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Open Innovation in a Systemic Innovation Context: Analyzing Online Mass Innovation Process from Systemic Perspectives

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ABSTRACT

This study briefly introduces the National Open Innovation System (NOIS) paradigm, which enables open innovation and online social network (OSN) approaches integration to National Innovation Systems (NIS) and higher education. With the help of interpretive field research methodology, we present our case study findings regarding the implementation of NOIS and associated mass innovation system as a part of Finnish NIS and especially higher education. This study builds a broad knowledge foundation which helps us to better understand the main obstacles and challenges of this implementation process. Our basic idea is to connect theoretical aspects of open innovation paradigm to a systemic innovation theory, especially to ecosystems thinking of innovation. It is suggested that the biggest implementation challenges are the recruitment of human resources and the ability to change the current practices of higher education organizations. On the basis of field experiment results, we propose that a system failure matrix should be used in the foresight process of open innovation processes. Also mass innovation process requires some background planning and proactive prevention activities of system failures.

Keywords: Open innovation, mass innovation, systemic innovation theory, national open innovation system paradigm

1 INTRODUCTION

In this article we analyze open innovation in a systemic innovation context. We pay special attention to analyze online mass innovation process from systemic perspectives. As we know modern innovation processes are influenced by many factors. Innovations are new creations of economic significance. Organizations and people are not innovating in isolation but in complex environments. They occur in interaction between organizational and institutional elements, which can be called "systems of innovation". "Systems of innovation" is a key concept of modern innovation studies. In the pursuit of innovation firms and other organizations interact with other organizations to gain, develop and exchange various kinds of knowledge, information and other resources. Organizations are suppliers, customers, competitors, financial institutions but also universities, research institutes, schools and local governments and other organizations. Innovating firms and other organizations cannot be regarded to be isolated and individual decision-making units.

Other organizations constitute constraints and incentives for innovations. The incentives include laws, health regulations, cultural norms, values, social rules and technical standards.

A key question in this article is to analyze this critical question, especially from the perspectives of open innovation process and mass innovation process. Open innovations and mass innovations emerge in such complex systems of innovation. If we want to describe, understand, explain and perhaps influence processes of innovation, we must take all important factors shaping and influencing innovations into account. What are these factors? The systems of innovation approach is designed to answer this question.

2 INTRODUCING THE THEORETICAL FOUNDATIONS

2.1 Systemic innovation thinking

The first person to use the expression `national system of innovation' was Bengt-Åke Lundvall (1992). After Lundvall, the concept was used by Richard Nelson (1993). The OECD and the European Union soon adopted the use of this expression. The systems of innovation approach and its development has been influenced by different theories of innovation such as interactive learning theories and evolutionary theories. The systems of innovation approach is compatible with the theoretical notion that processes of innovation are characterized by interactive learning. The process of innovation is seen as interactive. Thus, constrains and incentives of interactive learning are probably very important factors in innovation processes.

The neoclassical model of the profit-maximizing firm is seen an inappropriate tool for interpreting certain important aspects of the processes involved in generating and diffusing innovations. Many of the actors and organizations involved in R&D and processes of innovation are not primarily governed by profit-seeking motivations. Non-profit organizations and profit-seeking organizations interact with each other in complex ways when they pursue learning and innovation (Nelson & Winter, 1977, 50-52).

Technological change and innovation processes can be understood as an evolutionary process (Nelson & Winter, 1977). Key components of evolutionary theory are: (1) Reproduction of some entities, (2) mechanisms which create diversity, and (3) selection mechanisms of competition which constitute a filtering mechanism. (Nelson, 1995). According to evolutionary theory technological change is an openended and path-dependent process where no optimal solution to a technical problem can be identified. Innovation processes involve considerable randomness. Often innovation processes take a considerable time.

The systemic innovation approach underlines that the relations between organizations and institutions are crucial for the functioning and change of systems of innovation. Also specifications of different kinds of institutions and organizations matter. Thirdly, different kinds of institutional and organizational change are important in an analysis of the performance, structure and change of systems of innovation. (Edquist, 2005, 60).

2.2 Closed and open innovation thinking

The paradigm of closed innovation says that successful innovation requires control in organizations and institutions. In the closed innovation model organizations must generate their own ideas, and then develop, build, market, distribute and support them on their own.

Another alternative key concept of modern innovation studies is the concept of open innovation. Open innovation is an innovation research paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Thus, open innovation has been proposed as a new paradigm for the management of innovation (Chesbrough, 2003). The open innovation concept is related to (1) user driven innovation, (2) cumulative innovation, (3) Know-How Trading, (4) knowledge management, (5) innovation democracy, (6) mass innovation, and (7) distributed innovation.

