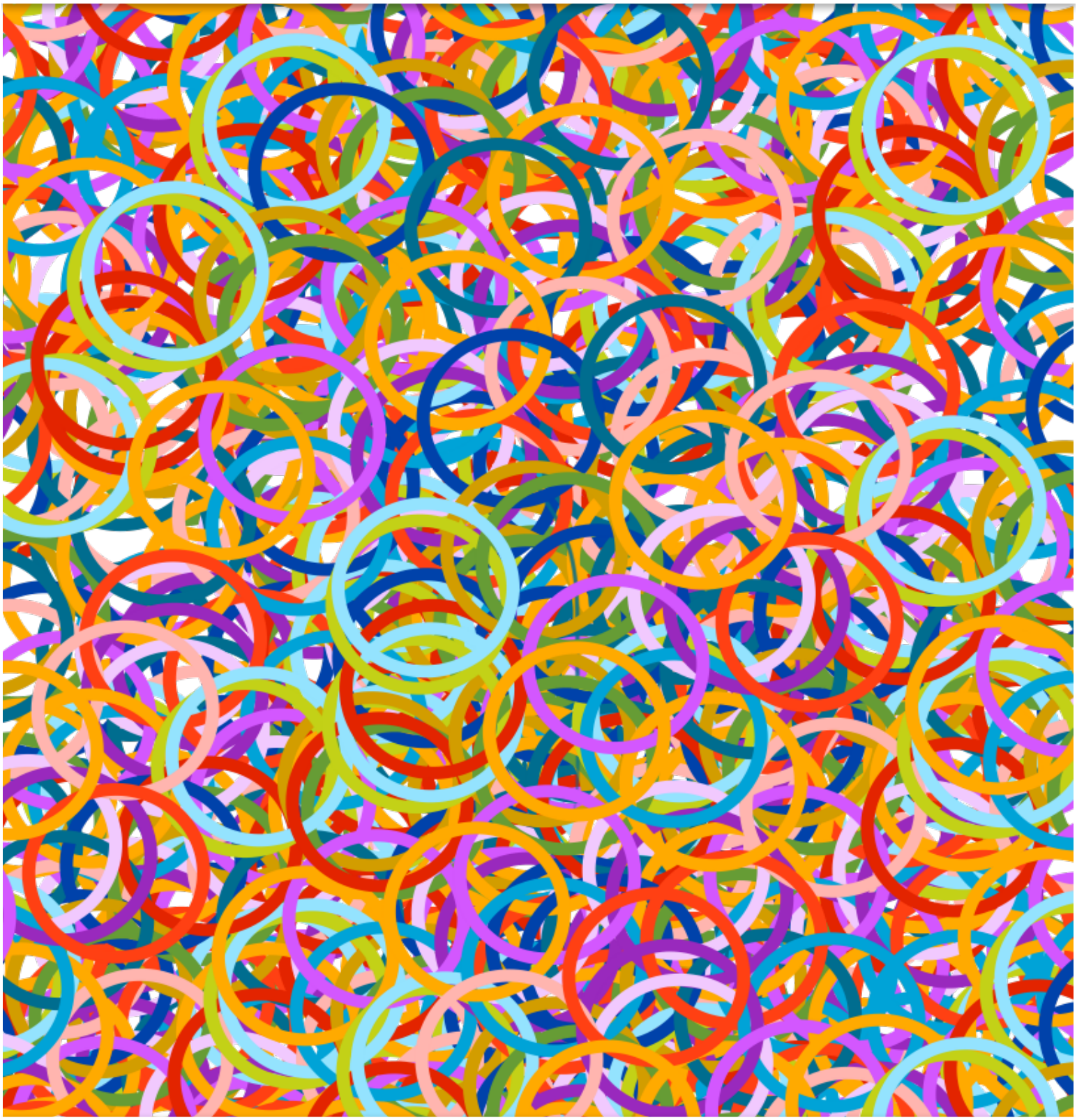
JIM
Journal of Innovation Management
The International Journal on Multidisciplinary Approaches on Innovation
Volume 5 Issue 2 | open-jim.org



ISSN 2183-0606
FEUP Edições

Journal of Innovation Management
JIM 5, 2 (2017) i-v
HANDLE: http://hdl.handle.net/10216/105431

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ISSN 2183-0606
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HANDLE: http://hdl.handle.net/10216/105431

Editorial

What makes for a good innovation management article?

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What makes a good innovation management article? Let's have a look at articles which incidentally have got the highest citations in the field of innovation management. These articles may give us some ideas on what a good innovation management publication entails. Notions below are not fully covering what should be included in article from introduction to final words; it is more about suggestions based on our cumulative experience in the field and some general observations as editors.

Most articles typically highlight some points within generally held assumptions in innovation management current literature. Extensive literature review is important for all papers, and here authors may go even beyond usual suspects. By expressing this, we mean *multidisciplinary approaches on innovation* where knowledge should flow from different sources into your innovation storyline. Most articles are not written using a T-shaped knowledge model initially discussed by IBM, but still tell us the story of innovation management in the broader context and allow us broadening our scope in the field. The Journal of Innovation Management is not just a new venue for publishing innovation related articles. We implicitly explained in our inaugural editorial that the Journal of Innovation Management concentrates on the combination and integration of horizontal perspective of innovation management into vertical perspective where we go deeply into the specific silos of highly technological knowledge. This is often tackled superficially in innovation management papers, unfortunately.

The connection between the results and conclusion needs to be carefully explained. Where the innovation lies in your story that explains carefully your conclusions made? One way to confirm is to ask yourself whether the outcome would be the same without innovation management element. By definition, innovation creates value and well-being, so in most cases, it means novelty with commercialization in the market.

Several articles showcase well known global corporations and their innovation management protocols. There is nothing wrong here, but the question is how you express the novelty. We are not only looking for well-known examples about companies which have been successful in the market for years and have been well explained already or well-known by the big audience in the market. These big companies should be used as an example as long as the innovation storyline behind

ISSN 2183-0606
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can be in reliable and explain explicitly what leads to the results and conclusions. The reasoning between connecting these two dots is not easy to tell as there are many other factors which can have an influence and typically, these are external factors that we cannot control internally when we explain our innovation management. For example, by 2017, central banks in EU, US, China and Japan have done quantitative easing by pushing more money to the market than ever in our history which have strong influence on stock valuations and consumer markets. It is definitely an external factor of innovation story and extremely difficult to connect to your innovation management storyline of a company.

Topical issues are interesting in general for a broad audience. Trend is your friend and one potential arena could be on how profits are generated and shared in a specific industry. For example, in the mobile phone industry in 2016, the leading player took over 80% of profits where hundred other companies barely managed to reach break even. Value generation seems to be easy for engineers, but value capturing is not that easy as it takes more than technological breakthrough. Teece (1986) introduced appropriability regime which may help us to understand and analyze the situation. And there are other industries as well like online marketing to name one. Here we may propose a 'new' pareto principle (original introduced by management consultant Muran in 1940s, named after Italian economist Vilfredo Pareto): instead of 80/20 we may say 20/60/20 where 20 percent of market population is extremely profitable, following 60 % makes some profits in good times and final 20 % make losses independently of market conditions. Does this make sense in several industries (mostly mature ones)?

Finally, we should not avoid conducting research and presenting stories of failures. We acknowledge that it is difficult to collect data about failures, or at least when company information is revealed, but still from a learning perspective we need those. So here upon we call for stories about failures – for public good and lessons to be learned!

Innovatively Yours,

Marko Torkkeli, Anne-Laure Mention, João José Pinto Ferreira
Editors

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Prescription for Profit

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Letter from Academia

AI is being marketed as a panacea solution or a complex “black box” by the PR spin doctors. How to profit from AI in business applications is still unclear. The lack of understanding of knowledge representation, data structures and feature engineering, are a few of the core underlying problems, devoid of easy solutions. This short guide is a note on strategy with respect to the use of AI tool kits. What is necessary for rational use and integration of AI tools with business are humans.

Keywords. AI, Digital Twins, Rational Agents, Logic, Ontology, Knowledge Representation, Data, Analytics, Computational Rationality, Neural Networks, Cognition, Machine Learning, ERP, Syntax, Semantics, Synapse, Speech, Vision, Neurobiology, Innovation, Management.

1 Pragmatic use of Artificial Intelligence

Pragmatic use of Artificial Intelligence (AI), which can catalyze corporations to profit from applications of AI, is the ultimate goal for business and industry. Academia could help industry achieve this goal, albeit in part, the rational part.

The probability of bursting the public relations bubble, and the hype about the promises made on behalf of AI, are increasing. It may be reduced if industry and management better understood why the world must opt to lower its expectations of “intelligence” as an outcome from AI tools.

The suggestions in this letter does not distract from the rational possibilities of using the principles of AI in data analytics, decision support, and even, in automation.

During 1955-56, the term “AI” rather than “computational rationality” was used to describe a “new” and “emerging” field. The difference between the terms is a matter of states because “intelligence” is continuous (core attribute of many biological processes) while “computational rationality” is a discrete process. The latter is explained by the boundaries of limited rationality which systems generate, based on computable models.

The cognitive glue, necessary to bond discrete events to form the continuum, may be a cherished objective, but remains an illusion for science, and delusion for engineers, at this time. This brings to mind the pithy words of John Searle "brains cause minds" as

ISSN 2183-0606
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if to say that a mere collection of cells (neurons, glia) will lead to thought, action and consciousness. It is true, the brain is a collection of these cells, but does that suffice to serve as a platform, to extrapolate the brain to the scope of the human mind?

To illustrate the issue on page 7 (see https://dspace.mit.edu/handle/1721.1/108000), I refer to (https://link.springer.com/content/pdf/10.1007%2Fs11633-017-1093-8.pdf) a recent paper. It starts with states (each binary bit has two states, 0 and 1) and memory storage capacity. A human brain has $1x10^{14}$ neural cells (100 trillion synapses) with approximately $2x10^{15}$ states, equivalent to a storage capacity of 500 terabytes (assume 4.6 bits of information stored by each synapse). Hence, $2x10^{15}$ is the number of synaptic connections in a human brain. Is this, then, the capacity of the human mind?

In our mind, cognition allows us to read, write, create, and understand language, simple and complex. Our vision can distinguish topology of objects, colors, size, depth, shades. Our five senses, in combination, can respond to an array of input, to produce a vast (unknown) number, and variety, of output. If artificial neural nets claim to "capture" the brain and if we can scientifically describe this *capture* as "brain in a box" then, this network, if etched on a "neuromorphic chip" is the sum total of "intelligence" that we may rely on, for all our activities. By this rationale, "intelligence" is governed by the maximum number of states of our synapses. That number is about $2x10^{15}$ and that is, by this account, the total number of instances or the magnitude of combinations of our thoughts. Is this a true statement?

As Danko Nikolic points out, an English speaker's vocabulary has about 15,000 words which consists of 5% adverbs, 20% adjectives, 20% verbs and 55% nouns (750, 3000, 3000, 8250 words in each of the four categories, respectively). From those numbers, we can calculate the number of all combinations, of sentences, of different lengths. For four word sentences, consisting of a noun, followed by a verb and ending with a noun plus an adjective, we obtain 8250×3000×8250×3000 or about $2x10^{18}$ combinations. We have not even pondered about the semantic boundaries of the syntax in the four-word sentences. This number ($2x10^{18}$) is already bigger than the limit that is posed by the total number of synapses in the brain ($2x10^{15}$). By this reasoning, there isn't enough memory in our brains to generate a different response even for sentences with 4 words!

At this stage, we have only considered "speech" and limited our expression to 4-word sentences. Limited by the storage capacity of the total number of synapses in our brain ($2x10^{15}$) we will not be able to see, hear, taste or touch, among other things. Do we still wish to continue, and support marketing campaigns, suggesting that deep neural nets are equivalent to biological intelligence, which powers AI? Hence, is there intelligence in AI?

The fact that humans possess at least five senses, and do much more than what $2x10^{15}$ synapses may allow, is due to the fact that this number is an anatomical representation of the number of discrete connections. This is the ***structure*** of the organizational aspect of the anatomy and topology of the human brain. Structure is ***not*** the same as ***function*** in the same manner that anatomy (human skeleton) is not equivalent to physiology and physiological function (human organism), even though the skeleton (structure) is quintessential for physiology (function).

It is ***function*** that generates the amorphous quality of intelligence and makes humans intelligent. The numbers in the structure are discrete. The numbers matter, of course.

With 302 neurons, potential structural relationships in *Caenorhabditis elegans* (worms) may not qualify to provide intelligent functions or even pattern recognition.

The function of intelligence is best perceived as a *continuous* fabric, inextricably linked with data, rules, patterns, experiences, knowledge and learnings to inform or support decisions.

The almost unlimited number of connected continuity, the underpinning of intelligent human action, is a result of $2x10^{15}$ synapses which are being formed, and re-formed, connected and disconnected, re-connected and re-configured, in an asynchronous, dynamic manner, in response to signals, perceived, received, in processing or being transmitted. Signals may originate from diverse sources (internal, external, autocrine, endocrine) or may be presented to sensory interfaces in a multitude of shapes or forms.

Continuity is not an attribute of a computable model. The term AI was less appropriate than "computational rationality" in 1956 and it is even less appropriate, today. But, we may use the term AI, for the sake of posterity, its magnetic image and public imprint.

The term intelligence is supposed to present a mental image relating evolution of words, objects, ideas, in terms of meaning and context. It is not a discrete, structural, one to one syntax, which can be translated. It is an *interpretation*, based on semantics, and by extension, logic, and ontology. The fact that intelligence may not be amenable to simple syntactic translation was demonstrated by the almost abject failure of the Russian to English translation during 1960s (prior to use of convolutional or recursive neural nets).

The "artificial" architecture of intelligence may have literary roots. Perhaps, a reference to *Leviathan* by Thomas Hobbes (1651) or similar, from that school of thought. Hobbes argued for "artificial animal" based on observation that the heart is a spring, nerves are strings and joints are wheels. Attempts to mimic birds and develop "artificial flight" did not lead to aviation. The right approach by the Wright Brothers was to view flight as a function of aerodynamics, which gave birth to the airline industry. Reality of flying, for human use, was not a reproduction of the fantasy of viewing birds in flight.

2 From Taylorisms to Terabytes

The movement from Taylorisms to terabytes needs AI, and its tools. Hence, AI, despite its limitations and a handicapped terminology, presents opportunities for companies to automate business processes. But, fantasy driven scenarios, about winning at GO or poker, may not suffice for integrating AI or ML applications, in the real world. While ERP implementations enhanced competitiveness, several companies also uncovered nightmares. The promised opportunity from ERP never came to fruition, for some. Do we have a sense of *déjà vu* with AI? The rain on the AI parade falls mostly on input data and the output/outcome. Unless reliably automated, the outcome requires people to do something with the information. Is it actionable? AI analytics cannot help if input data is noisy or corrupt. How do you know the data or the outcome is of poor quality?

AI and ML can augment performance. In case of AI (more than ERP) those changes create highly skilled tasks which require education, prudence and domain expertise, *from humans*. Businesses are forever in an elusive quest for "low hanging fruit" without gaining the wisdom from repeated failures. The pursuit of "low hanging fruits" require only low level skills. That *modus operandi* may not help, at all, to profit from AI.

Generating value from AI by recruiting more data scientists is an amorphous escape clause. Several domains converge under the umbrella of data science, which makes it impossible to ascribe the term data scientist, to any one individual. Data science is a team sport. Bringing the talent together, and synthesizing the unpacked problems, are tasks that few companies can execute because companies do not have, or rarely employ, strategic *cube-on-cube* thinkers.

Companies do not even know, that they do not know, that they lack trans-disciplinary cross-pollinators. Companies and HR are unable to comprehend that they need people with broad spectrum of knowledge "cubes" and a matrix of experiences, unlike those that can fit in a box. "Thinking different" is not a principle that HR departments can practice. Hence, the clamor for data scientists but lack of jobs describing the need for out-of-the-box thinkers, followed by an absence of zeal, to pursue the road not taken.

Thinkers are pivotal to assist teams to dissect problems into components, to identify the confluence of domains, and underpinnings of potential solutions. Creative thinkers are key to assist the leaders to move the fulcrum and mentor the rank and file to frame the correct questions. Hiring and allowing *cube-on-cube* thinkers to form agile, case-dependent teams, staffed with vertical experts, across silos (network of business units), may be the first step to profitability, from advanced applications, which are fueled by convergence, such as, AI, analytics, robotics and nanotechnology.

Data science must start with data. Data must be acquired, processed and curated to serve the business needs. Hence, the critical demand for domain experts, and field knowledge providers, who must help identify the obvious, common, and uncommon "features" that businesses are seeking. Then, add non-obvious relationship analyses, and garnish with unconventional wisdom. To harvest the latter, perhaps crowd sourcing may be useful.

Organized data, using the principles of knowledge representation and application of logic and ontology, is a starting point, to construct computable models/structures of the domains of interest (agnostic of industry, vertical or horizontal). In the computational phase, we can use algorithms and tools from AI including ML, DL, ANN, CNN, RNN.

The trinity of out-of-the-box thinkers, who can connect the cubes, with field knowledge providers, and computational experts, is the "secret sauce" which must be continuously stirred, shaken, configured and re-configured, to blend the correct team, case by case, to profit from AI, and use the ability of AI, in problem solving. This approach and grasp of the extended fabric, is lacking in businesses and absent within corporate leadership.

The marketing hype, which is furiously polishing the chrome, on the AI engine, may help to explode the bubble and trigger a second AI winter. Global warming will be essential to thaw the AI ice age. But, before we boil the ocean, let us try to warm up to what may be necessary, the prerequisites, what is missing, how deep is the abyss and how education may bridge the chasm. Let us imagine, we have managed to fast forward to the spring of AI. Assume, AI in the tool kit is generating probabilistic output.

As pointed out by Jeanne Ross, an AI application indicates that a lead has a 95% chance of converting into a sale, while another has a 60% chance. Should we assume the salesperson knows what to do with that information?

ML applications may help lawyers identify appropriate legal precedents, help vendor management teams ensure compliance with contracts, assist financial institutions to gauge risk. These systems use ML to perform mundane tasks. Systems can learn to

develop spreadsheets and search databases for relevant information. But, in order to generate competitive advantage from ML (AI), we may need skilled humans to process the outcome. Hence, companies must redesign accountabilities, motivate employees to deploy ML tools, when they believe it may enhance outcomes. The educated workforce of the future must possess higher order skills, capable of consuming intelligence, and trigger actions to benefit, and hopefully, profit, from the deployment of AI tool kits.

Hence, these AI tools must be capable of use by general employees. The tools may be drag and drop interfaces representing abstractions. The employee may not need to deal with the computational complexities, programming principles and Boolean operators. To use these abstracted tools and intuitive interfaces, the educated workforce, in future, must possess skills which catalyzes the *consumption of intelligence, the outcome*. The educated consumer is the best customer for the future of AI and to profit from AI tools.

This raises a critical issue concerning K-12 education and how learning must be adapted to deal with the imminent socio-economic disequilibrium. Education must address the changing face of the supply chain of talent as well as the ingredients which are necessary to future-proof workforce preparation and make the workforce future-ready.

The future is not about apocalyptic reduction of employment. It is about a refresh of skills, which must be updated and upgraded, for the humans in the loop, to play relevant roles. We need the AI tool kit to help reduce uncertainty, and better manage, volatility.

To achieve that goal, executives need to appreciate the principles of data analytics and AI. Leaders must support education, inculcate insight and remain eager to learn, before they leap to manage. Leaders must institute internal education and external learning liaisons, where thinkers are viewed as assets and not as cost centers. Leaders must stress on understanding how AI works rather than blindly purchasing "black box" solutions.

The digital world will still need to serve analog communities. AI may lead to profit, if allowed to offer reliable computational assistance to the workforce, customers, and the global ecosystem of consumers, seeking credible, rational, near real-time, and perhaps predictive, decision support.

All things considered, the path to profitability rests with the imagination and the vision of the executive management and their counterparts in academia, and government.

Corporate leaders must evolve in their leadership roles. Leaders must assume the risk of leadership. Leaders must engage to provide broader guidance, bring parties to the table (competitors) and advocate for interoperability of architectures, to enable digital connectivity. Without security, digital transformation could be annihilated. Without connectivity, without data from different systems and ecosystems, without knowledge of what is *beyond the boundary*, the ability of AI, analytics and tools such as blockchain applications, will be curtailed. The outcome will be less valuable, less actionable, less profitable.

Hence, leaders must champion digital transformation by leading, and inspiring global teams, and navigating businesses to lift many boats, not just their personal yachts.

Acknowledgments. 1) This "letter" also appears as APPENDIX 6 in the essay "03.AI" available from the MIT Library – see folder "CHAPTERS" https://dspace.mit.edu/handle/1721.1/106496. 2) *The Fatal Flaw of AI Implementation* by Jeanne Ross, MIT SMR (14 July 2017) served as a source of a few examples and the reference to enterprise resource planning.

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HANDLE: http://hdl.handle.net/10216/105431

Standardization and Innovation Management

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Letter from Standardization

Innovation management enables organizations to focus on competitiveness and successful performance. Standardization can enhance organizational capabilities in order to be aligned with national and international best practices as well as to develop internal competences, routines and processes that can leverage an innovation journey towards excellence. At national and international levels, evidence demonstrates the importance of standardization, as a body of knowledge, to contribute to business innovation and to increase competitiveness and realization of value.

Keywords. Standardization, Innovation Management, Measurement, Evaluation, Assessment.

1 Introduction

As a voluntary process, standardization is recognized as a potential driver for innovation. Several studies highlighted that it can help companies to demonstrate their innovative products features and to increase business value creation (Swann, 2010).

Also, through common and harmonized rules and guidelines, resulting from consensus among stakeholders, organizations can identify relevant innovation factors influencing its present and future performance as well as align its processes according to best practices, continuous improvement and standard requirements.

As in other domains, a controversial question that arises frequently is: "is standardization an innovation enabler or an innovation barrier?"

An answer to this crucial debate is not simple. Different types of standards can produce distinctive effects depending also from several factors, as dimension, technological intensity, culture and strategy, just to mention a few, influencing its adoption. Nevertheless, standardization diffuses knowledge, increases predictability, thus reducing uncertainty and risk, and facilitates state of the art dissemination to companies, benefiting SMEs.

The national and international frameworks already developed to harmonize innovation management reaffirm that standardization can leverage firms' capabilities to absorb, apply and transform knowledge into value creation.

ISSN 2183-0606
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Context and institutions matter. Their influence, through standards, enables innovation actors to guide its action and to easily identify and develop innovation enablers, processes and best practices.

2 Framework at national level - The case of Portugal

Since 2007, Portugal has launched several standards aiming to harmonize a common approach to innovation management concepts, processes, including innovation projects management , innovation assessment and innovation systems .

The Portuguese Standard NP 4457:2007 "Management of Research, Development and Innovation (RDI), RDI Management System Requirements" was based on an innovation conceptual model (Caraça et al, 2009) aimed to update business innovation management frameworks, still generally focused at a linear perspective of the innovation process, thus benefitting from an open innovation approach and from a broader definition of innovation (OECD, 2005).

From academic and practioners perspectives, studies have been developed, revealing that companies that implemented innovation management systems (IMS), according to the Portuguese standards, recognized its impact in different areas, including knowledge management, communication and networking, engagement and participation, project management, creativity stimulation and ideas management, new product development or reputation and internationalization.

During the first years of standards adoption by organizations operating in Portugal, results demonstrate that main benefits were identified (Table 1) and summarized in a guide that provided valuable information for other companies aiming to follow the same path (COTEC Portugal, 2010).

Table 1. Innovation Management Systems Standardization: Main Benefits

Main Benefits of Innovation Management Standardization in Portugal
Information (data consolidation about projects, practices, etc.)
Management improvement
Internal communication and debate on innovation
Stimulus of Innovation culture
Knowledge management
Adoption of tools and methods focusing innovation based value creation
Creativity and ideas generation

Source: Best Practices Guide in Innovation Management (Original: “Guia de Boas Práticas de Gestão de Inovação”), COTEC Portugal, 2010

Apart from the main benefits highlighted above, some other advantages were indicated,

in spite of being less referred by the 24 companies surveyed in 2010, and included top management involvement, innovation productivity increase, better and more efficient solutions for clients and for the organization, easy access to tax incentives and financing and finally workplace innovation.

Also, companies adopting innovation management standards aim to reinforce their internal capabilities, one of the reasons explaining why it is possible to find companies from different sizes, sector or maturity profiles under this movement.

Nevertheless, firms recognized some difficulties that cannot be neglected. The degree of novelty from the standards and the need to understand the underlying concepts were identified as obstacles to the implementation and certification of innovation management systems. Also, the absence of innovation management methodologies and tools sufficiently disseminated, including innovation projects and open innovation management, creativity and ideas management, evaluation of results and improvement as well as performance assessment, was considered as a weakness in many organizations.

3 Framework at international level

At international level, firstly at CEN – European Committee for Standardization (www.cen.eu) and nowadays also in ISO – International Standardization Organization (www.iso.org), innovation is considered as a priority topic for standardization, not only as a complementary domain to integrated management systems but also as a specific domain covering a broad spectrum of its activities.

Since November 2008, standardization documents were produced aiming to provide a systematic approach to innovation, complementing national initiatives, developed in Spain, Portugal, France and other European countries. Spain as a pioneering country in the innovation management standardization chaired CEN Technical Committee 389 "Innovation Management".

The main objective of the CEN "Family" of Technical Specifications (TS) is to guide European organizations to be aware and to develop innovation as a driver for competitiveness and value creation.

A brief summary of the seven TS can highlight its relevance for a systematic approach:

CEN/TS 16555-1:2013, Innovation Management System: This Technical Specification aims to present a framework, integrating activities crucial to generate innovations as a "routine" process and to target specific innovation determinants that include Organization Context, Leadership, Planning, Innovation Enablers, Innovation Process and Results, Innovation Management Techniques and Innovation, Performance assessment, briefly represented in the following conceptual model:

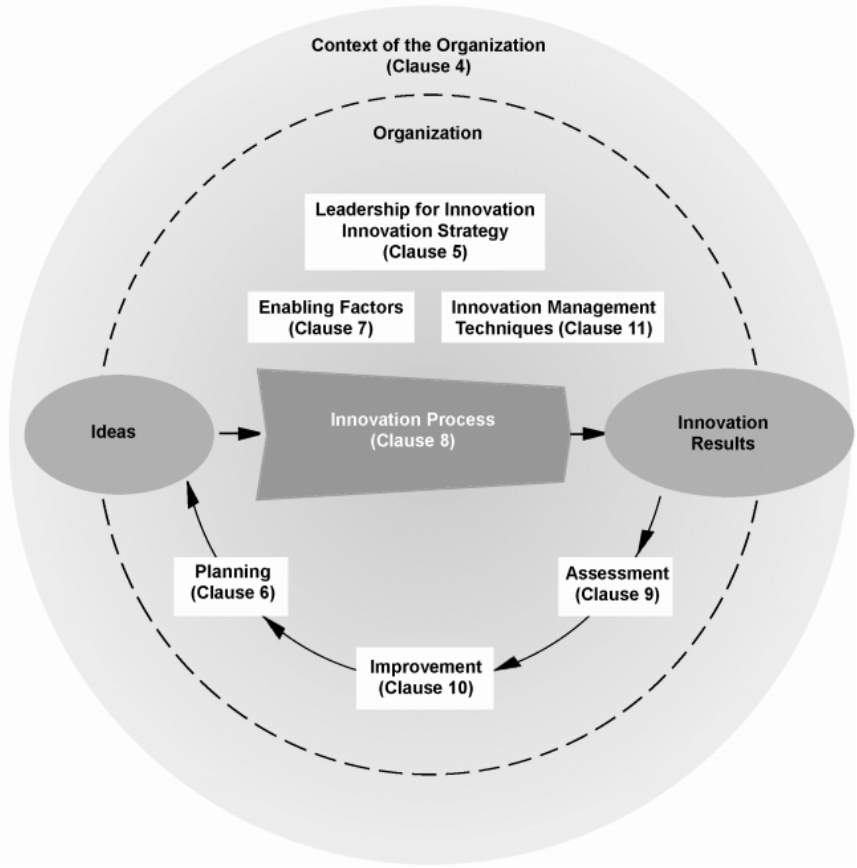

Fig. 1. Innovation Management System Elements.
Source: CEN. (2013). CEN/TS 16555-1:2013 "Innovation Management - Part 1: Innovation Management System", Figure 1 "Key elements covered by this Innovation Management System", European Committee for Standardization (CEN).

CEN/TS 16555-2:2014, Strategic intelligence management: As innovation management depends on organizational capabilities to translate strategic signals and emerging trends into valuable inputs to innovation strategy and projects, this TS can be used to ensure intelligence and foresight can support innovation management.

CEN/TS 16555-3:2014, Innovation Thinking: Based on a structured approach, that can be complemented by other methods and tools to promote innovation, Innovation Thinking aims to capture information, insights and experiences to maximize opportunities and problem solving in order to accelerate time to market and to create value added innovations.

CEN/TS 16555-4:2014, Intellectual Property Management (IP): Organizations must consider IPR as a strategic asset that can be linked to competitiveness, especially when considering value creation. Innovation management must consider IP as an enhancer and a tool to increase temporary market advantages and to use it as a knowledge

management method that can capture information about competitors scientific and technological competences and assets.

CEN/TS 16555-5:2014, Collaboration Management: Innovation management has been evolving towards an open and collaborative model. This TS targets collaboration as a new domain that needs strategic guidance and management processes capable to enable organizations with internal tools to address issues that include "Why", "When", "How" and "With whom".

CEN/TS 16555-6:2014, Creativity Management: Ideas are at the heart of the innovation process. By that reason, it was considered crucial to identify conditions necessary to nurture and develop ideas generation, collection, selection and implementation.

CEN/TS 16555-7:2015, Innovation Management Assessment: Evaluation and assessment of innovation contribution to firms performance, competitiveness and sustainability are powerful instruments. Among other reasons, learning and improvement can illustrate why innovation assessment is gaining relevance at micro and macro levels. Through this TS, organizations can identify which tools can be used, from simple check lists to more complex models as the maturity or benchmarking instruments (Figure 2), and which results can be obtained.

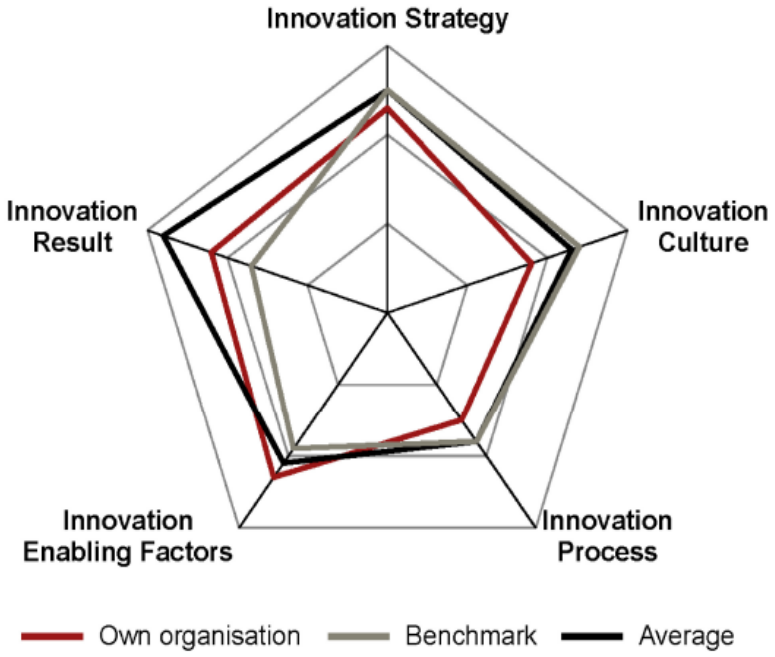

Fig. 2. Benchmarking assessment.
Source: CEN. (2015). Innovation Management - Part 7: Innovation Management Assessment (CEN/TS 16555-7:2015). European Committee for Standardization (CEN).

Created in 2013, and involving almost 50 countries, ISO Technical Committee TC 279 placed innovation management standardization at a global level. Its main purpose is to develop, maintain and promote standards contributing to long term competitiveness and

sustainability, identifying the main elements, or determinants, for innovation management, not only within the organizations but also in its interaction with other players of the ecosystem. It has been recognized the need to develop international innovation management systems standardization documents, following other management systems standardization movements like quality or environment.

As in CEN TC 389, four working groups (WG) were launched to define the IMS (WG1), the terminology (WG2), the tools and methods to support innovation (WG3) and the innovation management assessment (WG4). A common vision, shared by members and consolidated in a set of principles (WG1), highlights the importance of leadership, culture, strategy, openness, adaptability and experimentation for innovation management and its ultimate goal: value creation.

The Portuguese Technical Committee has been participating in those activities, as a mirror committee that proactively promotes the participation of about 30 organizations from the national innovation system.

4 Concluding Remarks

Organizations, in spite of its R&D and innovation profile, should consider innovation management standardization as a learning opportunity and a strategic instrument to target competitiveness enablers and processes.

Innovation Management Standards can be used as management tools enabling organizations to absorb knowledge, to learn from best practices and to apply already tested innovation management approaches and methodologies.

In Portugal, almost 200 companies have already applied innovation management standards and certified its systems according to NP 4457:2007. As indicated previously, advantages exist, including for SME that can access to global, harmonized and state of the art innovation management guidelines in a simple and systematic way. Also, as observed at national level, and as innovation is progressively linked to other management systems, organizations have the possibility to ensure its compatibility with other management systems already in place and to use standards, in a flexible way and for different, and complementary, purposes: certification, self assessment or assessment by any other interested party, contributing to increase the role innovation can play as a driver for organizational success in a context of accelerated change and uncertainty.

Considering innovation management standardization as a knowledge resource, one could expect that public policies support stakeholders in order to accelerate its dissemination and adoption, creating dynamic capabilities to sustain competiveness and value creation. And the challenge is not local or national anymore.

Acknowledgements. The author thanks to the Portuguese CT 169 members, specially Joana dos Guimarães Sá (Committee Member, ISO TC 279, WG 1) for comments and Eduardo Correia (Secretary of CT 169) for revision of an earlier version of this Letter.

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Journal of Innovation Management
JIM 5, 2 (2017) 15-25
HANDLE: http://hdl.handle.net/10216/105431
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Looking beyond official success measures: tales from the field of the complex forces shaping Luxembourg's ICT ecosystem

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Abstract. Information and communication technologies (ICT) are increasingly becoming an important component of economic development. Luxembourg's ICT sector is usually characterized as performing admirably - it is often at the top-end of different indices and international league tables. Nevertheless, headline statistics and high-level assessments often disguise the complexities of dynamic relations. Ecosystems are one way of understanding complex interactions and relationships. It is in this respect that this paper deploys the concept of ecosystems to investigate Luxembourg's ICT sector. The layered ecosystem model, devised by Martin Fransman, was utilized to map key actors that comprise Luxembourg's ICT ecosystem, following which a program of unstructured interviews were conducted. This empirical material, combined with documentary analysis, provides the basis for an analysis of the interrelated elements that are shaping the development of Luxembourg's ICT ecosystem. The study has identified the main forces that affect the ICT ecosystem and concluded that Luxembourg's strengths are related to its well-developed ICT infrastructures such as international fiber and national ultra-high broadband connectivity and high quality datacenters and its political vision for ICT that has led to a supportive policy environment. Its main weaknesses are related to an inappropriate educational system in which technical and scientific training is less developed, missing e-skills such as coding, application development, technical IT know-how as well a non-entrepreneurial mind-set and a risk averse culture. The paper highlights the importance of the different socio-economic, political, strategic and technological forces that shape the ICT ecosystem of a small country in order to provide a comprehensive basis for its policy makers. An empirical focus on a small country helps to redress the research imbalance, whereby small countries are often overlooked by scholars. Nevertheless, we contend that such "smallness" engenders a unique opportunity for research engagement with a majority of primary actors in ecosystems, which might be unfeasible in larger countries.

Keywords. ICT ecosystems, Luxembourg, qualitative analysis.

ISSN 2183-0606
http://www.open-jim.org

1 Introduction

Luxembourg has one of the most developed telecommunications infrastructures within the European Union (European Commission, 2013a). Broadband and Next Generation Networks (NGN) are available to 100% of the population. The latest mobile networks technologies are present almost everywhere and the country operates about 20% of the world's high resilience datacenter capacity (Luxembourg for Business, 2013). According to the Ookla netindex[1], in 2015, Luxembourg was positioned 9th out 113 countries with mobile download speed of 23 Mbits/s, and 19th out of 202 countries with about 40 Mbits/s download speed in fixed networks. Information technologies and e-commerce are seen as growth areas for Luxembourg (PWC, 2011). ICT technologies are widely used by households and businesses and about 17.000 people work directly in ICT and many more in the related financial industry. Over the last 15 years, governments have supported the development of the ICT sector as a policy maker, as a regulator but also as ICT service provider as the Government is a 100% owner of two telecommunications operators and has invested directly or indirectly in many ICT related activities (Binsfeld, Whalley, & Pugalis, 2013, 2015).

All of these activities have helped to create a dynamic ICT ecosystem (Rafique, Yuan, Tareen, Saeed, & Hafeez, 2012). In addition, Luxembourg has improved in the last 15 years its relative ratings in international indices, such as, for example, the networked readiness index published annually by the World Economic Forum (World Economic Forum, Dutta, Geiger, & Lanvin, 2015) in which Luxembourg is now placed among the top 10 most "network ready" countries in the world. Nevertheless, Luxembourg's ICT ecosystem also exhibits some frailties not always captured or transparent in international league tables.

This paper deploys a layered ecosystem model approach as proposed by Fransman (2010) as a means to identify the main actors in Luxembourg's ICT ecosystem. By applying this model, the authors aim to map the different actors in the ICT sector and analyse the relationships between the actors within the ecosystem in order to better understand how the ICT ecosystem in a small country like Luxembourg has developed over the last 15 years and more generally what are the internal and external factors that have helped to shape it over this period in time. These factors have been identified by direct interactions through extensive unstructured interviews with over 50 relevant stakeholders.

With this study, we intend to make both a contribution to better understanding the forces that shape ICT ecosystems in small countries as such countries are widely overlooked in literature and to provide an illustration of how the Fransman model may be used in practical terms. Luxembourg proves to be of particular interest for academic research and for policy making (in terms of implications) because it is a small but very open economy which is one of the most successful in the world. Luxembourg is located very centrally in Europe, is one of the founding members of the EU and is often cited in the top league international rankings. Furthermore, it can be compared to a region of larger countries and it may therefore provide some useful insight for small and open economies with similar features e.g. Singapore. In the other hand, Luxembourg does

[1] See http://explorer.netindex.com/maps?country=Luxembourg accessed 15.5.2015 – discontinued since

present some interesting peculiarities such as for example a very heavy reliance of the services sector.

The remainder of the paper is structured as follows. Section 2 presents different approaches to analyse an ICT economy and introduces the Fransman ecosystem model. Section 3 provides a brief overview of the ICT ecosystem and presents some of its major developments over the last 15 years. Section 4 argues the case to develop a better understanding of the situation by conducting a qualitative exploratory analysis and presents the methodology used. Section 5 presents the outcomes of this analysis and the final section discusses this outcome and draws some conclusions.

2 From Value Chains to Ecosystems

This paper builds on the definition of the ICT sector and the underlying classification suggested by OECD (2011) for "measuring the information society". This definition of ICT includes IT goods and services, information content as well as telecommunications goods and services including manufacturing and production of these.

There is a wide range of models available to make sense of the structure of the ICT industry. Many of these apply or develop the Porter's value chain to the ICT environment or parts of it (Maitland et al., 2002) or have extended this model to a so-called value net (Li & Whalley, 2002, Peppard & Rylander, 2006, Rafique et al., 2012). This idea which has also been taken up and developed further by, for example, Hallikas et al. (2008) or Oestreicher et al (2012). Similarly, Porter's model about competitive forces (Porter, 1990) has been adapted to the ICT environment (Karagiannopoulos, Georgopoulos, & Nikolopoulos, 2005). Along the same lines, Briglauer (2004) has developed a generic reference model in order to assess competition in different communications markets focusing on a regulatory viewpoint. Additional work has been done in characterizing the ICT Ecosystem as a network (Garcia & Vicente, 2012), as well as looking into how such networks are built and maintained (Partanen & Möller, 2011).

These models are essentially linear ones, but today's business environment is complex and dynamic and presents multiple relationships where companies are interacting to deliver their products and services. As a consequence, the ICT sector is increasingly characterized as a socio-technological (eco)system facing asymmetric and delayed feedback structures, which lead to turbulent changes (instability/existence of multiple equilibria) and high uncertainty.

