

PLEASE NOTE! THIS IS PARALLEL PUBLISHED VERSION OF THE ORIGINAL ARTICLE

To cite this Article: Santonen, Teemu (2009). Creating The foundations for Mass Innovation: Implementing National Open Innovation System (NOIS) as a Part of Higher Education. In Stimulating Recovery - The Role of Innovation Management. Proceedings of 2nd ISPIM Innovation Symposium. New York City, USA 2009. ISBN 978-952-214-863-6.

CREATING THE FOUNDATIONS FOR MASS INNOVATION: IMPLEMENTING NATIONAL OPEN INNOVATION SYSTEM (NOIS) AS A PART OF HIGHER EDUCATION

Teemu Santonen

Laurea University of Applied Sciences,
Vanha maantie 9, FI-02650 Espoo, Finland
E-mail: teemu.santonen@laurea.fi

Abstract: 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 initial findings regarding the implementation of NOIS as a part of Finnish NIS and especially higher education. Finland is one of the leading nations regarding innovation and educational systems and therefore it could be regarded as an extreme case. This study is building a strong knowledge foundation which helps us to better understand the main obstacles and challenges of this implementation process. It is suggested that the biggest implementation challenges are the recruitment of human resources and the ability to change the higher education organizations current practices.

Keywords: Open innovation; national innovation system; online social networks, higher education, mass innovation

1 Introduction

The most competitive countries in the world typically have sophisticated National Innovation Systems (later NISs) (e.g. Lundvall, 2007). In open innovation approach internal and external ideas and resources are combined on the way to introduce new products and services (Chesbrough, 2003). Recently online social networks (later OSNs) – communities and hosted services facilitating collaboration and sharing between users – have recently gained a significant interest among ordinary net users as well as professionals (Cachia et. al. 2007). We believe that it is possible to utilize open innovation focused OSNs as a part of NISs. This kind of system enables true mass collaboration and innovation in which masses of people are innovating together in an open infrastructure (Tapscott and Williams, 2006).

This study introduces the main principles from a novel mass innovation paradigm named National Open Innovation System (later NOIS). In year 2008 NOIS was rewarded as a best school related innovation in Finland, which according to Global Competitiveness Report 2008-2009 is one of the leading nations regarding national innovation and educational systems. Previous NOIS publications (Santonen et. al 2007, 2008a, 2008b and 2008c) have covered only the theoretical aspects of the NOIS, while

the practical experiences have been omitted. Therefore in this study we will focus on the findings of implementing NOIS as a part of Finnish higher education system.

2 Introducing the Theoretical Foundations

2.1 Theoretical foundations of National Open Innovation System (NOIS)

Theoretical foundations for NOIS were initially introduced by Santonen et. al. (2007) and later on refined in series of publications including: 1) the integration of OSNs to the Triple Helix model (Santonen et. al 2008), 2) increase of individual creativity with the help of content recommendation (Santonen et. al 2008) and 3) a definition of a solid reward model for NOIS (Santonen et. al 2008). Because of these publications the detailed theoretical background of NOIS is omitted in this study. The above studies are suggested as additional reading for those who are interested in more detailed theoretical information.

2.2 What is NOIS?

Following taxonomy is defined to describe what NOIS is. *First*, NOIS is a part of NIS, yet it is globally scalable. NIS is a set of institutions whose interaction determines the innovative performance of nation (adapted from Nelson, 1993). However, globally scalable requirement expands the NOIS geographical scope from nation level to global level. *Second*, even if NOIS is an OSN, yet has a strong offline support structures such as higher education system. *Third*, NOIS is grounded to open innovation (Chesbrough, 2003) which suggests that instead of doing everything by yourself, you should look also for external resources. *Fourth*, the content production model for NOIS is founded on user generated content model. User-generated or user-created content is typically associated to publically available contents in which the consumer is the creator, consumer and distributor of content (e.g. OECD 2007 and Le Borgne-Bachs Schmidt et. al. 2009). *Fifth*, NOIS is utilizing mass collaboration and crowdsourcing. Mass collaboration 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). In crowdsourcing a task is delegated to a large group of people, which then suggests their own solutions for the defined task (Howe, 2006). *Sixth*, NOIS OSN is build on a open source technology in which the software is freely and publicly available for use or modifications (e.g. Open Source Initiative definition at opensource.org). *Finally*, NOIS is a personal tool, which challenges our current mindset and way of work. At the first stage a novel idea is only an intention in individual's mind which later on is or is not shared with other people by verbal or written communication depending on the individual's willingness to share (Santonen et. al. 2007). This final sharing requirement is simple to define, but in practice it appears to be very difficult to execute. According to Nielsen (1997 and 2006) OSN are affected by participation inequality and in most communities, 90% of users are lurkers who never contribute, 9% of users contribute a little, and 1% of users account for almost all the action.