Open innovation is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively" (Chesbrough et al 2006, 1). Technology acquisition and technology exploitation are key elements of open innovation thinking (Lichtenthaler 2008). Technology exploitation includes purposive outflows of knowledge. Purposive inflows refer to technology exploration. Technology exploration refers to activities which enable organization to acquire new knowledge and technologies from the outside.

In a fully open setting innovation model, firms or organizations combine both technology exploitation and exploration in order to maximize value of their technological and other capabilities. Open innovation is a management challenge for SMEs and larger corporations, but it is also challenge for educational and academic organizations.

Closed innovation model assumes a different kind of systemic approach to innovation process than open innovation model. This is an interesting difference between these two alternative innovation models. In a closed model, incentives and constrains do to not promote knowledge sharing. In open innovation model an innovation system promotes knowledge sharing. Thus we can conclude that a particular innovation system determines whether closed or open innovation model works in reality.

2.3 Ecosystem approach to innovation process

What do we understand by ecosystems? It is advisable to discuss the semantic dimensions of such a biological metaphor. As we all know, continuous competition takes place between different species and between the individual animals of a single species. Changes in the environment are reflected in the food chain, the biological processes, and the population. Innovation begins with ideas, but ideas need to be transformed into useful commercial and social outcomes. An innovation ecosystem model encompasses more than knowledge inputs and incorporates all relevant factors and stakeholders that generate value to customers.

The importance of software technologies is increasing. Software has a special role because it is the technology that is used to implement the new forms of social and societal practice. A profound understanding of software technologies is a critical success factor of the knowledge society (including European universities). In the global economy the commercialization of innovations will be an increasingly central source of value. Knowledge economy is an innovation economy. This has already become visible in the fact that employment growth has focused on young well-educated workers. A highly evolved innovation ecosystem enables participants to work across company boundaries, focus on customer value creation, respond quickly and with agility to shifts in market demand, accelerate the transition from research to production, and be more adaptive to change. Innovation ecosystems build a collaborative advantage and a strategic asset for economic growth and profitability in the years ahead.

The scheme of the national innovation ecosystem proposed by the Council on Competitiveness (Watanabe & Fokuda 2005, 6) includes the following propositions:

 \Box Innovation is much more than technology — many additional resources and services are essential for market success;

 \Box As with human health, there is no single attribute adequate to capture innovation dynamics and multiplicity features;

 \Box The success and diffusion of innovation is ultimately determined by the demand side and not just by technical inputs and product features;

 \Box Firms are beyond the dichotomy of technology push and market pull; they are embracing both sides of the equation by collaborating more closely with customers, associating with external sources of innovation, networking resources into new business models, and focusing innovation on global market opportunities, and

 \Box Nonlinear dynamics characterize the entire innovation value chain end to end at the national and the firm level.

In Fig. 1 we have presented key elements of innovation ecosystem.

Figure 1. Elements and dynamics of innovation ecosystem (modified from Hautamäki 2008)



2.4. Defining mass innovation

Innovation literature has identified numerous definitions for innovation, yet something is common for most of them. The term innovation is typically used as a synonym for something new (Huiban and Boushina, 1998), which has been put into practice (Ståhle et al., 2004) and is bringing added value to companies and customers (Haho, 2002). To simplify the difference between idea and innovation, the following summary can be made: idea is always the starting point, plan or intention for potential

innovation. Idea changes to innovation during the successful execution process. Without the successful execution, the idea will not change to innovation (Santonen et. al. 2007).

When combining a wide range of people and their different but complementary insights and creative interaction, novel thinking outside the box is possible and mass innovations can emerge (Santonen, 2009 adapted from Leadbeater, 2008). Some authors use the term mass collaboration, which occurs when a large group of people work independently to achieve shared outcomes through communication technologies and loose voluntary networks (adapted from Tapscott and Williams, 2006). Without supporting technologies this kind of mass co-operation would be impossible.

3 RESEARCH METHODOLOGY

3.1 Sample selection

The data collection for this case study was carried out in Finland. According to the Global Competitiveness Report 2008-2009 (World Economic Forum, 2009) Finland is not only ranked number one in higher education and training indicators but also ranked number two in innovation indicator. As result of these rankings, we argue that our case selection – Massidea.org as a part of Finnish National Innovation System (NIS) – could be regarded as an extreme sample (Yin, 1990). Extreme cases are able to reveal more information than so called average cases and therefore are important tools in understanding a novel phenomenon such as mass innovation. Even if Finnish NIS has been rated high in comparison studies according to a number of other indicators, Finland's rating has been dropping in the past few years. In order to respond to the changes and challenges in the global environment, the Finnish NIS was recently evaluated by an international panel. The panel published their final report on October 2009 and indicated that Finnish NIS is facing radical reform (Taloustieto Oy, 2009). In our opinion this indicates that there appears to be demand for novel open innovation concepts such as Massidea.org.