Koslowski, Longstaff, Vidal & Grob (2012) see the ICT sector as an ecosystem of many heterogeneous organizations that are woven into a web of links and respond interactively to forces in the environments. Understanding the dynamics of one domain in isolation from the other is impossible, and demands both a systemic and evolutionary view to be adopted. According to Kim, Lee, & Han (2010) an ecosystem can be defined as an economic community involving many companies working together to gain comparative advantages as a result of their symbiotic relationships. They also argued that ecosystems permit companies to create new values that no company could achieve alone. Likewise, they identified symbiotic relationships that can provide some benefits for related parties such as consumers and partners. A recent discussion about using the

ecosystems model to analyze the ICT sector is provided in Basole, Park, & Barnett (2015).

Hence, it is important to examine ICT ecosystems in order to understand the co-evolution between technological and economic as well as regulatory forces and developments and to provide a comprehensive basis for policy makers, For the purpose of understanding the structure of the ICT ecosystem in Luxembourg, it is suggested here to use a layer model described by Martin Fransman (Fransman, 2001, 2002a, 2002b, 2004, 2006, 2014). This model allows a clear identification of the different categories of actors within the system as well as the "interfaces" and relationships between those actors and thus provides a simple yet effective way to gain a good understanding of the different types of actors, their respective roles and importance to the sector as well the interrelations between them (see figure 1).

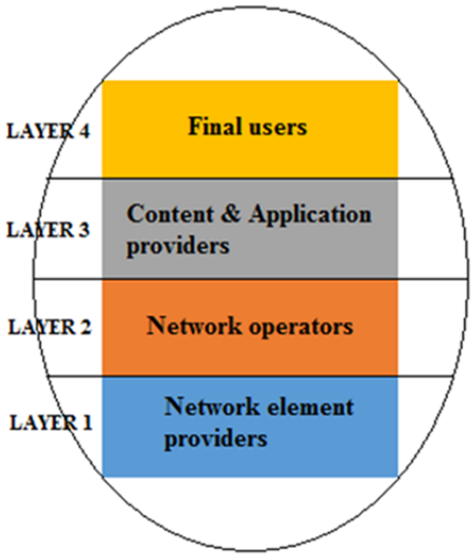

Fig. 1. The four-layer model

Fransman deliberately used the term ecosystem to stress the importance of the links between the various ICT actors. When looking at the supply side of the ICT ecosystem, four types of actors can be distinguished:

Layer I: Network element providers (e.g. Cisco, Samsung, Alcatel-Lucent, Ericsson, Nokia Networks)

Layer II: Network operators (fixed and mobile) (e.g. BT, Deutsche Telekom, Vodafone)

Layer III: Content & application providers (e.g. Google, Apple, YouTube)

Layer IV: Final consumers

In the "new ICT ecosystem" (i.e., post-internet), users are gaining a presence on the supply side of the system by co-creating with suppliers. In contrast to the so-called "old ICT ecosystem" (i.e. pre-internet), which could be described as a closed innovation system with the most important links being between network operators and network

suppliers (Layers I and II), the new ICT ecosystem is more open, more dynamic and more complex. In recent years, the focus has shifted to the interaction between platform, content and application providers (Layer III) and the ecosystem has become more dynamic with the relationships between the different actors and the environment also becoming more complicated.

Acknowledging these developments, Fransman (Fransman 2007, 2010, 2011), in more recent works, has focused on the role of the dynamic, or as he calls them "symbiotic", relationships between the different layers and their role for innovation (Fransman, 2014). These relationships can be described as multi-dimensional representing financial and material flows as well as information and input flows into the innovation processes within the ecosystem (see figure 2).

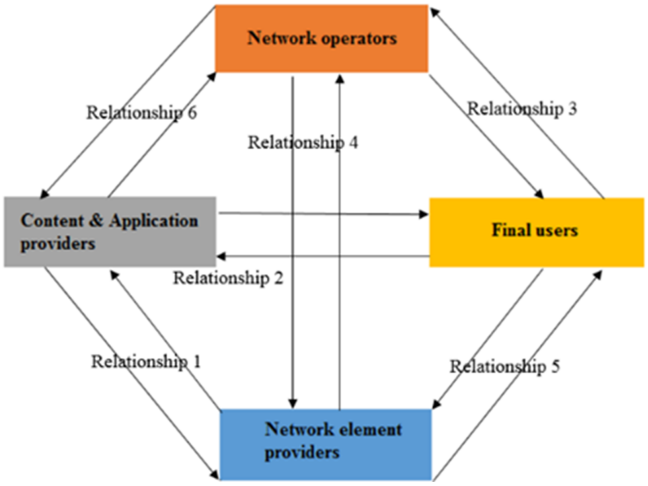

Fig. 2. Symbiotic relationships with the four-layer model

The Fransman model is not used very often by researchers in the field. Yet it is relatively simple and straightforward to apply as it builds on an ISO standardized layer model[2] which is largely used by IT engineers to explain interworking of computer and telecommunications networks. As such it provides a well-documented way of identifying the different actors and their activities which can easily be shared amongst ICT professionals as it is built on a common understanding. Furthermore, it allows to describe and identify the links and relationships between the different layers.

An example of how this model can be used to understand the interactions between different actors is provided by, for example, Arlandis & Ciriani (2010). It also includes a detailed database of players in the different layers but takes a high level view by looking at different economic cluster such as the EU, the US and Asia. Another application of the Fransman model can be found in Veugelers (2012). Here the model is used to understand why Europe's ICT companies are lagging behind the US with regards to the "leading platform providers who are capturing most of the value in the ICT ecosystem". It is argued that a very fragmented EU market, lack of entrepreneurial mind-set, as well as lack of risk capital are the main stumbling points to the

[2] https://www.iso.org/standard/16011.html accessed 8.4.2017

development of the ecosystem.

3 A brief introduction into Luxembourg's ICT ecosystem

There is an ongoing debate about what actually constitutes a small country and a summary of this discussion can be found, for example, in Roolaht (2012). Often indicators like size, population or GDP are applied. According to all of these indicators Luxembourg would actually constitute a very or even extremely small country and indeed it is one of the smallest within the EU with a land area of only 2,586 km2 and a population of 524,900 inhabitants (STATEC, 2013). When it comes to GDP/capita however, Luxembourg is one of the richest countries in the world (Thelen, 2012).

Following the OECD definition of ICT mentioned above, 7% of Luxembourg's Gross Value added is generated within the sector. This share is considerably above the EU-27 average which is around 4.6% of the total GVA and is the highest among EU member states (European Commission, 2013b). The country has not only a high proportion of highly skilled workers, but has also one of the highest shares of ICT-using occupations among OECD countries. The Luxembourg labour market has one of the largest shares of knowledge-intensive activities[3] in Europe, with 56% of all the jobs in 2011 falling into this category (Service des Médias et des Communications, 2013). With regard to ICT infrastructure and connectivity (Fransman's layers 1 and 2) Luxembourg has invested a considerable amount to build and efficiently operate multiple state-of-the-art high capacity fibre networks (see figure 3). This is to ensure national and international connectivity and connecting Luxembourg to major hubs in Europe (Service des Médias et des Communications, 2013).

By 2009 100% of Luxembourg's population was covered with 3G mobile networks, whereas in 2012 64% of the population were covered by the 4G network. Similar considerations apply to broadband connectivity and will be further developed, as, in its national strategy for very high-speed networks, issued in April 2010 (SMC, 2010a), the Government intends to increase the speeds of the existing networks, and provide, in the medium term, access to optical fibre in the entire territory. It is the Government's intention to transform Luxembourg into the first "fibred" country of the EU, if not in the world. Luxembourg has also grown into the premium location for data centre parks in Europe, with more than 19 data centres are operational (SMC, 2010b).

The 2015 STATEC bulletin on ICT in households and among individuals in 2014 (Bodson & Frising, 2015), highlights the recent expansion of social networks and cloud activities, especially among young people. In 2014, 60% of residents aged 16 to 74 participated in social networks, of which Facebook was the most popular as 57% of residents were active.

The Luxembourgish government has recognized the important role that ICT plays in national economic development. Luxembourg has, in recent years, experienced a major advancement with the accelerated development of the country's innovative technology companies, whether in the media sector, e-commerce, digital content, cloud computing,

[3] An activity is defined as being knowledge-intensive if the tertiary-educated persons employed represent more than 33% of the total employment in that activity (European Commission, 2013c)

big data or electronic payments (Kitchell, 2010).

The ICT sector has also become an economic player in its own right, attracting substantial foreign direct investments (see overview of main actors in figure 5) and is not merely limited to its function as a services provider to other economic sectors. In both ways, as an economic sector by itself and as a vector of competitiveness for all other socio-economic sectors, the ICT sector will play an important part in the modernisation, performance, competitiveness and efficiency of the country.

In order to strengthen and consolidate the country's position in the field of ICT and to transform its ICT sector into a 'high tech' centre of excellence, the Luxembourg government, in conjunction with ecosystem stakeholders, has recently presented a new digital strategy called "Digital Lëtzebuerg" (Bettel, 2014). This programme encompasses subjects as diverse as the computerization of government services and the development of new niche markets for new markets (big data, health technologies, innovation in services to the financial sector ("FinTech") as well as virtual currencies. The government accepts this strategy and has consistently sought to implement it across all its relevant policy areas (Gouvernment du Luxembourg, 2014b).

4 Methodology

Whilst all of the aforementioned tends to show that the ICT ecosystem in Luxembourg has developed very well over the course of the last 15 years, it is it not clear what have been the main reasons for this relative success and whether this evolution will continue in the future. Therefore, we have applied the Fransman model in order to explore the ICT ecosystem and to identify the different forces and relationships at hand.

In a first step, the main categories of actors have been identified (see table 1) in the different layers as well as the institutions that shape and influence the relationship between the different layers using a focus group of 9 experts. The outcome of this work resulted in a summary overview of the ICT sector in Luxembourg. This model was then discussed with different stakeholders and further developed by the lead author in an interactive and iterative manner which led to the model that is presented in figure 3 (below).

Applying Fransman to this model and focusing on the above mentioned "symbiotic relationships" within the ecosystem, it is possible to identify actors at the governmental and political level that shape the regulatory and policy environment for ICT within the framework of the regulatory packages set by EU (European Commission, 2014a). Similarly, the model also allowed us to identify the different state-owned agencies and institutions that provide support to the ICT sector in terms of public funding, awareness raising and training (upper box in figure 3).

The next level of actors concerns regulation in the broadest sense, including the National Regulatory Authority, the Competition Authority, the National Standards Agency, the Data Protection Commission as well as regulatory authorities for the financial sectors (right box in figure 3). The ICT ecosystem is also supported by R&D activities and organizations such as University of Luxembourg, public research centers but also venture capitalists and incubators (lower box).

Looking closer into the ecosystem itself, it is possible to identify ICT enablers that

provide the underlying infrastructures, these include network element providers and network operators corresponding to the layers 1 and 2 of Fransman's model. Building on this, one can find the ICT service enablers that would fit within Fransman's third layer and the customers or users of ICT, of which some have been identified in the diagram above, correspond to Fransman's fourth layer. They include most of the actors in Luxembourg's well developed financial sector (KPMG, 2013). Finally, we can also identify several institutions or organizations, private and public, that are active in promoting the sector both nationally and internationally.

Building on the figure below, we have chosen to conduct a qualitative exploratory analysis (Cresswell, 2014; Easterby-Smith, Thorpe, & Jackson, 2012) using extensive unstructured and face-to-face interviews (Schultze & Avital, 2011) with a representative subset of the major stakeholders within the ICT ecosystem as identified through applying Fransman's model. The objective was to study the forces that shape the ICT ecosystem and to understand the interactions between the different layers and actors (symbiotic relationships).

A two stage approach was adopted, using the above mentioned focus group consisting of major industry and institutional players in order to establish an initial template through a SWOT analysis (Anderson, 2010; King, 1998). This SWOT analysis was then used to design open-ended questions to start the interviews and to assist in the later coding process of the outcome of these.

Using a qualitative approach has some limitations in terms of drawing generally applicable conclusion as discussed for example in Lincoln (1995) or Yin (2009). However, because of the small size of Luxembourg, it has been possible to interview a very wide and therefore representative set of stakeholders.

4.1 Identification of relevant actors

When identifying the different actors, the following criteria have been applied: size and relevance of actor, number of employees, specialization, access to key stakeholders, nationality (local or international), start-up or established actor, years of presence in Luxembourg, public or private ownership (full list in table 1 below).

Care was also given to take into the structure of ICT ecosystem which is presented in greater detail in for example Krylova (2015, p 41). She claims that "the majority of companies in the ICT sector are small (less than 50 employees), whereas the number of big companies contribute to less than 3% of market share". It was also considered that the number of actors in layer 2 and 3 is far higher than in layer 1.

4.2 Data collection and analysis

The recordings of the interviews, which usually lasted around 1 hour, were then imported into NVIVO, a computer aided qualitative data analysis software, to be processed (Bazeley & Jackson, 2007; Beekhuyzen, 2010; Neill, 2013; Welsh, 2002; Wong, Medicine, & Lumpur, 2008). As NVIVO allows the coding of the data directly in either text, pdf, audio or video files, it was decided to code straight on the audio content, transcribing and translating the main ideas and topics into text as well. Due to the multilingual workforce of Luxembourg, interviews have been conducted in four languages - Luxembourgish, French, German and English - and were partially

translated. An advantage of NVIVO is that is allows almost instant access to any of the underlying data so that everything that has been said can be traced back directly from coded outcomes.

Coding started with the initial template from the aforementioned SWOT analysis but evolved over time. If and when a new topic emerged a new theme (code) was added in NVIVO. Interviews have been conducted until no further new codes or topics arose. Translation, partial transcription and coding took about 4 hours per interview. The use of NVIVO gives a lot of facilities, for example it allows immediate display all the codes per interviewee, it allow basic statistical analysis for example on frequency of codes, time spent on a specific message, how often a certain code or indeed expression has been used. It also allows for a graphical representation of interviews, the topics covered as well as the relationships between codes.

On the other hand, understanding and setting up the tool can be cumbersome, the raw data generate large files that are difficult to handle, the coding takes a lot of time and is necessarily somewhat subjective. As a consequence, based on some samples, coding verification has been undertaken. The tool, however, also has an "autocoding" function that could unfortunately not be used because of the respondents' use of different languages.

Table 1. Companies and institutions interviewed

Fransman's layer	Interviewed Organizations and Institutions	Individuals
I – network element providers	Alcatel-Lucent, Cisco, HP, Unify	4
II – network operators	Broadcasting Center Europe, British Telecom, Cegecom/Artelis (2), Eltrona (2), Fédération des Opérateurs Alternatifs Luxembourg, HotCity, Join Wireless, Post (2), Société Européenne des Satellites,Telecom Luxembourg	13
III - content and application providers	Association des professionels du secteur financier, Association des professionels du secteur de l'information, CTTL, Data4, Datacentre Luxembourg, Ebrc, Itrust, Luxconnect (3), Luxcloud, Netcore, Systemat, Telindus (2)	15
IV – consumers	Appolo Strategies, Association des Banques et Banquiers, Exxus (2), Gartner, Ikano, Fédération des Artisants,,Luxembourg Business Federation, ProNewTech, PwC	10
Outside influencers – finance, regulation, standardization	Interdisciplinary Centre for Security Networking and Trust (2), Institut Luxembourgeois de Regulation, Luxinnovation, Luxembourg Institute of Technology, Ministère de l'Economie, Moskito, Service des Médias et des Communications	8

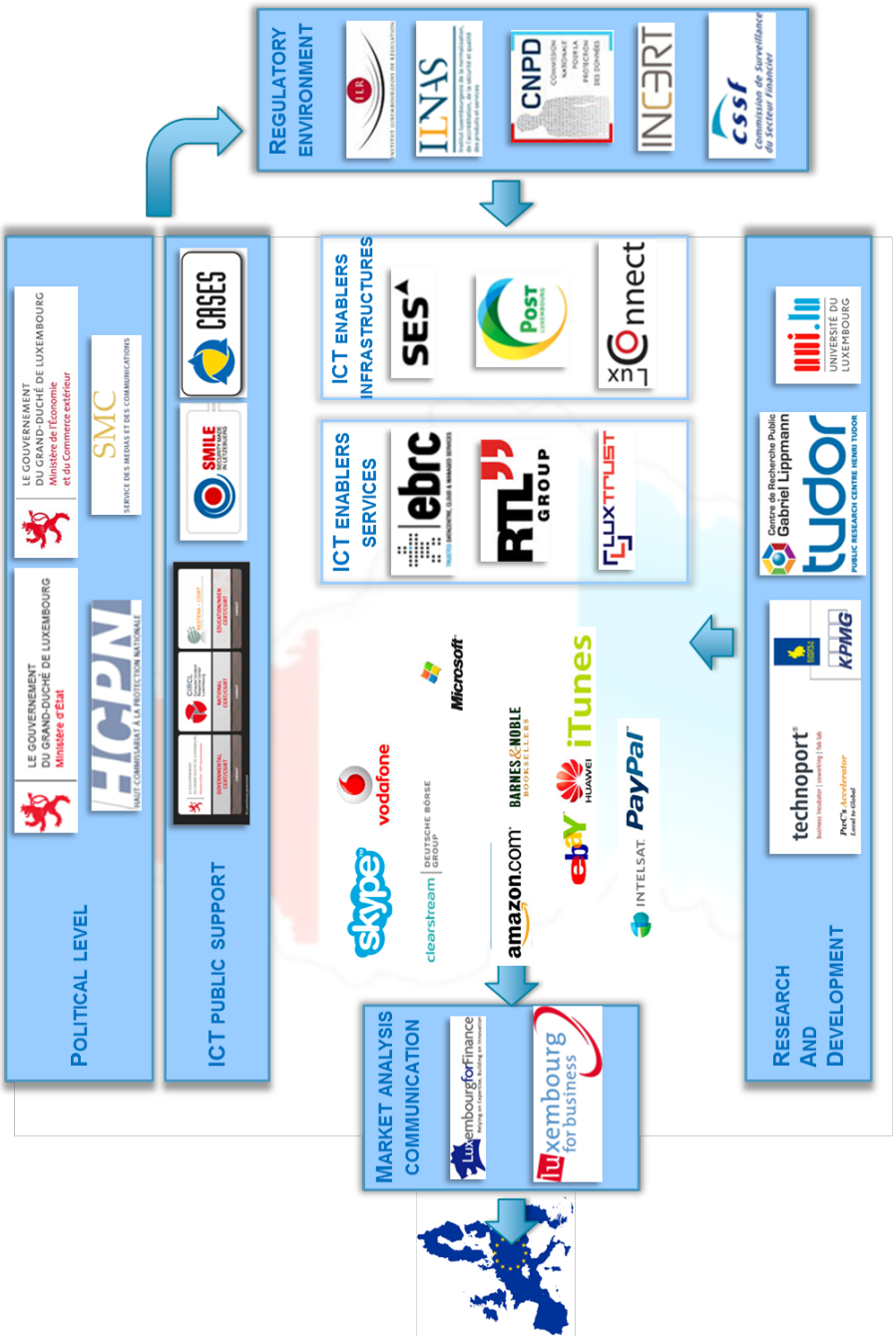

Fig. 3. Luxembourg's ICT Ecosystem (with a subset of major players) 5. Main forces shaping the Ecosystem

5 Main forces shaping the Ecosystem

The following section presents the outcome of the interviews with the different stakeholders identified in table 1. In a first analysis, the different issues mentioned were simply counted and the diagrams below show how often a given topic was mentioned. It is assumed that the frequency at which a certain topic was mentioned acts as a fair indicator for the relevance or importance of the issue. In addition, quotes have been extracted from the data and are also presented below in order to highlight and illustrate the importance of some of the major issues identified. A large majority of interviewees suggested that to make a difference between factors that Luxembourg and the actors in the ecosystem might have some control over (endogenous factors) and those that were "outside" of the ecosystem and driven mainly by the wider EU regulatory and the geopolitical competitive environment (exogenous factors). This structure is followed below.

5.1 Exogenous Factors

As shown in table 2 below, the interviewees identified primarily EU regulations as well as international competition as the major two external factors affecting the development of the local ecosystem.

Table 2. Examples of exogenous factors

"Our competitors are more aggressive, in particular the Dutch are real salesmen". "For security related topics Switzerland is a major competitor, they follow the same strategy as Luxembourg" **Head of international sales, incumbent operator**	"We should follow closely what is happening at EU level and implement changes quickly to gain a competitive advantage compared to other countries e.g. Big data, trust, security, this was traditionally a strength of Luxembourg and we should build on this" **CEO of cloud service provider**
"The Netherlands are more aggressive and more dynamic, Luxembourg is more "down to earth" **CEO Alternative Telecom Op.**	"The EU is pushing for single market, this means more competition within Luxembourg but we are not big enough to exploit the international opportunity" **Representative of alternative operator association**
"Almost all major European Cities are competing with Luxembourg" **Member of Management board of bankers association**	"Does Europe not have a general problem here - what is still left for us? " **CEO of small consulting company**
"The question is not what should the government do, but what are they still allowed to do" in terms of industrial policy "Luxembourg needs to do more lobbying at different levels in Brussels" **Representative of Business Federation**	"Low VAT has attracted a lot of customers, but this money has not been invested wisely and has not helped to develop IT sector" **CEO alternative telecom operator**

"EC is putting pressure on Luxembourg because of IP, but there are countries that do provide more tax advantages" **Director at one of the "big 4" consultants**	"EU regulations might limit what Luxembourg can do in the future ....even PSF might not be allowed. Why do we not push it on the EU level?" **Country director global telecom equipment provider**
"The whole competitiveness issue being discussed in Europe is really disadvantageous to small countries" **Representative of Luxembourg's university**	

The influence of EU regulations. A large majority of the stakeholders are well aware that the Luxembourgish ICT ecosystem is heavily influenced and evolves within the framework of the different EU regulatory packages (see, for example, European Commission, 1987, or European Commission, 2013b). These programs that have been put in place mainly in order to stimulate competition and the move towards a digital single market (European Commission, 2010).

This topic was mentioned on over 50 occasions. It was felt that often these EU regulations are not working in favor of the ICT ecosystems of a small country like Luxembourg and the pressure towards a single EU wide market favors large or indeed global players. In this context, the discussion about reducing or abolishing roaming charges for mobile communications within the EU was mentioned on 12 occasions and is widely reported in the press, see, for example, De Fooz (2014a) or Henry (2014b) The fact that there exist many restrictions with regards to access to on-line content and geo-blocking is largely applied by major content owners was also mentioned especially by stakeholders involved with TV offers (CATV or IPTV). This prevents Luxembourgish consumers from accessing such content legally (Boston Consultancy Group, 2013).

On the other hand, several stakeholders and, in particular, those more closely linked to the financial sector, mentioned the effect of the different VAT regimes on electronic commerce. This has had, so far, a positive influence on the development of the industry (PWC, 2011). However, these stakeholders were also aware that this effect is currently about to disappear in line with EU rules (Post Telecom, 2014).

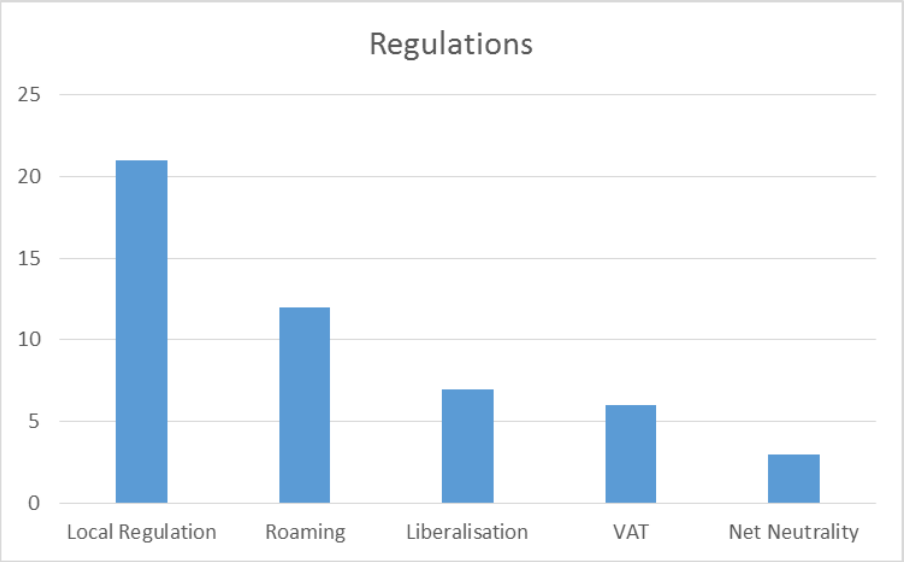

Fig. 4. Number of citations of different external regulatory/policy measures

Over 20 stakeholders identified issues related to the local implementation of the EU regulations and, amongst other things, it was felt that the national regulatory authority did not actively enough intervene in the market and did not have the necessary resources. This issue is also widely reported in the local press (Dard, 2013; Gaudron, 2011; ILR, 2013a; Le Jeudi, 2015; Poujol, 2013, 2014a) and is of particular importance to the telecommunications operators in Fransman's layer 3.

Growing international competition. In addition, international competition from different EU member states, both to attract ICT activities and on the export level, were also identified by about 20 interviewees and were said to be of growing importance. In this context, the main competitors identified were the Netherlands, Ireland as well as Luxembourg's immediate geographically neighboring countries (see figure 5 below). It was felt that competition was generally becoming more intense and that recent events around "Luxleaks" (Paperjam, 2014b; Raizer, 2014b), as well as Luxembourg's image as a "tax heaven", were negatively affecting Luxembourg's position (Guardian, 2014). It also becomes increasingly difficult to identify and communicate Luxembourg's unique selling points, with some actors commenting that a new marketing and communication strategy might be urgently needed (Bervard, 2015; Fondation Idea, 2014; Gouvernement du Luxembourg, 2014) and that the current promotion efforts needed to be better coordinated.

Overall, participants felt that both of these sets of external factors had a major influence on the ecosystem and suggested that Luxembourg, due to its small size, might be more vulnerable or exposed to the these forces that the Fransman model gives less emphasis to, as it focuses more on endogenous factors and the relationships internal to the ecosystem.

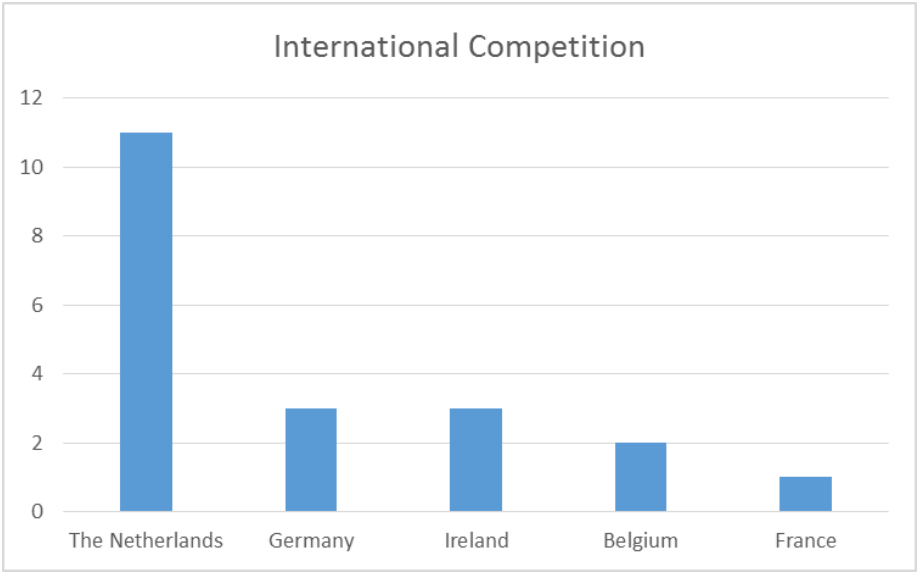

Fig. 5. International competition according to different countries

5.2. Endogenous Factors

Figure 6 below shows the endogenous factors that were mentioned by the different stakeholders as well as their frequency. It can be seen that these issues were mentioned far more often than the exogenous factors and the list of endogenous factors is much longer. It will, therefore, in the context of this study, not be possible to address them all in depth. Instead the objective of this paper, is to provide a broad overview and thus the following discussion will be structured by order of the importance expressed as measured by the number of times a certain topic was mentioned.

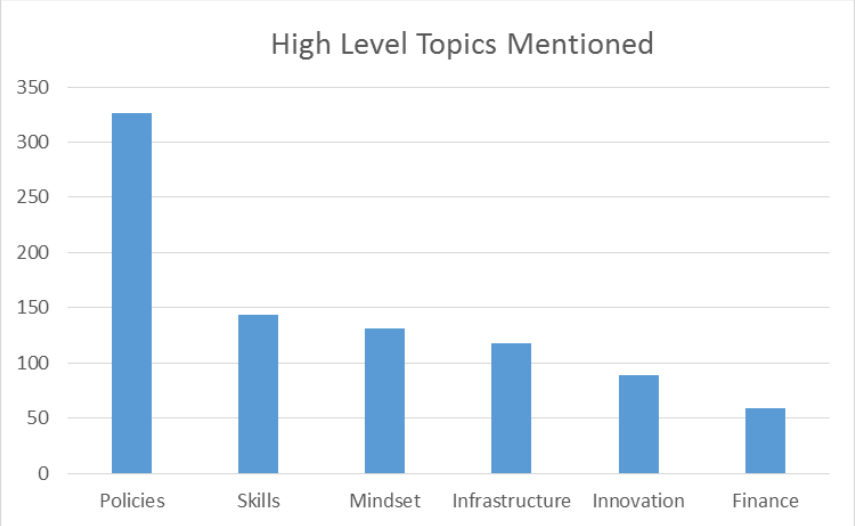

Figure 6 - Most important endogenous forces by number of mentions

Government Policies. A wide range of different policy initiatives have been identified and commented on as this subject was mentioned over 300 times. Examples of some of the main messages are presented in table 3 below.

There was, however, a large and general agreement that successive governments had taken ICT seriously and developed, as expressed by the World Economic Forum (World Economic Forum et al., 2015), a "vision for ICT" and launched a wide range of initiatives that have helped the sector to develop.

Table 3. Examples of policy issues mentioned

"A lot of efforts are made by the government to diversify the economy, there is a strong link as well between government and industry players due to the small size of the country." **Country director Gartner**	"We have different interfaces to the Government - we are not really represented on the important European Level etc....we only have a limited set of experts but we do not use them efficiently enough" **Professor at German University**
"The new government has a different approach and they seem to be more willing to find solutions to improve Luxembourg's position". **CEO Satellite Service Provider**	"Luxembourg is still very flexible and quick in creating the legal environment, perhaps we should have more resources to spot quickly enough the new opportunities" **Head of international sales incumbent operator**
"We have good infrastructures, a legal and in particular fiscal environment that is favourable but we need to improve	"Luxembourg is lacking a bit the creativity - it is not enough to focus on "Legal or regulatory" niches.

constantly" "Would E-archiving have been a good niche to enter into - well it took a lot of time to set up the legal environment and we still have nothing finalised" "One of the strengths of Luxembourg was and still is to a certain extend its ability to adapt quickly and flexibly the EU regulations (e.g. tax rulings)" **CIO global IT service provider**	"We have invested a lot in Biotech - this is not a very good investment - there is no local ecosystem and no industry that could take advantage of the research in this area" **CEO satellite service provider**
"We should develop our image as European Trusted Information Centre" **Country manager global telco equipment provider**	"Vision for ICT is there - there are some good ideas - we need more courage, we need more ambitions, a mindset change is needed" **Serial entrepreneur in ICT**
"We are missing an overall strategic plan although the government is shareholder in all 3 companies (RTL, SES, POST)" **Representative of Business Federation**	"We are flexible and small, access to politicians is easy, but what happens then?" **CEO datacentre provider**

Having said this, it was felt that more could have been done in terms of marketing and promotion of Luxembourg to the outside world and that the sector also needed a more coherent approach in terms of its representative bodies. Indeed, too many associations, forums, federations, clusters and agencies are claiming to represent their individual members' interests, but there is a lack of overall representation of the sector, both nationally as an interface to policy makers and internationally. In that respect, participants welcomed the recent creation of an overarching federation called ICT Luxembourg (Gaudron, 2014) as well as a new government strategic plan called Digital Lëtzebuerg (De Fooz, 2014b; Land, 2014) and expressed their hopes (and fears) that these initiatives might improve the situation.

Figure 7 (below) provides further details in terms of the policies initiatives that have been commented upon. Many participants, and in particular foreigners working and living in Luxembourg, identified its "smallness" as a major factor. This smallness leads to a high quality of life (low pollution, safety, nature, high standard of living) and, most importantly, to easy access to political decision makers implying the potential to react flexibly and quickly. On the other hand, many stakeholders also mentioned that this high standard of living also leads to high living costs and, consequently, high employment costs. In particular, housing has become extremely expensive making it difficult for young entrepreneurs to move to Luxembourg (Sorlut, 2014).

Several specific government initiatives were positively commented on. These included: the creation a specific status and certification for services providers to the financial sector (Deloitte, 2013), the focus on security, trust and data protection (Trân, 2013), initiatives around the usage and exploitation of big data (KMPG, 2014) and the legal framework on intellectual property rights (Raizer, 2014a). However, some people commented negatively on the fact the Luxembourg had still not managed to create a

legal framework for "e-archiving"[4] (Cencetti, 2014a; Ministère de l'Economie et du Commerce Exterieur, 2013). Some participants also felt that more could have been achieved in terms of "e-government" (Gouvernement du Luxembourg, 2005) and "e-health" (Henry, 2014a; PWC Luxembourg, 2013). It was also suggested that too much effort and money was spent on biotechnologies (Gouvernement du Luxembourg, 2013) as Luxembourg had experienced difficulties positioning itself in this competitive industry.

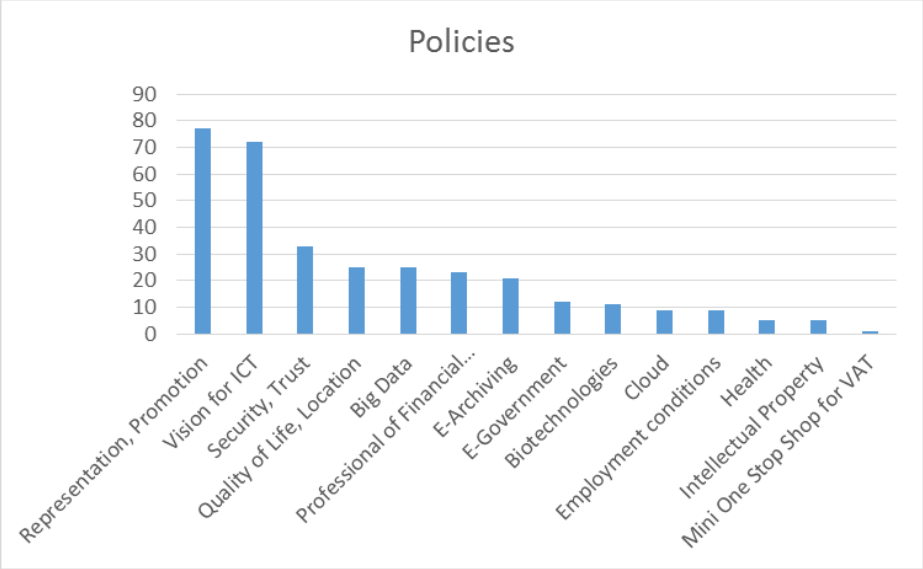

Figure 7 - Government policies identified according to number of mentions

Education and e-skills. The interviewees also insisted on the importance of relevant skills, both on a technical and scientific level but more generally the e-skills necessary to make the best use of ICT. It was found that Luxembourg has performed particularly badly on these "softer" elements. Participants actually complained about the fact that it became increasingly difficult to recruit the necessary employees on the local and even regional market, and that substantial effort was needed to attract such employees to Luxembourg. One or two interviewees identified missing e-skills as a major hindrance to their further growth and development. Several national studies are available to confirm this situation (Fedil, ABBL, & CLC, 2014; Gouvernement du Luxembourg, 2011). However, this topic also appears to be a major issue in surrounding countries and generally in Europe (European Commission, 2014b; Gareis et al., 2014).

[4] The relevant law finally passed the parliament in July 2015 (Poujol, 2014b)

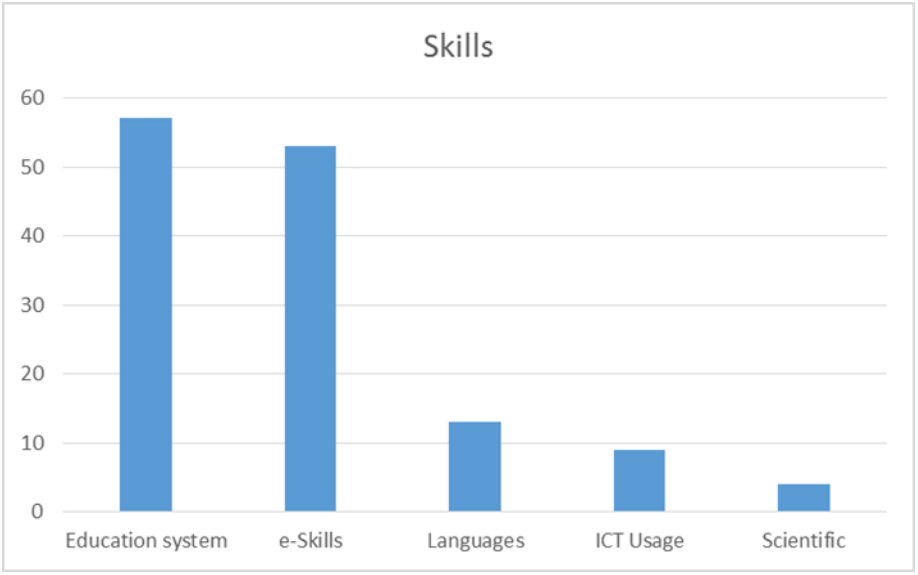

Fig. 8. Major issues related to education and skills according to number of mentions

Moreover, participants mentioned the lack of appropriate training and education within Luxembourg both in terms of software programming but also more generally in terms of technical and scientific education (European Schoolnet, 2012). Some also commented more broadly on the efficiency and effectiveness of Luxembourg's educational system, a system that is based on "tri-language" education and which needs some adaptations in the light of the quickly evolving social and technological environment (Gouvernment du Luxembourg, 2014a; OECD, 2014). Many of the participants highlighted the urgency of this issue and hoped that the government's new strategic plan would help to ease the situation (De Fooz, 2014c).

As an illustration of above, table 4 (below) provides a transcription of the statements made by some of the interviewees. This clearly shows that the topic is relevant at all level of the ecosystem and is also recognized by some of the education providers. Despite this apparent agreement, there is little agreement about what actually needs to be done and who should take this matter forward. Some participants argued for an initiative to be driven by the ecosystem actors themselves rather than by the different government ministries in charge. Independent from this discussion, all participants agreed that urgent action was needed as potential changes to the educational system could take several years before any noticeable effects emerge.

Table 4. Some of the main messages related to education and skills

"To develop the "digital business" we need first and foremost energy and cooling but in addition we have to be able to attract young talents full of ideas and competencies. The difficulty of Luxembourg is that it lacks attractiveness	"We need to promote the fact that there are 6 universities around us and that we have our own. But there is little companies that are created by these universities (seed-fund), there is no process, the professors are not motivated

for these people, they want to work hard and play hard, they want fun – we need to be able to attract them" **CEO Docler Holding**	to act in such a way" **CEO Data Centre provider**
"Parents are oriented their children into non-technical jobs" **Head of Sales Luxconnect**	To find the right people – quickly, this is the main issue" **CTO ICT Integrator**
"We are not hiring any local people anymore" **COO Media Services Provider**	"The is no cooperation between the educational system and industry" **CEO ICT Integrator**
"The Educational systems does not serve ICT" **University of Luxembourg**	"our schools are not producing the right profiles" **CTO ICT Integrator**
"English language should be more developed - rather than being multi-lingual we should be more international - we tend to become regional focussing on French, German and Luxembourgish, Public school in English would increase attractiveness tremendously" "We have a problem recruiting Non-EU staff, sometimes the process can take over six months" **Unit Manager University of Luxembourg**	" Our education system is expensive but not efficient, languages are still an advantage but there is an issue with English" **CEO Data Centre provider**

Mind-set. Stimulating entrepreneurship and facilitating the creation of start-ups were also mentioned as important elements for the development of the ICT ecosystem.

It was found that Luxembourg lacks both the necessary processes and procedures but, more importantly, an entrepreneurial mind-set and this subject was mentioned more than a hundred times in different guises.

Participants also identified a general mind-set issue in terms of the risk awareness particularly of the local population. Indeed, a lot of young people prefer a job as a civil servant in an administration or local community to, a sometimes less well paid, job in the private sector.