2.1 Defining mass idea and mass innovation

According to Santonen et. al. (2007) idea is a novel representation in individual's mind relating to conception or notion of something to be done or carried out. The new idea is first born in individual mind and then in the second stage shared with others. According to Taatila et. al. (2006) economic innovation refers to novel ideas that have been implemented, producing more financial value than has been invested in creating them (Stevens and Burley, 1997), i.e. financially and commercially successful innovations. Idea is always the starting point, plan or intention for potential innovation. Idea changes to innovation during the execution process. Without the successful execution, the idea will not change to innovation.

The *mass* term e.g. in mass communication indicates great volume, range or extent (of people or production) and reception of messages (McQuail, 2005). Accordingly in order to qualify as a mass idea/innovation, large segments of the population (even at the same time) must be involved in the open creative processes. Basically mass ideas/innovations are emerging from a mass of creative interaction between a wide range of people who combine different but potentially complementary insights and contents (adapted from Leadbeater, 2008). In our opinion a genuine mass idea/innovation is not possible to invent and develop without the contribution of masses of people. In the case of mass idea, the initial idea is also first born in the individual's mind but as a result of the (simultaneously) interaction with a great quantity of other users and shared contents. Furthermore afterwards the newborn mass idea should be openly shared back to the community. Like in the typical idea-to-innovation processes, the mass idea transfers to mass innovation as a result of successful implementation process which again should involve masses of people.

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 – Finnish 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 tool to understand a novel phenomenon such as NOIS.

In order to better understand the starting point of this study, we also present the structure and the status of the Finnish higher education system in brief (Ministry of Education, 2008 and 2009). The higher education system in Finland consists of two complementary sectors: *first* universities and *second* universities of applied sciences, which are also called as polytechnics. Universities are focusing on research and education based on researches while universities of applied sciences are training professionals in response to labour market needs and conducting R&D which is supporting instruction and promoting regional development. This system is still fairly new and the structure was started on a trial basis in early 1990's. By 2000 all universities of applied sciences had turn to permanent structure.

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 NOIS concept.

3.2 Unit of analysis

European Social Fund (ESF) is funding Open Innovation Banking System - project (later OIBS) which is implementing NOIS as a part of Finnish higher education. OIBS-project is developing and maintaining massidea.org online social network website which combines and implements the NOIS theory and practice together. OIBS-project is coordinated by Laurea University of Applied Sciences and lead by author of this paper Dr. Santonen. Project includes 13 universities. In this study the unit of analysis is the OIBS-project. OIBS-project was started on May 2008 and it is scheduled to end in June 2011. Afterwards it is assumed that NOIS will a part of higher education system in Finland. The timeline of this study covers autumn 2006 to spring 2009.

3.3 Research strategy

The research strategy of this study is loosely following the seven principles for interpretive field research presented by Klein and Myers (1999). According to these principles we understand a complex phenomenon from preconceptions about the meanings of its parts and their interrelationships. The whole and parts consists the parts from the history with proper perspective to the historical context. The method also requires a critical reflection of the social and historical background of the research. Therefore it is evident that readers need to know how the current situation has emerged. As a result, in the sample selection we briefly pointed out the structure, history and current status of Finnish NIS and later on this study we will introduce the history of NOIS and OIBS-project.

In an interpretive field research the interpretive researchers' and other research participants preliminary understandings and interactions are also affecting on the study results. Therefore it is important to note that the interpretive researcher and author of this study has not only presented the original idea for NOIS, but 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) official ESF reports and documentations, which are OIBS-projects tools to communicate with the funder and report the project progress, 2) OIBS Wiki, which is the home of OIBS-developer community including all development and marketing documentation, 3) OIBS project in www.sourceforge.net, which offers web-based management tools to open source software projects, 4) seminars and events which brings together the project partners and finally 5) personal documents, discussions and emails between author of this study and other project participants.