European Social Fund (ESF) is funding Open Innovation Banking System - project (later OIBS) which is implementing Massidea.org as a part of Finnish NIS. OIBS-project is developing and maintaining www.massidea.org online social network website including required online and offline supporting structures. OIBS-project is coordinated by Laurea University of Applied Sciences and lead by co-author of this paper Dr. Santonen. OIBS-project was started on May 2008 and it is scheduled to end in June 2011. In this study the unit of analysis is the OIBS-project.

3.2 Introducing Massidea.org case

An open innovation (Chesbrough, 2003) online community Massidea.org – smashing ideas is founded on series innovation theories (Santonen et. al., 2007, 2008a and 2008b, Santonen 2009). Figure 2 presents an Innovation Triangle framework which can be implemented as an online social network site such as Massidea.org.



Figure 2. The Innovation Triangle – Stimulating unexpected findings - throughout content recommendation

With the aim of generating new ideas (i.e. the top cube) the framework includes two different yet complementary innovation sources: first, current market environment information, presenting today's challenges derived from history (i.e. the left cube) and second, future market environment information, presenting visions of the future (i.e. the right cube). Today's challenges based innovation process is producing novel ideas from practice, which typically generates small incremental improvements (i.e. incremental innovation) to current offering (Junarsin, 2009). This approach is certainly important, but it is not complete. Therefore mankind needs developers and researchers who are able expand our current understanding and knowledge into new fields by following the vision of the future. On the contrary to challenges based incremental innovations, this foresight driven approach is more likely leading to real novelties. These radical or disruptive innovations and technologies are innovations which eventually overturn the existing dominant technologies and innovations in the market (Clayton, 1995).

According to Herstatt and Lettl (2000) in technology-push theory, an emerging technology or a new combination of existing technologies provide the driving force for an innovative product and problem solution in the market place, while in the case of "market pull" the product or process innovation has its origins in latent, unsatisfied customer needs in the market place. In practice ideas are transferring to innovations only if there is a balance between market pull and technology push. Even if an idea is possible to construct and implement as a concrete entity, it does not necessarily mean that there is a market need for it.

3.3. Defining a common content format

When masses of people collaborate and share their insights, eventually a large cumulative database of contents will be created. In order to make the communication and interaction between contents and users easy, a common content format should be defined. In a fast-paced world readers do not want to spend more than few seconds in the information-gathering process, yet they do want to collect all the required information. For this reason adjusted press release format is suggested as a good tool to share innovation related information. A press release is typically kept to one page or roughly 300 to 500 words. In press releases, the Five Ws concept (who, what, when, where and why) is a popular way to deliver the whole story in a compact format. Therefore, distributing innovation related information content one should give basic answers to the following questions depending on whether it is a challenge, a vision or an idea: (1) what is the thought, (2) why the thought is important and valuable, (3) who is the target group and who is working on the thought, (4) when (temporal dimension) the thought is topical and (5) where

(geographical or physical location or circumstances) the thought is happening? By following the above guidelines, easy to read and link cumulative content repository can be created.

3.4. Increasing the likelihood of unexpected findings

By integrating various content recommendation tools (Santonen, 2007) to the innovation triangle (i.e. the arrows in the middle), we can increase the dynamics of the individual's creativity and increase the likelihood of occurrence of unexpected findings from expected findings. In case of an expected finding, the phenomenon fits with human expectations relating to the future while in case of an unexpected finding, phenomenon is not coherent with the individuals cognitive and belief system and it therefore breaks the conventional habit (Santonen et. al. 2007). For example, serendipity is a process by which one accidentally discovers something fortunate, especially while looking for something else entirely (Thagard and Croft, 1999). Obviously, the likelihood of unexpected findings naturally increases when the number of interacting users and content increases. However, without advanced content recommendation systems, the unexpected findings potential might remain modest.