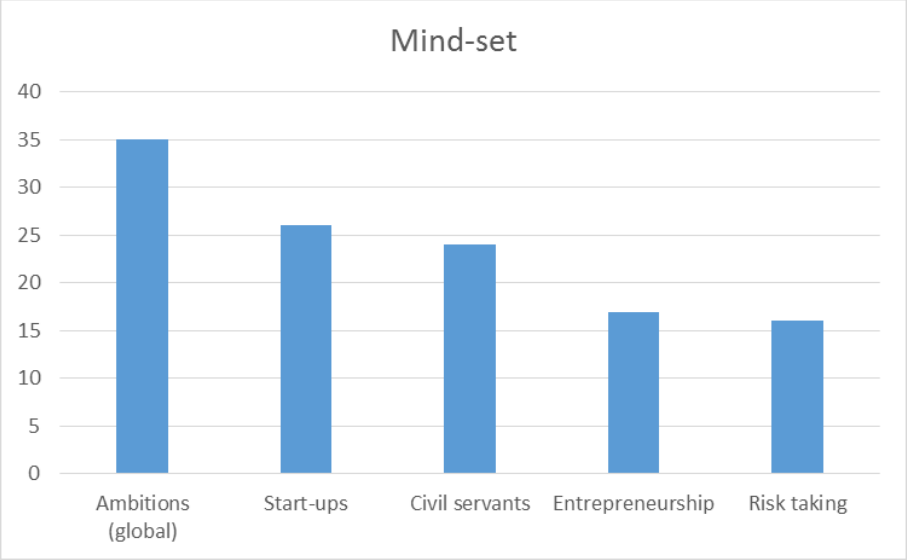

Fig. 9. Lack of entrepreneurial "spirit" according to number of citations

As for the education discussion detailed above, table 5 (below), provides examples of the comments collected during the interviews or collected from public statements. Again, all levels of the ecosystem are aware and somehow affected by this issue and it is interesting to note that even Luxembourg's prime minister is also aware of it.

Table 5. Some of the main messages related to "mind-set"

We are not ambitious enough - on an international scale we can do more. We have Luxembourg trade and investment offices in many places but we are not making best use of them. There is a lot of bright people but we are not using them. We are not clear what markets/customers to target? Where can we deliver an added value? **CEO Network Equipment provider**	"We are focussing too much on ourselves and we believe to be better than we actually are. We should question ourselves more because otherwise after a while it might be too late" "In Luxembourg unions are very strong and have major influence on political decisions" **CIO IT Service provider for IKEA**
"Luxembourg can only overcome its internal inertia with the help of foreigners but Government meetings tend to be closed to non-Luxembourgers because of language issues" **Head of MVNE Alternative Mobile Operator**	"Major projects are driven by civil servants that do not want to make any mistakes rather than by managers that see the business value for Luxembourg" **Member of management board of bankers association**
"Risk taking culture and mind-set is literally in-existent" **CEO Alternative Telecom Op.**	"We want to stay what we are" **Unknown – Luxembourgish saying**
"Luxembourgish people prefer a job as	"if a start-up fails everybody looks down

civil servant" **CEO Satellite Operator**	on it and it is very difficult to get another chance" **Prime Minister**

Innovation. Luxembourg's university, which is only 12 years old, was felt by many participants not yet to be fully aligned with the requirements of Luxembourg's economy (Paperjam, 2014a). It was also suggested that the same was true for the country's public research centers (Lambotte, 2014b). Technical, and in particular ICT education programs, are missing or very narrowly focused. There is also no business school attached to these programs (Luxemburger Wort, 2015).

There also have been only very limited creations of spin-offs or start-ups created through these institutions. It was felt that organizations facilitating these processes were not working efficiently (Cencetti, 2014b; Luxinnovation, 2013; Machuron, 2014) and that better coordination between them was needed. Many of the statements made have been recently confirmed in an OECD study about innovation policies in Luxembourg (OECD, 2015).

Luxembourg's financial center is well developed (Bourgain, Pieretti, & Høj, 2009; Merker, 2013) and this may explain that access to finance was not generally found to be major issue (IT One, 2014). Access to initial, high risk, venture capital was identified as being of some importance but overall the main problems seems to be the lack of initiatives and ideas for new start-ups rather than their financing (Antzorn, 2014b; Lambotte, 2014a; Machuron, 2014)

Infrastructures. Developing ICT infrastructures has been confirmed as an important building block for a successful ICT ecosystem. Participants agreed that Luxembourg has been doing very well on these elements, with extensive high-quality, high-resilience data center capacity (Service des Médias et des Communications, 2013), low-latency international connectivity and broadband internet access are in place and used both by private individuals and professionals - see table 6 for examples of statements.

Table 6. Some of the main messages related to infrastructures

"Perhaps we have focussed too long on infrastructures only. This is of course a very important element but an element only -without it we would not exist on the internet map" **Global CIO of IT service provider for IKEA**	"We have attractive electricity prices so far - this is a real advantage on an international scale. We do not produce electricity but we buy the cheapest and we have a small network leading to low transport charges" **CEO Cloud service provider**
"we focus too much on infrastructures, we are doing well in international rankings but the reality is a bit more nuanced". "we have everything we need to create an international media hub (RTL, SES, POST), why are we not developing this?" **Representative of Business Federation**	"Logistics is also an issue, relatively poor flight connections, more and more traffic jams" "Why have we spent that much money in T4 datacentres? This leads to a pressure to "sell-off" because the overcapacities are merely costing money. We have no clear strategy and positioning." **Head of International Sales incumbent telecom**

	operator
"The broadband plan was created for the residential market - but this is again strengthening POST, as indeed the CATV networks are not associated to this development, this was only again an "alibi" plan to explain to the EU that we are following the rules as we should" **Representative of alternative operators' association**	Infrastructures? Yes we are not experiencing any problem with this - however there is too much focus on the Tier4 datacentre segment - we also need lower availability solutions - which are then cheaper **CEO Security service provider**
"Datacentres - a very good initiative by the Government - Luxconnect is a real success, DRP sites are needed by all of the banks" **Representative of bankers association**	"…is there still a business for the pure international connectivity? is this not just a commodity, is this really a major differentiator?" **CEO international datacentre provider**
"Infrastructure is ok but Luxembourg risks to become a bit-pipe provider only. we have problems to deliver VAS" **CEO of public Wifi network provider**	

These need to be supported, however, by investments in complementary infrastructures such as transportation (Antzorn, 2014a) and energy distribution networks (ILR, 2013b). Some participants made critical comments about unused capacity, both in terms of international communication links and data centers and mentioned the lack of space for larger data centers of a lower quality standard (Labro, 2015). Some also suggested that perhaps too much focus had been given to providing fiber connectivity to each household as part of the government's broadband strategy (SMC, 2010a). A more focused approach, making more use of the already existing CATV networks, might have been more effective (Henry, 2013; OPAL, 2013).

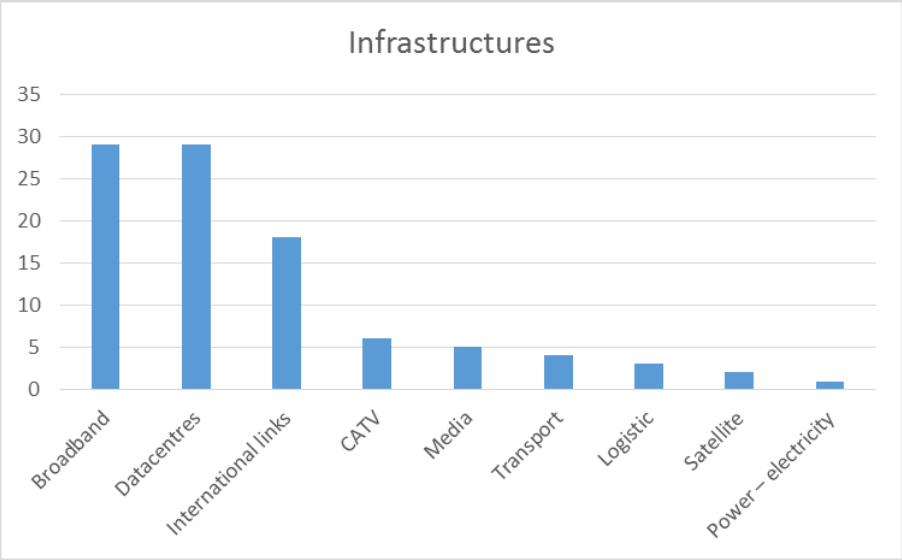

Fig. 10. Infrastructure related topics by number of citations

Participants were also asked how they saw the structure of the market following several years of liberalization and privatization efforts. It was felt by the participants to be very important to have an adequate mix of public and private investments, but that the incumbent operator after years of liberalization of the market was still very dominant. This could prevent both local investments as well as foreign direct investment par major ICT or telecommunications actors.

6 Discussions and conclusions

In this paper we have applied the layered model of Fransman to identify major industry participants within the different layers. An exploratory qualitative analysis building on interviews with over 50 participants in the ICT ecosystem in Luxembourg was undertaken.

Figure 11 (below) summarizes the main findings of the analysis. These have been derived using an inductive approach from the statements made by the interviewees. Interviewees have identified the different underlying internal and external forces. For some factors (green) the participants felt, to a large extend, that Luxembourg was performing well and that the ICT infrastructure as well the government's "vision for ICT" were considered to be particular strengths of Luxembourg. Educational topics, e-skills and the missing "entrepreneurial mindset" were identified as major weaknesses. Growing international competition was identified as the main external threat that the ICT ecosystem is currently facing.

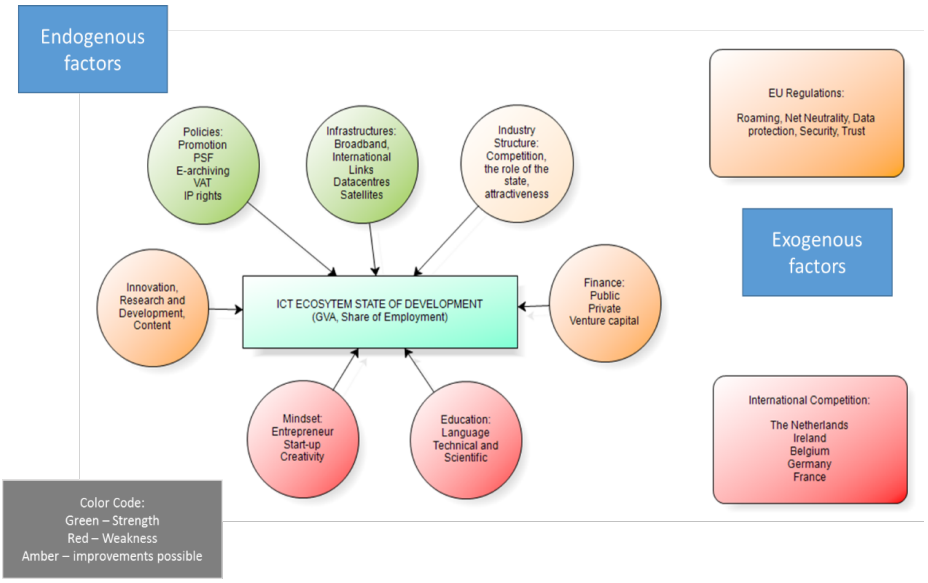

Fig 11. Summary overview of main forces affecting Luxembourg's ICT ecosystem

Participants confirmed that, according to them, Luxembourg has been successful in developing its ICT sector over the past 15 years, which is reinforced by international rankings and comparisons and 'official' reports. The government's initiatives have contributed to developing the underlying ICT infrastructures in terms of international connectivity, broadband and ultra-high broadband access as well as datacenter infrastructures. However, several participants also discussed the fact the success should not be defined and measured in terms of infrastructures alone and raised questions about the sustainability of this "kind of success". This was also confirmed by a recent public debate about the demand for datacenters (Labro, 2015) and uptake of broadband connectivity (Thiel, 2015).

Participants also confirmed that the industry structure has changed over time and that competition in several segments of the sector has increased. This competition has resulted in innovative products and services being offered at appropriate pricing levels, and these services have been adopted by both private users and enterprises. This, in turn, has led to the creation of jobs and added value for Luxembourg's economy. On the other hand, participants acknowledged that new challenges have appeared over time and that past policy initiatives may not be enough to sustain the sectors present set of competitive advantages. Clearly, Luxembourg is impacted by changes in EU rules and regulations which make it increasingly difficult to offer financial or tax advantages to companies investing in Luxembourg, and the government has faced some strong international pressures recently in that respect (Lecadre, 2014; Paperjam, 2014b; Raizer, 2014b, 2014c, 2014d). Consequently, it becomes more difficult to position Luxembourg successfully in the context of increased EU and even global competition and Luxembourg needs to make changes to its ICT ecosystem (Bervard, 2015).

Innovation, entrepreneurship, the willingness to take risks and to start new ventures also appear to be underdeveloped. This issue was also confirmed by OECD (2015). Most importantly, participants felt that changes would be needed to innovation policies and R&D orientation of Luxembourg, as well as to the legal and regulatory environment to better facilitate or event stimulate the creation of start-ups. This was also confirmed by a previous study in which, Meyer (2008) discussed the difficulties to establish for example a "productive" R&D environment in a small country like Luxembourg and concluded that it was very dependent on contributions from outside. There was also a wide consensus amongst participants that the strategy and vision of Luxembourg's university should be revisited and better adapted to the needs of local industry (Lalieu, 2015) and, in particular, its financial sector (Cencetti, 2015; Luxembourg for Finance, 2015).

Many factors could potentially contribute to the creation of 'unique selling points' for Luxembourg, but participants expressed concern that Luxembourg has been over reliant on developing its ICT infrastructures in terms national and international fiber connectivity and datacenters. Derived from interviews, we have also identified that Luxembourg has been unable, to date, to institutionalize an educational framework equipped to "produce" the necessary IT skills on a local basis due to a natural inertia in adapting the curriculums. Instead it has relied on importing knowledge from neighboring countries whilst focusing on its language skills and legal, financial and humanities education. In that respect the recent publication of the EU's digital economy and society index positioned Luxembourg in last position in the EU in terms students interested in technology, science and mathematics (Mateus, 2015). Different initiatives are now under discussion both on the supply side (new training programs, private schools, professional development) and on the demand side (promotion of Luxembourg as an attractive place to live and work) but all of these will take time to develop.

Finally, participants mentioned the relative lack of exploitation of the so-called "symbiotic relationships". One would expect that, due the small size of the country and the fact that access to political decision makers is quick and easy, ecosystem actors would be able to work closely together and establish both private and public-private partnerships and networks to develop the sector together as for example argued in Roolaht (2012). In practice, however, this is often not really the case as many of the larger actors are foreign and strategic decisions are taken outside of Luxembourg (Meyer, 2008). The government tries to improve this situation by, for example, the setting-up of several cluster initiatives (Federspiel et al., 2013) or the organization of common marketing and promotion activities in the context of economic missions (Luxembourg for Business, 2014).

6.1 Managerial and policy implications

Overall, the case of Luxembourg illustrates that it is important to examine the exogenous and endogenous dynamics of ICT ecosystems, which can reveal some nuances erased from international indices and high-level analyses, which could aide policymakers. The above analysis provides a first step and part of a wider effort to better understand the ICT ecosystem in Luxembourg, or in other small economies. The results are provisional as the research is on-going. Indeed, there is a need for deeper analysis of interview material for example by looking more deeply into the potentially

different answers from actors within specific layers.

On the other hand, the conceptual framework presented in figure 11 can be applied in different settings and serve as a generic model to better identify and analyze the forces which shape for example ICT ecosystems within other small countries within the European Union.

6.2 Limitations and avenues for further research

The paper has benefitted from applying Fransman's model, which proved useful in identifying key stakeholders at different layers of the ICT ecosystem. It allowed the development of an overall summary diagram of the ecosystem (figure 3). It also allowed generating a representative sample of interview partners by strictly following the layer model.

The vast amount of qualitative data collected calls for a more in-depth analysis of the positions of actors within the different Fransman layers. Are there any similarities or differences in their respective views? Are some of the issues identified more important for actors of given layer? Are there any priorities that can be identified? A comparative analysis between the different layers might allow an even deeper understanding of the forces at play within Luxembourg's ICT ecosystem and the authors are currently developing their analysis further in that respect.

The Fransman model also had some limitations. It did not allow for example, the identification of all of the different subcategories that might have substantially different views and requirements within the different layers. Moreover, it is, by its very nature static and does not adequately cope with the dynamics of the ecosystem and recursive interrelationships that are manifold even during the short period covered by the study. Moreover, stakeholders can be – and are often –players in one, two or even more of the different layers and adopt a different position depending on the layer concerned. In addition, the model does not in itself give sufficient importance to external factors such as regulations or international competition. It does not, therefore, allow for the clear positioning of any supporting institutions and supporting agencies, such as for example, "Luxembourg for Business" or the different regulatory bodies as shown in figure 3.

These limitations notwithstanding, to the best of our knowledge, this is the first time that an in-depth analysis of Luxembourg's ICT ecosystem has been performed. This helps to redress the research imbalance, whereby small countries are often overlooked by scholars. Nevertheless, we contend that such "smallness" engenders a unique opportunity for research engagement with a majority of primary actors in ecosystems, which might be unfeasible in larger countries.

Comparative analysis, making use in particular of the conceptual framework in figure 11, of ICT ecosystems of small countries might be an interesting avenue of further research.

Furthermore, the general approach presented above, might also be transposed to other sectors or industries within Luxembourg and beyond.

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Journal of Innovation Management
JIM 5, 2 (2017) 26-55
HANDLE: http://hdl.handle.net/10216/105431
SM: Mar/2016 AM: Jun/2017

Experience of presence as an inner shift towards a more holistic approach of innovation?

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Abstract. This article focuses on experiences of presence and their potential to increase creativity. The question posed is about whether singular experiences of presence are constituents of creativity and innovation, and if so, what we can learn from them. The material studied includes descriptions of the experiences of presence of 418 around in Finland. Certain main characteristics were found between the experiences, such as finding new perspectives, being connected, and meaningfulness. Many experiences recalled in the descriptions, and the three main themes, seem to be related to the inner shift, which is the necessary part of the new approaches of creativity introduced in this paper. Due to the interconnectedness of the founded themes of the experiences of presence and also to the more broad and multifaceted approaches of innovation, it is possible to think that the experiences of presence could be one of the key factors towards more creative, and more sustainable future.

Keywords. Presence, Experience, Creativity, Holistic approach, Innovation, Sustainability.

1 Introduction

> *"And while I stood there, I saw more than I can tell and I understood more than I saw; for I was seeing in a sacred manner the shapes of all things in the spirit and the shape of all shapes as they must live together like one being." - Black Elk –*

Previous quotation describes the moment when the holy man of Sioux, Black Elk as a child, got the insight of the structure of unity of all living (DeMallie, 1984). Correspondingly, there is a description among the data of this research based on a diary-note of young Finnish girl: "I stopped to admire a drop of water glimmering on a birch leaf. I looked at the drop and suddenly I realized that I was seeing the structure of the whole universe in that drop. I realized that the pattern repeated itself and extended everywhere..." (Woman, 27 years, Student of Health Care)

The both experiences have happened when one has contemplated nature by being conscious and present at the moment. The visions tell about integration of the various dimensions of life into a single whole, about the bigger picture of living systems. In Black Elk's larger vision, there is also an ability to connect strong individuals and groups as a unity, and integrate the various dimensions of life together. The unification of different groups as a unity and the integration of different dimensions are two aspects that can help us to understand what sustainable development really is (Bopp and Bopp,

ISSN 2183-0606
http://www.open-jim.org

2011; Goldman Schuyler, 2016; Senge, Scharmer, and Winslow, 2013).

The purpose of this article is to compare the existing literature of new, more holistic approaches of creativity and innovation to the Finnish individual experiences of presence, whether there are connections between peoples' descriptions and new theories of organizational creativity.

1.1 The need of a more holistic point of view

Nowadays, we are living middle of the global challenges, which are linked with ecology, society, economy, and culture. The specialists of the holistic innovation development and managerial thinking introduced in this paper (such as Katrin Kaufer, Otto Scharmer, Peter Senge, Kathryn Goldman Schuyler, and Karl-Erik Sveiby) are convinced that the next great opening of a new, creative worldview will have to be an internal one. The next level of human development is the stage about bringing back the interior to be in balance to the exterior (Kaipa, 2007; Scharmer and Kaufer, 2013), as the shift in the social field, and as the important part of the needed innovation ability (Scharmer, 2009). By becoming aware of your mind construction by observing it, you may learn a lot about yourself, others, and creativity (Goldman Schuyler, Skjei, Sanzgiri, and Koskela, 2017; Kaipa, 2007; Scharmer, 2009; Scharmer and Kaufer, 2013). World economist Brian Arthur has said: "Every profound innovation is based on an inward bound journey; ongoing to a deeper place where knowing comes to the surface" (Senge, Scharmer, Jaworski, and Flowers, 2005, p.13). Consequently, solving global crises requires new kinds of creativity and more sustainable innovativeness instead of old paradigms and patterns (Koskela and Goldman Schuyler, 2016; Moss, 2012; Scharmer, 2009; Scharmer, 2010; Scharmer and Kaufer, 2013; Sveiby and Skuthorpe, 2006). We will not be able to solve our problems if we disregard the global problems facing our planet and if we do not reconsider our approach consciously towards the fundamentals that uphold life, the unity of all living in the planet. Peter Senge calls this kind of aware moment of presence as participating in a large field for change: "When this happens, the field shifts, and the forces shaping a situation can move from re-creating the past to manifesting or realizing an emerging future" (Senge et al., 2005, p. 13-14). It is necessary to change a reductive kind of awareness that is based on alienation and separation to one of co-creation (Senge et al., 2005). This is a new point of view to the Western technological thinking, which has its roots in Judeo-Christian traditions, where nature is considered to be separated from human beings, and instead it exists for the benefit of humanity (Klemola, 2004; Koskela and Goldman Schuyler, 2016; Singer, 1993; Varto and Veenkivi, 1997; Varto, 2011). In many indigenous cultures, nature has been the critical factor for the production function (Kaipa, 2007; Scharmer and Kaufer, 2013; Sveiby and Skuthorpe, 2006; Sveiby, 2011; Varto and Veenkivi, 1997).

This article focuses on the phenomenon of Finnish presence and its links to the new, holistic approaches of creativity and innovation. For this qualitative study, there were analyzed and thematized 418 subjective descriptions of individuals' recollections of experiences of presence, and the founded themes were looked through the new sustainable waves of creativity and innovation. The aims of the research was to find out three different things: 1. How the Finnish awareness of being at the moment manifest itself? 2. What variation there are between different experiences? 3.Whether the

experiences are linked to the needed holistic creativity and innovation of our time? The results of this paper will show how the experiences of presence can be seen through the three different main themes, which are strongly linked to creativity and also to some new, holistic approaches of innovation. It seems that a singular experience of aware moment of presence could be an important part of broader space of human interaction, managerial thinking and creativity. Or like Scharmer and Kaufer (2013) explain the gist of this framework:"The quality of results produced by any system depends on the quality of awareness from which people in the system operate" (p. 18).

1.2 The birth of this research

The idea for this study was born during the year 2011 when I got an insight about the common need of being at the moment, the ability of being present - middle of chaotic working life. At that time, I was working in an innovation unit of university, and my work was to facilitate practice-based innovation sessions and try to develop more creative work community together with the members of different organizations. As a long-term community facilitator (also as a theatre pedagogy which is my profession), I soon noticed that many people do not truly have time, space, or tools to encounter each other in their daily communication at work. This situation is apt to deliver "bottlenecks" of interaction, which profoundly affect the entire organizational system, increase uncertainty and decrease creativity. After this grassroots' observation, I started to contemplate if the experience of presence could be used to alleviate this issue. That was the birth seed of my dissertation research, the first step to research people's individual experiences.

1.3 The progress of the research and the research questions

The first participants for this study were collected through social media (Facebook). I asked for 300 people, if they were interested about the experiences of presence. There was about 10% of them (exactly 28 people), who wanted to answer my research questions by sending me self-written narratives about their individual experiences. Some people asked me to interview them, because they found it easier to talk than write about their tacit experiences. That is why there are also many interviews in a data. It was important that people could describe their individual experiences with their own ways and words. For methodology, I chose phenomenology because it prioritizes direct experience (Bentz and Rehorick, 2008; Cunliffe, 2009; Halprin, 2003; Van Manen, 2016). After the collected narratives and first interviews, I had a possibility to start collect experiences of presence in the innovation workshops at my work as a facilitator, and as an art based -tools experienced community trainer. Therefore, my research is also extensively process-based and developed by en route. The 'certain human experience' (the nuclear of phenomenological studies) that I wanted to understand, is the human experience of presence, the ability to be in the present moment, how people experience and describe it. Being a phenomenologist requires a mindful engagement with phenomena, which may be the lived experience of self or others. (Simpson, 2008; Van Manen, 2016.)

The main research questions have been the same from the very beginning: What are the individual experiences of presence like? How do people describe them? In addition, do the experiences of presence have any connections to innovation and creativity?

2 Literature

According to Francisco Varela (Scharmer, 2000) the problem of Western science is not that we do not know enough about the brain, the problem is that we do not know enough about our experience (practice), about the importance of taking seriously first-person experience (Goldman Schuyler et al., 2017). We have had a blind spot in the West for that kind of methodological approach, which is in other words: consciousness (Goldman Schuyler, 2016; Scharmer and Kaufer, 2013), or, the process of becoming aware (Carroll, 2007; Scharmer, 2000; Senge et al., 2005). Western science and Eastern Buddhism have this common fingerprint: they both examine human experience through observation, analysis, and empirical experience (Goldman Schuyler et al., 2017; Bruce and Davies, 2005). The human experience is related to every single human being's capability to innovate, which must be nurtured since birth along with the values like liberty, responsibility, solidarity, and compassion (Tribolet, 2013). According to the literature, an organization that has encourage, free, diverse, and collaborative culture of open communication increases creativity and innovation. Information flows are dependent on organizational culture. An organic and communicative organization facilitated greater creativity and innovation compared with a mechanistic one. (McLean, 2005.) In addition, self-knowledge is possible only if the relation between people and creation is understood to be a dialogical relationship. In human encounters, there is the space where the creative processes take place. (Yaron, 1993.) Individual creativity is at its best, when human mind experiences the unity, the whole, and is keen on to solve the problem of the world (Varto, 2008).The essence of organizational creativity and innovation is to re-create the world according to a particular mission and value (Takeuchi, 2006).

This paper is a qualitative study with phenomenological approach to discover the different ways that people experience presence and how people's experiences are connected with the literature of organizational creativity and innovation.

2.1 The nature-connected lifestyle as an example for a more holistic point of view

Many indigenous tribes of humanity have (or have had) same kind of holistic and phenomenological approaches to life, the aboriginals are no strangers to their own experiences (Varto and Veenkivi, 1997). For example, Karl-Erik Sveiby and Ted Skuthorpe (2006) have researched Australian aboriginal culture, where the "recipe" for sustainable progress happens in a deep connection with the inner and outer world. This selective way of creative act consider consequences before introducing new technology into society (Sveiby and Skuthorpe, 2006). The aboriginals' daily actions in nature is led by the ancient all-encompassing creativity and intelligence (Hidalgo, 2015; Sveiby, 2011; Varto and Veenkivi, 1997). A lucid example of the sustainably society is one of the world's oldest (and longest-living) cultures, the Australian Nhunggabarra (Sveiby and Skuthorpe, 2006). The main difference between Western society and the society of the ancient Australian Aboriginals lies in the perception of being connected with nature. Western people, "Homo Economicus", have used nature as a property and a source of produce to be possessed and to be sold (Hidalgo, 2015; Louv, 2011; Macy, 2014; Sveiby and Skuthorpe, 2006) whereas aboriginals have been aware of their connection with it. In their language there is no word for 'time', instead past, present and future

are the same - existing in the present moment. Innovation is perceived as being the discovery of ideas that have always been there, you just have to pick it up. For the indigenous Australians, the effect of actions depends on the "innovativeness" of people in their own community in interaction with other communities and the environment. The "recipe" for sustainable progress, which happens always in a deep connection with the inner and outer world, is to be selective and to consider consequences before introducing new technology into society. (Sveiby and Skuthorpe, 2006.) Certain indigenous myths include the conceptions of the visible and invisible worlds and entities being brought firmly together without any dichotomy (Koskela and Goldman Schuyler, 2016; Varto and Veenkivi, 1997). Anthropologists, such as Paul Radin and Mircea Eliade, have noticed similar universal ideas of contemplative thought focused on meaning (as opposed to calculative thought and resultorientation) everywhere and at all times (Tedlock and Tedlock, 1992). Certain American Indian legends also speak of a simultaneous future which has already happened (Bopp and Bopp, 2011; Louv, 2011; Varto and Veenkivi, 1997).

The mental and holistic aspects of individual creativity and innovation ability have so far only been researched marginally. However, during recent years, the subject has slowly aroused more interest for example in some studies into biomimicry that draw inspiration from admiration and respect for nature. Nature is "not an enemy to be vanquished, but our design partner; not the problem, but the solution" (Louv, 2011, p. 190), even it is still often seen as something to travel to – not something, we are dependent upon for our physical, emotional and mental health (Baker, 2009). According to international studies, the power of nature and connection with the natural world are fundamental for human intelligence, well-being, spirituality and survival (Frumkin 2001, Louv, 2011), and the observations of nature can evoke a sense of spirituality (Louv, 2010) and a desire to protect the environment (Chawla, 2007). Previously, there are even found many relations with nature and creativity in the new research (Williams, 2017).

Some theorists in the field of sustainable innovation suggest or talk about the 'bigger picture', the holistic model that portrays the interdependencies and interconnectedness between economy, society and environment (Bopp and Bopp, 2011; Draper, 2013; Koskela and Goldman Schuyler, 2016; Seebode, 2011). The economy depends on society and the environment (although for many people, society did and still does exist without a formal economy). Nature will continue to exist without humanity and human activity. The holistic view breaks down barriers between sectors and disciplines, because it allows diverse, currently unaligned and even competing players to work together. This interconnectedness is seen to be the important key to sustainable development. (Koskela and Goldman Schuyler, 2016; Seebode, 2011.) This task of interconnectedness is typical for evolution. Modern quantum physics teaches us that all living creatures and elements are connected in this kind of creative way (Bopp and Bopp, 2011.), and the most creative learning happens in groups (Robinson, 2010). For example in a world, where children play in their local green space and are welcomed to do so, they become part of the community, understand more, feel and behave better, are healthier, and work more cooperatively (Moss, 2012). There is a lot of new studies that emphasizes that being outdoors and the contact with nature inspires and increases creativity, and decreases stress and depression (Louv; 2009; Louv, 2011; Williams,

2017). In some of these research, it is found that children exposed to nature improved their awareness, reasoning and observational skills; did better in many school studies; were better at working in teams; and showed improved behavior overall (Moss, 2012). Sir Ken Robinson highlights (2010) that according to the large international studies we all have the capacity of "genius level" until kindergarten age. When we go to school and become educated, the level of this creativity decreases year after year. Robinson criticizes our modern Western education about too mechanistic thinking, and calls for that we have to start think differently about human capacity. Creativity, the process of having original ideas that have value, is nearer very little children who are still open to the world with all their senses than educated adults. (Robinson, 2010.)

2.2 The difference between creativity and innovation

Creativity and innovation are closely related constructs, but not the same phenomenon. In the fields of organizational studies, the difference between creativity and innovation is often described that innovation is part of creativity. Words associated with the definition of creativity include for example idea and invention, when innovation is on taking a creative idea and bringing it to fruition. There are many ideas that never see the light of day in organizations. A useful idea, which is processed from concept to market, must be recognized for its potential in many various ways. This important process is referred to as innovation when talking about creativity in the context of organizations. McLean (2005) highlights that in the context of organizational development creativity without innovation is of significantly diminished value and the same vice versa, without creative ideas the innovation is an engine without any fuel. Another intrinsic difference between creativity and innovation is that the focus of creativity is usually on the individual, when the focus of innovation is more on interactions, and dynamics among parts of the organizations and its environment (Martins and Terblanche, 2003). (McLean, 2005.)

There are many unutterable ways to understand innovation. Innovation is often understood as a new idea, device, method, or a process of introducing them, and one of the main characteristic for the birth of innovation is the ability to co-operate, collaborate, learn collectively, and create trustful and creative atmosphere with the people who are participating in the process (Harmaakorpi and Melkas, 2005). Another way to understand the innovation ability is a situation, when there is found new solution for the problem by considering the phenomenon in a new point of view, and by developing new tools and methods for this necessity (Melkas and Harmaakorpi, 2012). Organizational culture is a critical factor in the success of any organization. The basic elements of organizational culture and interaction are for example shared values, beliefs and behavior. All those factors influence also creativity and innovation. If the organizational culture supports creativity, it encourages innovative ways of finding solutions, too. According to the literature, one of the best approaches to describe organizational culture is based on open systems approach, which offers a holistic perspective that allows the investigation of the interdependencies and interaction of the different sub-systems and elements in an organization. The organizational interaction between people, technology and the external environment represent a very complex environment, where creativity and innovation can be influenced by several variables. For example, the values, beliefs and behavior of individuals and groups that play a role

in organizational creativity can either support or restrain creativity and innovation. Personnel must feel emotionally safe and trust to be able to act creatively and/or innovatively. Open communication between individuals is an important key for that. (Martins and Terblanche, 2003.) Creativity is a dynamic and interactive process that is linked with the peculiar ideas and value, and it is often born in interaction between different views (Robinson, 2007). Nowadays there have been started to consider the multidimensional character of innovation also in all human and organizational interaction and relations (e.g., Darso and Hoyrup, 2012; Elkjaer, 2004; Nilsen and Ellström, 2012; Pässilä, Oikarinen, and Vince, 2012).

To understand creativity in all of its richness is to emphasize pluralism and different theories, assumptions, and methods. There is no need to emphasize any theoretical perspective at the expense of others. The more complex the system, the more freedom there is for individuals. Freedom is necessary for ideational variation and creativity, which usually needs also divergent thinking. Sometimes too much divergence may lead to ideas, which are not creative in the sense of originality or usefulness. (Kozbelt, Beghetto, & Runco, 2010.) Creativity has also the shadow side on it: some people may be unaware or unwilling to anticipate the dark side of their creative work. They may blinding themselves to evil consequences, because for example of the prospect of money and fame or the manipulation of a dominant principal. (Cropley, 2010.)

In organizations, creativity also need abilities to facilitate so called 'open spaces'. These situations need that facilitators will have exhibit to sense people and things around, and inside yourself. Peter Senge calls this ability as a work of an artist. (Senge et al., 2013). One intrinsic role of leadership is to facilitate the dynamic and continuous knowledge-creating processes and understand them (Nonaka, Toyama, & Konno, 2000).

In this paper, the focus is in the individual experiences of presence and its interrelation with creative thinking, and with more holistic way of innovation, which presume factors like the ability to interact collectively and create open relationships between the innovating partners in order to solve collective problems (Harmaakorpi, 2006; Kallio, 2012).

2.3 Presence – the inner ability of being at the moment

In this article the concept of 'presence' - 'the state of condition of being present' – as defined by the Illustrated Oxford Dictionary (1998), is used to signify a combination of sensing and being present. Presence is described as being fully conscious in the present moment when one no longer waits for the following moment to fulfill this current one (Senge et al., 2005; Tolle, 1999), and to be connect with the source of the highest future possibility and to bring it into the now (Scharmer, 2009). The roots of phenomenon of presence are in the Buddhist Philosophy wherein the emphasis is direct experience in the here and now (Bruce and Davies, 2005; Scharmer, 2009). The understanding of the phenomenon has spread to the Western world through different approaches of meditation, yoga, mindfulness, and contemplation. Presence can be defined as a quality of awareness, a flexible state of conscious (and mindful) mind that includes the intentional ability to pay attention non-judgmentally to the present moment, and notice new things (Bishop, 2002; Kabat-Zinn, 1996; Langer, 2000; Takanen, 2013; Tugend, 2013). In the mindful moment, people are more aware to what

is happening at the moment than they were a moment before by being highly attentive to one's experience and surroundings, so their attention is focused on present-moment both externally and internally (Dane, 2010). Over the last decade, much research in this area has been carried out under the label of mindfulness (Dane, 2010; Grossman, 2010; Grossman, 2011; Grossman and Van Dam, 2011; Rinpoche and Swanson, 2012; Weick and Putnam, 2006). The recent leadership research support the perception that leaders need to be self-aware and present to those whom they lead, and to the emerging situations (Scharmer and Kaufer, 2103; Senge et al., 2005; Weick and Putnam, 2006). There is still lack of research that would investigate whether presence, or mindfulness, matters – for example from an organizational standpoint (Dane, 2010).

In phenomenology, presence may be seen as an actor that makes every moment appear constantly new and fresh, reorders itself every moment and changes individual denotations of phenomena (Varto, 2011).

2.4 New waves of innovation - the sustainable, holistic approach

Humanity is now facing global challenges (climate change, hunger, pollution, economic crisis etc.), which need new perspectives for our outdated technological and organizational thinking. There is need to build new patterns of creative thinking and innovation in relation to all life forms on the planet Earth (Bopp and Bopp, 2011; Macy and Brown, 2014; Scharmer, 2009; Scharmer and Kaufer, 2013; Senge et al., 2005; Sveiby and Skuthorpe, 2006; Sveiby, 2011). For that, we have to see and consciously recognize our own, individual and experience-based ways of thinking: we have to be aware of our blind spots (Flipse, Vrielink, and van der Sanden, 2015; Scharmer, 2009; Scharmer and Kaufer, 2013). Blind spot is the part of human thinking and doing that is usually invisible, or, the inner place of source from which a person operates, and the part which matters most (Scharmer, 2009). These blind spots have their influences in innovation economy as well; they have an impact on the environmental and societal consequences of new products. Innovation is not always 'good'. According to such organizational thinkers as Peter Senge et al. (2009), Otto Scharmer and Katryn Kaufer (2013), and Karl-Erik Sveiby (Sveiby and Skuthorpe, 2006; Sveiby, Gripenberg, Segercrantz, Eriksson, and Aminoff, 2009) there is needed more discourses on desirable and undesirable consequences of innovation, because we face today the problems, which are the result of thinking whose time has passed. There is need to invent the institutional innovations that will upgrade the economic operating system from 'me to we', from ego-system to eco-system logic and awareness (Scharmer and Kaufer, 2013). This kind of innovating as an attitude towards the world (Tribolet, 2013) includes many elements of sustainability (Prud'homme van Reine, 2013; Senge et al., 2009; Sveiby and Skuthorpe, 2006), but it also needs the individual awareness of one's acts and attitudes, the 'social technology of presencing´, as Otto Scharmer describes it in his Theory U (2009; Scharmer and Kaufer, 2013). This signifies realization a new, more conscious way of understanding meaning that especially leaders need to take into consideration wider perspectives, such as inner development towards the common values that uphold all living on our planet in order to cope (Koskela and Goldman Schuyler, 2016; Santorelli, 2011; Scharmer, 2009). New tools, approaches, and ways of collaborating and innovating are needed across boundaries by shifting the current leadership culture of into a culture of empathy, and transparency. The way for that is to

become more aware of what is happening - inside of yourself - and outside in the world. This is also a one way to find creative solutions to humanity's tricky challenges. (Drader, 2013; Scharmer, 2009; Scharmer and Kaufer, 2013; Senge et al., 2005.)

Many new approaches of sustainable innovation want to take different systems in a new direction - beyond 'business as usual': systems which are more resilient, more equitable, and able to continue into the future (Drader, 2013). These kind of approaches are related to the way of life where the goal is to achieve more sustainable and interactive development in every dimension of the organizational, living systems (Bopp and Bopp, 2011; Hidalgo, 2015; Koskela and Goldman Schuyler, 2016; Senge et al., 2009; Sveiby and Skuthorpe, 2006; Sveiby, 2011). Nature is an integrated entirety, full of colors, shapes, circles, and an immense diversity of relationships that hold different systems together. This diversity is also an expression of practical and sustainable problem solving. If people had better ability to understand the complex natural system that support life on Earth, then they would be more likely to respect the limits of the system and to create communities that operate in balance with the natural world. This is the key requirement of sustainability. (Hempel, 2014; Juniper, 2013; Sveiby and Skuthorpe, 2006.)

In this paper, there is contemplated and analyzed through the practice-based experiences, whether the ability of being present at the moment could be one approach, or method, to the new kind of creative thinking in organizational development and innovation.

2.5 Scharmer's ways of listening as a model for inner shift and for more creativity

Scharmer claims that the old paradigm of government aid is simply inadequate to the challenge, because the crisis of our time reveals the dying of an old way of thinking, and enacting collective social forms (Scharmer, 2009; Scharmer and Kaufer, 2013). Many participants of this research are the frontline professionals, like managers, teachers, nurses, physicians, laborers, entrepreneurs, and artists who share the current reality where they can feel the heat of an ever-increasing pressure to do more work in a spinning hamster wheel. Scharmer (2009) believes that inside of the hamster wheel there is rising a new form of presence and creativity that starts to grow spontaneously:"… a different quality of connection, a different way of being present with one another and with what wants to emerge" (2009, p. 4). It is a different social field, which manifests through a shift in the quality of interaction. In that shift, people can connect with a deeper source of creativity by stepping into their real power of their authentic self. Scharmer calls this change as a shift in the social field, in which there are four different levels of projecting, or the levels of listening. The organizational creativity and leadership need all those levels together. (Scharmer, 2009; Scharmer and Kaufer, 2013.) The four levels of listening are seen in the Table 1.