The remaining four principles for interpretive field research include the principles of 1) abstraction and generalization, 2) dialogical reasoning, 3) multiple interpretations and 4) suspicion. These principles mainly influence the results and discussion stage of this study.

4. RESULTS

The following results are presented in a historical timeline from autumn 2006 to spring 2009. Due to strict length limitations, only the most important observations are described.

4.1 Project planning phase

The original idea for NOIS was invented by author of this study in autumn 2006. Dr. Santonen was stimulated by a new academic working environment and realized that his previously identified practical need – how masses of people could generate ideas and innovations without causing significant extra costs – might be solved. In November 2006 NOIS idea was first time publically presented. An open call to join yet the non-existing project was announced in a national seminar. As a result 7 universities of applied sciences indicated willingness to participate. The first informal project group meeting took place in February 2007.

A specialist from VTT Technical Research Centre of Finland was also invited to this meeting. VTT had developed an application to support the idea generation and at the time it was considered as a potential tool for NOIS. However, later on it became evident that combing both open innovation and open source approaches would result the best combination for NOIS. Since VTT's application was based on proprietary technology, they were excluded from the project group.

In order to define a project plan, a Goal-Oriented Project Planning (GOPP) workshop was organized in March 2007. The number of participating organizations was increased by four. The project was put on hold for the summer, since the great majority of the university faculty members are on long holidays.

4.2 First fundraising attempt

In fall 2007 the Finnish Funding Agency for Technology and Innovation (later Tekes) launched a new programme call. This programme was targeted to increase and broaden the services development of the Finnish industry and to promote academic research in service related areas. Open Innovation Banking System (later OIBS) named project proposal was filed to Tekes in November 2007. During the fall Dr. Santonen also participated in series of workshops organized by the new Tekes funded public-private partnerships network called the Strategic Centre for Science, Technology and Innovation in the Field of ICT (SHOK). This network was preparing series of research programmes in the ICT industry and services sectors and the aim was to integrate the OIBS-project as a part of these programmes.

In February 2008 the rejection from Tekes program was received. According to Tekes the rejection reasons were following: 1) OIBS is not targeted to indicated industry areas, programs themes or it does not include enough new standpoints and 2) the project plan as a whole was not considered credible. Since the level of expected funding from Tekes SHOK programs would have been minor at the time, it was regarded as a useless route.

4.3 Second fundraising attempt

The European Social Fund (later ESF) was starting projects to develop knowledge and innovations systems and networks. This appeared to fit well for the OIBS-project

purposes and a project proposal with slight changes in project consortium was filed in January 2008.

Interestingly in April 2008 OIBS-project was awarded by Finnish Inventor Support Association. According to award donor the project was seen as one of the new Finnish success story. About the same time a tentative financing decision from ESF reached the project group. However, a series of additional information request were indicated by the funder. The most significant requests focused on the budget cut from 1.9 M€ to 1.1 M€. The consortium was facing the major challenge. According to 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 restructure. This increased the risk of implementation failure since nearly the same outcome was about to deliver with half of the assumed resources. Also it was noted that the cost structure is likely to front-loaded on the contrary to required back-loaded model.

Since the 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 simultaneously rewarding with study credits and project funding was also prohibited by the funder.

The preliminary consortium agreement was updated. In the agreement common goals for content production were defined: In first year 15%, second year 30% and third year 50% of the total number of students in a partner university had to be engaged to content production. Each student was expected to produce about 10 basic contents (estimated length was about ½ to one A4). In addition, students were assumed to actively comment and rate contents. Achieving these goals would result nearly 20.000 students producing 200.000 new contents annually. The consortium agreement was posted back to funder by the end of July 2008.

4.4 Project kick-off

A project kick-off was held in September 2008. Participants included the key persons responsible for starting the project activities in their home universities. In the kick-off it was indicated that project's short term goal is 1) to launch the first OSN web site version in the beginning of January 2009, 2) to start and pilot test the content production right away without fully functional OSN. In order to speed up the technical development a partner responsible for technology development had started the software development during the summer by employing two ICT students. The resulting application – having only limited functionalities – was introduced in kick-off. Partner network was invited to participate in the open source development and preliminary content production.