3.5. Defining the key players

In order to identify the key players, we ground our suggestions to the enhanced Triple Helix model. The Triple Helix is the most well-know framework to describe the collaboration between universities, policy institutions and industry (Etzkowitz and Laydesdorff, 1999, 2000). In the Triple Helix model each actor has its own task: universities produce research, industries manufacture, and the government secures certain stability for maintaining exchange and interaction. The Triple Helix regime operates on these complex dynamics of innovation as a recursive overlay of interactions and negotiations among the three institutional spheres. The different partners engage in collaborations and competitions as they calibrate their strategic direction and niche positions.

In the past, national innovation system models grounded on the Triple Helix model have been very successful. However, in our opinion Triple Helix is lacking a genuine market orientation (Kohli and Jaworski, 1990, Narver and Slater, 1990) and is not fully utilizing users as innovators (von Hippel 1986, Urban and von Hippel 1988) and users as content creators phenomenon (Le Borgne-Bachschmidt et al. 2009), which currently are emphasized in innovation literature. Critical thinkers might say that the voice of user, consumer and people is totally missing in Triple Helix. Moreover, Triple Helix does not recognize the innovation potential of other educational sectors such as basic education and upper secondary education, which are covering children and young people. On the contrary to traditional Triple Helix model, the taxonomy for online social network based open innovation system requires strong end-user interaction and does not exclude other educational sectors besides universities (Figure 3).

Figure 3: Key players in Massidea.org based open innovation system



3.6. Data collection analyzing framework

The research strategy of this study loosely follows the principles for interpretive field research presented by Klein and Myers (1999). In interpretive field research, the interpretive researchers' and other research participants' preliminary understandings and interactions also affect the study results. Therefore it is important to note that one of the interpretive researcher and author of this study is also leading the OIBS-implementation project. For this reason multiple sources of evidence were used to increase the credibility of our findings (Yin, 1990). These evidence include: (1) www.massidea.org online social network website, (2) official ESF reports and documentations, which are OIBS-projects tools to communicate with the funder and report the project progress, (3) OIBS Wiki, which is the home of OIBS-developer community including all development and marketing documentation, 4) OIBS project in www.sourceforge.net and www.github.com, which offers web-based management tools to open source software projects, 5) seminars and events which bring together the project partners and finally 6) personal documents, discussions and emails between authors of this study and other project participants.

3.7 Analyzing framework: Understanding obstacles and challenges of mass innovation process

According to PFI (profiting from innovation) tradition of systemic innovation research we can use the following framework to investigate obstacles and challenges of mass innovation process and the functioning of open innovation approach (Teece 2006, 1138-1143). According to the PFI research tradition these kinds of critical issues are important in the innovation system:

3.7.1. Complementary innovations

Complementary innovation and complementary technologies are critical assets for the open mass innovation processes. Many technologies and innovations are systemic. That is why complementary innovations and technologies deserve a special attention in the innovation process. Successful commercialization requires bringing together complementary technology and patents. If complementary innovations are not available, also open mass innovation can fail.

3.7.2. Supporting infrastructure

Supporting infrastructure is also a very important success factor for the implementing innovations. New institutions, organizations and laws and the provision of complementary assets may be necessary before certain innovations can be developed. Public sector can provide a supporting infrastructure for innovations.

3.7.3. Capabilities

Capabilities create a critical constraint for a innovation process. Especially the diversity of capabilities is a critical factor. Capacity building can help to solve various problems related to capabilities.

3.7.4. Finance

Finance is always a constraint for innovation process and commercialization of ideas. Availability of risk and venture capital is important for innovative organizations.

3.7.5. Decision framework

Decision framework is an important factor in innovation processes. Decision-making processes in organizations can support innovations or not support them. Typically, imposing an "outside view" (Kahneman and Lovallo 1993) is likely to assist in generating less biased view. A limited cognitive framework may cause problems for innovation implementation.

3.7.6. Supply chain issues

All the innovations are connected to some kind of a supply chain. Typically there are three basic alternatives: (1) outsourcing, (2) collaboration and (3) internalization in relation to a supply chain choice (Teece 2006, 1140). Innovators must make decisions in relation to supply channels and chains. Wrong decisions may destroy successful commercialization of ideas and innovations.

3.7.7. Standards, increasing returns and network effects

Katz and Shapiro (1994) have emphasized the importance of network effects and increasing returns in the context of innovation process. Also dominant design and associated standards can create increasing returns and network effects. Wrong design choices can lead to a loss of network effect and increasing returns.

3.7.8. The multi-invention licensing option

If an innovation is systemic, the multi-invention licensing option is an important aspect of innovation process. Today in the field of biotechnology and microelectronics many inventions are systemic. Wrong licensing arrangements may be harmful for new innovations.