Table 1. The new levels of listening by Otto Scharmer (2009, p. 11-13)

1.	– "I-in-me" –attitude, where the conversation reconfirms what you already knew: "Yeah, I already know that". This approach depends on the "past" and customary ways of doing things where the matter and source are separated each other. This is still the most used way of human behaving in many organizations.
2.	Factual/Seeing/Suspending – "I-in-it" –attitude you disconfirm what you already know and notice what is new, an ability to see things with fresh eyes: "Ooh, look at that...".

This is called open mind, which mirrors new facts, ideas and views. This is typical level for research and education.

3. Empathy/Sensing – "I-in-you" –attitude is seeing the situation through the eyes of another: "Boy, yes, now I really understand how you feel about it". This is called open heart, capacity to empathize with others. The space between two separated worlds (I and the Other) starts to shift and open up – like a new landscape.
4. Generative/Presencing – "I-in-now" –attitude is reflecting the power of silence where you are no longer the same person you were when it began: "I can't express what I experience in words. My whole being is slowed down. I feel more quiet and present and more my real self." This is called open will, which operates creating from the Source and helps you step into the Field of Future. It is an ability to access authentic purpose of self.

According to Scharmer (2009), and Scharmer and Kaufer (2013) most organizations, institutions and larger systems still remain on the levels 1. or 2. because they are not capable of cultivating these capacities on a collective level. In the ideal circumstances, when the three first attitudes (I-in-me, open mind and open heart) are connected in the experience of open will, it will access spiritual intelligence, i.e. the authentic purpose of self, and carry you to the possibilities of your future potential. The most important tool in new organizational leadership is the last one, open will as a connection to our real source of presence, yourself, purpose, creativity and power. Open will is a turn inside of ourselves, by silencing our minds and observing our expressions – by come in, emerging future identity and purpose. (Senge et al., 2005; Scharmer, 2009; Scharmer and Kaufer, 2013.)

The contribution of this qualitative article (with practical implications for further research) is recognizing a Finnish experience of the presence and benefitting from it as a factor contributing to more holistic and sustainable approaches of creativity and innovation.

When going through all the data with phenomenological thematic analysis, it is seen that the most described meanings of the experiences may be separated for three main themes. They are a new point of view (inspiration, insight, change, understanding the other's point of view, etc.), feeling of connection (with nature, another person, or oneself), and meaningfulness (or bigger picture of your work, life, or mission). All these aspects of present moment are connected both with the inner shift and with different approaches of holistic innovation, creativity - and with the leadership capability (Goldman Schuyler et al., 2017; Koskela and Goldman Schuyler, 2016).

Common elements in different experiences suggest new approaches towards holistic ways of thinking, which encourages further research into the phenomenon of presence, which could become a necessary tool for a new, more sustainable way of thinking and acting.

3 Data and methodology

The data of this paper include 418 Finnish experiences of presence. The data has been collected during the years 2011 - 2016, it comprehends 36 free-written narratives, 16 interviews, and 366 post it -notes from presence-workshops or -sessions. The whole data are seen in the Table 2.

Table 2. The data.

Data material	When collected	Where	The amount of participants
Self-written narratives	2011 – 2012	Through social media from different parts of Finland	36
Interviews	2011 – 2016	In Tampere and in Lahti	16
Free-written post it -notes	2011 – 2015	In innovation workshops. Finnish organizations of public, private and third sectors.	366

The structured questions in collected narratives and interviews were:

1. Where/In what situation have you experienced a NOW-moment/presence (and in some cases there was also asked contrary: In what situation you have not been present at the moment)? Describe your experience with your own words.
2. How do you think your experiences have been affected to you?
3. Is this topic important to you? If it is, describe the reason? If not, why do you feel it is not significant?

The main questions in workshops - during the practice silencing your mind - were:

1. Where/In what situation have you experienced a NOW-moment/presence? Look at your experiences, pick a one, and re-examine it in all its details.
2. How did your experience affected to you?

In the workshops (after becoming acquiring and warm-up -practices) I asked people to silence their minds (with the help of basic meditation practice) by focusing with breathing at the moment. The next, and the most important exercise after meditation, was an image practice, where people were facilitated to remember several individual experiences of presence, and to pick a one of them: What kind of details was seen in the experience, what was it like? Who were present in that moment, where did it happen? What was the weather like, what time of the year or a day it was? How did the experience affected? What is the effect of that experience here and now? After these reflecting exercises, the participants of the workshops wrote down their experiences to the post it -notes. In the last part of workshop, there was a common session where people shared their memories, experiences, and insights together. It is called the 'common space of sharing', the space of equally shared knowledge, which may also be a space of new perspectives, ideas, or in some cases even social innovations - depending on the group and their goals.

Later in this paper, I will mention two workshop processes, which were both part of the data, and connected to the birth of social innovations - such as a social enterprise and a new collaborative tool for social work. The contemplative, art-based exercises - and the experiences of presence - were the main tools for collecting the business ideas (Konsti-Laakso, Koskela, Martikainen, Melkas, and Mellanen, 2016). There is a strong link between the arts and community innovation and development (e.g., Skippington and Davis, 2013). It has been shown that art- and experiences -based tools may increase creativity and innovation, and challenge organizations to broaden their roles to include active support of the development of social and human capital in communities

(Scharmer, 2009; Skippington and Davis, 2013). Artistic, mindfulness and contemplative capabilities have also been shown to be valuable in creative community development including decision-making, creative problem-solving, design skills, interaction, reflection and evaluation (Koskela, 2012; Scharmer, 2009; Skippington and Davis, 2013). In all the workshops in this study were used contemplative, art-based, and experiential exercises, and the most important of them was the moment of silencing your mind, the moment of being present, and the image practice after that which asked participants to 're-member' their experiences of presence.

Because there were larger numbers of participants in this research, I entered the data into a database according to the phenomenological thematic analysis headings by using a facility to extract and compare both participants' descriptions and narratives, my research notes, entries, and theoretical emphasizes. This also enables data entered under different headings to be compared, particularly useful to identify relationships between different themes. (Lester, 1999.) The workshop post it –notes and singular interviews were transcribed verbatim. The purpose was to investigate so distinctly as possible the manifold of people's experiences by using their own words, descriptions and phenomenological analyses. Phenomenological analyses is a useful tool to discover the differences between understanding and experiencing certain phenomena (Marton, 1986; Van Manen, 2016) concerning the relationship between people and the world as well as to describe them (Hasselgren and Beach, 1997). Both positive and negative side of the phenomenological theme analyses is its living nature; it is challenging, or even impossible, to describe strictly the lived experience, which cannot be captured in conceptual abstractions (Van Manen, 1998). In this article, the phenomenological analysis is used to categorize the different, individual experiences of presence to pick up the most popular of them. In the next chapters, these main themes of the individual experiences is introduced more in detail.

4 Results

> *"Being present in the now provides the only way to silence inner speech, which along with conscious thinking, keeps the mind restless. (Woman, 42 years, MA)*

The collected experiences of presence were thematized based on the perceptions that people had of their experiences, and the types of qualitative differences. Most people used the word 'connection' to describe their experiences of silencing the restless inner speech, but their connections were different. When I had gone through the data several times by using phenomenological analysis I could separate and thematize three main characteristics with different emphasis between the narratives: 1. Finding a new point of view, 2. Feeling of connection (with oneself, another, or nature) which in many cases seem to lead to 3. Connecting with meaningfulness. All those three themes were linked to Scharmer's definitions of the states of open mind, open heart, and open will. The themes were also partly familiar with the theories of creativity and more holistic, sustainable innovation.

The three main themes are categorized in table 3. and compared with the levels of listening in Scharmer's theory of a new social technology (Scharmer, 2009; Scharmer

and Kaufer, 2013).

Table 3. The main themes of the data compared with Scharmer's three levels of new social technology of presence: Open Mind, Open Heart and Open Will (See Table 1.)

1. *New point of view:* Like a fresh look, perceiving objects and facts, observing from another perspective, uncontrolled thoughts, moving to the border of your comfort-zone, curiosity towards new things. All these characteristics are typical for an Open Mind in Scharmer's Theory U (2009).
2. *Feeling of connection:* Like connection with nature, connection with another person, connection with oneself: connection with harmony and stillness/empty mind, flow (bodily/mental connection), connection with synchronicity in everything (inside and outside of oneself) and feeling of respect and responsibility (towards oneself or the Other). All these characteristics are typical for Open Heart in Scharmer's Theory U (2009).
3. *Meaningfulness:* Like finding your roots, revelation, receiving comfort, love, grace or gratitude, "I know now" -intuition, "bigger picture" of everything, finding your mission and finding an answer, a solution. All these characteristics are familiar with Charmer's (2009) Open Will.

According to the data, people describe presence as a state where they are in touch (or connection) with themselves; their minds are relaxed and "off" yet focused although not on a task. Being sensitive to one's own mind in a state of relaxed alertness opens the mind to all possible options, sources of new viewpoints, in the current situation: "I was looking at a straw swaying in the wind and suddenly it happened: The moment became lucid. I could feel it all around my body as if I could feel all my cells and atoms…---…In a way I disappeared and in a way I was present more than ever before." (Woman, 24 years, Drama Student)

The experience of presence is often kind of a new awareness of your daily being. The participants of this research find both new perspective, feelings of different interconnections, and meaningfulness from their experiences. Several of details of these three themes are mentioned often in the data. There are lot of self-reflections connected for example with one's emotions, attitudes, interaction, and behavior - in other words: increased consciousness, or inner shift. Peter Senge, systems scientist and founder of the Society for Organizational Learning, describes this reflected process of increased awareness:"There is this Peter who is talking and one who is observing. It is kind of a binocular vision. You have to be in yourself talking, and also have that awareness of standing to the side of yourself. I think part of it is not being attached to your self. We all started to kind of disassociate ourselves from our mind strategies -- like if I do this, this will happen as opposed to just being present and saying whatever happens is fine. It is about really supporting our intentions and supporting people who are there." (Peter Senge's Interview by Kaipa, 2007.)

Creativity thinking in novel ways is facilitated when people are to put in up-front time to think in new way (Sternberg, 2006), from different points of view (McLean, 2005), or to share a common oneness with other people where the focus of that common oneness can be all inclusive or very specific (Bopp and Bopp, 2011). When individuals and environments are related to each other, the problematic situation can only be studied as a united whole. It is researched that when we understand experience as a transaction between individual and environment, we understand such experience both

as a process and a product where intuition, emotion, and body are important part of it, important part of organizational knowledge. (Elkjaer, 2004.) For creativity, and for innovative solutions, people need environments that are supportive and recompensing of creative ideas (Eaton, Hughes, and MacGregor, 2017; Moss, 2012; Sternberg, 2006).

The remarkable part of the experiences of the presence in the data happened somewhere outside in nature. One approach of creativity is found from the Australian aboriginal culture, which followed sustainable recipe for society tens of thousands of years in a nature-connected living-model where all are connected (Sveiby and Skuthorpe, 2006; Sveiby, 2011). Even today, it is possible that society is in balance with its various environments, respecting all living as having the same value, a sense of connection with life as holy (Macy and Brown, 2014). This kind of mental attitude towards nature is largely found through the data, especially in people's free-written narratives. Many participants have get ideas, inspiration, and insights to both their work and private life when they have been wandering around woods, parks, or lakesides of their cottages.

In the examples of the next chapters is described more deeply how the main themes of the experiences of presence are intertwined both the conceptions of open mind, open heart, and open will, and the other approaches of creativity and more holistic or sustainable innovation.

4.1 Experiences of presence as sources of new viewpoints and incentives to change (Open Mind)

Open mind can be seen as an attitude or a point of view, which may change one's attitude and perspective to see things for example with new eyes: "---… when being alone by myself, I do not control my thoughts or what I say to myself. It is easier to drift to a situation and a state of mind where something grabs my attention, empties my mind of all thoughts and I no longer see my surroundings the way they are." (Man, 45 years, Stage Worker)

Or in some cases people open themselves for everything what shows up from the mind by giving space for emptiness: "The most important insight about my experiences of presence has been kind of orientation of opening, not exclusion. When I am first accepting all the noise of my thoughts and images, even the dirtiest emotions, I may get space for emptiness". (Woman 34 years, counselor of social services)

Sometimes the experience is like a space which expands or appears during the challenging moment of a concentration: "Sometimes when I am writing, not any fiction but for example the financial aids, or some other official writings when you just have to justify your application. It is like you are detaching yourself during the work…and same time you may 'know' that 'this will be good'. This flow." (Woman, 52 years, Academic Degree Unemployed)

According to the data, it seems that opening your mind is the art of opening the space for something still unknown by letting go the old. Creativity needs opening oneself to new, sometimes even strange and foreign ideas (Senge et al., 2009). These kind of experiences are difficult to describe by words: "Actually, words cannot describe my experience; I do not believe that there is any way to describe that moment." (Man, 37 years, Project Manager)

The Western people usually are used to target, set goals and get benefits. But often,

when you try too much to force something, it fails. This is also mentioned in the data. It seems almost impossible to capture presence. In Western thinking, the focus – also in innovation and creativity - is often on individuality, individual rights (and wrongs), and self-determination – in myself. The difference between Eastern and Western thinking is that when the East generally encourages personal inquiry into the relationship between self and cosmos, the West encourages and value belief. (Jones and Mason, 2009.) An open state of mind is "a window away from oneself" (Scharmer, 2009, p.11), from the ego - like at the moment in the data when a couple is waiting for a birth of a first newborn: "…---…time stopped. There was nothing else, no baby yet, only my husband and me. There was no need to rush anywhere. We were there and waited for something to happen, but because we did not know what it was, we could not rush." (Woman 32 years, Research Scientist)

In creativity research, the shift of perspective can contribute to original insights and be useful for creativity, but not if the change is so extreme that ideas have no connection to the problem at hand (Kozbelt, Beghetto, and Runco, 2010). According to the data, the experiences of presence seem change many people's perspectives, attitudes, and preconceptions – by opening people towards the new world and experiences. The open mind may lead to boost out from the individual comfort zone, help to find new points of view, increase curiosity and activity, and in many cases, lead to change insights into future choices.

4.2 Feeling of connection (Open Heart) to inner and outer nature

The most used word in the descriptions of the presence was 'connection'**.** Connection to yourself, for example to your physical body and to your emotions (which are not always positive) was one of the most experienced 'presencing' at the data. A female worker of the child welfare organization writes about the experience when looking through the reports about children taken into custody: "Reading those stories for the first time I felt black blood flowing through my vessels." (Woman, 37 years, Customer Coordinator Manager)

Many experiences of presence have happened when people are feeling connection with other people, for example by encountering customers: "Presence has remarkable role in social work…Only by being present in certain situations gives you the possibility to encounter customers as best as possible." (Woman, 34 years, Social Worker)

Another typical feature in the data is that during the experiences of presence people are feeling more compassion for each other: "When I have listened to another person's sorrows, I have felt completely dissolved in the moment and present with my full potential..." (Woman, 27 years, Student of Health Care)

Open heart as listening with empathy means capacity to connect directly with another; the world is seen through someone else's eyes forgetting one's own agenda (Scharmer, 2009). The authors of the Presence (2005) write that the key word in this state of connection is "we". When the 'theys' go away and the 'we' shows up - without blaming others for every problem - people's awareness - and capability to do things - change. (Senge et al, 2005). The act of authentic sharing and co-operation of 'we' is the stone foundation of community development (Bopp and Bopp, 2011; Scharmer and Kaufer, 2013; Sveiby and Skuthorpe, 2006). According to the literature, when workers perceive

that an organization has their best interest in mind, when an open debate is in place, and when trust exist among interaction between people, employees can take more risks and put forth creative ideas (McLean, 2005). In one workshop process, during the years 2011-2012, all the workers participate to this research by trying to increase their abilities to be more present with their customers, one female social worker describe the workshop collaboration and sharing like this: "Self-guidance of the group is a useful technique to incorporate. It would not be meaningful to be working with something given from outside. The group dealt with issues that were relevant and came up with positive development ideas."

According to all the collected data the presence in interaction between people is a skill, which is not hierarchical. It is often created in the state of equality, in the place of open dialogue, which can be facilitated with the help of art-based tools. Presence is a multi-dimensional capacity that involves releasing, accepting, surrendering and letting go, even if we don't exactly know what it is like or how to describe it. 'Presencing' can only be learned through personal experiences and awareness – like reflecting learning by doing, which is one of the most important part of learning for example for the leaders or whoever, who have to take charge, make decisions and be responsive to other people (Taylor, 2005). If we started championing instead of worshipping competition, our thinking would improve, and we would stop to crucify each other's courageous thinking. If we transformed the "killing meetings" with heightened awareness, we would stop to kill all energy, initiative, innovation and insight in them – by equal listening and talking. (Kline, 2015.) Organizational culture that supports open flow of communication between people will be more likely to have more creativity and innovation, when organization that encourages control will result in diminished creativity and innocation (McLean, 2005).

Some experiences have happened also during the strong connection with things, or with doing something with a focused intention: "When you are concentrating on what you are doing, time seems to disappear and you experience that you are fully present." (Woman, 62 years, Journalist)

Identifying with nature. The most common place of connection of the data seems to be a concrete one: outside nature. Nature is present in almost 90 % narratives. People tell for example how the mindful experiences in nature have helped, provided insight, changed direction, given perspective, taken people back to their roots, induced retrospection, empowered and inspired creative processes, and assisted in making the right decisions regarding the future as well as given meaning to life and a sense of spirituality. The scale of inspirational influence of being in nature is huge through the data. It is obvious to perceive that the outside nature is substitute of kind of supportive environment that is essential element of creative thinking (Sternberg, 2006). When by contemplating the elements of the nature, it may wake up your emotions and help you to find a connection between yourself and the creature. In that meditative state of mind, it is possible to experience and identify how the tree is breathing, and how liquids are flowing inside of it. (Hidalgo, 2015.) This kind of coalescence and emphatic identifying with nature is common among the participants. Connection with nature seem to help to get connection also to yourself, your intuition and insights. In many experiences, nature has been the source of inspiration and ideas: "I breathed deeply and suddenly I noticed that I was at one with nature. The feeling was marvelous! I was no longer conscious of

time but everything around me was powerfully healing. I could not distinguish my body from the natural surroundings; I was ultimately at one with it. ..---…when resting there I had a vision that I need to repair the summer cottage that I had inherited…---….nature has an important, invigorating effect and a message, too – whenever I am ready to hear that message." (Woman, 40 years, Interpreter)

Nature can lead a person deeper into the meaning of why he or she is here, and be a place of awareness (Macy and Brown, 2014; Senge et al., 2005; O'Donohue, 2010).

The results support the idea of nature's positive impact on people's senses and intelligence (Louv, 2011; Sveiby, 2011). People's experiences in nature seem to be subjective in the same way how the landscape may be seen through its own natural subjectivity and self (O'Donohue, 2010). In the nature, it is easy to forget all the daily problems: "When I am in nature, I always feel fully present because I cannot or do not want to think about anything but the beauty of the nature when I am there." (Woman, 35 years, Economics Student, Employed)

Nature is something to be respected in its own expressions, to be experienced with its own spirit. Interaction with landscape may be individually healing, or it can also return its pain to human being if he abuses or damages it. (Louv, 2011; Macy and Brown, 2014; O'Donohue, 2010; Sveiby and Skuthorpe, 2006; Sveiby, 2011.) Hempel thinks (2014) that developing emotional connections to the natural world (to wild places, wildlife, plants and natural beauty) is as important for protecting the nature as for example breakthroughs in environmental science or policy. According to the data, people honor nature as a place of awareness, and an idea-refinery temple. "Then, what a hell we are doing here inside of our box offices and staring our computers if we really are creative and innovative outside in nature?", asked one adult student in a leadership education workshop, where people were sharing their experiences of presence together. According to the collected narratives, the experiences of presence when happening in nature are singularly inspiring, stimulating, and assimilated. Many participants can reach new depths of understanding about themselves, their abilities and their relationship with the world inside and around them. Nearly all the studied narratives include the elements, which are familiar with the worldview of nature-connected indigenous cultures (Sveiby and Skuthorpe, 2006; Sveiby, 2011; Tedlock and Tedlock, 1992), where people's holistic approach of life, ideas, emotions, and actions are interconnected. Their nature-connectedness may be perceived also as a messenger: "All morning voices surrounded me. My mind was filled with an overwhelming brightness and a happiness that came with it: this is your life, this is the purpose of your life, what you should do and protect with your life." (Man, 37 years, Project Manager)

In the aboriginal recipe of sustainability, all - people, animals, plans, ancestral spirits - live together equally in timelessness world, which is mirrored on earth everywhere. Similar elements of nature-connectedness is seen in the data of this research. Nature helps people to connect with their real selves and with other living beings. Nature also serves people as a metaphor for insights, "right answers" and gives paths to follow. (Koskela and Goldman Schuyler, 2016; Sveiby and Skuthorpe, 2006.) : "The only thing that bothered me was that I could not find the right location [for a certain sequence in her first short film]…---…After the day's filming I decided to find the right place. I went alone. When I left, I felt being present in that moment and connected to nature…---…I was walking around in the woods for about an hour and I was confident that I

would find the place I was looking for. I changed direction at random when it felt right. Then I started to hear steps behind me, I didn't turn to look, but continued. The footsteps were following me but not very close by, I understood that it was an animal. I concentrated on listening to the steps and stopped when they stopped. I turned to look behind me and I saw an elk that turned and started to walk away from me. When I turned around again I saw that I had arrived at the perfect location for my film." (Woman, 41 years, Film Director)

In ancient Australian stories, nature is full of symbolic images like a physical map that remind people about creation, and leads the way home, the way to back yourself (Sveiby & Skuthorpe, 2006). Mindfulness, the one description for ability to be at the moment, is also described to be a path which may lead you deeply into an authentic way of being (Tugend, 2013), or way 'back to home' as many participants describe it. A modern example of this kind of "map" is the experience of a young woman who used to be a drug addict. She had been off drugs for two months and was sitting on a bus looking out of the window when she suddenly noticed: "Has the world always been this bright? I looked at the pattern in the ice on the window of the bus and I was moved to tears by its beauty… Has the world always been this beautiful?" (Woman, 29 years, Therapist of Chinese Medicine)

According to Karl-Erik Sveiby (2016), our modern society may learn a lot about the holistic approaches of aboriginals, for example in making corporations and governments develop more ecological key production methods. A needed new focus for innovation includes social consciousness and global ecological responsibility. (Sveiby and Skuthorpe, 2006; Sveiby 2011.) The ancient "recipe" for sustainable progress is "to be selective and to consider consequences before introducing a new technology into society" (Sveiby and Skuthorpe, 2006, p.193). Scharmer finds also similarities between aboriginals and Finns in the concept of power-places, "simple cabins in the woods" where parents teach their children to listen to the forest. He thinks that this kind of heartfelt relationship with the presence of places in nature is special, and it may have contributed to the many successful technological innovations in Finland. (Scharmer, 2009.) For example, different kind of reflective and contemplative practices can build the capacity for discernment, and respect human relationship to nature and environment (Eaton et al., 2017). "Forest bathing" is standard preventive medicine in Japan, where also is an own term for death of overwork, which is karoshi. People come out from cities, go to the landscape and shower in the greenery in Japan and South Korea. With the help of the nature, they are able to become relaxed and feel all their five senses in authentic way. Their blood pressures decrease, and people find balance for their hectic life. Nature-connection and its benefits are natural for Japanese people because of their long tradition and culture, where nature belongs to their minds and bodies through philosophy. All things are relative to something else, when in Western thinking, all things are absolute. (Williams, 2017.)

According to the data, there is still some aboriginal spirit living inside the Western individual. Maybe we can learn from the first peoples, both in terms of sustainable environmental practices and in terms of more equal leadership (Sveiby, 2011), but also in terms of trust for our own senses and intuition. Creativity needs to stem from ethics and values that respect all life understanding the laws of nature and being at one with them (Macy and Brown, 2014; Moss, 2012). By connecting with nature, one can see

oneself as a part of a larger whole, of a unity (Scharmer, 2009; Sveiby and Skuthorpe 2006), and as a part of the possible future (Moss, 2012; Senge et al., 2005).

4.3 Meaningfulness – experience of presence as homecoming, seeing the bigger picture, or a spiritual experience (Open Will)

Presence is also appreciated as deep listening, of being open beyond one's pre-conceptions and historical ways of making sense by seeing the importance of letting go the old identifies and the need to control (Scharmer, 2009; Scharmer and Kaufer, 2013; Senge et al., 2005). Open will as generative listening means often that "I am connected with something larger than myself." (Scharmer, 2009, p.12). It can be understood also as a phenomenological space of interface, the experience of human existence, which is monistic state in which spirit is present in every part of the body (Varto, 2011). In interface, man is one with the world and opens towards it (ibid.). In the data, many experiences of presence appear in the shape of interface or coalescence, or as remarkable spiritual experience of "homecoming": "In those moments, the world is not out somewhere, but it comes up. I can't say that I am a part of nature, universe, or anything else, but I feel that I am home." (Man, 37 years, Project Manager)

The meaningful understanding of you 'Home', seeing the 'Bigger picture' of your life, or feeling the existence of something larger than yourself may lead sometimes to an insight, which may change your life: "I remember it very clearly, although I was drunk at the time. Enlightenment struck me like a lightning bolt and woke me up from a dream. It felt like I saw everything for the very first time, although I was in the middle of the place (a pub), where the people and everything were actually too familiar for me. Everything around me was strange and I no longer felt the communal spirit that I had thought there was." The woman, who had been frequenting the pub for many years, wandered around and kept asking everybody: "Why are you here?" People looked at her as if she had lost her mind. "In my mind I understood it crystal clear. This was not what I wanted and this was not my life." She felt that she was given instructions from "above" and she obeyed them. The incident made her realize that she was in charge of her life and made her own choices, and "As a consequence of the night, I went to rehab and started to take care of myself and my life….—-…I understood distinctly that I cannot steer my life with my own power. It was my first humbling experience as well." (Woman, 31 years, Social Worker)

The main key factors towards the more creative thinking are a compelling vision and sense of deeper purpose that means something to people they will commit to, the level of openness and reflection so that people are challenging their ways of thinking. Through that process, people are getting better at seeing how they are depending on and part of the larger systems. (Goldman Schuyler, 2016.) The kind of spirituality acts important part in some cases of the data. According to research, spirituality is the anchor of ethics and social morality for most people. In work life, it removes bottlenecks and barriers and eradicate us-against-them mentality between employees and employers. It increases the effectiveness of teamwork and induces a creative culture. Being in touch with your inner spiritual being enables people to identify and use their best qualities such as confidence, alertness, courage, trust, commitment and hope. Recognizing subordinates' spirituality would help leaders to motivate and inspire their subordinates and to intensify the unity of the group. (Fairholm and Fairholm,

2009.) The data shows that understanding the meaning or the bigger picture of the value of your action is an important experience. To becoming aware of your ability to be present at the moment may mean that you become conscious about the values and truths you are involved, for example in your daily work. Like one woman describes about her experience: "Presence means that you know yourself as a worker, too; what are your strengths, and in what areas you still need to develop. This way you may benefit from your own resources as a worker and not burn yourself out. The presence has a big influence on the work community. Presence affects well-being and the structures of the (work) community." (Woman, 35 years, Social Worker)

5 Discussion

When comparing the main themes of the data and the concepts of new approaches of organizational creativity and sustainable innovation (for example Scharmer, 2009; Scharmer and Kaufer, 2013, Sveiby and Skuthorpe, 2006), it seems that there are parallels between them. If the more holistic innovation ability needs a shift in your consciousness, the experience of the female social worker is a good example for that: "I have been more present by myself; I am more aware of my body, senses, attitudes and emotions…What could this mean in working life?"(Social worker, 37)

Many experiences seem to be similar to the kind of presencing that Scharmer (2009) and Senge (Senge et al., 2005) see as essential for addressing complex societal issues that are resistant to resolution within existing organizational structures. A capacity to intentionally bring oneself into the present moment is fundamental as the most exciting organizational change being undertaken aiming toward global change (Koskela and Goldman Schuyler, 2016; Goldman Schuyler et al., 2017; Scharmer & Kaufer, 2013; Senge et al, 2005).

Both creativity and innovation are present in this paper, because they seem to be connected with experiences of presence in various ways and levels. The individual experiences of presence may include such actors of creativity as a new point of view, better communication, empathy, understanding the bigger picture, meaningfulness, nature-connectedness, or broader awareness of what is going on. In addition, the experience of presence also include different possibilities be used in the development of innovation sessions in groups. By using such tools in a group as silencing your mind for the present moment (meditation or contemplation exercises), or sharing your experiences, for example of your work creativity by listening and telling consciously, may in some cases lead your group or society to a new social innovation (Konsti-Laakso et al., 2016; Koskela, Oikarinen, & Melkas, 2015). In this case, creativity is found to be connected with an individual experience of presence, when innovation seem to be connected with a creative group working. According to literature, the focus of organizational innovation is more interrelationships, interactions, and dynamics among actor and environment (McLean, 2005). Nevertheless, this result will need much more practice-based experiences in the working field, 418 people is still a little amount of participants. Peoples´ capacities for reflection are essential for their meaning-making about their world and their participation in it, and the ability to pause, step above the frey, and imagine alternative futures can help them think more creative and systemically (Eaton et al., 2017). Through the experiences of presence is seen that

human flourishing is not a mechanical process; it is an organic process – like creativity in itself (Robinson, 2010).

The multifaceted experience of presence has a plausible role both in a state of individual awareness (as an inner shift), and in a communal innovation ability. The ability to calm your mind has its role also in the significant change that is happening now both around us, and inside our organizations and societies. Meeting the global challenges requires more sustainable and holistic tools and ways, to innovate, and become agents of practical change (Mateus-Berr, 2015; Sveiby, 2009; Sveiby, 2011). Global leaders need to shift from "ego-system awareness" to "eco-system awareness" (Scharmer, 2011; Scharmer and Kaufer, 2013). But the shift in society and organizations will not happen before the individuals will change. The change has to be happen first in the individual level, and after that, it will spread to society and its organizations (Hidalgo, 2015; Scharmer and Kaufer, 2013). We could concentrate more on our experiences of aware moments of presence which help us to ask such questions like "Who am I?", "What am I here for?", and "What is my direction?", because the path of real innovation is that you do what you love and you love what you do (Scharmer, 2013).

The experiences of presence are not necessary positive experiences; they can be also evil ordeals of negative emotions, or pains. They varies in many ways and levels, from a small everyday detail of cooking to the strong apparition of one's professional mission. Essential for the experiences of presence is that the participant is always aware of her or his experience. She is so conscious of it, that she can easily remember it afterwards, because it is one way or another special and memorable.

Connections to the practice-based innovation research. The data shows that understanding the meaning or the bigger picture of the value of your action is important experience for many. Today, when organizations list values they do not really live (Kline, 2015), becoming aware of your ability to be present at the moment may mean also that you become conscious about the values and truths you are involved, for example in your daily work. This is useful ability also for today's leaders (Koskela and Goldman Schuyler, 2016; Goldman Schuyler et al., 2017).

In the workshop session during the year 2011 in a child-welfare organization, one female worker got an individual insight about the experiences when she was not present at her work. This insight led to a collective process, which changed something in the workers working style in that organization. They noticed that inside their work is a huge "natural" spiral of negative thinking and connotations, which increases strain and disharmony and decreases presence. It is the reports about the customers. The reports the workers read all the day are full of negative testimonies of bad backgrounds of the children. The workers and customers (children) have to repeat repeatedly these bad upsetting past experiences. The collective idea during the process was crystallized in one worker's sentences: "Our goal should be the presence. We need to be more courageous to change our old myths, routines and limits." After that, the workers changed the ways to report for a more positive. They wanted that all the reports should include also positive, or neutral, information about their clients, not only negative one. The workers noticed also how the formal, social-worker-based education of the foster families should be changed towards the contents produced by the customers; the education should be more individualist, more child-based, and more interactive. This was a significant and creative shift in the daily routines of the child-welfare

organization (which includes to the data of this research). I have described this case more closely in one conference paper of the European Evaluation Society (EES). (Koskela, 2012.)

Another case example of practice-based social innovation connected to this research by using the individual experiences of presence of the participants, was the participatory design process for a new social enterprise in the Lahti (Päijät-Häme) Region, Finland, to employ rehabilitates of mental health. There were many people with entrepreneurial interests and skills, but there was a lack of concrete business ideas. The innovation process was implemented between the years 2012-2013 with the help of presence-workshops and the participants' experiences of meaningful acts. Business ideas were collected through co-creation, co-learning, and ability to be present and reflect your experience. This social innovation process of the common business ideas is described more closely in the journal of WORK 55 (Konsti-Laakso et al., 2016). In organizations, it is possible to create social innovation in workshops and groups with the help of aware collaboration (Koskela et al., 2015).

When people share experiences with each other in a community, there is also a possibility for the community to turn to its highest ideals (Bopp and Bopp, 2011) or towards its future potential (Scharmer, 2009; Scharmer and Kaufer, 2013). Unfortunately these kind of practice-based workshop-processes, which could be essential 'living labs' to test, develop and formalize the experiences of presence as a tool for a more creative and sustainable work inside the organizations, need real interest, time and resources. If we want to change our working routines, we first have to be aware of them, then to search and develop them, after that change them, and finally we have to adjust them to our daily work. It is not an-one-afternoon -process. I think this a larger problem in the area of innovation and development projects inside the Finnish organizations. Conscious change is not a quick trick. This is also one of the limitations of this research; there should be needed more and longer periods of practice-based experience in the field for proper results.

Fortunately, I have had also an opportunity to compare these results to the corresponding international studies, too, from the point of view of sustainable leadership (Koskela and Goldman Schuyler, 2016). From the year 2012, I have had an honor to work and study in this issue together with Professor Kathryn Goldman Schuyler and her colleagues who have been interested about almost the same theme, but described it as the "waking up" –moment. Our first, common paper was presented in the Academy of Management Conference in Philadelphia, 2014. After that, we have written couple of published papers (included also in this study) together.

6 Conclusions

And as the result of this paper, I may countenance myself to say that one possible new path for the more holistic approach of innovation could be an individual experience of presence, the inner shift, which may help you to get new perspectives, connections, or meaning to your daily life and work: "… There is now more room for listening both to myself and to others. Maybe these experiences have given me creativity and courage that I can use in my art." (Woman, 37 years, Visual Artist)

According to the most common themes of the experiences of presence, it is seen that when a person has opened one's mind to a new point of view, it is also easier to open one's heart to connect with somebody, or something. Then, after opening one's heart, a person has more space and possibilities to achieve the state of open will, the level of aware and authentic purpose of self. (Scharmer, 2009; Scharmer and Kaufer, 2013). It is also possible to facilitate and create open, common spaces of shared experiences in organizations with the help of contemplative or creative methods. These kind of spaces, which have been involved in this study as the presence-workshops, are near to the 'ba', the shared context for knowledge creation (Nonaka, Toyoma, and Konno, 2000). If the tacit, experienced-based knowledge, which is an important part of organizational capital, is shared and deferred together, it will be increased the organizational creativity (Koivunen, 1997; Nonaka, 1994; Nonaka & Takeuchi, 1995).

In this research, I have tried to show how the processes of presence, which in many cases are also parts of the creative insights, could also be the seeds of new social innovations and a more aware (sustainable) approach of leadership (Koskela and Goldman Schuyler, 2016; Goldman Schuyler et al., 2017). It is still crystal clear that it is needed more research for that. In the huge and international field of the studies of organizational creativity and innovation, the amount of 418 Finnish individual experiences of presence is still too few for the prominent and comprehensive results.

In the middle of the global challenges, we as humans, leaders, and workers face issues that require us to slow down, and need to start really paying attention, listening, sensing 'what wants to happen', reflecting, and connecting to our inner source of knowing (Scharmer, 2010). Experiences of presence could provide a holistic anticipatory perspective to meet, for example, organizational challenges, but unfortunately, it cannot be obtained just like that. Presence as a phenomena is hard to handle. Ability of presence cannot be controlled, nor induced, forced or learned from textbooks. Only possible is to live it through with the help of your own experience. Even so, the experiences of presence are constantly shifting, fleeting and momentary; they are never at a standstill, but always on the move like a flow – like the whole evolution or a human mind. Moments of presence come without planning and effort by just being there: "The flow was gone. Then some of it returned. Oh, I wish I had the courage to be/do/paint what I actually feel without rationalizing! ... Desiring it is a problem. You cannot experience a moment of presence by will or way… If you have a clear idea, desire or goal etc. you will not be relaxed and your mind will become rigid." (Woman, 37 years, Visual Artist)

Researching experiences of presence is particularly challenging, because the subject is new in the field, the literature is hard to find, and the experiences are fleeting. There is not much research to be found of this topic. Further research into actual experiences of presence will be needed as well as developing methods of being present at work situations and studying through practice-based experiments whether the awareness of the present moment increases creativity and innovativeness in organizations. One-step for the daily testing could be to be more aware, to be an observer of the singular experiences of presence, and share them together in a bigger group, in the center of the organization's interaction. The singular experiences of presence could help us to understand more about ourselves, others, and the spaces and connections in our societies and environments.

Now, going back to the second poetic experimental citations of this paper, and read forward the last words of the experience of fourteen-year-old girl: "After that experience, I understood everything much more clearly. I understood why dreams and physical reality so often are mixed up in my head, why I experienced time both merged and as fluttering shards. I understood that everything was one and the same, a reflection and a shadow of the universe." (Woman, 27 years, Student of Health Care)

On the other hand, like Peter Senge, et al. (2009, p. 50) state: "The revolution is not about giving up; it's about rediscovering what we most value. It is about making quality in living central in our communities, businesses, schools, and societies. It is about reconnecting with ourselves, one another, and our fellow non-human habitants on earth."

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Journal of Innovation Management
JIM 5, 2 (2017) 56-80
HANDLE: http://hdl.handle.net/10216/105431
SM: Dec/2016 AM: Jun/2017

The culture of design thinking for innovation

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Abstract. Design thinking has been adopted widely as a tool for innovation by companies and other organizations. However, statements by researchers and practitioners about what design thinking is are often seemingly conflicting with each other. This paper aims to improve our understanding of what design thinking for innovation is and under which conditions it can be implemented successfully. It discusses design thinking for innovation in the broader perspective of organizational culture. A framework of nine innovation culture dilemmas or 'tensions' is used as an organizing device to analyse the existing literature on design thinking for innovation and accounts of using design thinking for innovation in practice. It is argued that the power of design thinking is in the tension between seemingly opposite ways of thinking, such as analytic thinking versus intuitive thinking, and linear thinking versus thinking in iterative processes. For design thinking to flourish, it needs to be embedded in an organizational culture capable of maintaining a dynamic balance on a number of fundamental tensions in innovation processes. It is shown that the innovation dilemmas framework can be used as an analytical tool to evaluate to what extent organizations are equipped to benefit from design thinking for innovation.

Keywords. Innovation, design thinking, organizational culture, dilemmas, creativity

1 Introduction

Design thinking has been adopted by companies, higher education institutes and governments as an approach to innovation. Design thinking has even been dubbed 'the secret weapon for innovation' (Kelley, 2001, p. 8). Originally, design thinking referred to the methodology used by designers to solve complex problems and find desirable solutions for clients (Cross, 1982; Rowe, 1987). For example, Rowe (1987) observed as a distinctive aspect of design thinking that design professionals rely on hunches and presuppositions, not just facts. Theorizing about design thinking for innovation started from the first design thinking symposium in 1991 (Cross et al., 1992). Cross et al concluded that although there was a basic understanding of how designers think and reason, a simplifying paradigm of design thinking was lacking. According to Cross et al, previous attempts to formulate simplifying paradigms, such as viewing design as problem-solving, had failed to capture the full complexity of design thinking. The idea behind design thinking for innovation is that innovators can use design thinking without actually becoming a designer (Tonkinwise, 2011). Dorst (2011) acknowledges that the eagerness to adopt and apply design practices in other

ISSN 2183-0606
http://www.open-jim.org

fields has created a demand for a clear definition of design thinking, while the design research community cherishes multiple perspectives and has been reluctant to oversimplify its object of study. Luchs (2016) recently defined designed thinking as "a systematic and collaborative approach for identifying and creatively solving problems". Although this definition adds some elements to the 'simplifying paradigms' mentioned by Cross et al (1992), it still does not seem to fully capture the complexity of design thinking. Brown, the president and CEO of the American design company IDEO, defines design thinking as "a human-centred approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" (Brown, 2016). Beverland et al (2015) define design thinking as "a creative and strategic process characterized by the following hallmarks: abductive reasoning, iterative thinking and experimentation, holistic perspective, and human-centeredness". The definitions of Brown and Beverland introduce different elements of design thinking such as designer's skills, technology and user needs (Brown) and abductive reasoning, iterative thinking, experimentation and human-centeredness (Beverland et al). The definitions have in common that they point at the need for several elements to be 'integrated' (Brown) or connected in a 'holistic perspective' (Beverland et al), however, they do not address how these should be connected or integrated.