Surprisingly, also in the September 2008 the funder requested additional changes to consortium agreement. Only after these changes, the funder would make the official and final funding decision. After about one month debate the funder was accepting the suggested agreement. The partner network commenting and signature round was finished in November 2008 and final agreement was then filed back to funder.

In practice the lack of official funding decision had a significant effect during the fall 2008. As a result of “in-between” situation a part of the group was unable to start resourcing the project. According to them their administrative processes required official funding decision for the project start even if funder delivered encouraging message “to start”. Soon it became evident that project would leave behind the schedule right from the start. Coordinator tried to motivate the group, yet the lack of resources was inevitable. This started a vicious circle. Since the project did not have the resources, it was unable to develop the OSN fast enough. Since the OSN was missing the content production was hard to motivate. Only minor amount of contents were produced by few partners during the fall. The warning signals relating to lack of human resources and flexibility of organizations were first time observed.

4.5 Starting full scale activities

The official funding decision came in mid January 2009 from ESF and the project consortium was informed to start the full scale activities immediately. It was emphasized that especially the technical development required a significant amount of new resources since the absence of actual OSN was holding back the content production. Technical development was boosted by arranging a developer day in February 2009. The participants included all the partners having technology development role in the project. As a result a core technology team now included 7 students from three partner schools. However, this was clearly less than expected. The resources allocation warning signals were second time picked up by coordinator.

The geographical distribution of the technical developers led to changes in the development processes. The codebase development was transferred to sourceforge.net, which is argued to be world's largest open source software development web site. This change enabled a genuine distributed development without strong central control. In April 2009 the first OSN demo was published. It made content production possible, yet had still a limited functionality. Interestingly only few partners utilized the offered possibility to content production even if the preliminary request to start content production was brought to knowledge in autumn 2008. The total number of published content remained modest. However, the OIBS Wiki – the home of the development community – seemed to be alive. By the end of spring Wiki included 560 development related pages, 135 files, 156 register users and a total of 38.000 page views.

4.6 Making the first corrective actions

During the spring semester 2009 each co-partner was contacted multiple times with email and telephone. Coordinator also visited each partner at least once. The purpose of these meetings was to evaluate the achievement of the set goals and estimate how probable the realization of planned tasks was. The technical infrastructure was still developing slower than expected as result of smaller development team than originally estimated. The corrective actions were carried out by the coordinator. It was suggested that the funding aimed to technology sub project would be focused to those partners who were actively taking part to development. It was evident that this action increased the tension between the coordinator and some of the partners. As a result only one partner was willing to reduce their share. However, this university was going to emerge with other partner due to structural development of Finnish universities. Their share was then agreed to transfer to this partner who has been active in the development. As a result of

the funding reduction suggestion the number of technical developers increased to ca. twenty persons for the forthcoming summer period 2009.

5. Discussion

NOIS is a good example of innovation theories, which suggests that a practical need or working environment change effect to the birth of new idea. The NOIS idea has gained a significant amount of interest from early on and evidently a great number of people and organizations are seeing the assumed benefits. However, the practical implementation process has confronted a number of challenges which on the other hand can not be considered a big surprise. The biggest challenges seem to be the recruitment of human resources and the ability to change the organizations current practices.

As a result of project funding structure and NOIS idea itself, the majority of the development work and content production is based on voluntary contribution (i.e. not paid by the OIBS-project). Even if a lot of people are convinced the goodness and benefits of the idea, it is amazingly hard to recruit faculty members and students to contribute. This on the other hand is inline with previous studies which have identified the participation inequality in the case of OSNs. The diffusion of innovations theory is also offered as an explanation (Rogers, 1962). It appears that only innovators – the first individuals to adopt an innovation – are joining to NOIS. Teacher's and student's 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 outcomes to masses of people – have been printed hard in higher education. Changing this is a slow process, but if succeeded might deliver a substantial competitive advantage to participating individuals, universities and nations.