3.7.9. Intangibles and knowledge management

Intangibles and knowledge management is big issue in innovation processes. A good knowledge base promotes learning and innovation processes. Investments in intangible capital are a big trend in leading firms of the global markets. Strong intellectual rights and ownership of the complementary assets are together a foundation of successful innovation process.

3.7.10. Other elements of business model

Business model is of course an important issue for innovation commercialization. The product/services architecture and business model together define the manner by which the firm deliver value to customers, entice customers to pay for value and concert those payments to profit. (see e.g. Chesbrough and Rosenbloom 2002, 533-534).

3.7.11. Systemic issues

In some cases (1) system boundaries, (2) system failures and (3) system elements create problems for innovation processes. Key systems can be technical, economic or social.

In Figure 4 Systems failure analysis process and system failure matrix are presented. Systems failure analysis begins with a clear understanding of the failure. This includes a definition of the problem in innovation ecosystem. Once this has been accomplished, all potential failure causes are identified using fault tree analysis (FTA). Actually the key results of the PFI tradition can create a fault tree analysis. Fault tree analysis means identifying all potential failure causes (Leveson, & Harvey 1983, Sinnamon, & Andrews 1996)). Fault tree analysis is a graphical technique that identifies all potential failure causes. FTA has been used in new product analysis but its use can be widened to the analyses of open innovation process and systemic innovation process. FTA may be qualitative or quantitative. When failure and event probabilities are unknown, qualitative fault trees may be analyzed for minimal cut sets.

The process then objectively evaluates each of the potential failure causes using several techniques. These techniques help in converging on the causes of failure among many identified potential causes.

These techniques are: (1) Complementary innovations analysis, (2) supporting infrastructures analysis, (3) capabilities analysis, (4) financial analysis, (5) decision framework analysis, (6) supply chain analysis, (7) standards, increasing returns and network effects analysis, (8) multi-invention licensing option analysis, (9) Intangibles and knowledge management analysis, (10) Business Model analysis and (11) system boundary, internal system failure and system elements analyses.

Once the system or systemic failure causes have been identified, the approach outlined herein develops a range of corrective actions and then selects and tracks optimum corrective action implementation. FTA can also help stakeholders of innovation process to manage risks in a better way (see. Condamin, Louisot & Naim 2006).

Figure 4. System failure process, fault three analysis and system failure matrix based on PFI research tradition



Thus, we recommend that the FTA methodology is integrated to the PFI methodology to manage systemic aspects of innovation failures. This is a new idea and requires further methodological development.

4. **RESULTS**

In the following we will present our results based on four elements of PFI research tradition (Teece 2006) including finance, supporting infrastructure, decision framework and capabilities. In this article we are focusing on 4 key issues of mass innovation. The reason why we are not presenting wider analysis is that the project OIBS is still running and it is too early to make final conclusions of the project. Later we can provide deeper insights but not we focus on the issues where we have reliable research findings and case study observations.

4.1. Finance in the case study

In November 2006 the project idea was first time publicly presented by Dr. Santonen. An open call to join the yet non-existing project was announced in a national seminar. As a result, eleven universities of applied sciences indicated willingness to participate and a Goal-Oriented Project Planning (GOPP) workshop was organized in the March 2007. Later on two funding applications were filed. The Finnish Funding Agency for Technology and Innovation (later Tekes), rejected the first application, but a tentative financing decision from the European Social Fund (later ESF) reached the project group in April 2008. Before this successful funding decision the implementation activities remained modest.

A series of additional information requests were indicated by the funder. The most significant requests focused on the budget cut from 1.9 M \in to 1.1 M \in The consortium was facing a major challenge. According to the funder, especially the personnel costs had to be significantly cut off and back-loaded. Basically the project's human resources had to be cut nearly in half and moreover totally restructured. This increased the risk of implementation failure since nearly the same outcome was expected with half of the assumed resources. At the time it was also noted by project management that the cost structure is likely to be front-loaded on the contrary to required back-loaded model.

Since the final project consortium included 13 partners, the level of funding per one participant would remain rather modest (ca. 45.000 €per co-partner in three years, excluding those having a special role in the project). Therefore a structure having only a minimum core team was seen as an only solution. The majority of the project work would have to be integrated as a part of normal duties of the faculty members without extra costs. However, this was inline with NOIS theory, which suggested that development and content production is possible to integrate as a part of normal duties if there is a real will. Moreover it became evident that the main currency for students would have to be study credits instead of money. The simultaneous rewarding with study credits and project funding was also prohibited by the funder.