Researchers and practitioners of design thinking (Kimbell, 2011; Nussbaum, 2011; Plattner et al, 2016) have pointed at the need for a better understanding and a critical rethinking of design thinking. Although there is general agreement that the essence of design thinking is empathy with user needs and putting the final customer central, there is a lot of confusion about what it needs to become a design thinker. Lists of prerequisites for design thinkers focus on individual skills, such as pattern recognition, visual communication, storytelling and empathy (Wroblewski, 2008) and on the need for developing a design thinking mindset (Luchs, 2016). This paper will discuss design thinking for innovation in the broader perspective of organizational culture. Calabretta et al (2008) find indications that for design orientation to flourish in an organization, it needs to be embedded in a conducive organizational culture, but conclude that further research is necessary to identify the characteristics of such a 'design thinking culture'. Other authors have suggested elements of a culture conducive to design thinking for innovation, e.g. inclination to experimenting, tolerance for failure, and stimulating everybody to participate in innovation (Brown & Martin, 2015; Rosenberg et al., 2016), but an overall model is lacking.

Accounts of design thinking in practice support the relevance of organizational culture for the application of design thinking for innovation. The companies best known for their focus on the design thinking approach to innovation are Apple Inc. and IDEO, whose founder David Kelley was part of the team that helped design Apple's very first computer mouse (Martin, 2009; Brown & Martin, 2015). In both companies, the application of design thinking for innovation has been linked to organizational culture. IDEO claims to have a culture 'focused on innovation and driven by design' (Brown 2009). At Apple, co-founder and former CEO Steve Jobs is credited for creating an environment conducive to designers (Buxton 2007). He diffused the principles of design throughout the organization, thereby creating a culture of design thinking. The success of Apple and IDEO has inspired other

companies to develop a design focused culture as well. At Samsung for example, former chairman Lee Kun-Hee is credited for creating a design-focused culture that supports world-class innovation (Yoo & Kim, 2015).

This paper explores under which conditions design thinking for innovation contributes to a culture of innovation and explores the challenges in developing cultures conducive to design thinking for innovation, by relating an analysis of the academic literature on design thinking for innovation to accounts of design thinking for innovation in practice.

2 Research approach

The systematic analysis of the academic literature covered peer-reviewed academic journals such as 'Design Studies', academic books, and journals which connect research- and practice-based knowledge such as Harvard Business Review, Stanford Social Innovation Review, MIT Sloan Management Review and Design Management Review. The literature search of accounts of design thinking for innovation in practice has been extended to professional and business publications such as Fortune, Wall Street Journal and Financial Times; websites known for reliable information on innovation such as FastCompany.com and Wired.com; business books discussing accounts of design thinking for innovation in practice; and corporate websites.

In selecting the theoretical approach to analyse the literature on design thinking for innovation, the comments of Cross et al (1992) about the need to capture the complexity of design and the comments of Dorst (2011) about the importance of multiple perspectives for design research were taken into account. The theoretical approach needs to address the inherent tensions in design thinking (Beverland et al 2015). Design thinking is often presented as a radically new approach to innovation (Brown, 2009; Dorst, 2011), and as the opposite of 'established ways of thinking' (Kimbell, 2011, p. 288). Other proponents of design thinking contrast it with 'traditional linear thinking' (Lenstra, 2016), 'traditional analytic thinking' (Hawryszkiewycz, 2013), or 'engineering thinking' (Courage, 2013). However, there are indications that design thinking is not about shifting completely to the opposite side of 'traditional thinking'. For instance, Martin (2009, p. 137) and Dennehy et al. (2016, p. 162) write about design thinking as balancing analytical thought processes and intuitive thinking, and Ingle (2013, p. 2) writes about design thinking being largely nonlinear although designers need the discipline to be organized and deliberate. This suggests that the challenge of design thinking is in handling the tension between seemingly opposite ways of thinking relevant for innovation processes, such as analytic thinking versus intuitive thinking, and linear thinking versus thinking in iterative processes. Dealing with tensions is actually a main skill of design engineers (Dorst, 2006). Designers are trained to satisfy potentially conflicting considerations simultaneously (Whitbeck, 1998, p. 56). Seeing the challenge of design thinking in handling the tension between seemingly opposite ways of thinking is consistent with the design science paradigm (Van Aken, 2004), which helps to understand how professionals involved in design activities deal with complex realities. Van Aken asserts that the ultimate mission of design science is to develop design knowledge, i.e. knowledge that can be used in designing solutions to problems

in the field in question. According to Van Aken, the development of design knowledge occupies the middle ground between descriptive theory and actual application. This suggests that design thinking should not be seen as the opposite of descriptive and analytic thinking but rather as a synthetic thinking.

The dilemma approach of innovation cultures (Prud'homme van Reine & Dankbaar, 2009), seems to be a promising approach to understand the challenges in developing cultures conducive to design thinking for innovation, because it acknowledges complexity and multiple perspectives, and offers a method for handling tensions by balancing or 'reconciling' the dilemmas. The dilemma approach of innovation cultures is based on the dilemma approach of organizational culture (Trompenaars & Prud'homme van Reine, 2004). In the dilemma approach, cultures are not assessed as a fixed set of value orientations, but by how they pursue seemingly contradictory criteria simultaneously. Innovation cultures are conceptualized as cultures capable of maintaining a dynamic balance between the extreme positions on each dilemma (Prud'homme van Reine & Dankbaar, 2009). Dumaij et al (2009), in a discussion of the possible application of this innovation dilemma framework for healthcare innovation, write that "making the innovation dilemmas explicit does right to the complexity of innovation" and "creating an innovation culture is a dynamic process in which areas of tension and fundamental innovation dilemmas should meet rather than follow a recipe to implement role models and towards success criteria".

The innovation dilemma approach of organizational culture has been used in practice by companies (Trompenaars & Hampden-Turner, 2010) and has been used as the main theoretical framework in empirical research projects (Prud'homme van Reine & Dankbaar, 2011; Clifton et al, 2014). In section 3 and 4 of this paper, the dilemma approach will be used to investigate to what extent design thinking for innovation can be understood as maintaining a dynamic balance on a number of fundamental tensions. In section 3, the tensions behind the innovation culture dilemmas (Prud'homme van Reine & Dankbaar, 2009; Prud'homme van Reine, 2015) will be used as an organising device to analyse the tensions in design thinking for innovation. In section 4, the relationship between design thinking and culture change is discussed for the situation that design thinking for innovation is taken to the strategic level. The examples and cases used in section 3 and 4 of this paper are based on the extensive literature research on culture, innovation and design thinking, and on the own experience of the author as an innovator in an industrial R&D lab, as a coordinator of R&D in a business services sector company, as a manager of innovation processes for a multinational company, as a consultant in developing cultures of innovation in the profit and non-profit sector and as an academic researcher of innovation processes. Section 5 gives conclusions and avenues for further research.

3 Design thinking as maintaining a dynamic balance on fundamental tensions

3.1 Introduction

Table 1 shows the nine organizational culture dilemmas as identified by Trompenaars & Prud'homme van Reine (2004). These organizational culture dilemmas show up as

'innovation dilemmas' in innovation processes as well (Prud'homme van Reine & Dankbaar, 2009; Trompenaars & Hampden-Turner, 2010; Prud'homme van Reine, 2015). Therefore, it is expected that the tensions behind these dilemmas will also show up in design thinking for innovation, as indicated in table 1. The tensions will be used as an organising device to analyse the results of the literature research on design thinking, to investigate to what extent the tensions are relevant for design thinking and to what extent design thinking for innovation can be understood as handling the tensions between seemingly contradictory elements. Each of the tensions will be discussed in detail in the sections 3.2 – 3.10.

Table 1 Organizational culture dilemmas and corresponding tensions expected to show up in design thinking for innovation

	Organizational culture dilemmas (Trompenaars & Prud'homme van Reine, 2004)	**Expected tensions in design thinking for innovation** (derived from innovation culture dilemmas discussed in Prud'homme van Reine & Dankbaar, 2009; Prud'homme van Reine, 2015)
1	Specific (segmented thinking) versus Diffuse (holistic thinking) cultures	Analytic thinking versus Intuitive and creative thinking
2	Internal drive versus Responsiveness	Product push versus User empathy
3	Rational versus Inspirational	Focus on functional aspects versus Focus on aesthetics and emotional aspects
4	Competing versus Partnership orientation	Closed versus Open approaches to innovation
5	Consistency versus Pragmatism	Innovation as a structured process versus 'Bricolage'
6	Stable continuity versus Dynamic change	Linear thinking versus Non-linear, iterative processes
7	Individualism versus Group orientation.	Individual creativity versus Group collaboration
8	Egalitarian versus Hierarchical cultures	Leadership in design thinking: Egalitarian versus Hierarchical leadership
9	Short term versus Long term orientation	Short term versus Long term approach to innovation

3.2 Analytic thinking versus intuitive and creative thinking

Design thinking is often presented as creative and intuitive thinking, and as the opposite to 'traditional' analytic thinking (Hawryszkiewycz, 2013, p. 20). However, Bauer and Eagen (2008) have suggested that analytical thinking is part of, not the opposite of design thinking. Design thinking requires logic *and* creativity. Apple CEO Cook, who has an engineering background himself, pointed out (Isaacson, 2011, p.

360): 'engineers are taught to make a decision analytically, but there are times when relying on gut or intuition is most indispensable'. Design thinkers need to be able to use analytical tools such as spreadsheets next to creative tools such as visualisation, storytelling and pattern recognition. Former Apple-CEO Jobs referred to his experience as leader of a technology company (Apple) and of a company in the creative industry (Pixar) when he said: 'I am one of the few people who understands how producing technology requires intuition and creativity, and how producing something artistic takes real discipline' (Isaacson, 2011, p. 397).

Combining analytic thinking with intuitive and creative thinking in innovation processes is by no means new nor the exclusive preserve of designers. The need for innovators in an industrial R&D setting to combine analytical and intuitive, creative thinking has been observed already in the ''great age of American innovation'' at the Bell R&D labs of AT&T, famous for the invention of the transistor. Mervin Kelly, the president of Bell labs in the 1950s, called it 'an institute of creative technology' (Kelly, 1950). In Kelly's effort to approach innovation as 'organized creative technology', scientists and engineers for Bell Labs were selected based on exceptional analytical skills *and* creativity.

An example of solving a technological problem by rigorous analysis combined with intuition and creativity is the following experience of the author of this paper at the time that he worked as an innovator in the R&D labs of technology company Philips. It concerned a highly profitable product, high-pressure sodium discharge lamps for street lighting. The problem was that the wall material of the discharge tube, consisting of high density translucent polycrystalline aluminum oxide, got attacked by the aggressive high pressure sodium vapour during the operation of the lamps, resulting in microcracks in the discharge tubes and subsequent failure of the lamps. Careful analysis with sophisticated techniques revealed that the process took place along the grain boundaries of the aluminum oxide. It turned out that even an amount of less than 10 ppm (parts per million) of impurities in the aluminum oxide resulted in the segregation of compounds on the grain boundaries which are not resistant to high pressure sodium at high temperatures (Prud'homme van Reine,1983). The 'analytical thinking' solution was to introduce a cleanroom manufacturing process for the aluminum oxide tubes, a very expensive solution. The creative idea was adding a small amount of a compound to the aluminum oxide that would have an impurity-scavenging effect. Combining analytical and creative thought processes resulted in experiments with adding a very small amount of a so-called rare earth oxide (erbium oxide) based on the idea that it would absorb the impurities on the grain boundaries and form a sodium resistant compound at the grain boundary intersections, blocking the path of attack by the aggressive sodium vapour. It worked, and the invention was patented (Prud'homme van Reine, 1987) and utilized in commercial products.

We conclude in line with Ingle (Ingle, 2013, p. 2): 'design thinking is an exploratory approach to problem solving that includes and balances both analytical and creative thought processes'. It can be practiced by innovators across industries, and is not limited to the creative industry or to designers by job title or educational background.

3.3 Product push versus User empathy

In the traditional approach to innovation, companies push their technology and

products on the customer, convinced that what they developed is the right solution for perceived customer needs. Gradually, the insight has grown that understanding customer needs requires user empathy. Designers played a crucial role in this process because of their ability to think from the customer perspective. CEO Brown of IDEO (Brown & Martin, 2015, p. 60): 'In the design-oriented approach popularized by IDEO, the work to understand users was deeper and more ethnographic than quantitative and statistical.' Ethnographic research requires not just different methods, it requires a different mindset. It requires the attitude of an anthropologist rather than that of a salesman or an engineer. Anthropologists are trained in doing ethnographic research using methods such as participant observation. It means getting into the field and observing the process of using a product, a shopping experience, a classroom or an operating room in a hospital. In design thinking, participant observation is key in finding out what people actually do in order to define the problem. Design thinking also requires the 'naïve outsider' attitude of the anthropologist in order to come to a deeper understanding: constantly asking questions *why* things are done in a certain way. Moreover, anthropologists are trained in using triangulation to get insight from various perspectives and to use an interpretive approach to understand meanings behind observed behaviours (Geertz, 1973).

In 1994, even the diehard technology oriented company Philips Electronics started to hire anthropologists for its corporate design department to study customer behaviour, because they realized that competitors such as Sony were paying much more attention to design (Prud'homme van Reine, 1994). Samsung benefited from its investments in ethnographic research in 2003, when anthropologists came up with the apparently obvious observation that TVs are off far more than they are on in most homes. Samsung improved the visual appeal of its TVs and started with models with round curves. It was a huge success (Yoo & Kim, 2015).

The work of Von Hippel (Von Hippel, 1986; Von Hippel et al, 2011) shows that understanding the customer is just a first step in involving users in the innovation process. More and more, consumers and users play a central and very active role in innovation. Involving customers is not just a matter of listening to the voice of the customer, it also includes lead user methods and user co-creation. Design knowledge and tools are nowadays readily available for consumer-innovators. Von Hippel et al (2011) present this consumers-as-innovators pattern as a new paradigm and contrast it with the 'traditional innovation model' that sees consumers simply as the market. Accounts of design thinking in practice show promising results of balancing product push and user empathy by accepting and building upon prototypes developed by users. For instance, 'living labs', which started as places where innovations were being studied and tested in real-life contexts with real users, become more and more places where innovations are co-created with users. Based on recent research, Brankaert, & den Ouden (2017) show the potential of a 'design-driven living lab' approach, involving users as co-creators and including design qualities such as exploration.

An example of using design thinking in balancing 'product push' and 'user perspective' is Apple's introduction of the iPod music player and iTunes music store. Based on the philosophy of the computer as digital hub of lifestyle technology, the

starting point in the design process was that it should be easy to use. Seamless connection between the player and the music store was seen as key (Buxton, 2007). The idea to use a scroll-wheel as user interface to control the player came about because marketing management was already involved in the early stage of the design process. There was a 'push' side in the development of the iPod as well. The iPod/iTunes combination was a closed system, limiting the choice of customers. However, Apple managed to convince its users that a closed system was necessary to provide a stable and reliable customer experience.

Some Apple users feel that Apple has shifted too much to the 'push' side in recent years. The recently introduced iPhone 7 has no headphone jack, apparently to force customers to buy Apple's (expensive) wireless headphones. Reactions of customers were that Apple had become "arrogant" and "user-hostile".

A recent development is that not just product oriented companies, but also business services companies recognize the potential of design thinking. Large consulting companies recently acquired specialized companies in design services (Kolko, 2015), e.g. Deloitte acquired Doblin, Accenture acquired Fjord, and McKinsey acquired Lunar. These consultancy companies acknowledge that in the past, they were basically pushing their existing services onto clients. Now they recognize that the user empathy of design thinking can be fundamental to business success. The concept of design thinking offers opportunities to gather data and insights on how customers behave, think and feel as the basis for innovation of new services. In the design thinking approach, innovation often starts with designing a customer journey map to explore the problem space. An example is how the entrepreneurial company Uber took the traditional taxi branch by surprise. Uber came with the solution to skip the 'middleman' by defining the problem as how to organize mobility, not how to organize a fleet of taxis and a pool of drivers. Uber redesigned the relationship between user and transportation service (Chafkin, 2015). Other examples are airline company KLM which uses design thinking for innovation of flight handling services (Calabretta et al., 2016a) and financial services company Credit Suisse where employees were asked to spend a day in a wheelchair to better understand life from the perspective of disabled customers (Ford, 2012).

We conclude that design thinking is about maintaining a dynamic balance between 'product push', out of passion for the organization's products and services, and 'customer perspective' approaches.

3.4 Focus on functional aspects versus focus on aesthetic and emotional aspects

In the traditional approach to innovation, engineers are responsible for the functional aspect of a product, such as utility and product specifications, and designers turn it into an aesthetic product by making it look nice from the outside. In the traditional approach, innovation processes are engineer-driven. Functional aspects tend to be seen as serious and relevant, and aesthetics as subjective and not quantifiable (Tonkinwise, 2011). In the design thinking approach to innovation, the aesthetic and the overall emotional aspects of the user experience get much more attention: it is about finding motivations, feelings, needs, what makes the experience fun. One of the success factors of Apple is that there is an emotional relation between consumers and Apple products. However, this does not mean that design thinking is only about

aesthetic aspects. As former Apple-CEO Jobs said in interview: 'design is not just what it looks, it is how it works' (Walker, 2003). Design thinking can be seen as an integrative approach which considers both form and function, takes both functional aspects and emotional involvement into account. The challenge is in creating the balance between emotional meaning and functional aspects.

One of the inspirations of the design thinking approach is the German modern architecture movement 'Bauhaus' of the1920s. The Bauhaus style seamlessly integrated form and function. Bauhaus designs are simple and functional, yet expressive. Jobs got inspired by the design philosophy of Bauhaus when he attended the International Design Conferences in Aspen in 1981. He was impressed by the Bauhaus design concepts applied in the buildings and furniture of the Aspen Institute (Isaacson, 2011, p. 126). The influence of design thinking can be seen in Apple's Human Interface Guidelines for App makers: "Aesthetic integrity is not a measure of how beautiful your application is. It's a measure of how well the appearance of your application integrates with its function" (Apple Inc, 2010, p. 31).

Apple products are built with complex technology, but customers experience it as simple to use because of the seamless blend of appearance and functionality. Design thinking is not just about a good looking design, it is about design of the whole user experience and therefore an important part of business strategy (Brown, 2009, p. 7). In a design thinking culture, it is the mindset for all people involved in innovation. As a result of the integrative approach of design thinking, a company such as Apple espouses a feeling as an organization which can be referred to as 'style'. Interestingly, the Bauhaus movement which stood at the foundation of design thinking was in turn influenced by the Dutch art movement "De Stijl' ('The Style') in which the term 'style' stood symbolic for integration of function and form (Janssen & White, 2011). An example of the impact of style is how Sennheiser, the German manufacturer of high quality headphones, was overtaken by Beats Electronics, the headphone company of rapper Dr. Dre, who turned the headphone into a lifestyle product by offering a unique user experience.

The integrative approach requires different methods as well. While the functional approach is fact based, using quantitative methods and statistics, aesthetics requires more qualitative methods such as visual thinking. At airline company KLM, new management trainees get training in drawing to express their ideas (Calabretta et al., 2016a), in line with the advice of Brown (2009, p. 80): "words and numbers are fine, but only drawing can simultaneously reveal both the functional characteristics of an idea and its emotional content". We conclude in line with the findings of Ingle (2013) that design thinking requires a balance between quantitative and qualitative approaches.

3.5 Closed versus open approaches to innovation

Chesbrough (2012) has coined the term 'open innovation' as the alternative for the 'old' model of 'closed innovation' In 'closed innovation', a company controls its innovation processes by investing in internal R&D and protecting innovations coming out of these investments via intellectual property rights (Prud'homme van Reine, 2015). The closed innovation approach is associated with internal focus, sticking to existing company practices, and may lead to faulty assumptions because of 'tunnel

vision'. Open innovation is about accepting that you cannot do everything inside and making the world your laboratory by bringing in external expertise and insights. The Center for Design Research of Stanford University has suggested that design thinking is a form of open innovation (Kim, 2016). Open innovation and design thinking indeed have a lot in common. Both processes involve community generated problem solving and innovation. Design thinking can be seen as a solution oriented process to achieve innovation (Cross, 1982, 2001, 2006), characterized by outward focus, an open, entrepreneurial and 'thinking outside the box' attitude. Design thinking requires bringing together deep insights about humans and therefore looking at a problem from more than one perspective. It relies on sharing resources and leveraging knowledge to understand problems and develop solutions by looking for ideas among competitors, lead users, academics, suppliers and different industries. Outward focus is associated with design because looking outside for information is what designers tend to do. Apple co-founder Jobs famously took the idea for Apple's graphical user interface from Xerox. However, recent research shows that successful innovation strategies *connect* internal and external sources of innovation by developing a dynamic balance between closed and open approaches to innovation (Prud'homme van Reine, 2015). Creating and sharing knowledge and ideas in networks is only possible when companies invest in own R&D and innovation capabilities to acquire 'absorptive capacity': the ability to identify, assimilate and exploit knowledge from the environment. Therefore, introducing design thinking should start with building a culture that embraces network embeddedness, i.e. the willingness and ability to identify, assimilate and exploit external sources of innovation in such a way that it contributes to performance. An example is how the technology needed for the iPod was pulled together by Apple from internal and external sources. We conclude that design thinking for innovation is about maintaining a dynamic balance between closed and open approaches to innovation.

3.6 Innovation as a structured process versus 'bricolage'

Peter Drucker defined systematic innovation as follows: "systematic innovation consists in the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic or social innovation" (Drucker, 1985, p. 42). This emphasis on 'systematic', 'organized' and 'purposeful' appeals to managers of innovation processes. Many attempts have been made to develop systems and structures that promote consistency and predictability in **i**nnovation processes, such as 'innovation scoreboards', 'innovation scans' and other quantitative measurements of returns of innovation. Although engineers and scientists generally resist control by their managers, the systematic innovation concept appeals to them to some extent as well. Scientists and engineers do like the concept of innovation as a systematic process in which their role is to develop the universal 'one best solution'. Design thinking is a more loosely structured organizational process stimulating innovation (Brown, 2009; Kimbell, 2011). It accepts that design is messy, needs probing, and that showing and testing unfinished work is part of the process. Bricoleurs (from the French word 'bricolage', meaning 'tinkering') are not looking for the 'one best solution', but develop the best possible solution with the tools, materials and other means that happen to be available. It leads

to unique and unpredictable results, often with a personal touch of the designer. Former Apple-CEO Steve Jobs was more of a bricoleur than an engineer, a scientist or a manager, which can be understood by going back to his youth. Steve Job's father was passionate about tinkering with old cars in his garage and he involved Steve at an early age in 'bricolage': repairing cars with whatever they could get for their projects in local junkyards (Isaacson, 2011, p. 7). In the same garage where Jobs learned 'bricolage', he later 'tinkered' the first Apple computer with co-founder Wozniak.

It has been suggested that all design is a form of bricolage (Louridas, 1999). However, design thinking can be better seen as a dynamic balance between structured innovation and bricolage. Paradoxically, structure can actually enhance creativity by forcing the design thinker to come up with a creative solution. Already in 1972, the famous American designer Charles Eames said in an interview: "design depends largely on constraints" (Neuhart & Neuhart, 1989, p. 15). Accepting (or even embracing) constraints, that is, accepting to work within a certain structure, challenges the designer to think out of the box.

The tension between structured innovation and bricolage is related to the reliability versus validity dilemma in design thinking, identified by Martin (2009, p. 37). The goal of reliability is to provide consistent, predictable outcomes. The goal of validity is to produce outcomes that meet a desired objective, which may incorporate aspects of subjectivity and judgment. Validity is open for surprise and gives the designer room for originality, for putting something unique in it. Martin suggests that design thinking blends reliability and validity (Martin, 2009, p. 44). In other words, the challenge is in maintaining a dynamic balance in the tension between systematic innovation and bricolage.

At Apple, the balance between systematic innovation and bricolage was inherent in the combination of the two founders: engineer Wozniak and 'bricoleur' Jobs. In a later stage, Jobs managed to sustain Apple's culture of design thinking as a CEO by being open for surprise while not ignoring reliability and consistency. Jobs repeatedly likened his engineers to 'artists' who had to surprise him, in line with the design philosophy: 'you need to embrace change'. Paradoxically, the transition to new products at Apple was eased by consistency in what to expect from Apple products, i.e. 'style'. 'Stylistic consistency' (Beverland, 2005) is characteristic for the balance between consistency and bricolage in Apple's design thinking culture. Similarly, PepsiCo uses design thinking to balance launching innovative products e.g. new flavours, and developing meaningful, consistent experiences across their portfolio of brands (De Vries, 2015).

3.7 Linear thinking versus non-linear, iterative processes

Traditional innovation follows a linear, milestone based process: from research to development, engineering, design, manufacturing, testing, marketing and distribution. Design thinking organizations are different. In a design thinking organization, you will see prototypes all over the place. These physical, digital, or just visual representations of 'the product in becoming' reveal a bias for action. 'Rapid prototyping' fits a culture that values exploration and experimentation in a fast paced environment. Rapid prototyping is a non-linear, iterative process (Plattner et al, 2014). At design company IDEO, iterative prototyping was introduced to

acknowledge that designers would never be able to fully predict users' reactions to a final product, despite efforts to come to a deep understanding of user needs. It is a process of reengaging with users in parallel to development, in order to get feedback and to come to short cycles to improve the product in.

That design thinking has a circuitous nature doesn't mean that it is completely non-linear or even chaotic. Brown & Wyatt (2010) describe the design thinking process at IDEO as 'a system of overlapping spaces rather than a sequence of orderly steps'. They distinguish the three spaces inspiration (identifying the opportunity or problem), ideation (generating, developing, and testing ideas) and implementation. Dorst & Cross (2001) describe creative ideas as 'bursts of development' on top of a linear process in design thinking. So, design thinking balances planning and experimenting. In design thinking, judgment in formulating the problem statement gets postponed: design thinking is about letting problems and solutions co-evolve (Dorst & Cross, 2001).

Steve Jobs spoke at Apple about 'concurrent engineering' and 'cross-pollination' (Kahney, 2008, p. 97): simultaneous collaboration between departments instead of a sequential development process. The development of the iPod serves again as an example. The technology needed was pulled together in an iterative trial and error design process. Concurrent engineering, or 'synchronizing the sequences' is the ultimate balance between linear and iterative thinking.

3.8 Individual creativity versus group collaboration

Design thinking requires individual creativity but is in the end a group collaborative effort in which sharing information and ideas is essential. Design thinking requires divergent thinking, so that it is crucial to have a diverse group of people. Dunne & Martin (2006) emphasize the need for expanding perspectives by collaborating with individuals unlike oneself. Leonard and Straus (1997) go one step further. They argue for 'creative abrasion': the constructive collaboration of people with different cognitive approaches. The idea is to encourage innovation by hiring and developing people who make one uncomfortable.

Stimulating collaboration between diverse people is a theme that comes back in accounts of design thinking in practice as well. At Apple, Steve Jobs was very much aware that organizing collaboration could generate far more innovation than just relying on the creative ideas of individuals: "the best innovation is sometimes the company, the way you organize a company" (Isaacson, 2011, p. 334). Multidisciplinary people often have the capacity and character for collaboration across disciplines e.g. artists with business insight. A personal experience of the author of this paper as manager of a group of innovation professionals at Philips Electronics serves as an example. Unhappy about the lack of diversity in a glass technology innovation group, I struck an agreement with a glass artist. The artist was allowed to freely use raw materials, heating equipment and energy to heat glass for his experiments in making artistic glass sculptures, under the condition that he would give feedback on the design of process and product innovation going on in the lab. The relationship between the artist and the technologists was initially indeed abrasive, but after a few months it was seen as a mutually rewarding experience. The diversity of backgrounds and perspectives turned out to help in building an innovative culture

in which people dared to challenge what was possible.

Brown (2008) affirms that the best design thinkers don't simply work alongside other disciplines: 'many of them are multidisciplinary themselves'. Brown's design company IDEO employs people who are engineers *and* marketeers, anthropologists *and* industrial designers, architects *and* psychologists. Brown & Wyatt (2010), in a discussion of the traits that IDEO seeks in its new hires to ensure that they can operate within an interdisciplinary environment, talk about the 'T-shaped' person: an individual who has strengths in two dimensions. On the vertical axis of the 'T' is the depth of the skill that allows them to make an individual contribution to the outcome. In order to be or become a design thinker, they need to have at the top of the 'T' empathy for people with different backgrounds and for disciplines beyond their own.

We conclude that design thinking requires striking a dynamic balance between individual creativity and group collaboration by stimulating 'creative abrasion' in diverse groups.

3.9 Leading design thinking: egalitarian versus hierarchical leadership

Ingle (2013, p. 2) describes design thinking as "an egalitarian skill set that can be learned, practiced, and championed by professionals across industries and job titles". The talent and creativity of the entire organization needs to be used: 'a good idea doesn't care who has it' (Flynn et al., 2003). During design thinking brainstorming sessions, everyone is equal regardless of his or her role in the organization. "Design thinking is about creating a multipolar experience in which everyone has the opportunity to participate in the conversation" (Brown, 2009, p. 192). To succeed with design thinking, everyone on the design team must be free to speak and everyone is obliged to listen to the person who speaks. Hierarchy or power based on status discourages deep engagement. Everyone must be encouraged to be creative and to participate.

However, that doesn't mean that there is no such thing as 'design leadership' in the design thinking approach. Accounts of design thinking in practice reveal that a certain balance between egalitarianism and decisiveness is required. Design thinking sessions usually have a moderator with a certain authority in the room. Cloud computing company Citrix grants 'Design Hero' awards to people who demonstrated design leadership (Courage, 2013). Design leadership is needed to ensure that decisions are taken and to focus on priorities. Increasingly, companies appoint a CDO (Chief Design Officer) as a member of their management board in order to overcome the gaps between silos in the organization.

The balance between egalitarianism and leadership in design thinking should be reflected in the notion that everyone can be a design leader. Moreover, the leadership role in design should not be a hierarchical role, but the role of a coach, facilitator and/or sponsor. For instance, cloud computing company Citrix makes sure that every project has a clear executive sponsor. They learned from experience that the complete intervention necessary to implement an innovation based on design thinking requires a strong support system.

At Apple, it was often CEO Jobs himself who took the role of decisive design thinking leader. He was known for always putting on a few priorities and saying no to

many things: "he was in charge and he did not rule by consensus" (Isaacson, 2011, p. 333). Jobs sometimes took his role a bit too far. He has been described as "autocratic" (Isaacson, 2011, p. 362) and even as "one of the great intimidators" (Kahney, 2008, p. 163). However, he was also known as a leader who liked to be challenged himself.

The leadership of Airbnb, a company that successfully applied design thinking to its innovative services, apparently sees Jobs as a role model. Airbnb co-founder and CEO Chesky, who was educated as an industrial designer, recently said: "a consensus decision in a moment of crisis is very often going to be the middle of the road, and they're usually the worst decisions" (Gallagher, 2015).

Summarizing, design thinking is about finding the balance between on the one hand ensuring that everybody involved has a voice and on the other hand ensuring focus by clear leadership. It requires a type of leader that likes to be challenged.

3.10 Short term versus long term approach to innovation

Neumeier (2008) sees design as the cure for the number-one wicked problem cited by corporate leaders in his research: the conflict between long-term goals and short-term demands. Many companies have shifted the horizon of their innovation activities from long-term basic research to shorter-term applied innovation. Design thinking, as it is integrative thinking, has the potential to restore the balance between the short term interests of shareholders and the longer term interest of all stakeholders (Dunne & Martin, 2006). According to Ad van Berlo, CEO of the leading Dutch design company Van Berlo Group and associate professor Entrepreneurial Design of Intelligent Systems at the University of Technology Eindhoven, design thinking combines vision for the future and solving practical problems on the short term (van Berlo, 2012). In an interview van Berlo added: "I want to show that design thinking can make an organization future-proof. We are used to looking into the future and transforming creativity into concrete ideas" (Zeemeijer, 2016). Former Apple CEO Jobs played such a visionary role in Apple. He was known for his ability 'to describe the future' and instilling employees with his passion reflected in the mission statement "we're working to make the world a better place" (Kahney, 2008, p. 151).

In the services industry, balancing short term and long term approaches to innovation is particularly important. Service design is increasingly seen as a means for societal transformation in the direction of a more sustainable society: "Service designers work increasingly across organisations and communities to enhance such transformational processes" (Sangiorgi, 2011, p. 35). One example of how design thinking can connect short and long term thinking is Mindlab, a public sector innovation lab in Denmark. It combines design thinking and social science approaches to capture the subjective realities experienced by citizens and businesses to create new solutions for society (Carstensen & Bason, 2012). At first, Mindlab did short term oriented service design projects but over time it has moved on to projects with more complex dimensions and deliverables, such as engaging in policy making and reform to create the conditions for long-term transformation processes. Mindlab is an example of the 'living labs' approach in which user experience prototype environments are designed and built, with end users immersed as individuals, groups or communities (Meroni & Sangiorgi, 2011, p. 264).

Brown (2009, p. 184) predicted that design thinking would result in longer term oriented innovation processes in the service industry: "Eventually it will be as natural to see innovation labs in service-sector companies as it is to see research and development facilities in manufacturing companies". A recent example is the foundation of Uber Artificial Intelligence Labs in San Francisco. Uber's lab aims at making computers capable of learning more like humans, by extrapolating a system of rules from just a few or even a single example, instead of just feeding them enormous amounts of data (Metz, 2016).

Another company in the services industry using design thinking to connect long and short term perspectives in innovation is the Dutch airline company KLM. Employees trained in design thinking at KLM are asked to think about the passenger experience in 5-20 years' time *and* about what needs to happen now to make that experience possible. The risk of such an approach is that it leads to conflict between the innovators and the operational department, whose response might be like: 'Nice visions for the future, but we are busy to keep this place running'. In order to prevent such conflicts, KLM designated three gates at Amsterdam Schiphol Airport to test new ideas. As a result, the impact of the new solution on the short term and on the long term are considered and culture change takes place as part of the process.

3.11 Design thinking for innovation as balancing contradictory elements

The discussion in this section indicates that design thinking for innovation in products, services and customer experiences requires a mindset that accepts contradictory elements and knows how to deal with the tensions between them. It seems that the prerequisites for design thinking for innovation closely match F. Scott Fitzgerald's famous saying: "The test of a first-rate intelligence is the ability to hold two opposite ideas in mind at the same time, and still retain the ability to function" (Scott Fitzgerald, 1936). A design thinking mindset, then, requires holding in mind the seemingly contradictory elements in the following tensions (see table 1 and paragraphs 3.2 – 3.10):

- analysis versus imagination,
- passion for the organization's products versus user empathy,
- functionalism versus aesthetic ways of knowing,
- closed versus open approaches to innovation,
- consistency versus pragmatism,
- linear planning versus experimenting,
- individual idea generation versus collaboration,
- stimulating everybody to participate versus decisiveness,
- creating immediate benefits versus exploring possibilities of what could be

The discussion indicates that at organizational level, design thinking for innovation requires developing an agile organizational culture capable of maintaining a dynamic balance on each of these tensions.

4 Design thinking as a strategic tool for innovation: cultural challenges

4.1 Design thinking, strategic change and culture change

Over the past decade, many organizations have made efforts to become design-driven at strategic level by using design thinking as a strategic tool for innovation instead of just as a tool for product innovation (Dvorak, 2008; Kolko, 2015; Micheli & Perks 2016). Managers started to show an interest in design thinking because their organizations faced increasingly complex challenges, and they felt the need to broaden their range of strategies to address these challenges (Dorst, 2011).

As pointed out by Brown & Martin (2015), change associated with a design intervention involves two simultaneous and parallel challenges: the design of the artefact in question and the design of the intervention that brings it to life. The latter one involves change at the strategic level. According to Weick (1985), strategy and culture resemble one another and it is becoming increasingly difficult to separate strategic change from cultural change. Ed Schein, another leading thinker on organizational culture, added to this: "culture constrains strategy by limiting what the CEO and other senior leaders are able to think about and what they perceive in the first place" (Schein, 1989, p. 382). Weick's and Schein's observations imply that culture can limit strategic options significantly and can restrict an organization's ability to assess and to adapt to certain environments. Culture influences which solutions organizations and leaders tend to prefer. Adopting design thinking as a strategic tool for innovation is, therefore, not just a matter of implementing some design practices that can simply be copied or appointing a Chief Design Officer. Using design thinking at strategic level cannot be seen separately from developing a culture conducive to design thinking. Adopting design thinking as a strategic tool requires an organizational culture that can keep itself in a constant state of inventiveness by maintaining a dynamic balance on the tensions as described in section 3 of this paper. Neumeier (2008) refers to this as developing a 'designful mind' and a 'designful company'. Organizations interested in using designing thinking as a strategic tool for innovation have to take these organizational culture challenges into consideration. Luchs et al (2016) mention four type of organizations that will face organizational culture challenges when they use design thinking at the strategic level: start-ups with an entrepreneurial culture; large companies with traditional organization cultures; companies that use design thinking for innovation of business models; and services organizations. For each of these organizations, the organizational culture challenges in design thinking for innovation at the strategic level will be discussed in section 4.2, on the basis of cases and examples.

4.2 Organizational culture challenges in design thinking for innovation Startup company using design thinking

According to Luchs et al (2016), grounding the product development process in design thinking will help the rising number of relatively 'green' entrepreneurs to succeed as they encounter investors and in the marketplace. An example of a startup company that successfully used design thinking for innovation is Airbnb.

Joe Gebbia, chief product officer and co-founder of Airbnb tells the following story about how design thinking transformed Airbnb from an almost failing startup to a successful business (First Round Review, 2015). In 2009, the leadership team of Airbnb was in a brainstorming session at its headquarters in San Francisco, trying to figure out why people weren't booking rooms and growth had come to a standstill. The pattern they discovered was that the photos of listed properties on the company's website were amateurish and unattractive. They decided on the spot to travel to New York, the company's biggest anticipated growth market. They rented a professional camera, visited the listed properties and made some more professional high-resolution pictures. After arriving back at headquarters they upgraded the website. Within a week after publishing the improved pictures, revenues doubled. Gebbia calls this 'an example of design thinking that changed the trajectory of their business' (First Round Review, 2015). Although Airbnb is a data driven company, the team did not respond reactively to data but came up with a creative hypothesis, spontaneously decided to do an experiment, implemented change, reviewed the impact of the change and then repeated the process.

The example of Airbnb shows that to use design thinking for strategic innovation, several tensions need to be balanced at the same time. The leadership team balanced an analytic, data driven approach with intuitive and creative thinking; balanced passion for the company's product with customer empathy; and balanced linear planning and experimenting. Airbnb was able to use design thinking for innovation at a strategic level because it already had the required mindset among its leaders and a dynamic, adaptive or 'agile' culture as a startup. The two co-founders, CEO Chesky and Gebbia, are both designers by education. Moreover, CEO Chesky is reportedly 'particularly obsessive when it comes to culture' (Gallagher, 2015).

Challenges for design thinking in traditional organizational cultures. Airbnb was able to assess the environment and adapt to it because of its agile culture as a startup. Tonkinwise (2011) discusses the organizational culture challenges that more traditional companies face when they want to use design thinking as a strategic tool for innovation. According to Tonkinwise, managers of more traditional companies who are interested in design thinking as a strategic tool often downplay the emotional and aesthetic part of design. They are uncomfortable with the stylistic aspects of design because these are not easy to quantify. Tonkinwise even claims that style is often repressed in managerial design thinking. Design thinking implies tolerance for failure, but most managers do not like the risks involved in styling. Tonkinwise emphasises that style is central to design, and that seeing style as strategic helps designers to design. Avoiding the primacy of the aesthetic in design runs the risk of blocking innovation. Likewise, Neumeier, in his plea for 'the designful company' (Neumeier, 2008, p. 10), calls for 'the rebirth of aesthetics': "Innovation without emotion is uninteresting. Products without aesthetics are not compelling". Tonkinwise and Neumeier both show the need to maintain a dynamic balance between functionalism and aesthetic ways of knowing while the emphasis in many organizational cultures is still too much at the functional side. A case in point is traditional car manufacturer Ford. Ford has adopted design thinking but still "has a long road ahead after decades as an engineering-led company" (Kuang, 2016). In

2012, Ford has established a Research and Innovation Center within walking distance of the Palo Alto headquarters of Tesla, the car company that positions itself as a design company focused on energy innovation. According to Ford's director of interaction and ergonomics, creating a new balance between functionalism and aesthetics is one of the goals of tapping into Silicon Valley's design thinking for innovation processes: 'a more beautiful product is almost inevitable if you create a more beautiful process'. In the change process, Ford struggles with several of the other tensions in design thinking for innovation:

- passion for the organization's products and user empathy. Part of creating a new mindset at Ford are mobility experiments set up around new user experiences such as peer-to-peer car hiring arrangements. However, these initiatives meet internal and external scepticism: "you have to wonder how much Ford actually can change" (Kuang, 2016).
- linear planning and experimenting. Not everybody at Ford's headquarters appreciates that experimenting might mean driving around barely working prototypes.
- stimulating everybody to participate and decisiveness. Ford struggles with adapting the organization and how decisions are made in such a way that the user's point of view is represented.

