraid they might lose their intellectual property.

For companies, it's a way to go open without revealing who they are. As there are problems from many different companies, problems can be anonymised on the marketplace, which further limits problems related to confidentiality. Further, technology, broadcasting problems and community management is taken care of by hypios, which saves costs for companies. As the main business of a provider like hypios is to optimise the chances of finding experts and solutions, companies benefit from advanced technologies that might be considered too costly to develop internally and for which they don't have any specific competence.

The result: two kinds of problems and how to deal with them (case studies)

The many cases where hypios successfully solves corporate R&D problems can be divided into two kinds according to what kind of profile a Solver has. In some cases, this profile can't be anticipated, but in others it can. According to the anticipated profile, hypios will target Solvers differently. We will present two cases which illustrate this difference.

On the one hand, there are problems that are most likely to be solved by experts. This is where hypios expert-identification technologies are most relevant. In these cases, hypios gets a very specific R&D challenge which a company can't easily solve because they don't have the right people, for example because it's a problem at the periphery of the company's activity.

A series of questions about the Frame Dragging Effect posed by a company in aerospace engineering was one of these cases. They were questions that could only be solved by someone with knowledge in the theory of general relativity. The company's engineers weren't experts in general relativity, which doesn't come as much of a surprise. While also using our large broadcast, hypios identified several experts and invited them to submit solutions to the problem, offering them USD 4 500 should their answers be chosen.

In the end, five experts submitted very detailed answers to the problems, two of which were chosen by the company. hypios later talked to one of the winning experts and he told us that he had been highly motivated by the possibility of applying his knowledge to a very concrete need and that he loved to think about how to best communicate his expert knowledge to a public of engineers that were

non-experts. In his reply, he had even replaced the notation usually used in physics by the notation usually used in engineering.

On the other hand, there's solution transfer, which is usually associated with crowdsourcing. In this case, solutions come from other domains and are adapted to the concrete need in the case at hand. If you can find a formulation that a non-expert can understand, this is usually a good indicator of a problem amenable to solution-transfer. One of these cases on hypios was related to factual HR management. A company wanted to better structure the attribution of irregular low-level tasks to a large number of employees and was looking for a system to do so.

The winning solution came from a mathematician in New Delhi. Upon reading the problem, he realised that an optimisation algorithm well known in his branch of mathematics could be used for this problem. He sent in about 10 pages with explanations on how to use this kind of algorithm with the variables given in the problem-description.

Exotic cases like airplane seat design or engineering foldable shoes are often cases, where the best solution comes from a non-expert. But non-expert doesn't necessarily mean no targeting. Some non-experts are better suited to solving a problem than others. One of the major tasks of hypios' Semantic Research today is to figure out how to use semantic proximity to identify less obvious non-experts. The next section is about how hypios identifies both experts and non-experts for our problem-solving competitions.

This double approach, where a large broadcast and targeted expert-invitation are combined, is characteristic of hypios. More recently, companies have requested to use our expert-identification technologies to identify experts for closer collaboration.

How to find the experts

Leaving traces on the Web

In his or her Web-life, a typical user writes blog posts, tweets, creates Slideshare presentations, writes blog comments, makes friends, organises content using tags, reads RSS feeds, and so on. All these activities leave behind valuable traces about their interests and their knowledge. We can divide these traces into five categories:

Content created by user: blog entries, Tweets, research publications, comments, mailing list and forum posts

sources for expert search and examples of possible queries giving the lists of experts is presented in our paper 'Looking for experts? What can Linked Data do for you?' on the Linked Data at the Web 2010 workshop.

Benefits of linked data-based expert search approach

As opposed to earlier expert search approaches that worked with legacy data, the linked data approaches benefit from increased flexibility. The data in the Linked Data is to be provided in a perspective-agnostic form, i.e. with many possible uses and perspectives in mind. On the contrary, legacy data approaches used to define a certain expertise metric (e.g. experts are people who wrote research articles on a certain topic) and then extract and formalise only the data needed for this specific metric. For instance, an expert-finding approach might extract and use data from research publications (their topics and authors) but initially omit the conference and date information. Further approaches would then be unable to reuse the same data for metrics taking into account the conferences where the authors we present and the dates when they started to publish articles in a certain domain. Although simplistic, this example shows a real phenomenon that we have discovered in our analysis of expert search approaches. Changing this approach after the fact proves difficult. With the Linked Data approach, since data is created for multiple purposes we can easily manipulate the

data-views, switching from looking at authors of research publications to the members of programme committees at various research events. When data is published in Linked Data form it is generally perspective-agnostic, and supports various views on the same entity (e.g. a person) and various scenarios of use.