4.2. Supporting infrastructure

Evidently without technological support, mass innovation is impossible. The technological platform for Massidea.org has gradually been developed during the project as an open source project. Most of the coding for Massidea.org application has been conducted by the students as a paid job or as their internship tasks. Typically the technical team has included five to seven students at a time. However, it was assumed during the project planning that the participant technical universities are able to smoothly integrate the platform development work as a part their normal courses (e.g. some application features would have been coded as a part of course tasks). If this would have succeeded, the number of technical recourses would have increased significantly. Now with limited number of technical team members, the progress of technical platform has been significantly slower than planned. As a result, the end-users have been forced to use beta versions with limited functionality, which does not fully support the defined NOIS and Massidea.org concept. This has clearly resulted frustration especially among the participant teachers, who have been waiting the fully functional application. This expectation has made the implementation process more difficult, even if the project management has since the beginning pointed out that the project participants are supposed to develop concept and technical platform together.

Moreover, the current multiple campus model is clearly causing challenges. Most participant universities have multiple campuses in different cities, which in addition appear to very independent. This combined with the academic freedom of each teacher to execute their lectures as they which, results in a significantly fragmented "market", which basically means implementation one by one teacher/course. When this kind of market is combined with the current limited resources, it has become evident that implementation is extremely slow and human resource intensive. Interestingly, many teachers also appear to be so busy with their current workloads and working models, that voluntary contribution to what at the first glance looks something "extra" is out of question.

4.3. Decision framework in the case study

As a result of the project funding structure, the majority of the development work and content production is based on voluntary contribution (i.e. not paid by the project). Based on our observations even if a lot of people are convinced of the goodness and benefits of the project idea, it is amazingly hard to recruit university faculty members and students to contribute especially when the technological infrastructure is not fully ready. There also appears to be structural and organizational barriers. In order to fully integrate something to educational processes in universities, there should be integration to university specific curriculum. If the way of working is not a part of the objectives of the curriculum, it must be implemented by individual teachers. Basically this means winning hearts one by one. The curriculum integration takes easily years since university curriculums are not changed annually. Especially the teachers responsible for basic courses (i.e. having masses of students) are in a key role in content production. Other key target groups are 1) the teachers responsible for internships, which are compulsory in universities of applied sciences and 2) teachers responsible for thesis supervision and seminars. Only if these teachers are defining studying tasks whose outcomes are shared to NOIS, the critical mass of users can be achieved.

In participating universities, the project management has requested that the suggested working model should be tightly integrated to above processes. However, the lack of university management support at the decision-making level has been evident. The management willingness to force or even to officially recommend the teachers to utilize Massidea.org as a part of these processes has been impropriated in most cases. Instead of strong central implementation support, project is supposed to act on its own and follow the winning hearts one by one implementation model. This is somewhat confusing since during the consortium agreement each participant member promised to engage 50 percent of their students to Massidea.org by end of project. At the moment only small part of this goal has been reached and stronger tools have been asked from the university management, yet without success.

4.4. Capabilities in the case study.

The tradition of the increasing number of ever changing technological applications teachers must master is causing trouble in project implementation. It has been said in some participant universities that the limit of learning new applications has been reached and there is no more room for learning new technical application and working methods.

Most of the participating universities in project are universities of applied sciences, which are focusing applying things in practice instead of theoretical issues. This on the other hand attracts those students who are into doing things in practice instead of theoretical issues. Therefore, the capability to write quality content is not as strong as it is in traditional universities. Also generally speaking the way of writing content favors longer project reports and documents, instead of the short press release kind of format what massidea.org is using. Finally, there is a clear learning curve for newcomers to participate in the development activities. Hence a longer period is required to start effective development work.

All these issues are related to capabilities and willingness to change current practices. Interestingly, these observations are in line with previous studies which have identified the participation inequality in the case of OSNs. The diffusion of innovations theory is offered as an explanation (Rogers, 1962). It appears that only innovators – the first individuals to adopt an innovation – are joining the project. Teachers' and students' contribution evidently requires changes to the current studying model. Necessarily these changes are not big in workload point of view, but are demanding from the state of mind viewpoint. The old habits – e.g. studying individually or with a small team, not openly sharing the unfinished outcomes right away to masses of people – have been printed hard in higher education. Changing this is a slow process, but if succeeded, it might deliver a substantial competitive advantage to participating individuals, universities and nations.

5. SUMMARY

This study briefly introduces the National Open Innovation System (NOIS) paradigm, which enables open innovation and online social network (OSN) approaches integration to a National Innovation Systems (NIS) and higher education. With the help of interpretive field research methodology, we present our case study findings regarding the implementation of NOIS and associated mass innovation system as a part of Finnish NIS and especially higher education.