Ford's CEO acknowledged: "challenging our cultural norms takes time" (Kuang, 2016).

Business model innovation and design thinking. Organizational culture challenges are also likely to come up in business model innovation e.g. when product based companies change to service based offerings. It has been shown that design professionals can support companies in addressing such challenges in strategic change by instilling service-oriented practices and by maintaining commitment to the servitization transition (Calabretta et al., 2016b). The contribution of design consultancies in such innovation efforts is that they help the organization to change the culture: from a product oriented culture to a culture that balances passion for its products and connecting deeply with users, from a rational culture to a culture that balances rationality and emotion, and from an analytic culture to a culture that balances analytic and intuitive approaches. A recent case of business model innovation using design thinking is the Dutch company Wavin, a supplier of plastic pipes and connectors for building projects worldwide. Their direct customers, general contractors of building projects, demanded lower prices. The response in Wavin's traditional organizational culture was to make a thorough financial spreadsheet analysis, suggesting building a new local factory as a solution. However, Wavin's supply chain and operations director personally drove a design thinking initiative to find creative other options based on user empathy. Wavin decided to send a team abroad to observe their customers at work on construction sites (van der Pijl et al., 2016) and gave team members freedom and trust to experiment and come up with an innovative solution. They found out that their real customers, the plumbers, were more interested in working smarter by gaining more knowledge than in lower prices per se. They wanted to become more competitive and deliver higher quality to their customers. Based on these new insights, Wavin established a local 'Wavin Academy', a training centre where plumbers receive free training in using materials and tools.

The result is that Wavin has a much closer relationship with its customers, the plumbers, and learns from them as well. The Wavin case shows that using design thinking to develop an innovative business model requires creating a dynamic balance on several tensions: product focus versus user empathy; rational (focus on price) versus emotional (close relationship with plumbers), and analysis (financial spreadsheets) versus creativity.

Design thinking for innovation in public services. Another example of organizational culture challenges in using design thinking as a strategic tool for innovation is innovation in public services. Innovation in public services often reveals tensions between creating immediate benefits (short term orientation) and exploring possibilities of what could be (long term orientation). Dorst (2011) reviews the case of a city council dealing with problematic behaviour of youngsters in an urban entertainment area with bars and clubs. Dorst uses the term 'new frame creation' to show what design thinking can do. The problems in the entertainment area were framed by authorities as 'a law and order problem'. They proposed short-term solutions such as increasing police presence. It didn't help, actually, the situation got more grim. Designers reframed the problem as 'how to organize a group of young people who want to have a good time'. Now, the broader problem situation could be addressed in an innovative way, with solutions similar to how one would organize a youth festival e.g. additional activities to prevent boredom, organizing transport, creating relaxed spaces and focusing on safety instead of on security. The designers created a new frame, based on the themes that emerged from their investigation, moving away from the frame in which the problem was originally expressed, thereby removing constraints and providing a long term solution. In this case, it was necessary to hire designers as external consultants to bring a new frame to the problematic situation. Dorst's concept 'new frame creation' is close to 'creating a new mindset' or 'instilling culture change'. It would be better to integrate design orientation into the organizational culture from the very beginning (Beverland, 2005) to link design practices and organizational innovation to create new frames.

4.3 Discussion: cultures conducive to design thinking for innovation

The exploratory research of organizations using design thinking for innovation at strategic level leads to the following tentative conclusions. The cases and examples discussed indicate that organizations interested in using design thinking as a strategic tool for innovation need to develop an organizational culture that can keep itself in a constant state of inventiveness by maintaining a dynamic balance on the tensions in design thinking for innovation. Using design thinking as a strategic tool for innovation often requires balancing several of the tensions simultaneously. The framework of nine fundamental tensions can serve as a tool to identify which of the tensions in the framework need to be addressed to develop a culture conducive to design thinking for innovation.

5 Conclusions and further research, Insights and managerial implications

Design thinking for innovation should be seen as a mindset (at individual level) and as a culture (at organizational level). Design thinking is often presented in the published literature as a radically new approach to innovation, as the opposite of 'established ways of thinking', 'traditional linear thinking' , 'traditional analytic thinking' and 'engineering thinking'. By relating an analysis of the academic literature on design thinking for innovation to accounts of design thinking for innovation in practice, this paper comes to the tentative conclusion that design thinking for innovation can be better seen as an approach that helps to establish a dynamic balance on a number of fundamental tensions in innovation. The power of design thinking is in the tension between seemingly opposite ways of thinking, such as analytic thinking versus intuitive thinking, and linear thinking versus thinking in iterative processes. Design thinking for innovation needs to be embedded in an organizational culture capable of continuously anticipating and adjusting to change. Conceptualizing organizational culture as how the organization handles a number of fundamental tensions or innovation dilemmas in such a way that a dynamic balance is maintained, makes it possible to operationalize such an 'agile' culture. All the nine tensions or innovation dilemmas derived from an existing model of organizational culture turn out to be relevant for understanding design thinking. The framework of nine tensions as listed in 3.1 can be used by managers as a tool to evaluate to what extent organizations are equipped to benefit from design thinking for innovation, by exploring the dynamics of how each tension is handled: is the organization capable of maintaining a dynamic balance on each tension?

Copying design practices from other organizations as 'a secret weapon for innovation' is not a viable option – how to maintain a dynamic balance on each of the tensions depends on the existing culture of the organization, its history and its environment. The analysis of how the tensions are handled will reveal the strengths and weaknesses in the capacity of the organization to apply design thinking for innovation and the organizational culture challenges that can be expected. Based on such an analysis, the framework can be used to identify innovation approaches that have the potential to create a dynamic balance on all the dilemmas relevant for the organization. For instance, it has been shown in sections 3.3 and 3.10 of the paper that the living lab approach can contribute to balancing the product push versus user empathy dilemma and the long term versus short term dilemma. Recent research (Brankaert & den Ouden, 2017) suggests that 'design-driven living labs' have the potential to help balancing other tensions as well, such as closed versus open approaches to innovation, by giving more room for input from various stakeholders, and linear thinking versus non-linear, iterative processes, by exploring innovative solutions to complex societal challenges potentially leading to more disruptive, open-ended development of innovation.

Detailed guidelines on how dilemmas can be balanced or 'reconciled' by using scorecards can be found in other publications on dilemma methodology (Trompenaars & Prud'homme van Reine, 2004; Trompenaars & Hampden-Turner, 2010).

Limitations and further research. A limitation of the research is that the examples and cases used in this paper are based on literature research and on the own experiences of the author as an innovator, manager, consultant and researcher. Systematic empirical research of organizational culture challenges of different type of organizations using design thinking for innovation is still lacking and is recommended as an avenue for further research.

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Journal of Innovation Management
JIM 5, 2 (2017) 81-110
HANDLE: http://hdl.handle.net/10216/105431
SM: Nov/2016 AM: Jun/2017

How Chinese commercial banks innovate: process and practice

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Abstract. This paper describes the financial innovation approach and process adopted by large commercial banks operating in China. Data are collected from three case firms using a qualitative case study method. The research shows that regulation can be a catalyst or a hindrance to financial innovation, depending upon the degree of coherence between a bank's innovation strategy and local government policy. Performance pressure helps drive innovation, whereas organisational bureaucracy and trajectory are major barriers to innovation. Banks adopt different approaches to the innovation process due to differences in institutional arrangement and institutional environment. Practitioners should consider the institutional effects when engaging in financial innovation. This research contributes to current practice by pointing out an integrated approach to financial innovation and regulatory dialectic.

Keywords. Innovation Process, Innovation Model, Regulatory Dialectic Financial Services

1 Introduction

Financial services represented 10% of China's gross domestic product (GDP) in 2014, growing by 17% annually. Innovation in financial services is undergoing a massive change in China with the rise of the mobile Internet, cloud computing and the Internet-plus economy (based on the study of Lee and Yang (2014), it is similar to Industry 4.0 in the Western literature). Large IT firms such as Alibaba, Baidu and Tencent have penetrated the financial services industry through third-party online payment platforms and have begun to provide branchless banking services. They have started to disrupt the traditional ways in which financial services are provided by using an agile service model and offering an enriched customer service experience. These in-pocket banking services are available to users anywhere, anytime, 24x7. Financial innovation by outsiders helps drive creativity and big data analytics on customer spending behaviour. Some banks have started to work with IT firms to deliver new banking services to consumers over the mobile Internet.

However, these new forms of financial innovation have also had an unexpected impact on financial stability. Standard & Poor (S&P) estimates that, as of the end of 2014, shadow banking in China totalled RMB 25 trillion and provincial government had accumulated debt of RMB 115 trillion, 55% and 250% of China's GDP respectively. The Financial Stability Board (FSB, 2011) defines shadow banking broadly as "credit intermediation involving entities and activities outside the regular banking system".

ISSN 2183-0606
http://www.open-jim.org

These unregulated financial activities create credit and liquidity risks in the Chinese financial system, as a result of over-leveraging and a rapid increase in lending activity. Shadow banking in China will continue to grow as long as commercial bank lending is unable to meet the liquidity demands of business and interest expectations for investment.

Some of this debt has been created as a result of the booming Internet finance (according to Schueffel (2017), it is equivalent to the term "FinTech" using in the Western literature) economy and limited investment channels in China. Internet finance refers to financial activities driven by IT firms leveraging the innovative power of Internet technology. It is a new form of economy driving consumption and microfinancing in China. Internet finance is easily accessible by low-income individuals for immediate financing, without any mortgaging or comprehensive credit rating. It also offers high-interest wealth management products over the Internet to individuals without any appropriate risk tolerance checks.

The increase in shadow banking and under-regulated Internet finance activities is due to the reluctance of commercial banks to supply credit to small and medium enterprises (SMEs), despite the fact that Chinese SMEs account for approximately 60% of GDP and supply more than 75% of jobs in China. With the marketisation of interest rates and the further opening up of the banking industry to foreign investment, Chinese banks will need to be more innovative in their operations, products and services provision in order to remain competitive. However, exactly how Chinese banks innovate remains a neglected research area in most innovation studies.

This paper studies the innovation process and approach adopted by large commercial banks in the context of their institutional arrangement and the Chinese financial institutional environment. Process can be defined as a set of activity flows that take place within relatively stable contexts, such as the organisation or the institutional environment. This exploratory research also reviews the implications of regulatory environment on a bank's innovation model. Three large commercial banks in China, with different equity ownership, innovation strategies and organisational trajectories, were selected for case study. The paper ends with a cross-case analysis and a discussion of managerial and policy implications.

2 Literature review

2.1 What is innovation?

There is no uniform definition of innovation. In general, innovation is associated with original, never-before-seen products or the use of cutting-edge technologies. Innovation can be the development and commercialisation of new products or services (Rogers, 2003); the development of new manufacturing processes or forms of service provider relationship (OECD, 2005); drastically different concepts or completely new ways of setting apart existing business (Hamel, 2000); changing a company's organisational and management style and the administration of the production process (Van de Ven, Angle & Poole, 2000); or ways of commercialising new products, new delivery methods and changes in packaging (Jaramillo, Lugones & Salazar, 2000).

Innovation can be defined based on four schools of thought:

(1) The classic definition: "a historic and irreversible change in the method of production of things" and "creative destruction" (Schumpeter, 1934);
(2) The OECD definition: "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005, p.46);
(3) The theory of change definition: innovation as something new (Barnett, 1953); a conduit of change (Drucker, 1985; O'Sullivan & Dooley, 2009); a process (Aiken & Hage, 1971; Rasul, 2003); a value driver (Wang & Kafouros, 2009); or an invention (Zaltman, Duncan & Holbek, 1973);
(4) The competitive advantage definition: "a source of competitive advantage and is seen as a decisive factor for economic growth and the basic condition of company development in a competitive environment" (Johannessen, 2009); or "a tool for the creation of new knowledge. The use of new products, services, processes and paradigms that are embedded into existing innovation leads to new ways of thinking and new knowledge" (Acs, Anselin & Varga, 2002; Strambach, 2002).

Other contemporary descriptions of innovation, to name just a few, include "blue ocean innovation" (Kim & Mauborgne, 2005); "frugal innovation" (Tiwari & Herstatt, 2011); "organic innovation" (Moore, 2005); and "open innovation" (Chesbrough, 2006). In this paper, the author prefers to define innovation as a conduit of change and creator of values (Poole, 2004). Innovation is always followed by change, but the change does not necessarily result from innovation. Change can be a result of objectives being compromised, or of regulation compliance (Van de Ven & Poole, 1995). Innovation nowadays not only means the creation of something new; it is also a panacea for survival and growth. Innovation is required to continue to enhance the value proposition of a business. The innovation concept has changed – from the invention of new things, to value creation and being a change agent. Innovation is seen as market conquest and a profit driver in business today.

2.2 What is financial innovation?

Lerner and Tufano (2011, p.6) define financial innovation as "the act of creating and then popularising new financial instruments, as well as new financial technologies, institutions and markets. The innovations are sometimes divided into product or process variants, with product innovations exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products, and process improvements typified by new means of distributing securities, processing transactions or pricing transactions."

Products of financial innovation in the early 2010s were financial instruments such as ETFs (exchange-traded funds), hybrid complex MTNs (medium-term notes), sovereign CDS (credit default swaps on sovereign debt) and liquidity swaps, and new trading practices such as HFT (high-frequency trading) (Muniesa and Lenglet, 2013). Frame and White (2004, p.118) further conclude that financial innovations may embrace "new products (e.g. adjustable-rate mortgages, exchange-traded index funds), new services (e.g. Internet banking, online securities trading), new production processes (e.g. credit

scoring models, electronic record-keeping for securities) or new organisational forms (e.g. new types of electronic exchange for trading securities, Internet-only banks)".

Most literature considers financial innovation to be an organisational process (Cooper, 1998; Oke & Goffin, 2001) which includes idea generation, concept evaluation, development and commercialisation (Luecke, 2003; Vermeulen, 2004). The innovation process can be episodic or continuous (Weick & Quinn, 1999), first-order or second-order (Meyer et al, 1993) and competence-enhancing or competence-destroying (Abernathy & Clark, 1985). Rothwell (1994) defines innovation development in six generations: technology push, market pull, coupling, interactive, network, open innovation.

Financial innovation takes many forms. It can be incremental or radical (Tushman & Romanelli, 1985), sustaining or disruptive (Christensen et al, 2003). Atherton and Hannon (2000) consider business strategy to be the building block and antecedent to all kinds of innovation. From a practitioner view, financial innovations include ICT-based innovation (Lichtenthaler, 2007), product innovation (Vermeulen, 2004), service innovation (Kutvonen et al, 2011), process and platform innovation (Coles & Edelman, 2012), channel innovation (Prahalad & Krishna, 2008), integration innovation (Ward & Daniel, 2012) and open innovation (Chesbrough, 2006).

Llewellyn (1992) identifies three fundamental differences between financial innovation and innovation in other sectors: (1) unlike in many industries, the R&D costs of creating new products are relatively low in the financial sector; (2) due to lack of invention patent protection, financial innovation is easy to copy; and (3) financial innovation is strongly influenced by regulation – it often derives from the desire to elude legal stipulations or exploit regulatory gaps or grey areas. The fact that financial innovation is visible and immediately copied contributes to increasing financial integration at an international level (p.16).

Four distinctive features of financial innovation have been emphasised in the literature. First, the role of regulation either as an innovation catalyst or as a hindrance factor has been widely debated (Marcus, 1981). Second, until recently most financial innovations were not considered eligible for patent protection (Kumar & Turnbull, 2006; Lerner, 2006). Third is the propensity of innovation activities to entail cooperation. Vence and Trigo (2009) find strong evidence of inter-firm cooperation, whereas Oliveira and Von Hippel (2011) highlight the importance of users as co-creators in the retail banking industry. Fourth, innovation in financial services is usually depicted as incremental. Weak appropriability regimes and ease of imitation, combined with a resource-intensive, time-consuming and costly innovation process, hinder the development of radically new offerings (Easingwood, 1986; de Brentani, 2001; Alam, 2002).

2.3 Characteristics of financial innovation

A positive relationship has been found between networking, open innovation and business performance. Banks can achieve higher revenue growth by participating in networks and engaging in open innovation (Chaston, 2011). Involving customers in the open innovation process can enhance innovation quality and outcome. Stakeholder integration and the involvement of supporting activities units (Akamavi, 2005), and engaged communication with lead customers (Athanassopoulou & Johne, 2004) and

project team members (Lievens & Moenaert, 2001), are important to the success of financial innovation. However, Costanzo and Ashton (2006) find the innovation process to be more market-oriented than customer-oriented, and thus most banks adopt a strategy of targeting the quick launch of slightly modified offerings as a response to competition, rather than truly identifying and meeting customer needs. Direct involvement of customers appears extremely rare, which may be explained by the degree of inherent complexity of financial innovation and the lack of customer interest in these innovations (Vermeulen, 2004, p.94). Using a co-creation and co-profiting approach, Martovoy et al (2014) suggest that financial institutions should select customers who are more demanding and with whom it is possible to cooperate (in retail markets), and customers with whom they have longstanding and intertwined relationships (in corporate markets). Instead of searching for innovation best practices, Bátiz-Lazo and Woldesenbet (2006) suggest that multiple adoption patterns could be possible in banking.

In terms of the pattern of financial innovation development, Martovoy and Mention (2016) identify four patterns of new service development (NSD) processes: problem-driven, proactivity-driven, market-driven and strategy-driven. Most banks are found to keep a balance between being open and closed to cooperation with external partners in the innovation process. In general, service concept development is the innovation stage most open to cooperation, while introduction to a market is more in-house oriented.

Romelaer (2015) classifies innovation (also applicable to financial innovation) in five major models: rational, behavioural, technocratic linear, concurrent with outsider help, and progressive with intrapreneur models. Each model is different in terms of innovation actors, activities and communication types. The model moves from a supposedly 'rational' model to a more realistic and practical model. It shows an increasing use of initiative, bottom-up processes, decentralisation, co-development, shared governance and use of outside resources.

Numerous scholars have studied factors affecting financial innovation process, efficiency and performance. These factors include organisational structure (Berger & Udell, 2002); organisational culture (Vermeulen, 2004); human resources (Glaveli & Kufidu, 2005); top management support and customer focus (Gerstlberger et al, 2010); information and communications technology (ICT) (Berger, 2003); legal environment (Jawahitha et al, 2003); communication flow (Lievens & Moenaert, 2000a); competition (Bradley & Stewart, 2003a, b); and cost (Gurau, 2002). Different means such as patents (Lerner, 2006), technology embeddedness (Frame & White, 2004) and user stickiness (Rigby & Zook, 2002) are used to protect the proprietary nature of financial novelties. Financial innovation activities are usually measured by investment in information technology (Beccalli, 2007), new product rate (Sumita, 2008) and research and development (R&D) expenditure (Adams et al, 2006). The use of ICT is also considered a relevant prerequisite for financial innovation, because of the high volume, variety and velocity of financial transactions that need proper recording to safeguard financial asset ownership (Gerstlberger et al, 2010).

2.4 Current literature gaps

Current literature shows limited understanding of how financial innovation is being managed and why banks manage the innovation process in the way they do. This is due

to the general reluctance of banks to reveal their innovation decision-making process. Access to data is difficult due to regulatory restrictions and business confidentiality. Financial service firms rarely report R&D spending, and financial patents were used only infrequently until recently (Lerner and Tufano, 2011). Lerner (2006) takes a new approach in addressing this gap by developing a measure of financial innovation based on news and stories in the *Wall Street Journal*. He finds firms that are less profitable in their sector are disproportionately more innovative. These results are consistent with Silber (1983), who says that more marginal firms contribute the bulk of the innovations in the financial services sector. However, this is in contrast to the last decade, during which most new financial innovations were initiated by large financial institutions with the advantage of market size in product diffusion and transfer of risk.

The innovation process proliferates into complex bundles of innovation ideas and divergent paths of activities by different organisational units (Van de Ven & Poole, 1995). Blazevica and Lievensb (2004) suggest future research should consider case studies that provide more insight into the different stages of innovation and its interaction with the communication necessary to ensure innovation success and competence development. Lerner and Tufano (2011) further suggest that comparative case studies can offer additional evidence to help uncover the innovation spiral process. By judicious selection of case banks of systemic importance to the Chinese financial system, the researcher can "walk the path" (Calori, 2003) of the innovation process in practice, and identify gaps between "espoused theory" and "theory in use" (Argyris & Schon, 1978).

Romelaer (2015) suggests that innovation study should consider a better understanding of formal-informal-cultural aspects of the innovation; how innovation links to strategy, internal and external constraints and resources; and inside and outside governance in relation to types of project managers, owners and investors, district, regional or state influences. The organisational type may also have a strong influence on the innovation model applied. However, it is unclear to us why certain innovation models are more common in certain national or regional cultures (Asia and China), in certain industries (such as financial services), and in certain types of firm (foreign, state-owned and privately owned). Can all types of innovation process be gathered in a single framework? What are the specific advantages, disadvantages and managerial concerns of each model? An empirical study that is based on direct observation or experiences in the field might be able to unearth these mysteries.

3 Research methods

Process study is increasingly popular in the study of organisational change and innovation. It focuses on how change unfolds by narrating the temporal sequence of events in an organisational setting (Poole et al, 2000). In empirical research, process study employs clinical designs to identify the process or multi-concurrent processes through direct observation, archival analysis or multiple case studies (Van de Ven & Poole, 2005), but a process study's generalisability depends on its case study's versatility – "*the degree to which it can encompass a broad domain of developmental patterns without modification of its essential character*" (Poole et al, 2000, p.43).

To gain practical insight into the financial innovation process, we need information from experienced managers involved in the end-to-end innovation process. Three research activities were conducted (see Table 1): an exploratory study, case studies and a pragmatic study. A total of 30 informants were interviewed several times between 2013 and 2015.

Table 1. An overview of empirical research activities (2013-2015)

Research activity	Goal	Research instrument
Exploratory research	Preliminary data collection and concept review	Executive interviews and field observations
Case studies	Empirical study data collection and analysis	Executive interviews, workshop discussions, field observations and written documents review
Pragmatic study	Identification of gaps between espoused theory and theory in use	Executive interviews, field observations and internal documents review

First, an exploratory study was conducted to collect preliminary data from the field about the research subject and practitioners' voices. The key goal was to understand the research fieldwork environment, people, main themes and key concerns. The exploratory study was conducted in a pilot case firm, based on semi-structured and open-ended interviews. All interviews followed a common protocol. Informants were first asked to describe the innovation process, and subsequently more specific issues about innovation drivers, barriers, measurements, learning and development were discussed.

The empirical study was conducted based on an extended case study approach (Burawoy, 1991), using a theoretical sampling method (Eisenhardt, 1989). Three case firms were selected, based on a maximum difference approach (see Table 2). The idea is that greater variation in case firms leads to a higher chance of discovering similarities and dissimilarities among case firms for potential literal and theoretical replications (Yin, 2009). Under an embedded case study approach, all the case firms have significant operations in China and are subject to the regulatory governance of the China Banking Regulatory Commission (CBRC) and the People's Bank of China (PBOC). This exploratory case study attempts to answer the research questions "What is the innovation process?" and "How is innovation being managed?" in the Chinese banking industry. This study does not aim to describe propositions, test hypotheses or attempt to develop causal explanations in a real-life context.

Table 2. An overview of case study firms

	H BANK	C BANK	P BANK
Ownership	Foreign bank	State-owned bank	Joint stock bank
Headquarters (HQ)	Outside China	China	China
Total assets	USD 2.5 trillion	USD 2.5 trillion	USD 0.35 trillion

	H BANK	C BANK	P BANK
Years of operation	150	60	60
Branches in China	150	14	550
Core business	International and private banking	Traditional deposit and lending	Banking, insurance and investment
Core competency	Global business network	Connection with policy-makers	Comprehensive financial service offering

Finally, end users' opinions were collected to evaluate the innovation quality and performance of the case firms. Additional interviews were conducted at D FIRM to collect the user experience with the case banks' innovation products and innovation deployment process. Under this approach, the researcher and actors were engaged in a process of communicative action in the real life world, in order to reach an understanding by 'walking the path' together and trying to reach a mutual understanding. This additional study helps identify gaps between "espoused theory" and "theory in use" (Argyris & Schon, 1978). Based on the pragmatic study approach (Calori, 2002), the various theoretical concepts are used to capture the lived experience of innovation activities at the selected firms.

To ensure the collection of high-quality, reliable data from interviews, interviewees were selected based on the notion of 'key informants' who are the subject matter experts in the innovation process. These informants included organisational actors from different hierarchical levels, functional areas, groups and locations involved in the innovation process. Interviews began with semi-structured questions and switched to a conversational manner towards the end. An informal approach allowed the researcher to explore new themes and compare empirical data from different sources. The aim was to seek elucidation and elaboration from various participants, to reveal many-faceted themes and dimensions of financial innovation in a real-case experience. The interview transcripts were mainly recorded verbatim to preserve the raw data (Patton, 1990).

Within-case and cross-case studies were conducted to analyse the empirical data collected. Viewpoints were themed and grouped to look for patterns of similarities and contrasts, as well as uniqueness, rarity and disruption. As the interviews progressed, the analysis became more systematic and structured. Empirical data were organised and grouped to represent similarities and differences. Based on the grouping, key concepts were distinguished, categorised and integrated to find new themes and interesting patterns. Finally, storylines were developed as analytic threads to unite and integrate the major themes of the study.

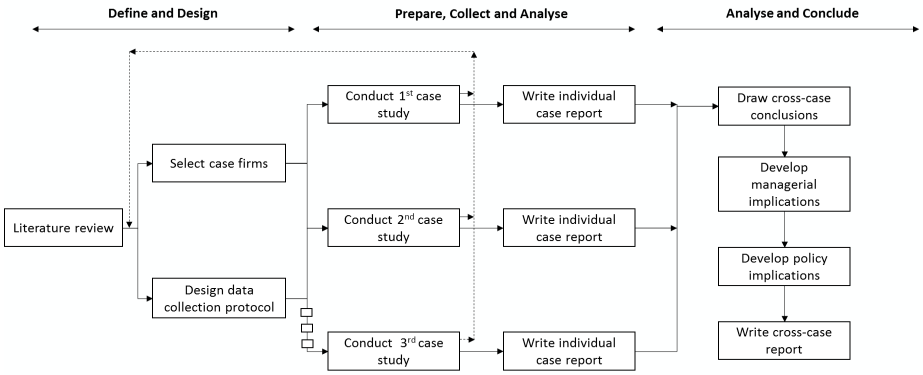

Fig. 1. The research approach and process

In the next section, three case studies on the innovation process of Chinese commercial banks are presented. Each case study begins with an illustration of the regulatory environment and business challenges facing the case bank in China. The innovation actors, key activities and processes are then analysed to present a holistic view of the innovation model adopted by the case bank.

4 Empirical studies

4.1 Case Study 1: H BANK's actor network model

China needs to open its banking sector to foreign competition in line with its commitment to the World Trade Organisation (WTO). As of December 2012, there were 42 China-incorporated foreign banks, 95 foreign bank branches and several hundred foreign bank representative offices in China, with total assets in 2012 of RMB 2.3 trillion. Some foreign banks made strategic minority investments in state-owned banks when these banks were privatised. Most foreign banks had support from the parent bank in the home country to help foster innovation, risk governance and a relationship with local authorities.

Although foreign banks have become familiar with navigating the Chinese market, they still face critical challenges.

- Regulation: excessive and complicated financial rules and regulations, limited access to the bond market and imposed constraints on capital and liquidity requirements.
- Operation: human resource issues, a complex legal environment, high operating costs and low profitability.
- Market growth: interest rate margin compression, the loss of retail customers and increasing competition from domestic banks.

Despite these challenges, the internationalisation of the Renminbi, interest rate liberalisation and relaxed regulations in free trade zones have given foreign banks new hope. To seize these opportunities, foreign banks need to establish an innovation process that can adapt to the Chinese regulatory environment yet comply with their

global innovation policies and standards. "*Regulation reformation is key to promoting financial innovation and diffusion. The Shanghai Free Trade Zone (SFTZ), for example, provides us opportunities to venture into new customer bases and supply chain financing needs. We successfully migrate mature financial products from other markets to meet the surging demand in the SFTZ,*" said H BANK's product manager.

Branches of international banks prefer to use the knowledge and experience possessed by other affiliates belonging to the identical corporate group (Martovoy & Dos Santos, 2012; Martovoy et al, 2012). By doing so, these firms only adapt services to local needs – services which were otherwise developed in a different context and without the involvement of clients (Schueffel and Vadana, 2015). H BANK manages innovation activities on a global scale, actively using international talent teams in response to local innovation needs. Having global innovation capability and local participation in the innovation activities helps ensure business process standardisation and international practice harmonisation. However, this arrangement prevents H BANK from responding quickly to volatile market conditions and changes in local monetary policy.

The empirical study shows that H BANK has adopted a global-driven innovation strategy and process. New products need to align with global product standard and the business strategy. H BANK does not promote local product development, unless there are compelling legal and market outlook reasons. Local government can significantly influence foreign banks' decisions on product innovation. "*In financial service sectors, the innovation decision is quite often affected by the relationship with the local government,*" said the business risk manager. Lu (2008) finds an interactive commitment between the Chinese government and H BANK, and this commitment relationship reduces H BANK's transaction costs by limiting the possibilities for government opportunism.

Two types of innovation communications were observed at H BANK. In global-local communication, the global team conducts a cross-market review of new development ideas, product concepts, specifications, risk controls, testing and deployment details with the local team within each business function. In local-local communication, the local team conducts domestic cross-functional coordination activities in the innovation deployment process, from domestic legal review and knowledge transfer to innovation diffusion. Although both forms of communication improve innovation engagement and diffusion across locations and business functions, having both increases the development cycle time and time-to-market. "*Over-communication can be a constraint to innovation in a large organisation such as H BANK. Our innovation operates in a multidisciplinary and matrix reporting environment. Consensus takes time to achieve when all functions are trying to avoid risk-taking. Therefore, leadership commitment is important to ensure collaboration in the organisation. Effective allocation of resources and communication with legal and regulators are critical to innovation diffusion success,"* said the bank manager.

The global team is located in the home country and has limited knowledge of the domestic market and policy framework. The local team needs to justify the innovation or modification to the global team. After the global team agrees the development priority, budget, timeline and supporting resources, the local team co-designs and co-tests the new product with the global team. The whole process is conducted in different time zones, cultures and languages. However, a multidisciplinary approach does

encourage knowledge-sharing and absorption among the actors. "*Involvement in the multidisciplinary product development team allows me to understand and leverage successful innovation practices and experiences in other markets. I learn from the global team about new product experience in other regions, and I discuss how these can be adapted to our local market. We have regular cross-functional innovation sharing sessions to learn what is happening in other regional banks*," said the customer account manager.

H BANK tends to exploit new applications of current innovation rather than explore new concepts or technologies. This indicates that innovation learning and localisation are important in H BANK. The product manager said, "*We are a conservative bank. Normally, we do not launch brand-new financial products. It is easier to add new features to the existing product groups and explain to the regulator that the new enhancements do not change the risk profile of the already approved one*." To achieve innovation deployment across business functions and locations, it is necessary to implement a global business template, standardise business processes and streamline the IT platform for global application. Technology development activities are conducted in the software house in India. The underlying idea seems to be that centralised innovation development is likely to promote product consistency, risk management, generalisability and overall cost-saving.

The following diagram illustrates the actors and their activities at H BANK in relation to the financial innovation process.

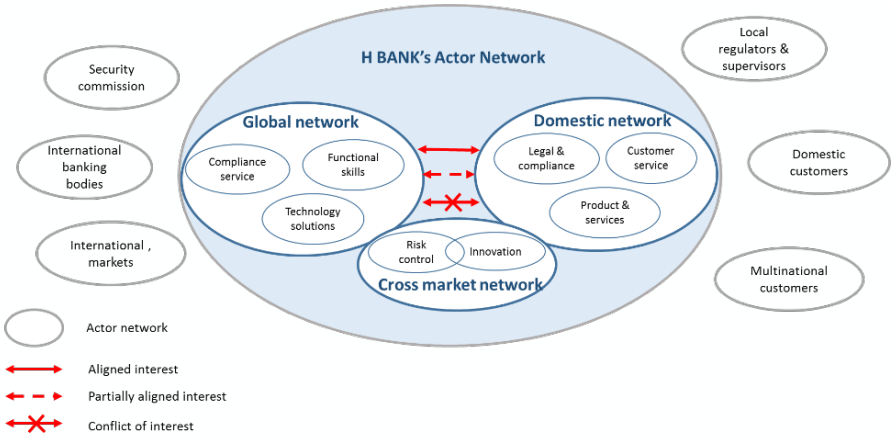

Fig. 2. The actor network model at H BANK

There are three main groups of actors in H BANK's actor network. The domestic actors are local functional teams that constantly interact with the in-country regulators, business partners and consumers. They sense changes and trends in domestic markets, understand needs and channel innovation ideas or requests to the global actors. The global actors are central policy-makers and headquarters teams that continue to liaise with international regulatory bodies, security commissions and worldwide markets. They are responsible for transforming regulatory requirements into company policy, developing in-house best practices and initiating strategic innovation. The cross-market actors are IT, legal, risk, finance and product specialists who are subject matter experts

in their own fields. They help the domestic actors group to pre-screen innovation requests, give details of innovation specifications and support innovation development.

H BANK applies an actor network model in managing its innovation. According to Callon and Latour (1981), these networks can be potentially transient, existing in a constant making and re-making. The networks of relationships are not intrinsically coherent and may indeed contain conflicts (such as regulatory dialectics). In a network-based environment, relationship supersedes formality, and therefore it is important to ensure actions conform to the interests of other clusters within the network. Involvement of different actors in the innovation process can greatly enhance innovation generalisability but also increases communication time and cost. To sum up, innovation development at H BANK shows a dialectic model in which changes are progressive outcomes of confrontation and conflict resolution among interested parties.

4.2 Case Study 2: C BANK's two-layer model

State-owned banks are large in terms of assets, branches, employees and customers., The Chinese government continues to have a strong influence over the lending practices and administration of state-owned banks, despite their being partially privatised. The board of directors and the senior bank officers are typically appointed by the Communist Party, and usually come from central government or Party agencies or one of the state-owned banks. In addition, the promotion of senior officers largely depends on Party agencies' recommendations, which makes them more responsive to the wishes of the central government than to the interests of the shareholders. Very often, central government agencies put direct pressure on bank officials to provide loans and services to specific government projects or state-owned enterprise investments (Martin, 2012). With the government as their largest shareholder, China's state-owned banks enjoy massive state support, fast growth and protection from direct competition with foreign banks. Chinese banks enjoyed high revenue growth of 13.5% compared to the 5% of foreign banks in 2014.

State-owned banks generally perceive SMEs to be high-risk, low-return clients. In general, they prefer lending to large clients such as China's state-owned enterprises (SOEs) and big private corporations, to assure repayment of loans and good relationships with increasingly influential figures in China's political system (Ma & Sun, 2009).

In recent years, state-owned banks have been facing more challenges than ever before:

- The Chinese economy is slowing down.
- The risk of economic periodic fluctuation is causing assets to undergo significant value adjustment.
- Interest liberalisation and the rise of Internet finance are squeezing profits.
- Foreign banks, privately owned banks and Internet finance firms are challenging their monopoly and power.
- Their state-like remuneration and career path make it more difficult for them to attract and retain talent.
- Their innovation capability and risk management mechanisms generally lag behind the market.

"In China, most of the financial market products introduced over the years came from Western banks. I have worked in the industry for 28 years, at different banks in China, and although I say this in connection to C BANK, I think that all of the Chinese commercial banks have the same problem with innovation. Our clients also have more and more sophisticated financial service needs, not just limited to loans and deposits," said the division manager.

Most of C BANK's innovations are found to support government policy implementation, such as financial inclusion, farmer financing, sustainable development and corporate social responsibility. As one of the largest employers in the country, C BANK assumes a social responsibility to ensure a healthy level of employment and financial and economic stability in the country. It continues to expand financing according to policy direction, and is gradually developing its innovation capability to meet the requirements of the new business landscape. As a result, business strategy and performance may not be fully oriented to profit maximisation.

However, in recent years the government has begun to reform the banking system, moving toward a market-oriented economy. More financial innovation from local banks has emerged as a result of deregulation. For example, in December 2006, CBRC requested that local banks, especially state-owned banks, increase their share of non-interest income (which generally accounts for over 50% of total revenue in major international banks, but less than 30% in Chinese commercial banks) through innovation.

Foreign strategic investors have played an important role in C BANK's innovation capability by transferring knowledge of advanced banking practice, product design and risk governance to their Chinese counterparts. Collaboration between C BANK and its strategic foreign investors in quality systems, risk governance, IT platforms, international banking and data analytics has strengthened C BANK's innovation capabilities. *"Through strategic programme partnership, we have been exposed to international banking practices and advanced financial instruments R&D. We consider that implementing modern corporate governance practices is central to achieving our objective of becoming an internationally competitive and modern commercial bank. We recognise that innovation is the way forward for the industry, and it plays a key part in the growth journey of the bank. We are committed to continuing to enhance customer experience and bring added value to our clients through financial technology adoption,"* said the bank manager.

Instead of engaging in costly radical innovation, C BANK prefers to copy mature foreign products or enhance existing products to make them more consumer-oriented and localised. C BANK, however, also engages in brand-new product development when it needs to support government policy implementation. As the product manager said, *"When we are a follower, we focus on enhancing the product features of other banks' innovation. When we are an innovator, we have to carefully plan and manage the innovation product lifecycle. The design, flexibility and sustainability of an innovation can create market differentiation and help enhance the bank's innovation capability."*

Based on the empirical study, organisational trajectory, bureaucracy and a hierarchical, risk-adverse culture are found to be restricting C BANK from radical innovation. Employment in state-owned banks is considered safe and secure, and therefore no one

wants to risk their career path for risky innovation. The incentive system in state-owned banks is loyalty-based and does not encourage creativity. Everyone tends to play safe and apply the principles of 'more control is better' and 'sign-off practice' for collective responsibility in the innovation process. Most state-owned banks generally lack sales support, product packaging, customer care and internal coordination across branches and departments in innovation diffusion, compared to international banks. "*State-owned banks should continue to enhance their IT capability and market service mindset. IT is important as an innovation designer and executor,*" said the customer care manager. As a state-owned bank, C BANK is subject to government control over its operations and leadership appointments. As a listed entity, it has financial fiduciary responsibility to shareholders and customers. C BANK needs to balance these agency issues and stakeholder responsibilities in its operation and innovation model.

The following diagram illustrates the different actors and their activities at C BANK in relation to the financial innovation process.

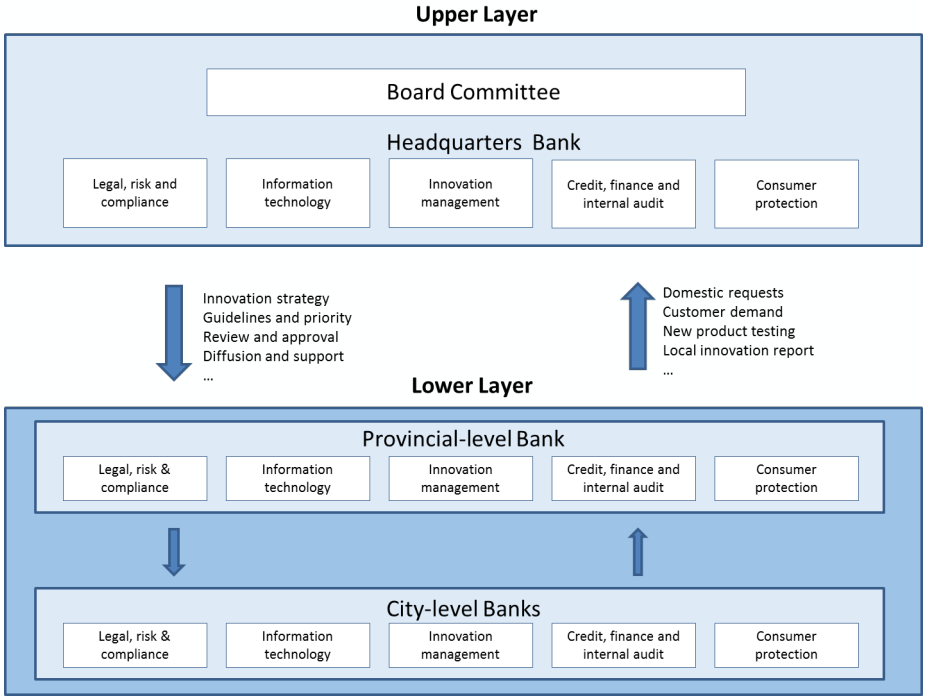

Fig. 3. The two-layer model at C BANK

The upper layer represents the board committees and the product R&D team at headquarters (HQ) that are responsible for interpreting government policy, establishing an innovation roadmap, overseeing innovation development and allocating innovation resources. The lower layer represents provincial banks and team members who participate in the innovation process on a selective basis and are responsible for providing market insights and testing the product before launching. Their involvement helps validate the product conceptual design in the early stage of development and allows the R&D team to hear the voice of customers.