Linked Data also gives us access to hubs of general-purpose knowledge like DBPedia and Freebase, which facilitate work with expertise domains by helping us define categories in standard ways. Also, these sources provide information on the 'closeness' of topics (e.g. their family resemblance), and thus allow us to search for experts in closely resembling domains or domains that are broader than the domain in which the problem was initially found.

Semantic Web standards also make it easy to identify the equality of expertise traces (such as research papers, blogs, etc.) on various sources.

At hypios, we explore how we can make use of all those benefits to bring R&D problems closer to their potential solvers. We seek to find domain-experts, people interested in topics related to the problems, all using the traces available as Linked Data on the Web. Our efforts will soon expand to filling in the gaps that exist in the current LOD cloud to make expert finding even better supported.



Contact

Klaus-Peter Speidel

hypios co-founder

Vice-President, Concepts & Communications

hypios. Learn to love problems.

kspeidel@hypios.com

Milan Stankovic

Researcher

hypios, France

hypios. Learn to love problems.

mstankovic@hypios.com

Annex

Open Innovation Strategy and Policy Group (OISPG)



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OISPG Mission

OISPG is an industrial group established by the EC (Directorate General of Information Society and Media – ICT addressing societal challenges) in order to support policy development for Open Innovation. The Group regards Open Innovation as a crucial condition for the competitiveness of the European services sector, both for service providers and related supporting industrial actors.



OISPG objectives:

- Recognition of Open user-centric innovation as part of European Policies
- Recognition of 'service science' as a new, emerging multidisciplinary research area
- Putting the 'right' elements together to foster the development of a EU-based services industry by:
 - Fostering critical technologies development: open functional platforms, open reference architecture for services, collaborative technologies for mass interaction
 - Supporting Lead Market initiatives in the services sector
 - Linking international actors around and across projects on service innovation
 - Developing and fostering policy, legal and operational frameworks for Open Innovation for services at EU and national levels.

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OISPG conducts studies on different aspects of Open Innovation. Its latest publications include:

- *The Trends of Open Innovation in Services*
- *Intellectual Property and Legal Issues in Open Innovation in Services*
- *Service Innovation Yearbook 2009-2010*
- *Put the Users in the Centre of Services*

OISPG's upcoming publications include:

- *Socio-economic studies on Open Service Innovation*
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Open Innovation - the main focus

Current changes in pervasive connectivity and computing are creating new approaches to, and values in, the design, development and deployment of services. It is arguable that a paradigm shift is underway that involves a move away from centralized decision-making processes to more open and polycentric environments that enable processes of innovation.

This shift makes the capturing of the dynamics that underpin service innovation of paramount importance. From a technological standpoint, innovation is largely based on new web technologies and open platforms for collaboration that present the potential of extensive user involvement. This is creating a basis of a new collaborative culture that can involve all key actors in the innovation of services.

At the same time, service users' roles are changing rapidly. When the potential of users as innovators is taken into account, not only the hit rate for services is increasing, but also the possibility of creating new, competitive, personalized and scalable services, directly deployable in real world settings is significantly strengthened.

One of the key issues in this shift is to capture the experiences of leading industries in this Open Innovation process. This is the main objective of the OISPG as the group has a wealth of experiences of successful approaches to Open Innovation. Open Innovation generates several economic and social benefits to service providers and, consequently to its consumers by delivering services which are better adjusted to the market expectation, increased creative adoptability, better access to knowledge, and quicker and cost-effective innovation cycle. However, to this functional interoperability depends not only on technical but mainly service convergence that is in line with market demand.

For the EU services industry one of the key questions is how to capture societal innovation, societal networks, and social capital as a basis for new user-centric business. Public Private Partnerships is evolving to Public-Private-People Partnerships where all the stakeholders build together [service]innovation ecosystems. Open Innovation presents considerable challenges to existing EU laws, such as IPRs, competition, and privacy, and creates a pressing need for action at both a policy and regulatory levels, in order to make the legal framework supportive of Open Innovation.

OISPG Members



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