This study builds a broad knowledge foundation which helps us to better understand the main obstacles and challenges of this implementation process. Our basic idea is to connect theoretical aspects of open innovation paradigm to a systemic innovation theory, especially to ecosystems thinking of innovation. In this study we used key findings of PFI research tradition and created a test tool for this case study of mass innovation. By the help of this PFI based tool, it is possible to avoid systemic problems of innovation process beforehand (on the basis of ex ante evaluation), but also use this PFI based tool in ex post evaluations of innovation process. In this case we used 4 key issues as PFI evaluation tool. Evaluation gave us many interesting results concerning the development of a mass innovation. These new results can

be used in later phases of the pilot project. It is also useful to use other PFI based "control" issues in later evaluations when the pilot project is fully finalized.

On the basis of this case study we suggest that the biggest implementation challenges are the recruitment of human resources and the ability to change the higher education organizations' current practices. On the basis of field experiment results we propose that FTA failure matrix based on PFI research tradition should be used in the foresight process of open innovation processes. Also mass innovation process always requires some background planning and proactive prevention activities of system failures and systemic failures.

We recommend that the FTA methodology and the PTI methodology are integrated to manage complex systemic aspects of innovation failures. This methodology can be useful in the implementation of open innovations and mass innovations. This is a new idea and requires further methodological development.

References

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

Chesbrough, H. & Rosenbloom, R.S. (2002). The role of business model in capturing value from innovation. Evidence from Xerox Corporation's technology. Industrial and *Corporate Change* **11(3)**: 529-555.

Chesbrough, H., Vanhaverbeke, W. & West, J. (eds.) (2006). *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press.

Clayton, M., C., & Christensen, C.M. (1995). Disruptive Technologies: Catching the Wave. *Harvard Business Review*. January-February 1995: 43-53.

Condamin L., Louisot J.-P. & Naim P. (2006). *Risk quantification: Management, Diagnosis and Hedging*. Chippenham, Wiltshire: Antony Rowe Ltd.

Edquist, C. (2005). Systems of innovation approaches – Their emergence and characteristics. In C. Edquist (ed.) *Systems of Innovation. Technologies, Institutions and Organizations.* London: Routledge: 1-35.

Etzkowitz, H. & Leydesdorff, L., (1999). The future location of research and technology transfer. *Journal of Technology Transfer* **24** (2–3): 111–123.

Etzkowitz, H., & L. Leydesdorff, L. (2000). The dynamics of innovation: From national systems and 'Mode 2' to a Triple Helix of university-industry-government relations. *Research Policy* **29**: 109-123.

Haho, P. (2002) Strategic and Operational Process Innovations in NPD Processes Applying Evolutionary Change Management, 4th International CINet 2002 Conference, "*Continuous Innovation in Business Processes and Networks*".

Hautamäki, A. (2008) Hautamäki, A. (2008). Kestävä innovointi Innovaatiopolitiikka uusien haasteiden edessä. Sitran raportteja. Helsinki: Edita Prima Oyj.

Herstatt, C. & Lettl, C. (2000). Management of technology push development projects, available at: http://www.tu-harburg.de/tim/downloads/arbeitspapiere/Working_Paper_5.pdf

Huiban, J. P & Boushina, Z. (1988) . Innovation and the quality of labour factor. *Small Business Economics* 10: 389-400.

Junarsin, E. (2009). Managing discontinuous innovation. International Management Review, 5(2): 10-18.

Kahneman, D. & Lovallo, D. (1993). Timid choices and bold forecast. A cognitive perspective on risk taking. *Management Science* **39(1)**: 17-31.

Katz, M.L. and Shapiro, C. (1994). Systems competition and network effects. *Journal of Economic Perspectives* 8(2): 93-115.

Klein, H.K., Myers, M.D., (1999). A set of principles for conducting and evaluating interpretive field studies in information systems, *MIS Quarterly*, **23**(1), 67-94/March

Kohli, A.K. & Jaworski, B.J. (1990). Market orientation: The construct, research propositions, and managerial implications, *Journal of Marketing*, **54**(2):1-18

Leadbeater, C., (2008). *We-think: Mass innovation, not mass production:* The Power of Mass Creativity. Profile Books

Le Borgne-Bachschmidt, F., Girieud, S., Leiba, M., de Munck S., Limonard, S., Poel, M., Kool, L., Helberger, N., Guibault, L., Janssen, E., Van Eijk, N., Angelopoulos, C., Van Hoboken, J., Swart, E. (2009). *User Generated Content: Supporting a participative Information. Society* Study for the European Commission DG Information Society, Final Report.