Strategic and nationwide innovations (related to regulatory changes and international banking) are initiated and constructed at HQ. Provincial and municipal banks may also engage in innovation activities based on guidelines from HQ. These innovations are generally developed to support the municipal government's domestic economy and financial policy. They are, however, confined by the existing product category and approval from HQ.

There are two types of innovation communication at C BANK. In top-down communication flow, long-term innovation goals, intentions and roadmaps are translated into operation goals and communicated down to drive collective actions with a minimum of discretion (Burgelman & Grove, 2007). Messages from the top provide broad direction. Lower-layer staff autonomously undertake specific actions that serve domestic needs. Slack and Lewis (2011) describe this process as "*objectives and actions, at least partly by the knowledge it (organisation) gains from its day-to-day activities*" (p.13). Bottom-up communication is upward reporting and innovation ideation: collecting information on market trends and customer needs, conducting business case analysis and providing innovation suggestion to upper management. Additional control features are suggested and added to the innovation by upper management, to mitigate risk. The resulting innovation outcomes can be significantly different from the initial proposals, after multiple rounds of managerial review and functional modification. The new products sometimes can be too conservative and therefore lack creativity and commercial value. "*Perhaps we should look into some mechanism, such as new product insurance or a financial laboratory test, to protect the bank's risk (consequential loss) and yet encourage creativity in the innovation process,*" said the product manager.

The innovation process at C BANK is characterised by pro-government policies, centralised control and a top-down function-based governance structure. This innovation model enhances R&D efficiency, but also leads to increased diffusion costs, due to a lack of cross-division coordination. The layered innovation model is suitable for C BANK: the innovation process is rational, well documented and collectively accounted for. Innovation at C BANK shows a lifecycle model that prescribes a series of planned activities grouped into stages or phases. People at C BANK proactively adapt to their environments and make use of rules to accomplish their goals.

4.3 Case Study 3: P BANK's iterative loop model

A joint stock commercial bank is owned by several large investors. These investors can be local private companies, foreign banks or companies, local government (or its agencies) or individual investors. A joint stock equity structure means that several key investors must collaborate to formulate the bank's market strategy, development plan, product profile, customer policies and innovation roadmap. It is similar to the idea of a joint venture, where two or more key strategic partners collaborate to create a new company, product or service, or to enter a new market.

By opening up ownership and control to outsiders, a commercial bank can leverage the know-how of its strategic investors to develop new market strengths and innovation capability. Joint stock banks are considered more open and innovative than state-owned or foreign banks. This is because of their flat organisational structure and lean operation, which can promote innovation and profit optimisation. Fu and Heffernan

(2007) assess the impact of different ownership types and bank performance on X-efficiency (the ability of a firm to get maximum output from its inputs) in 14 key banks (1985-2002), and find that on average joint stock banks are more X-efficient than state-owned banks. Similarly, Yao et al (2007) use panel data on 22 state-owned and non-state banks in China for the period 1995-2001. They find that two factors have a significant impact on the level of efficiency: ownership characteristics and equity/asset ratio. On average, non-state banks outperform state-owned banks by 8-18% in terms of profitability.

However, joint stock banks face challenges in loan and resource allocation (Martin, 2012):

- Continued presence of local government or its agencies, with direct and indirect means to influence the operation of the banks.
- Pressure from private stockholders to provide preferential treatment to their companies, their families and/or their friends.

Two types of innovation are found at P BANK – group-driven and local-driven. The former refers to breakthrough, strategic and cross-functional innovations which are centrally managed and coordinated by the group. A centralised innovation process allows ideas to be prioritised, resources to be best allocated and new technologies to be invested in long-term evolution. The latter refers to incremental, operational and single function innovations which are domestically developed and deployed to meet local or specific market needs. A decentralised innovation process allows speed-to-market and local partnership for quick wins and market penetration. To encourage grounded innovations, the group also organises an annual innovation competition to select and promote top innovations to roll out to other markets or business units. The core idea is to avoid repeated investment and fully exploit existing innovations for new markets, new customers and new uses.

As a financial conglomerate, a rich product portfolio is fundamental to P BANK's diversified customers and markets. Including related business entities in the value chain (banking, insurance, credit guarantee, investment, security and financial asset exchange) of the innovation planning process helps align innovation priorities, avoid competitive or repetitive development, and ensure a structured product catalogue to unearth business synergy from a shared customer portfolio and IT platform. The bank manager said, "*P BANK's innovation is to fulfil the comprehensive business needs of its large customer base across different service lines. The integrated or bundled financial products help us to improve our customer loyalty and customer lifetime value, which is a measurement of the total expected revenue from a customer over their entire relationship with our firm. For example, trade finance can bring terminal market customers to the bank. Credit cards bring insurance customers to the banking business. Micro-financing can integrate trade finance and credit card customers together in a single platform*."

Financial conglomeration also poses new challenges to the Chinese financial supervisory framework, which is segregated by financial industry type. For example, the China Banking Regulatory Commission (CBRC), the China Insurance Regulatory Commission (CIRC) and the China Securities Regulatory Body (CSRC) separately supervise banks, insurance companies and securities firms respectively. The

development of mega-banks is a new trend in China, with traditional commercial banks beginning to consolidate other non-bank financial offerings or venture into new areas of business such as e-commerce. Supervisory functions need to evolve to address increasingly open and IT-oriented banking operations.

Instead of the conventional sequential model, for speed-to-market P BANK adopts a concurrent engineering (Nonaka, 1990) approach to innovation. The innovation phases loosely connect, overlap, expand and contract with some elasticity in member or functional diversity. In a parallel processing set-up, internal conflicts may occur, which trigger innovation objectives and specifications to revisit and redefine regularly. Group identity is developed through knowledge sharing and constant interaction. When knowledge is shared within a cooperative and tight-knit relationship, scepticism is normally perceived as less hostile and good ideas are generally well received. This reduces barriers to innovation and creative ideas. The following diagram illustrates innovation activities at P BANK.

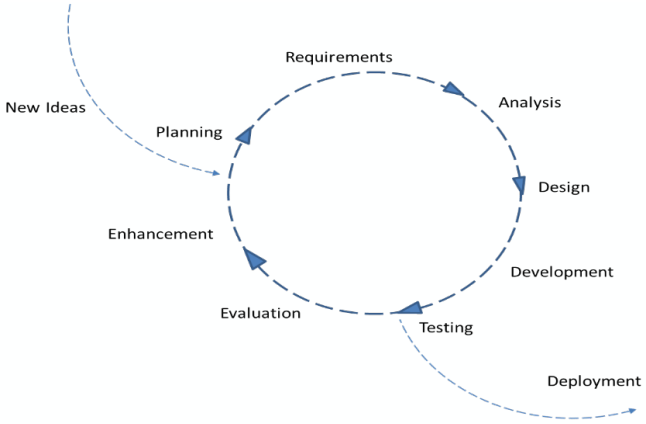

Fig. 4. Iterative loop model at P BANK

Business groups at P BANK initiate an innovation proposal by submitting a business case. The innovation process at P BANK begins with a new idea entering an iterative development loop. The loop comprises ideation, planning, requirements clarification, analysis and prioritisation, conceptual design, product development and testing activities. After successful testing, the innovation is deployed in the market. The product team continues to observe and evaluate product performance in the market. Some minor adjustments may be needed to generalise the product, in order to meet larger market needs. Over time, the product team accumulates feedback and enhancement requirements from front-line staff and key customers. Once significant enhancement needs have been justified, the product goes into a second loop. This loop entails multidisciplinary team involvement, multidimensional coordination and communication, elastic and cooperative development, continued product perfection and risk governance.

Speed to market is prioritised over product functionality in the initial launch. The product development manager said, "*P BANK continuously learns from and with customers, moving away from a product focus to a total concept focus – one customer, one account, multiple products and one-stop services – where activities are conducted*

in parallel by cross-functional teams." This innovation model enables P BANK to rapidly construct a prototype within a short timeframe. It helps the product team to evaluate product design, user experience and market acceptance at an early stage. Each iterative development loop adds new features to the product and improves its overall quality and performance. However, iterative development may increase communication time and cost. The concurrent working team must have tacit knowledge of the other functions before it can contribute to the development. There is a great deal of training and coordination before development speed can pick up.

The innovation process at P BANK features multiple business groups, elastic phases, value chains and iterative loop-based innovations. The advantages are rapid development time, leverage of existing competencies and a flexible workforce. However, there are challenges in the informal coordination between phases, execution risks if formal planning is superior to informal negotiation or adjustment, and political risk if the informal process kills the formal process. Management needs to exercise extra care to allow increased mutual adjustments, additional explaining and redoing, the sourcing of suppliers and clients, and the development and stabilisation of relations (Romelaer, 2015).

The iterative loop model is suitable for P BANK, as the innovation decision is coordinated, interactive and fast-tracked to meet market needs. Innovation development at P BANK shows an evolutionary model in which change is a repetitive sequence of variation, selection and retention events among entities in the population. "*A greater number of diverse variations are more likely to produce innovations than a process that generates a small number of homogeneous variations*" (Van de Ven and Sun, 2011).

5 Discussion

Most researchers agree that the innovation process does not "unfold in a simple linear sequence of stages and substages. Instead, it proliferates into complex bundles of innovation ideas and divergent paths of activities by different organisational units" (Van de Ven, 1995). Also, as Poole (2004) puts it, "*… managers and change agents should realise how difficult change and innovation are to script and manage, as these processes constantly move in unexpected directions and are driven by dynamics that are either too powerful to control or too subtle to understand*." Based on the empirical study, the innovation process adopted by Chinese banks shows a variety of models and interesting themes.

Table 3. Cross-case analysis: commonalities and differences

Comparison	Commonalities	Differences
Innovation approach	Multidisciplinary team using a project management approach	H BANK: International connectivity C BANK: Government policy implementation P BANK: Business and client synergies

Comparison	Commonalities	Differences
Innovation process	Generic process consists of ideation, conceptualisation, evaluation, development, testing and diffusion	H BANK: Globally consistent process C BANK: Top-down process P BANK: Concurrent and integrative process

Based on the empirical analyses, Chinese banks use a multidisciplinary project team to develop financial innovations. The project manager and core team members are usually full-time staff from the function(s) responsible for leading the innovation process. Representatives and subject-matter experts from other supporting functions are involved as needed. In the innovation process, H BANK emphasises the ability to gain adequate market insights, identify key customer segments and develop customer-centric solutions. To leverage global innovation competencies, a consistent innovation approach with minor adaptations for local regulatory compliance is applied at H BANK. C BANK focuses on comprehensive requirements collection, alignment with government policy and the bank's market proposition. For C BANK, it is important to support government policy implementation and fulfil its social responsibilities as a state-owned bank. P BANK prioritises speed-to-market and an integrated solution approach for its insurance, banking and asset management businesses. The integrated approach helps P BANK to develop innovative solutions that can maximise its business and client synergies in the value chain.

Based on the above findings, it seems that innovation approach is largely influenced by a bank's ownership, organisational culture and operation priorities. However, a multidisciplinary project team and organisational complexity also lead to inefficiencies such as inter-team conflict of interests, excessive communication to align objectives and tasks, overlapping duties and unclear responsibilities, and complexity in managing relationships and coordinating work. "*Sometimes we spend too much time talking, instead of getting the work done,*" said the product manager. This study finds that functional diversity facilitates a more open innovation process with integration of knowledge from different functional disciplines, whereas functional similarity facilitates an in-depth innovation process where competence in a deep sense within a single or limited discipline enhances knowledge breakthrough.

Compared to P BANK, C BANK and H BANK are more risk-averse and conservative when dealing with innovation. Mangers in H BANK and C BANK display risk-avoiding behaviour, with risk-taking considered unwise. These managers avoid taking risks, in order to protect their jobs. Bureaucracy and a hierarchical decision-making process result in managers being afraid to make mistakes that may lead to political scapegoating. They err on the side of caution, being more stringent and adding extra scrutiny measures to the innovation process. As a result, the approval process becomes more complicated and lengthy. The additional control requirements lead to the innovation losing some of the flexibility and user-friendliness of the original proposal. Some of these controls are not necessary to protect financial consumers.

All three processes analysed above have common features encountered in any financial

innovation process: ideation, conceptualisation, evaluation, development, testing and diffusion. What is new here is that we see that in the same industry, here banking, the processes have original features that seem to be related to the property regime and organisation of each bank. For example, H BANK establishes an innovation network with multiple levels, and different clusters come together to act as a whole. H BANK leverages its international connectivity and global competency in innovation learning and deployment. Actions taken by domestic actors include implementing consistent business models, re-engineering global functions and processes, and streamlining the IT platform for effective diffusion in the local market. C BANK, on the other hand, has a bureaucratic and hierarchical organisational structure that supports a rational decision-making process. Pro-government policy, centralised, top-down control and conservatism are dominant and embedded in the organisational culture of state-owned enterprises like C BANK. To enable a top-down innovation process, it is important to develop an innovation strategy and roadmap, policy and procedures and broadly communicate them to the entire bank. What is interesting at P BANK is an integrated business model that emphasises a total business concept for customers, services, distribution and product integration. Innovation at P BANK entails cross-disciplinary action and high levels of integration at both intra- and inter-firm level, through open innovation with external partners, alliances and vendors. The overall objective is to build an integrated finance business ecosystem by leveraging P BANK's large customer base in the insurance business.

Therefore, we can say that innovation is a dynamic system that responds to severe market challenges and regulatory constraints or pressure. Innovation is a continuous change management process which is often messy and chaotic, striving to succeed amidst the complex silos in financial institutions. A successful financial innovation process encompasses myriad strategic and operational changes, involving modifications to processes, technologies, workflows, distribution channels and service deliveries. For example, financial innovations largely depend on ICT for development, discourse and delivery. Product concepts that seem promising but cannot be developed without major changes in information systems become an innovation constraint. For example, C BANK's legacy IT system constrained its innovation capability. It failed to meet the business needs of the new Internet finance regime. In 2015, C BANK did a major upgrade of its banking system to provide mobile technology-enabled e-banking and self-service offerings.

The case studies find that there is no one-size-fits-all innovation model. The innovation process is specific to business strategy and organisational trajectory. Therefore, firms need to diligently select and adopt an innovation process that matches their operating environment, innovation maturity, organisational structure and behaviour. As our three banks have different ownership regimes, we could at this point be under the impression that ownership dictates the nature of the innovation process. However, things seem to be a bit more complicated. The bank ownership structure strongly influences innovation strategy, approach and process. An innovation strategy that has a strong relationship with the state can offer protection and influence competitive intensity. Finally, regulatory and economic conditions may also influence the incentives for innovation. Lack of patent protection has also resulted in banks not being motivated to invest in product innovation. Instead, process innovation can create a more sustainable

comparative advantage for banks. The majority of financial innovation activities are conducted sequentially, though some activities can run in parallel.

6 Managerial and policy implications

Innovation is a coefficient result of exogenous and endogenous drivers. Exogenous drivers are government policy, market competition and customer demand that can be manipulated by the authorities through regulation. As a regulated industry, bank operations are sensitive to government policy direction and political agenda. Government can impose restructuring requirements to consolidate players or relax regulation to induce competition. Customer demand is affected by regulations on financial products, services and capital controls. Financial innovation is costly, time-sensitive and risky. Regular regulatory dialogues, cross-checks and exchange of information help banks to pre-empt policy change and adjust their innovation strategy accordingly. Endogenous drivers include organisational set-up, performance pressure, organisational culture and incentive system. Organisational ownership, size, structure and diversification have significant effects on a bank's approach to innovation and related strategies. Innovation strategy is also affected by a bank's path dependency and leadership. Pro-innovation leadership, an open business culture and a performance-based incentive system help promote creativity and innovation. The above findings enrich the linear innovation model by connecting the innovation drivers to the innovation process through the selection of an appropriate innovation strategy.

Customer insight is found to be a key contributor to the financial success of an innovation. Besides policy changes, banks need to monitor fast-changing customer needs and build their ability to meet these increasingly sophisticated demands with more customer-centric products and easy-to-use features. Engaging customers in the innovation process is, however, easier said than done. Most banks still rely on an in-house research department, external consultants and customer relationship managers to collect customer feedback for innovation. Some banks have started to collaborate with IT firms in big data analysis to improve their products' conceptual design and end-user usability for targeted customer groups or segments, based on identified customer attributes and transaction variables (van de Vrande et al, 2012).

Organisational trajectory is found to be a key constraint to financial innovation. High compliance costs, complex hierarchies, legacy systems and IT bottlenecks also affect the scope and openness of innovation. The organisational structure and historical constraining issues, according to Vermeulen (2004), are organisational trajectories whereby individual actors have a certain amount of freedom to act, but not everything is possible due to the restrictions imposed by the history of the trajectory. Existing monopolies and competencies can hinder innovation due to path dependence and competency traps (March, 1991; Levinthal and March, 1993). Managers must proactively adapt to their environments and make use of rules to accomplish their goals. It is common in China to have trial procedures before a formal change is put in place. Managers collect operational data to improve and formalise the trial procedures. A more permanent solution or formal policy and procedure is then established, based on the trial run results and implementation feedback.

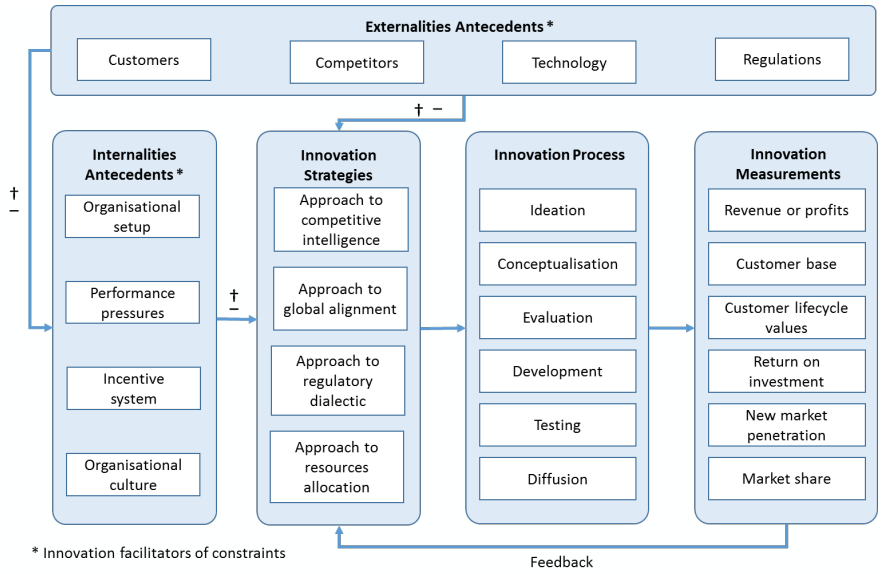

Fig. 5. An integrated approach to innovation in financial services

Applying an integrated framework can help managers to maintain a holistic view over the innovation process and outcome. The framework covers four dimensions: innovation antecedents, strategy, process and measurement. Innovation antecedents or drivers are further divided into two key types: externalities and internalities. The antecedents can have a positive or negative impact on a firm's innovation strategy, process and performance. Innovation professionals must conduct comprehensive environmental screening to identify the influential antecedents – antecedents that have a significant impact on the firm's innovation in terms of compliance, opportunity, resource allocation, market share, financial performance, customer segments and competitiveness advantages. Failure to identify and take proactive action to adjust the firm's innovation strategy may lead to innovation failure, regulatory punishment, negative financial impact and loss of market share. Besides observing and monitoring the trends and movements of the antecedents, innovation professionals can develop programmes to adjust the antecedents in order to build positive momentum or energy in the innovation process. For example, in P BANK, through adjusting the incentive system, establishing strategic alliances and investing in ICT technology, new inventions created new opportunities for the firm which would not have existed with a 'do-nothing' strategy.

Innovation strategy is closely linked to antecedents and a firm's business strategy. There are three key components of innovation strategy: alignment with long-term business strategy, approach to regulatory dialectic and resource allocation policy. For example, H BANK adopts a 'trusted foreign friend' approach to financial innovation in China. This means the approach to regulation dialectic is to follow and support Chinese policy direction, which leads to a risk-adverse innovation strategy in China with an overall theme of engaging in regular dialogue with regulators, formal or informal, to make sense of the political direction.

Innovation process management consists of ideation, conceptualisation, evaluation, development, testing and diffusion. The innovations can be new products, services, channels, processes, business models, etc. For different types of innovation, the focus of the innovation stages can be significantly different. For example, product and service innovations involve all the stages and have multi-disciplinary participants from different functions or hierarchical levels. Channel innovation, on the other hand, is likely to focus on diffusion and commercialisation. Business model innovation likely involves strategic partnerships, expansion into new business areas and a comprehensive business case review. To measure the success of innovation, banks apply a combination of measurements, which can be general or specific; financial or non-financial; quantitative or qualitative; short-term or long-term performance indicators. Revenue, profit margin, investment return, customer base increase, asset and liability balance, and customer lifecycle value are found to be the common key performance indicators in the financial industry in measuring innovation results.

Regulation is a mounting concern across many industries, particularly those directly affected by healthcare reform, financial legislation and environmental changes. The integrated approach to innovation helps practitioners in highly regulated and innovation-driven industries, such as financial services, healthcare, automotive, pharmaceutical and life science, to effectively manage regulatory risk when engaging in innovation activities, in order to ensure both process and outcome compliance. This approach is also applicable to technology-driven industries where a firm's institutional arrangement and institutional environment are subject to rapid change and have strong influences over its innovation strategy, process and outcomes.

A key challenge for policy-makers is to strike the right balance between regulation and innovation – to regulate financial market operations without stifling innovation. The basic assumption is that innovators continuously take advantage of regulatory loopholes to innovate, whereas regulators close the loopholes by tightening the regulations. Based on Kane's (1977) regulatory dialectic, banks always search for new modalities to circumvent the regulations that affect their profitability. The conflict is intensified by the rapid development of the Internet finance economy in China, which includes the rise of online payment platforms, P2P lending platforms, online distribution of financial products and crowdfunding.

In this regard, Chinese regulatory bodies should consider the following measures in addressing the regulation dialectic:

1. **Online and offline integrated supervision.** Using cloud computing, big data and advanced data analytics techniques, regulators can obtain real-time innovation and compliance data from banks' systems. Advanced risk modelling can be developed to analyse and monitor banks' online and offline risks. Small and Micro Financial Services Group (2014) envisages that the regulatory framework will eventually transform into one that is real-time and interactive, similar to the financial big data flowing within, and that focuses on the lifecycle of data, namely its generation, transmission, usage, etc.
2. **Principle-based, rather than rule-based, approach to supervision.** Chinese financial laws and regulations are complex and issued by different regulatory bodies. A principle-based approach is more flexible, to accommodate the continuing evolution of financial instruments and risk. Limiting regulations to

core principles and producing strong guidance rather than complex rules would be a significant step in this direction.

3. **Single regulator across banking operation jurisdictions.** The Chinese financial system is divided and regulated by multiple jurisdiction bodies. There are duplicated, conflicting or vague requirements from different regulators. More importantly, unclear responsibilities also result in unsupervised areas of bank operations. Chinese regulators should adopt a lead supervision model whereby a single regulator, usually the regulator responsible for a bank's core business activity, is responsible for the overall supervision of a bank. This should enhance cooperation and supervision quality across jurisdictions, with overall oversight being the responsibility of the lead supervisor.
4. **Prudential and conduct supervision integration.** The implementation of holistic business conduct supervision and consumer finance protection is relatively new for Chinese policy-makers. Advanced countries tend to integrate to a greater degree their financial sector supervisory structures. Improvements in overall public governance would also help drive Chinese regulators to adopt more integrated supervisory arrangements.
5. **Useful disclosure instead of over-disclosure.** Transparency is better achieved by the clear presentation of important information than by large amounts of raw data. Providing data without insight is potentially dangerous and could undermine the safety and soundness of individual banks and the industry as a whole in a volatile market. Regulators should encourage banks to provide the right, interpreted information to the public, instead of supplying excessive information.

7 Limitation and future research

The case studies focus on traditional commercial banking in China; therefore, the generalisability of the findings for other financial service sectors (such as Internet banking, trusts, asset management and securities) and other regulatory environments is limited. Also, a sufficient number of cases has to be evaluated in terms of the research questions and with regard to existing knowledge. With fewer than four cases, it is often difficult to generate a theory of much complexity, and the empirical grounding is likely to be unconvincing unless the case has several mini-cases within it. Also, data collection was principally based on interviewees, although triangulation was undertaken wherever possible by taping interviews, using two complementary methods for data collection, consulting internal documents and secondary data, and by observing the innovation in practice.

The author suggests that future research could enlarge the unit sampling to include privately owned, rural cooperation and Internet banks in different regulatory environments or countries. New forms of financial services, including cryptocurrency, Internet cloud banking, peer-to-peer lending, third-party payment platforms, online financial markets and asset securitisation, should also be considered in future research. Finally, the unit of analysis should consider different forms of innovation in banking, and where possible the integrated approach to innovation should be tested and validated in further research using a quantitative study approach.

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Journal of Innovation Management
JIM 5, 2 (2017) 111-138
HANDLE: http://hdl.handle.net/10216/105431
SM: Nov/2016 AM: Jun/2017

Sticky Transformation
How path dependencies in socio-technical regimes are impeding the transformation to a Green Economy

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Abstract. Many works in innovation research use path dependencies to explain the fact that change is often difficult to achieve. With regard to a transition to a Green Economy, this paper identifies specific path dependencies in 15 areas of transformation in the sectors of mobility, food, housing and raw material in Germany. In total, 30 subtypes of technological, economical, organizational, user-specific and legal path dependencies were identified and included in the analysis. One of the overarching observations is that for a successful transition to a Green Economy, the role of the state seems to be central. In many areas of transition, supposedly transformative regulation is full of loopholes and does not work, as special interest lobbying prevents the democratic implementation of effective, path-changing regulation.

Keywords. Evolutionary economics, path-dependency, transformation, transition, Green Economy.

1 Introduction

Many works in innovation research use path dependencies to explain the fact that change is often difficult to achieve, especially with regards to transformation to a Green Economy. The vast majority of contributions explain path dependencies as a primarily technical phenomenon. The historical typewriters QWERTY keyboard (Paul A. David, 1985; Liebowitz, 1995) and the video cassette systems Betamax and VHS (Vergne & Durand, 2010) are often taken as examples. However, path dependencies go far beyond technical lock-ins. The project "Evolution2Green" has the interim target to analyze essential obstacles to transformation with a particular emphasis on socio-technical path-dependencies in 15 diverse areas of transformation in Germany.
The ultimate aim of the project is to identify essential prerequisites for successful path changes and to compile best practices for the transformation to a Green Economy. The main objective of this paper is to identify concrete manifestations of path dependencies with a focus on fields of transformation towards the political objective of a Green Economy (BMU & UBA, 2012; UNEP, 2011).

ISSN 2183-0606
http://www.open-jim.org

2 Theoretical Background

In a routine path, considerable ties are generally at work that stabilize it over long periods of time and can make it highly resistant to changes of any kind. A deviation from the path becomes highly difficult and competing paths can be locked out. Evolutionary economics applies the concept of path dependencies to analyze and explain both the ties and the forces locking out alternatives (Nelson, 1987; Nelson & Winter, 1982). In this context, Gavetti and Levinthal (2000) differentiate between dynamics directed backward and building on experiences on the one hand and dynamics directed forward and supported by cognitive assumptions on the other (Gardini, Hommes, Tramontana, & de Vilder, 2009; Gavetti & Levinthal, 2000).

Nill (Nill, 2009; Nill, Sartorius, & Zundel, 2005) clearly distinguishes between lock-in in the case of competition between an incumbent technology and a new solution ("old/new competition") on the one hand and competition between two new technologies ("new/new competition") on the other. Path dependencies in the case of competing new technologies have been analyzed to explain lock-in, which may be driven by increasing returns and even happen in the case of not necessarily superior alternatives (Arthur, 1989). Through contingent events, one of the alternatives may get an initial advantage and later on dominate the market. Others study path dependencies with regard to competing new technologies in the phase of niche formation (Nill, 2009) and niche management (Kemp, 1994).

David (2000) intensively works on definitions of path dependency. Vergne and Durand also introduce a formal definition of path dependence distinguishing between path dependence and other 'history matters' kinds of mechanisms, linking cases of path dependence to stochastic processes, contingency events, self-reinforcing mechanisms and lock-in (Vergne & Durand, 2010, p. 741). Garud et al. (2010) systematically discuss and reject Vergne and Durand, opening the space for a discussion of path creation mechanisms. It must be admitted that the process they describe as path creation (Garud et al., 2010; Karnøe & Garud, 2012) very much overlaps with entrepreneurship research (Casson, 1982; Schumpeter, 1983) and works on the social networks of entrepreneurs (Aldrich & Zimmer, 1986; Jarillo, 1988) as well as the idea of cluster formation (Kärcher-Vital, 2002; Porter, 1998), which Ketels and Protsiv (Ketels & Protsiv, 2013) empirically apply to sustainable development.

In order to maintain the operability and policy relevance of the concept, in this paper, path dependency is very broadly defined as follows:

> *The term "path dependency" describes that an event is dependent upon previous events and patterns of activity. The concept of path dependency states in general that earlier events in the chain of events A, B, C, D, E ... have a causal effect on later ones.*

This definition was chosen while keeping in mind that the analysis based on this definition shall identify path dependencies with a focus on cases of "old/new competition", where generally speaking, an old non-sustainable technology or solution competes with a new, more sustainable technology or solution. The definition is much broader than that used e.g. by Vergne and Durand and might include effects which others may label more generally as obstacles.

In the literature that deals with path dependencies, different kinds of feedback-loops and self-reinforcing effects are discussed (Lehmann-Waffenschmidt & Reichel, 2000, p. 349)—yet in many cases, no systematic distinction between different types of path dependencies is made. This would be important to better understand opportunities for deliberate change and innovation. An interesting example of a more differentiated, systematic approach is found in Nill (2009, p. 138), who distinguishes six types of lock-in amplifiers (translated by the authors):

1. "Irreversible investments in the established technology,
2. switching costs due to technological complementarities,
3. uncertainty about the quality of the new technologies,
4. set-up costs of the new technology,
5. coordination problems among the actors promoting the new technologies, and
6. institutional barriers to change."

Unruh (2000) puts path dependency in the context of technological systems. Lock-in arises when inter-related components of a system develop a high value for the users as well as for producers and express themselves in specific and often very stable production and consumption patterns. As an example for a technological system Unruh (2000, p. 822) mentions cars and personal transport, including supply industries, petroleum production and distribution, rubber manufacturers and road builders into a broader system, which is bigger, has more power and is harder to change than an individual technology. The long-term stability of such a system is reinforced by the fact that firms are bound to the dominant design trajectory focusing on small-scale innovation to optimize their products and are rarely the source of radical innovation. Since incumbent firms usually generate higher profits and cash flows than possible competitors with new (sustainable) products, they have better access to capital to fund their investments, thus further exacerbating the lock-in conditions. Besides the resulting differences in available endogenous capital, the availability of external funding follows the same dynamic. Financial institutions are risk averse in their lending practices and more prone to invest in the established path than in competitors with new and less proven products (Unruh, 2000, p. 823). This dynamics has an important impact on basic sustainability innovations sincs Fichter and Clausen (2013, p. 275) found, that the majority of basic innovations are generated by new companies, whereas established companies develop the majority of incremental innovations and use them to extend the paths of their existing products.

When the system grows in size, industry associations and unions form and eventually merge their interest. Users are also bound to the system, since the high practical value of the systems services evolves in behavioral institutions and social norms. The main types of path dependencies to be drawn from Unruh are:

- A successful technical system which has evolved over time and includes physical, social and informational elements,
- producers of the dominant design owning their production facilities and making profit, with the long term effect of thinking only in the dominant design trajectory,
- industry associations and trade unions profiting from the established path and lobbying for their interest,

- users of the dominant design, owning the respective products and bound in the daily routines and cultures of using them.

Unruh uses the case of electric power networks to give an overview of underlying system dynamics. Public institutions play a specific role in the view of Unruh. While the above mentioned path dependencies are all elements of a market logic (similarily described by Kirchner (2008)), in which a stable interplay of actors are profiting from specific production and consumption patterns, public institutional policy may override the market logic (Unruh, 2000, p. 324). When such institutions are established, they tend to persist for long periods of time. Lobbying efforts by incumbent regime actors often make use of this dynamic to protect and prolong established paths from changing market conditions. However, for certain reasons government might choose to use its regulatory power to change a path. Such reasons might be national security or public safety, the provision of a universal service to everybody or cases of so called natural monopolies (Unruh, 2000, p. 325). Even in cases of a very successful technological system, detrimental effects on the environment might be a reason for government to change policy in a path changing way. It might be hypothesized that the actors of the established path would try to prevent government from doing so and if they do not succeed, to at least prevent it from implementing regulation which would really be effective in changing the path. Consequently, Nill (2009, p. 471) uses the notion of "path-effectiveness" to evaluate path changing policy approaches.

In this paper a first rough delineation of different types of path dependencies will be used, mainly building on the work of Unruh (2000) and a contribution by Fichter and Clausen (K. Fichter & Clausen, 2016; 2013, p. 90). The following main types of path dependencies will be distinguished:

- Technological path dependencies generated by a lack of complementary or alternative products or infrastructures,
- Economic path dependencies resulting from economies of scale and associated fixed capital investments,
- Organizational path dependencies resulting from process routines, procedural requirements, or corporate culture,
- User-specific path dependencies based on perceptions of uncertainty, behavioral routines, and cultural norms,
- Legal path dependencies based on laws, subsidies, technical norms, and approval requirements with a focus not only on the legal basis of the stability of the dominant path but also examining existing policy activities aiming at a path change.

3 Scope and Method

Based on focal areas of the Federal German Sustainabilitry Strategy (Die Bundesregierung, 2016) the analysis presented in this paper is carried out with a focus on the transformation areas of mobility, food and agriculture, energy and housing as well as raw materials. We choose areas in which progress towords sustainability is so far limited. The regional focus is Germany.

The paper strives to analyze essential constraints to the transformation processes

towards a Green Economy with particular attention to path dependencies in a broad spectrum of 15 transformation fields, which have been determined on the basis of a pre-study and a discussion in an expert workshop.

For each of the 15 fields of transformation a concise paper has been written wich is based on a literature analysis as well as four to six expert interviews. These areas are car drive systems (Clausen, 2017a), streets (Clausen, 2017b), alternative modes of individual transport (Korte, Göll, & Behrendt, 2017) and end-of-life vehicle recycling (Tappeser & Chichowitz, 2017c) in the area of mobility, meat consumption (Clausen & Mathes, 2017), nitrogen use (Tappeser & Chichowitz, 2017b), pesticides (Tappeser & Chichowitz, 2017a) and green infrastuctures (Tappeser, Kohlmorgen, & Marden, 2017) in agriculture and food, district heating (Clausen, 2017d), heating based on renewables (Clausen, 2017c) and heat insulation of buildings (Tappeser & Chichowitz, 2017d) in energy and housing and feedstock-change in the chemical industry (Behrendt, 2017a), recycling of technology metals (Behrendt, 2017c), persistent substances (Behrendt, 2017b) and decentralised production (Odenbach, Göll, & Behrendt, 2017) in the area of raw materials. The results of theses papers were subjected to a cross-sectional analysis, on the basis of which conclusions were drawn and discussed in an expert workshop (Clausen & Fichter, 2017).

This paper provides an overview of typical path dependencies impeding the transition to a Green Economy in Germany following the typology of path dependencies mentioned above. In the conclusion, some interdependencies of path dependencies are shown and first managerial consequences are described.

Limitations of the work arise from the high complextiy of the subject and the broad spectrum of transformation areas studied. Overall, we see the paper as exploratory study, shedding at least some light on the importance of path dependencies in the transition to a Green Economy.

4 Types of path dependencies

4.1 Technological path dependencies

Technological path dependencies have been described around the problem of switching, e.g., the historical typewriters QWERTY-keyboard (Paul A. David, 1985; Vergne & Durand, 2010). But it is not only a matter of technologies or artifacts, it is also the fact that many people, producers and users alike, are used to old designs. Changing a technological path might therefore be a long-term project.

The first example for technolgical path-dependencies impeding the transition to a Green Economy highlights a case of technical knowledge being concentrated in two countries leaving other countries with a strong disadvantage to enter the new path (Clausen, 2017a). The second example highlights plant and animal breeding and the danger of dependency of a new high-tech breeding path because of extinction of a wide range of agricultural plants and lifestock breeds (Clausen & Mathes, 2017).

For example, analyses by the Fraunhofer ISI (e-mobil bw (Hrsg.), 2015; Zanker, 2015) demonstrate how large the danger is that the German automobile sector will be outpaced internationally because of the change of technical path from the internal

combustion engine to the electric drive. Hybrid electric vehicles (HEV), plug-in-hybrid vehicles (PHEV), battery electric vehicles (BEV) (all together called xEV), and fuel cell vehicles (FCV) were examined in this study. The number of international patents in the individual countries was used as a measure of mastery of propulsion technologies. The analysis of patent applications is based on international patent applications in the years 2009 through 2011 (e-mobil bw (Hrsg.), 2015, p. 19). In the country comparison, Japan and Korea submitted between 40% (electric motors) and 60% (power electronics and batteries) of the international patents from 2009 through 2011. Germany matches Japan in just one category: the internal combustion engine. The real production figures of electric vehicles in the regions compared show a similarly unambiguous picture in 2013 (Zanker, 2015, p. 9).

However, technological path dependencies can also be consolidated long-term if necessary factors for taking an alternative path have not been maintained and at some point have ceased to exist. Such a finding emerges, e.g., from the analysis of the path taken in the early 1950s to breed hybrids of broiler chickens (IÖW et al., 2004, pp. 3–61), which resulted in economic success so vast and economic concentration so great that some of the broiler chicken breeds used before this path was taken have become extinct or are in danger of extinction. As a result, the option to take the previous path is practically no longer available today. This effect can be observed in the case of many animal and plant species used by the agricultural production system. In the area of breeding broiler chickens, the effect is intensified by the fact that the number of major companies anywhere in the world still active in this area has dropped to just three (Elfick, 2011).

Technical path dependencies as described above can be one of the most important reasons for an inability to transform. A long-term vision and clear plans may be important for driving R&D as well as resource conservation. Both of these aspects are necessary to prepare a transformation whose trajectory cannot be foreseen at the beginning of the process. What we need in firms as well as in policy is a kind of precautionary principle in the technology arena. Even if there is a dominant technology in a dominant path, alternative technologies and alternative paths should be kept open in case we have to make use of alternative options.

4.2 Economic path dependencies

Transformation will in many cases create or destroy value. Schumpeter (1983) coined the term “creative destruction,” which highlights both sides of change: the coming of the new and the termination of the old.

Economic path dependencies cover the potential lock-in effects of existing values (production plants as well as goods used by households as houses, cars and appliances), but also economies of scale. Valuable investments might become sunk costs if they cannot be used for the intended period of time. New investments have to be made (and financed) to achieve change. Economies of scale require careful observation since they tend to have a tipping point after which the innovation gains market share.

Investments. The transformation toward sustainability requires changing infrastructures, buildings, and facilities that represent substantial value. For example, significant investments in the housing stock are necessary to bring it up to an up-to-

date energy standard. The German Federal Ministry for Economic Affairs (BMWi) (2014, p. 13) assumes that approx. 350 euros/m^2 will be necessary to cut energy consumption in half[1]. Assuming approx. 45 m^2 living space per person[2], a population of approx. 80 million, and the need to refurbish approx. 60% of the buildings or living space, investment needs (i.e., costs of switching paths) will amount to roughly 750 billion euros in the period from 2015 to 2050. In the case that district heating is extended to about half of all buildings, further money will need to be invested (Clausen, 2017d).

While renovated buildings usually increase in value, some other investments can be expected to lose value. This might be the case for central heating systems based on natural gas or oil if they are no longer used because of climate policy. Denmark has already started a long process of phasing out such systems. To achieve the target of climate neutrality by 2050, Denmark has decided to ban gas and oil heating systems from use in new buildings since 2013 and oil heating systems in the case of replacement in old buildings if a district heating system is available since 2016. There is an ongoing discussion in Norway about a regulation to stop sales of gas and diesel cars by 2025 in order to achieve a climate neutral car fleet by 2040 (Regjeringen Norge, 2016). The activities show that in order to limit lost investment, it is necessary to draw up long-term plans which take into account the long service life of the products in question and the long time it takes society and business to build and install new systems. The German "Atomausstieg" (phasing out of nuclear power) is a prime example of such an exnovation strategy. While the original plan was drawn up in 2002, the last plant will be shut down in 2022.

Economies of scale. Another type of economic path dependency has to do with economies of scale. As a result of economies of scale, established products produced in large quantities can often be marketed very efficiently and at low cost. For this reason, it is initially difficult, but not impossible, for new products to enter the market if they are based on a fundamentally more efficient or attractive principle. One example of this was the highly energy-efficient LCD monitors introduced to the market in the late 1990s, which were at first significantly more expensive than the cathode ray tube (CRT) monitors dominating the market at the time. Around 2004, the prices of the two technologies converged, resulting in LCD monitors replacing CRT monitors within a brief period of just three years (see Figure 1).

[1] The fact that specifically the single-person households of older people between 65 and 75 years of age have especially large living spaces averaging 103 m^2 (cf. chapter 0) is a particular challenge here.
[2] Cf. press release of the German Federal Institute for Population Research (Bundesinstitut für Bevölkerungsforschung, BiB) of 24 July 2013, http://www.bib-demografie.de/SharedDocs/Publikationen/DE/Download/Grafik_des_Monats/2013_07_pro_kopf_wohnflaeche.pdf?__blob=publicationFile&v=3 last accessed 8 July 2015.

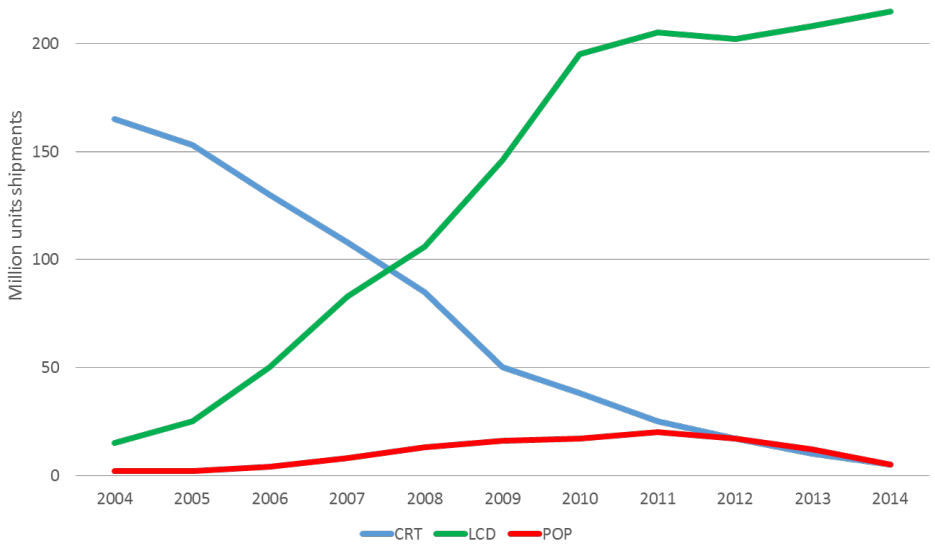

Fig. 1. Sales figures of cathode ray tube (CRT), LCD, and plasma (PDP) monitors Source: http://www.prweb.com/releases/2014/04/prweb11768569.htm of 18 July 2017.

In other words, the factor economies of scale has a dual character with respect to path dependencies. It first stabilizes the position of the established solution until a tipping point is reached; then the advantages arising from the economies of scale shift to the new product, and may do so very quickly, so that they then become a hindrance for the established product.

This tipping point in the energy market is in sight. Photovoltaics have already reached cost parity for consumer-produced household electricity[3]. Off-grid systems have apparently also reached the point where states such as Kenya are tending to opt for a decentralized solar-based energy system rather than for centralized power plants and grids (Mbithi, 2014). The German Advisory Council on Global Change (WBGU)(2011, p. 168) expects further progress in cost development dependent on growth in volume (see Figure 2).

[3] However, the cost parity that had been achieved and further expansion then became the starting point for the consideration that the EEG, which was amended in 2014, was to slow an additional rapid expansion of photovoltaics for consumers' own use by introducing the obligation to pay a portion of the EEG fee for solar electricity produced by consumers themselves (as well as for other kinds of electricity from renewables). This provision in the new EEG, too, can ultimately be understood as a path-extending measure for the centralized structure of the power grid with its fossil fuel-fired power plants.

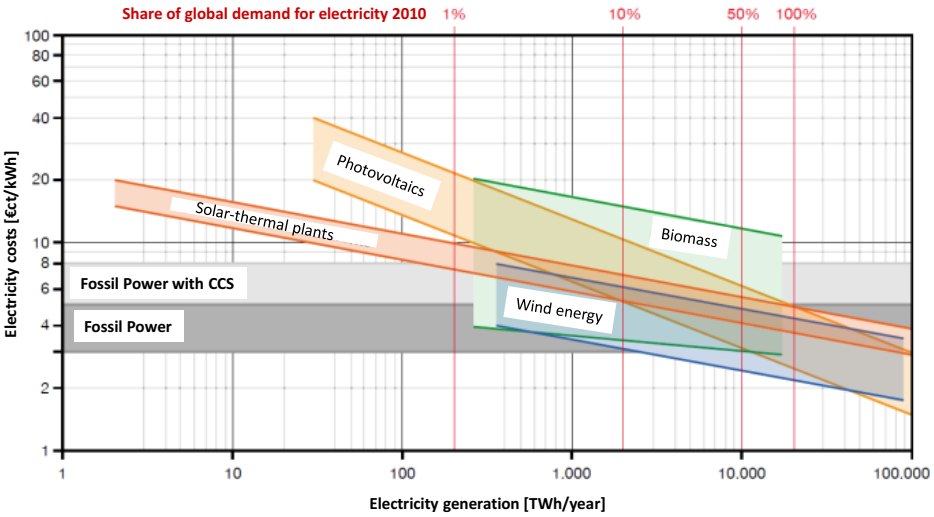

Fig. 2. Development potential of the costs of electricity from renewables Source: WBGU ((2011, p. 168)

Foreseeable changes in relative prices because of economies of scale are also relevant for the development of electromobility. For example, in its National Development Plan Electromobility (Die Bundesregierung, 2009, p. 10), the German federal government hoped that battery costs would drop from 1,000 to 1,200 euros per kWh to 300 to 500 euros, which would enable their entry into the mass market. A price of 300 euros per kWh has already been achieved, and additional reductions to approx. 150 euros per kWh are expected by 2018 (Hackmann, Pyschny, & Stanek, 2015).

If electric vehicles become more affordable and convenient than conventional alternatives by 2022 (OECD / IEA, 2013; Randall, 2016), this might be of importance for the German automotive industry, which is still not particularly busy developing and scaling up technologies beyond gas and diesel. A parallel increase in range, from 120 to 150 km today to then 200 to 250 km, could also reduce consumers' reluctance to purchase electric vehicles (Clausen, 2017a).

Economies of scale are important for all actors in a transformation process. While businesses have to monitor carefully how long their innovative competitors will need to achieve cost parity, policies may provide subsidies until parity is achieved to boost innovative markets. If a firm ignores innovative competitors' economies of scale, its market shares might shrink.

4.3 Organizational path dependencies

Organizational path dependencies are understood here as those in which ties develop because of process routines, procedural specifications, or corporate culture. The organized representation of interests, which is also often directed toward stabilizing a path, will be analyzed here as well.

Organizational routines and corporate culture. Process routines, procedural

specifications, and behavioral routines in keeping with corporate culture are special forms of routines in companies and organizations. They are embedded in a more or less firmly enshrined corporate culture. Schein (1995) differentiates three levels of corporate culture:

- artifacts as obvious elements of corporate culture (organizational structure, rituals, figures of speech, architecture of the company buildings, or visible patterns of behavior),
- the organization's values (what is important to the organization),
- basic assumptions (assumptions that are not questioned and not consciously reflected concerning human nature, the environment, time, or reality in general).

While the artifacts, which also include behavioral routines, are relatively simple to change, transforming the underlying values and basic assumptions takes considerable effort and time.

The Competence Center for Innovation and Sustainable Management studied the attitudes toward climate change of 159 decision-makers in industrial, service, and wholesaling and retailing companies (Tachkov, 2015). Tachkov finds that differences exist especially between explicit and implicit attitudes.[4] In other words, if the question is asked openly and directly, then a very strong majority of 85% expresses moderate to strong agreement with the responsibility of businesses for climate mitigation. Interestingly, in an implicit association test concerning implicit relative preferences for "growth" or "climate mitigation," approx. 50% of the sample are on each side of the distribution. Tachkov (2015, p. 18) concludes "that it is not enough to implement sustainability goals and visions and to demand that executives take them on and share them, or to survey their agreement with such goals." In other words, the dissonance between explicit and implicit attitudes would imply that when appropriate opportunities arise, executives confirm that they consider climate mitigation important. Yet they would make really important decisions without regard to the goal of climate mitigation.

One of the main reasons for the emergence of organizational path dependencies are false or no longer up-to-date basic assumptions, on the basis of which decisions are made. A number of examples have been found:

- Low prices for food and heating energy are implicitly part of the basic supply of the population and are seen as part of social care. Responding to the latest proposal by the environmental authorities to increase the value added tax on meat to the standard rate for non-food consumer products of 19%, the Minister of Agriculture commented that he did not want to prescribe what people should eat. Ultimately, government follows the Roman rule of "panem et circensis", which today might be fast food and television.
- Another basic assumption refuted by numerous studies (Rheinisch-Westfälisches Institut für Wirtschaftsforschung (Hrsg.), 2010; Umweltbundesamt (Hrsg.), 2005, 2008, p. 92) is the implied link between ever-increasing road construction and economic growth (Clausen, 2017b).
- In politics it is also taken for granted that – as a function of its historically

[4] Kora Kristof found similar assessments in relation to attitudes toward the environment and sustainability and therefore differentiates between "implicit theories" and "explicit theories"(Kristof, 2010).

> aquired status in environmental law - agriculture should be exempted from the majority of existing environmental regulation because it contributes decisively to the basic supply of the population with food. The fact that this exception - as demonstrated by the examples of water pollution and biodiversity loss due to the high use of nitrogen fertilizers and pesticides - obviously leads to the fact that in the foreseeable future agriculture will no longer be able to fulfill this function hardly irritates anybody in politics.

Corporate lobbying. Interest groups are established both by businesses and by civil-society groups. From the perspective of analyzing path dependencies, trade associations are very important; their interest is often linked to continuing existing business models. Yet it is difficult to determine the extent of lobbying in Germany due to a lack of data. In any case, the costs of these structures should be significant, but are not known for Germany (Lobby Control, 2013, p. 13). In the US, the business community spends approx. 3.3 billion dollars per year for this purpose (loc. cit.).

Again, lobbying to prolong existing paths is a strategy employed by management. Since many others in an industry association are also opting for certain activities, this confirms to individual managers that they are right. But successful lobbying might in the long run turn out to be a bad strategy for some actors. If change comes nevertheless, it might be too late to change firms that lobby for and stick to the old path.

Trade unions. The German Trade Union Confederation (DGB) with its member unions and its more than 6 million members in 2014 is also an interest group that cannot be viewed separately from economically successful industries. As the frantic actions of the political community in crisis situations make clear time and again, securing these jobs and grandfathering the rights of these workers are often highly important in the short term. But structural transformation often also generates losers. Exnovation explicitly results in certain products or technologies being phased out of the economic process, generally resulting in the loss of certain jobs and the necessity of creating alternative job opportunities.

For example, the number of jobs in the sector "mining/crude and manufactured minerals" in Germany declined from 317,000 in 1991 to 130,000 in 2000 and just 76,000 in 2010; in the sector "energy supply" from 382,000 in 1991 to 267,000 in 2000, and just 254,000 in 2010 (Statistisches Bundesamt, 2014, p. 349). 302,000 jobs were eliminated in the two sectors by 2000, and another 67,000 by 2010. The reasons for this are diverse. For example, German mining was highly dependent on subsidies and no longer internationally competitive as early as the 1990s. In the late 1990s, the energy sector took great efforts to increase efficiency in the course of market liberalization. Nonetheless, it is doubtless true that the beginning transformation of the energy system and in particular of electricity supply involved cutting jobs in conventional businesses since the year 2000.

But it is also important to note that a considerable number of new jobs is being created in the course of the structural transformation. For example, the 67,000 jobs lost in the conventional energy system between 2000 and 2010 are contrasted by an increase in employment in the renewables sector from 106,000 in 2002 to 360,000 in 2010 (Umweltbundesamt, 2014, p. 4). This amounts to a net increase of just under 200,000 new jobs in the energy sector.

Like management, trade union leaders bear responsibility for choosing the right option. If they collaborate with management and cooperate in activities prolonging existing paths, they might succeed in securing the jobs of their constituencies for a certain period of time. But if change comes nevertheless, it might be too late to change firms that stick to the old path, hence decreasing job security in the long run.

4.4 User-specific path dependencies

Innovations, and in this context in particular basic innovations, often involve uncertainties for suppliers as well as customers. Studies in the field of ecological consumption see uncertainties as an important reason for the more sluggish diffusion of innovations in the end consumer market. Antoni-Komar and Pfriem mention reservations about unfamiliar places to shop in the organic products segment as well as concerns about the security of supply when switching from fossil fuels to renewable heating energy sources (Antoni-Komar & Pfriem, 2010, p. 231).
Uncertainties are one, but not the only, reason for routines. Blättel-Mink et al. (2013, p. 95) also emphasize the simplifying effect of routines in everyday life. *"In light of the complexity of the circumstances of life described above, routines enable us not to have to think about, weigh, discuss, and decide anew every day which action is suitable for which situation"* (Blättel-Mink et al., 2013, p. 95). In other words, the tendency to simplify one's life by using routines also results in locking in certain patterns of behavior and consumption.
What is more, individual consumption is embedded in the context of the system of consumption and production of the culture in question, in other words, in what we have learned from others and are accustomed to recognizing as "normal".
A main fact is, that consumers are often satisfied with the function and price of conventional solutions.

- Large sections of the population are simply satisfied with the established regime and its products and services. Inexpensive meat, large, poorly renovated but cheap apartments to be heated cheaply due to low energy prices, high-priced, big and fast cars with a lot of comfort: many of us see the price-performance ratio of these offers to be very reasonable.
- Existing alternatives are often not able to arouse a desire for change because they do not provide added functionality at a comparable price. The renewable heating systems for houses, car-sharing services as well as electric cars all show that market dynamics alone do not lead to fast diffusion.

The maintenance of the usual forms of consumption is stabilized by lack of knowledge and uncertainties regarding alternatives.

- Consumers and, in some cases, farmers have such low awareness of the environmental impacts of conventional farming and the benefits of organic farming that consumer choices and production patterns do not change.
- Beyond the problem of high costs, uncertainties regarding function, range and charging systems cause a very slow development of the market for electric vehicles.
- Incorrect notions about the costs of refurbishment and ignorance of the advantages in terms of housing comfort result in a low number of homeowners investing in comprehensive energy refurbishment.

4.5 Legal path dependencies

Path dependencies originating from laws and regulations seem to have primarily indirect effects. In most markets, use of the dominant product in the market is not obligatory, and use of alternatives is not banned. As long as there is no major alternative, specific aspects of products, e.g., safety, may be subjected to certain standards or norms, but why should regulating bodies make a product obligatory or ban it from the market?

This situation changes if there is a convincing political reason for product regulation. If a product leads to severe negative externalities in the environmental or social domains, there may be a reason for the state to regulate. Such regulation only makes sense if the market can provide alternatives not producing said externalities ("functional equivalent"). Provided such alternatives exist, the government may plan to formulate regulation to achieve a market in which products without negative externalities dominate. Facing potential losses in market share, the various actors having an interest in the ongoing success of the current dominant product tend to make attempts at altering or influencing the envisioned regulation in order to make it less successful. As the following examples illustrate, this dynamic frequently leads to prolonged paths of socially and environmentally questionable products.

Laws and regulation. A first example is energy policy. Besides the Renewable Energy Sources Act (EEG), regulation of the electricity market in particular is of considerable economic relevance for the German energy market. Electricity market regulation has been criticized since the 1980s because it does not, or only to too small a degree, internalize the external costs of fossil and nuclear energy and has thus prevented competition with other forms of energy from occurring in the first place (Hohmeyer, 1988). Although the coalition government of the Green Party (Bündnis 90/Die Grünen) and the Social Democrats in Germany (1998-2005) took initial steps toward an ecological tax reform in 1999, its absolute increase of energy prices was modest. In a study for the German Federal Ministry for the Environment, the external costs of the various fossil fuels on the market were estimated at 6 to 8 cents/kWh on average (DLR & Fraunhofer ISI, 2007, p. 2). If these costs were internalized, this would more than double the price of electricity generated from fossil fuels and thus turn market conditions on their head. A similar situation can be found in the markets of natural gas and oil for heating (Clausen, 2017c) as well as for gas and diesel for cars (Clausen, 2017a) with low prices in both markets.

In other words, an important component of institutional safeguarding of the fossil energy sector is not the existence, but the lack of existence of a truly effective arrangement for internalizing costs. For this reason, the internalization of external costs continued to be high on the political agenda of the proponents of renewables in order to improve their market opportunities. The decision to introduce the EU emissions trading system in 2003 was an interim success. The price of certificates from their introduction in 2005 to 2007 was approximately €25, but it then declined steadily, with the exception of a peak at the beginning of the second trading period in 2008. This development was caused by details of emissions trading law, which resulted in a long-term oversupply of certificates, thus driving down the price in the absence of scarcity. The oversupply is considered to have two equally important causes: the number of

certificates issued, which was too large in any case, and the generation of additional certificates through Joint Implementation and the Clean Development Mechanism (Agora Energiewende, 2015, p. 7). Over the last six years, the surpluses have grown to roughly 1.3 times the number of certificates issued annually (cf. Figure 3).

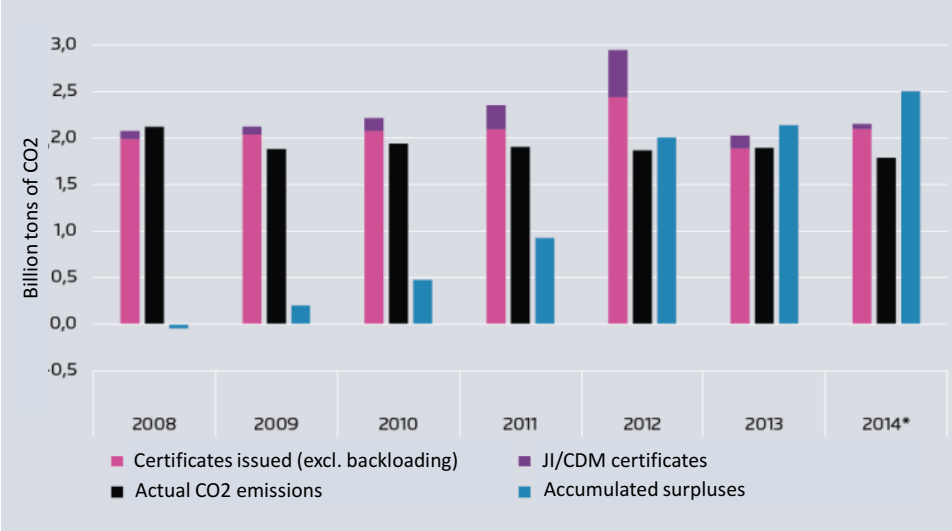

Fig. 3. Development of emissions and surpluses 2008 to 2014 Source: (Agora Energiewende, 2015, p. 10).

The deterioration of the price of emissions certificates is central to the failure of the market mechanism introduced to promote the energy transition. Nitsch makes this clear in a scenario study on the EEG (Nitsch, 2013) in which he demonstrates that the EEG causes persistent, high additional costs for electricity consumers in the absence of active climate policy that increases the price of certificates. But if the external costs of fossil fuels were included in the price of certificates and thus also in consumers' costs, then by 2050, the EEG would either result in significantly lower costs overall or even lessen the long-term burden on the economy by up to 450 billion euros cumulatively, depending on the scenario (Nitsch, 2013, p. 8). According to Nitsch (loc. cit. 9), the EEG has already reached its goal of cost degression and its effect of promoting innovation. However, it will not be possible to get on the path to further decarbonization as agreed at the 2015 G7 summit and in the Paris Climate Agreement by continuing to promote innovations, but only by implementing additional policy tools for internalizing costs and thus ultimately also exnovation, i.e., phase-out of problematic or harmful energy sources.

Two prominent examples of exnovation regulations are to be found in the energy sector, namely the German nuclear phase-outs of 2002 and 2011 (following the 2010 resumption) and the 2009 ban on incandescent light bulbs[5]. The advantage of a market ban is that it is simple and effective. At least the light bulb ban seems to work, classic

[5] Numerous other exnovation regulations exist in particular in the chemicals sector, e.g., in the ban on the "dirty dozen" in the German Foodstuffs and Consumer Goods Law and in the REACH regulations.

light bulbs are no longer for sale in Germany.

A second example is regulation concerning the fuel consumption of cars (Clausen, 2017a). As a first step, a 1998 voluntary agreement with the automobile industry attempted to reduce CO_2 emissions to 140 g/km by 2008. But that target was not met. In December 2008, the EU Council and Parliament agreed on a regulation to reduce the CO_2 emissions of new automobiles. The new goal for 2015 was now 130 g/km. The EU Commission[6] states that the average emissions of a vehicle sold in 2014 were 123.4 g CO_2/km, so the goal for 2015 has been reached. This corresponds to a reduction by 17g or 12% since monitoring began in 2010.

Here, too, a closer look reveals that the issue of safeguarding interests by shaping the legal framework appears even more complex. A more differentiated image of the attainment of the goal, which is encouraging as such, emerges if we also view the increasing difference between the figures given by manufacturers and the CO_2 emissions calculated on that basis on the one hand and real fuel consumption figures on the other. According to a study by the US International Council on Clean Transportation (ICCT, TNO, IFEU, & Sidekick, 2013), this difference averaged 23 percent for new vehicles delivered by German manufacturers in 2011. This discrepancy has displayed an upward trend since the beginning of the millennium: "… the average discrepancy between fuel consumption (and, by extension, CO_2 emission) values reported in spritmonitor.de and manufacturers' type-approval values increased from 7 percent in 2001 to 13 percent in 2007 and then jumped to 23 percent by 2011" (ICCT et al., 2013, p. 6). The German environmental organization Deutsche Umwelthilfe (2013) carefully lists 20 ways to tweak consumption figures by changing or optimizing the vehicle, the engine, and the testing facility. The successes achieved in this way seem to explain a large part of the EU's reduction requirements. In other words, the 21% reduction of CO_2 emissions from 2008 to 2014 (from 157 g/km to 123.4 g/km) is contrasted by additional measurement errors of approx. 10% from 2007 to 2011 alone, which account for half of the effect achieved.

The regulation of successful transformation requires politicians with courage. If a transformation is needed, then it is simply a sign of inconsistent policies or corruption if the necessary regulatory instruments are not watertight.

Subsidies. Subsidies are used for the most diverse purposes. In some cases, it is clearly recognizable that they serve to stabilize a path. The largest individual subsidy detrimental to the environment is the allocation of CO_2 emission certificates free of charge. At prices of CO_2 certificates averaging 15.40 euros per ton in 2010, the theoretical volume of subsidies was 6,098 million euros that year (Umweltbundesamt (Hrsg.), 2014, p. 24).

Path stabilization is also apparent in the case of subsidies for coal. For example, subsidies for hard coal amounted to 1,917 million euros, for the lignite sector at least 279 million euros, and energy tax relief for coal was 190 million euros in 2010 (Umweltbundesamt (Hrsg.), 2014, p. 62).

[6] cf. http://ec.europa.eu/clima/policies/transport/vehicles/cars/index_en.htm last accessed 30 August 2015.

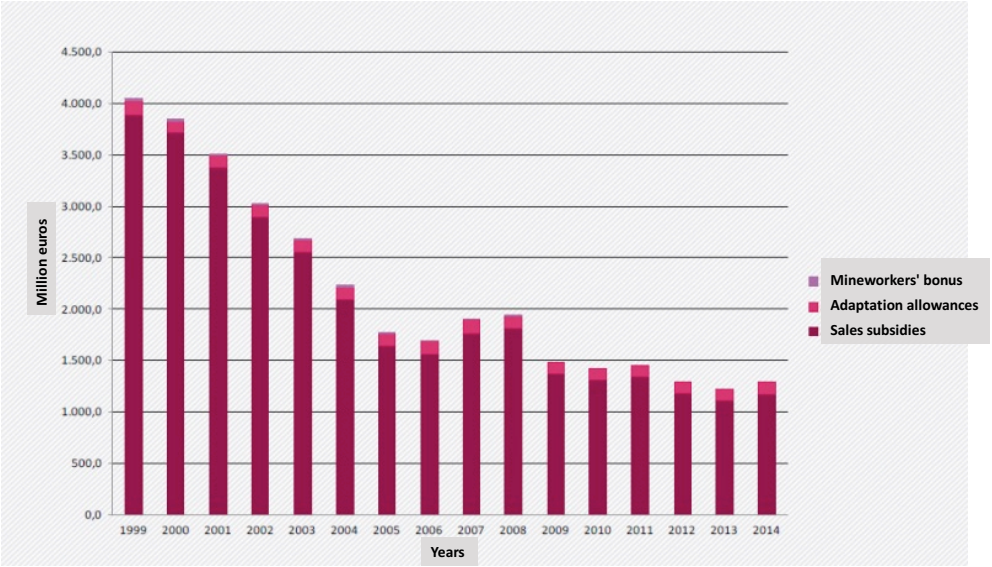

Fig. 4. Government funding for hard coal from 1999 to 2014. Source: German Federal Environment Agency (ed.) 2014, 20.

In the 16 years from 1999 to 2014, a total of approx. 33 billion euros of subsidies was paid to the coal sector and contributed to keeping the increasingly uneconomical sector alive longer. At least the subsidies for hard coal have been on a downward trend since the turn of the millennium. Support is scheduled to end in 2018, and the mines are to be closed then (Umweltbundesamt (Hrsg.), 2014, p. 19).

Further energy subsidies will not necessarily impact the energy mix, but should have an effect on the pressure to increase efficiency. They prevent prices from telling the ecological truth. Examples of such subsidies include (Umweltbundesamt (Hrsg.), 2014, p. 62):

- Reduced concession fees for electricity, or exemption from concession fees, for special-rate (i.e., energy-intensive) customers, equivalent to 3,500 million euros
- Reductions of electricity and energy taxes for the manufacturing sector, agriculture, and forestry, equivalent to 2,518 million euros
- Ecotax capping for the manufacturing sector, equivalent to 1,939 million euros
- Tax relief for certain energy-intensive processes and procedures, equivalent to 983 million euros
- The special compensation provision of the EEG for electricity-intensive businesses and railways, equivalent to 1,455 million euros
- Reduced cogeneration charge rates for energy-intensive businesses, equivalent to 103 million euros
- Favorable electricity grid charge rates for energy-intensive industries, equivalent to 33 million euros.

The reason given for these subsidies lies in maintaining the international

competitiveness of the companies in the relevant sectors, whereby their damage to the climate is not taken into account. The subsidies in the energy sector as calculated by the Federal Environment Agency amount to 21,649 million euros per year overall, or more than 200 billion euros over 10 years.

Additional subsidies relevant for the transformation toward a Green Economy are granted to the transportation sector and total 24,168 million euros (Umweltbundesamt (Hrsg.), 2014, p. 63). The largest items here are the reduced energy tax rate for diesel fuel, equivalent to 7,050 million euros; the distance-based commuting allowance in income tax law, equivalent to 5,000 million euros; the exemption of kerosene from the energy tax, equivalent to 6,915 million euros; and the exemption of international flights from value-added tax, equivalent to 3,490 million euros. Flat-rate taxation of privately used company cars, equivalent to at least 500 million euros, must also be mentioned. These subsidies have influence on the choice of the car as primary form of mobility and impede change in the mobility system (Clausen, 2017a).

Subsidies are an important means for policies to influence transformation processes. They can either speed up transformation or slow down change. Intelligent use of subsidies of both types might actually lower the burden society has to bear during transformation because transformation is too expensive if it is driven too fast (loss of value) or too slowly (not achieving targets). Corrupt use of subsidies might prolong an unsuccessful path and lead to a loss in national competitiveness.

Norms and standards. Norms and standards are also considered to be "secondary body of rules," a fitting description. At the end of the millennium, laws included references to approx. 20 % of all DIN standards (DIN Deutsches Institut für Normung e. V. (Hrsg.), 2000, p. 20).

Companies see the positive effects of industry-wide standardization on manufacturing and transaction costs (DIN Deutsches Institut für Normung e. V. (Hrsg.), 2000, p. 14). They also see its effect on market power over suppliers and—to a smaller extent—customers (DIN Deutsches Institut für Normung e. V. (Hrsg.), 2000, p. 16). A survey of companies by the Deutsches Institut für Normung (DIN) also reveals that standards inhibit innovation projects only to a small degree and that companies think that participation in the preparation of standards reduces the risk of misguided R&D.

Since the preparation of standards is a kind of technology transfer between businesses, it supports efficient diffusion of innovations (DIN Deutsches Institut für Normung e. V. (Hrsg.), 2000, p. 25). If both innovators and manufacturers who enter a market later on are included in the process of preparing standards, then ultimately many companies will benefit from participation in industry-wide standardization when they develop technologies. They gain know-how through the standards.

Since norms usually standardize the details of certain artifacts, but do not impact alternative artifacts (e.g., basic innovations with similar functions), it appears likely that standards indeed tend to be smaller barriers to innovation, but may be all the more important for the later diffusion of new technical solutions.

5 Outcome

Market capitalization as well as the value of real estate are of enormous importance for decision-making. However, they are not path dependent. Stock-exchanges value firms mainly because of expectations of future performance, which can hardly be called a "previous event".

Market capitalization can be better described as an outcome of a management process creating the foundation for expected future performance. Paths as well as expectations about coming path changes are of importance for market capitalization. This can be shown by the following example of energy industry, which after Fukushima and the German Energiewende obviously is stuck to a path with is expected to be terminated within the next thirty years.

5.1 Market capitalization

Capital markets and the values generated and disappearing there matter in the context of sustainability-relevant sectors. This notion suggests itself on the basis of the market capitalization of the 100 largest European companies in eight sectors calculated by PricewaterhouseCoopers. For example, the market capitalization of the 16 most valuable companies in the European energy sector dropped from approx. 1.6 trillion euros in 2008 to just approx. 980 billion euros in 2013 and bounced back to approx. 1.1 trillion euros in 2014 (PricewaterhouseCoopers, 2014, p. 14). By June 2016, the value declined to approx. 860 billion euros (Bloomberg, 2016). In other words, the 16 most valuable European energy companies lost approx. 47% of their market capitalization between 2008 and 2016. The corresponding values for Germany dropped from 140 billion euros in 2008 (PricewaterhouseCoopers, 2014, p. 14) to 39 billion euros in 2016, or approx. by 72% (Bloomberg, 2016).

No less than 750 billion euros of company value in the European energy sector were wiped out in eight years. That is almost four times the amount that disappeared in Germany's Neuer Markt of dotcom-firms around the turn of the millennium[7] (at the time approx. 200 billion euros) and is far more in total than the German bank bailouts following the subprime crisis in 2008.

The magnitude alone of the sums in question in the energy sector is reason enough for the most intense efforts on the part of the companies and their owners or shareholders to maintain their company value and to do everything possible to maintain the business model. In addition, there is an interesting constellation of interests because approx. 24% of the equity of RWE[8] and of many municipal utility companies are owned by municipalities. As a result, municipalities are in the dilemma that they diminish the value of their own holdings if they pursue systematic climate mitigation policy.

In the end, market capitalization is the responsibility of management. If firms ignore change, their market value will suffer, as the European energy industry is currently experiencing. The European automotive industry might see the same effects if it does not rapidly develop and produce the cars that the sustainable society of the future already wants to buy today. Auto Scout 24 (2015, p. 18) finds that only 6.3% of

[7] A temporary IT and dotcom segment of the German stock exchange that crashed in 2000.
[8] cf. Hannoversche Allgemeine Zeitung of 3 September 2015, 11.

Europeans expect to drive gas or diesel cars by 2040. In other words: it would be a good idea to phase them out now.

5.2 Real estate

The value of real estate outside the major urban centers with their partly astronomical prices has hardly been made a topic of discussion recently, and certainly not in the business press. Nonetheless, it should be mentioned here, quasi in parallel to the market capitalization of the energy companies. Real estate is relevant for the opportunities to shape the energy system, and not only within cities; the generation of bioenergy as well as wind energy or groundmounted PV facilities need space—the topic of competition for real estate has been addressed time and again, especially in the global context. It stands to reason that real estate prices could have increased and thus impacted opportunities to switch paths.

German federal statistics (Statistisches Bundesamt, 2013, p. 14) show that the average purchase value per hectare of agricultural land sold has increased significantly: from 8,692 euros per ha in 2005 to 16,381 euros per ha in 2013. The total value of agricultural land in Germany calculated from this figure thus increased theoretically from approx. 162 billion euros by 143 billion euros to 305 billion euros; agricultural land accounts for no less than 52.3% of the 357,000 km^2 of Germany's total land area. The increase in value of agricultural land during this period corresponds to a return of approx. 8% per annum. So while approx. 100 billion euros disappeared from the market capitalization of the German energy corporations between 2008 and 2016, even more than this amount is to be found in agricultural (energy) land. Besides investments in material assets and market capitalization, the value of real estate could also become established as a starting point of a new economic dynamics, since the land owners could form new constellations of interests for the purpose of further increasing value, which could potentially impact energy policy.

The change in value of real estate is not a means that policies can use to speed up or slow down change. But it might have social effects, e.g., on small farms. Rapid changes of real estate prices also encourage speculation, with potential risks for national wealth.

6 Conclusion

The analysis of path dependencies seems to be a fruitful task for transformation research. The systematic analysis of path dependencies generates a good overview of different group interests, possible values that might vanish during the transition towards a Green Economy, the legal positions of actors, and the legal framework which makes transformation easy or hard to achieve. An important fact is that existing sectors selling products in large quantities employ more people and have a greater lobbying capacity than emergent sectors with just a few innovative products.

The analysis of the five types of different path dependencies reveals some interesting insights. Some of these are:

- The basis of some legal as well as organizational path dependencies are false or no longer up-to-date basic assumptions regarding the appropriateness of existing arrangements, on the basis of which political decisions are made or

organizations are led. Such decision-making bases, which are characterized by Schein (1985, p. 14) as an "unquestioned basic assumption", can very effectively and over long-terms inhibit changes.

- At the center of environmental law, which is currently not very effective in many places, we found laws and regulations with gaps or other elements that limit their effectiveness. The case of such "incomplete environmental law", appears not only to be a matter of individual cases, but rather of a general principle that requires an in-depth investigation.
- Cost pressure and high path change costs impede change as well as missing technologies and infrastructures, the development and / or provision of which is connected with additonal costs. The minimization of path exchange costs should receive much more attention.
- The satisfaction of many users with the characteristics and costs of common, but environmentally problematic products is a fact that is often underestimated by environmental policy.

Additionally, these path dependencies are showing a number of self-reinforcing interdependencies (cf. Figure 5).

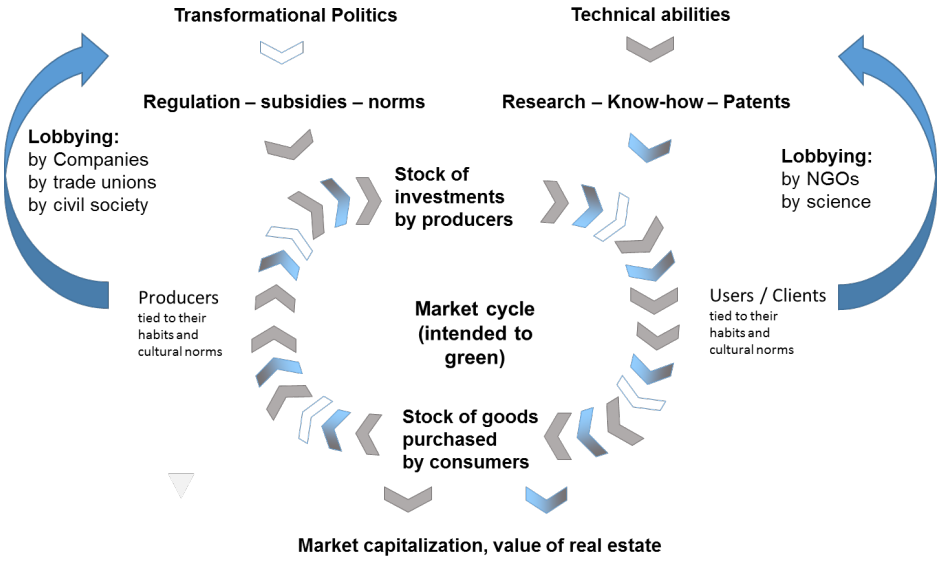

Fig. 5. Interdependencies of path dependencies. Source: Borderstep Institute

At the center of the transformation-dynamics there are a huge number of markets in which goods are sold and bought. Many of the goods or technologies are part of larger technological systems and regimes (Kemp, 1994) and the transformation of such markets is heavily interrelated. These goods or technological systems may or may not be sustainable, and suppliers as well as users are locked in habits, organizational structures, or simply in investments and infrastructures which make it easy to follow the old path.

A central external factor for change is technical ability. For instance, as long as only Japan and the US possess sufficient know-how (measured in patents as well as the number of cars actually sold) to build high-quality electric cars, the European auto industry will slow down change at any cost. Politics, influenced by the strong car lobby associations, supports them in prolonging the historic path of gas and diesel drives. R&D, if necessary with public funding, will be a central means for lock-out.

In addition, in terms of the production of food, Europe is about to hand over more and more genetic stock (of animal breeds as well as plants) to private companies, which may or may not preserve it. Potential paths back to sustainable agriculture based on regional and climate-resistant livestock and crops could thus be permanently locked out.

The real value of firms measured in market capitalization is in fact an outcome of the process. The energy sector shows that a non-transformative strategy, supported by strong lobbying by companies as well as trade unions, has not been successful. About 50% of market capitalization was lost in the years 2008 to 2016. It is in fact the job of top management to look ahead and invest in the solutions of the future, not in those of the past. This is the only way to secure the wealth of shareholders of incumbent firms in the long run.

A reason why incumbent firms are nevertheless important actors in transformation is that their possible influence on the diffusion of new solutions is high (K. Fichter & Clausen, 2016; Klaus Fichter & Clausen, 2013). It might therefore be a central task within transformation to pave the way for future success of incumbent firms. But our analysis also revealed that important path dependencies exist at the cultural level of exactly those incumbents. Not every manager in business or politician shares, e.g., the vision of 100% renewable energy, and some of them are not even able to imagine that the Paris Agreement will ever become effective. They simply cannot imagine a world without gasoline and diesel cars, without gas- and oil-fired central heating, or without the habit of building new roads. Even if they agree to rigorous climate protection targets, they are convinced that we will still need fossil-fueled artifacts in the future.

We are convinced that careful analysis of path dependencies makes it easier to have a realistic view of the transformation project in the various sectors. It enables us to identify winners and losers (there is no field of transformation with win-win situations only) and makes it easier to develop a policy integrating as many actors and groups as possible in the transformation project and to plan for those negatively affected. Historical examples might be the Dutch environmental covenants (Biekart, 1995) or the Japanese practice of negotiating policies between government and business and then jointly working on their realization (Jänicke, Mönch, Binder, Carius, & Forschungsstelle für Umweltpolitik, 1993). A promising strategy for effective transformation may consist of establishing transparency regarding the pace of the envisioned transformation. If the chosen speed allows for old, unsustainable investments to amortize while new and sustainable investments are made at the same time, then consensus-building will be easier.

But consensus must not result in inactivity. Our analysis also identified numerous regulations which seem to support change, while in fact they transfer old practices into the future through a variety of loopholes. Actually, some of these regulations do not support change at all. This “regulation without effect” serves as a political means to

pacify critical groups and change agents, while on the other hand it sheds light on politicians who themselves do not believe in or strive for real change. Again, the central actors enabling successful transformation seem to be politicians who believe in their own targets, e.g., those set in the Paris Agreement, and put them into practice, as well as a civil society, including the sciences, forcing them to do so.

But the link between actors of the established regimes and politics seems to be too close. Unruh asks in his article on the escape from carbon lock-in: "Is a major catastrophe required?" (Unruh, 2002, p. 323). Our analysis might show an alternative: Optimists might argue, that a consequent politics will establish a co-operative process to find a way out of non-sustainabiliy and will face opponents on this way in a target oriented and upright manner. Pessimists like Harich (2012) or ultimately Unruh might be convinced that the influence of established regimes on politics is too high and only the mentioned major catastrophe will ultimately lead to path change.

Acknowledgements. We want to thank three anonymous reviewers for their valuable input. This work has been supported by the German Federal Ministry of Education and Research within the Research for Sustainability (FONA) program.

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