Leveson, N.G. & Harvey, P.R., (1983). Software Fault Tree Analysis. *The Journal of Systems and Software* **3:2**,:173–181.

Lichtenthaler (2008). Open innovation in practice. an analysis of strategic approaches to technology transactions. *IEEE Transactions on Engineering Management* **55**(1): 148-157.

Lundvall, B.-Å. (ed.) (1992). National Systems of Innovation. Towards a Theory of Innovation and Interactive Learning. London: Pinter.

Nelson, R.R. (1993). *National Systems of Innovation: A Comparative Study*. Oxford: Oxford University Press.

Nelson, R.R. (1995). Recent evolutionary theorizing about economic change. Journal of Economic Literature **33**: 48-90.

Nelson, R.R. & Winter, S.G. (1977). In search of useful theory of innovation. Research Policy 6: 36-76.

Narver, J., Slater S., (1990). The Effect of a Market Orientation on Business Profitability. *Journal of Marketing*, **54** (4): 20-35.

Santonen, T., (2007). Defining a mass customization strategy for online banking, *International Journal of Mass Customisation*, **2**,(1/2): 95-113.

Santonen, T., (2009). Creating the Foundations for Mass Innovation: Implementing National Open Innovation System (NOIS) as a Part of Higher Education, In Huizingh K.R.E., Conn S., Torkkeli M. and I. Bitran (eds). Proc. of the 2st ISPIM *Innovation Symposium - Stimulating Recovery: The Role of Innovation Management*.

Santonen, T., Kaivo-oja, J. & Suomala, J. (2007). Introduction to National Open Innovation System (NOIS) Paradigm. A Preliminary Concept for Interchange. FFRC eBooks 8/2007. Finland Futures Research Centre, Turku School of Economics. Turku.

Santonen, T., Kaivo-oja, J. & Suomala, J., (2008a). Brief Intorduction to National Open Innovation System (NOIS) Paradigm: Integrating Online Social Networks and the Triple Helix Model. In: "Proceedings of the 2nd International Multi-Conference on Society, Cybernetics and Informatics: The 6th International Conference on Politics and Information Systems, Technologies and Applications: PISTA 2008, Volume III", Edited by Friedrich Welsch, Jose Vicente Carrasquero, Angel Oropeza & Chie Bein Chen.

Santonen, T., Suomala, J., & Kaivo-oja, J., (2008b). Brief Introduction to the National Open Innovation System (NOIS) Paradigm: Supporting individual creativity in an online social network with content recommendation, In: K.R.E. Huizingh, M. Torkkeli, S. Conn and I. Bitran (eds). Proc. of the XIX ISPIM Annual Conference. *Open Innovation: Creating Products and Services through Collaboration*.

Sinnamon, R.M. & Andrews, J.D. (1996) Fault Tree Analysis and binary decision diagrams. *Proceedings* Annual Reliability and Maintainability Symposium, Las Vegas, NV, USA, January 22–25, 1996, 215–222.

Ståhle, P., Pöyhonen, A. & Kyläkeiko, K., (2004). Towards operationalization of dynamic capabilities. In Hosni, Y. (Ed.), *Internet Economy: Opportunities and Challenges for the Developed and Developing Regions of the World*. Amsterdam: Elsevier.

Taloustieto Oy, (2009) *Evaluation of the Finnish National Innovation System – Full Report*. Helsinki: Helsinki University Print, 2009, Taloustieto Oy.

Tapscott, D., Williams, A.D., (2006). Wikinomics: How Mass Collaboration Changes Everything, Penguin Group.

Thagard, P. & Croft, D., (1999) Scientific discovery and technological innovation: Ulcers, dinosaur extinction, and the programming language JAVA. In L. Magnani, N. Nersessian, and P. Thagard (Eds.) *Model-based Reasoning in Scientific Discovery*. New York, NY: Plenum Publishers: 125-137.

Urban, G. and von Hippel, E. (1988). Lead User Analyses for the Development of New Industrial Products. *Management Science* **34(5)**:569–82.

Von Hippel, E. (1986). Lead Users: A Source of Novel Product Concepts. *Management Science* **32(7):**791–806.

Watanabe, C. & Fukuda, K. (2005). National Innovation Ecosystems. The Similarity and Disparity of Japan US Technology Policy Systems toward a Service-oriented Economy. Interim Report IR05057. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Yin, R.K., (1990). Case Study Research: Design and Methods. Newbury Park, CA: Sage Publications.