There appears to be also structural and organizational barriers. In order to fully integrate something to educational processes, there should be integration to university specific curriculum. If NOIS is not a part of objectives of the curriculum, it must be implemented by one teacher. 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 key role in content production. Only if these teachers are defining studying tasks which outcomes are shared to NOIS, the critical mass of users is able to achieve.

Other key target group is the teachers responsible for internships, which are compulsory in universities of applied sciences and teachers responsible for thesis supervision and seminars. In technical and other NOIS related development tasks, there is a clear learning curve for new comers. Hence a longer period is required for effective development work. Because of the current economical crises, students and particularly international students have been in troubles to find internships places. For these students projects like NOIS are offering stimulating working environment, which in our opinion represent the future way of work.

6. Conclusions

In this study we have introduced the National Open Innovation System (NOIS) in brief, which is enabling open innovation and online social network ideology integration

to NIS and higher education. With the help of interpretive research methodology we have presented our initial findings regarding the implementation of NOIS as a part of Finnish NIS. This study is building a knowledge foundation which helps us to better understand what kinds of obstacles are faced during the implementation process. Only when the practical barriers are identified, there is a possibility to find the solution these obstacles.

We must stress that the selected research methods – one case and interpretive research strategy – is limiting our possibilities for generalization. Our results present only the project managerial point of view, not the whole OIBS-project group or other key player of NOIS, including public and private sector organizations and end-users. Only by evaluating NOIS implementation from all key players' points of view, can one generate a comprehensive understanding of the NOIS. Therefore a future research should expand the sample group to the other target groups of NOIS. These studies might give insight why it is so difficult to get people involved.

7. Acknowledgements

Author of this study would like to express his gratitude for European Social Fund (ESF) and State Provincial Office of Oulu which is the ESF national funder for OIBS-project. Author also expresses his acknowledgement to all OIBS project partners and personnel.

References and Notes

1. Cachia, R., Compañó, R., Da Costa, O., (2007), Grasping the potential of online social networks for foresight, *Technological Forecasting and Social Change* 74(8), pp. 1179-1203.
2. Chesbrough, H., (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press. Harvard.
3. Howe, J., (2006), *The Rise of Crowdsourcing*. Wired magazine, Issue 14.06
4. Klein, H.K., Myers, M.D., (1999), A set of principles for conducting and evaluating interpretive field studies in information systems, *MIS Quarterly*, Vol. 23 No.1, pp. 67-94/March
5. Le Borgne-Bachs Schmidt, 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*
6. Leadbeater, C., (2008), *We-think: Mass innovation, not mass production: The Power of Mass Creativity*, Profile Books, ISBN: 978-1861978929
7. Lundvall, B-Å., (2007), *National Innovation Systems-Analytical Concept and Development Tool*, *Industry and Innovation*. Sydney: Vol. 14, Iss. 1, p. 95.
8. McQuail, D., (2005), *McQuail's Mass Communication Theory* (fifth edition), Sage, ISBN: 1412903718
9. Ministry of Education (2008), *Education and Science in Finland*, Ministry of Education publications 2008:25, ISBN: 978-952-485-552-5 (PDF)
10. Ministry of Education, (2009), *Finnish Education System in an International Comparison*, Ministry of Education Policy Analyses 2009:2, ISBN: 978-952-485-778-9

11. Nelson, R. (ed.) (1993), *National Innovation Systems. A Comparative Analysis*, Oxford University Press, New York/Oxford
12. Nielsen, J., (1997), *Community is Dead; Long Live Mega-Collaboration*", Jakob Nielsen's Alertbox for August 15, 1997
13. Nielsen, J., (2006), *Participation Inequality: Encouraging More Users to Contribute*, Jakob Nielsen's Alertbox, October 9, 2006:
14. OECD, (2007), *Participative Web: User-created Content*, DSTI/ICCP/IE(2006)7/FINAL, prepared by Sacha Wunsch-Vincent and Graham Vickery, Directorate for science, technology and industry; Committee for information, computer and communications policy
15. Rogers, E.M., (1962), *Diffusion of innovations*, Free Press of Glencoe
16. Santonen, T., Kaivo-Oja, J., Antikainen, M., (2008), *National Open Innovation System (NOIS): Defining a Solid Reward Model for NOIS*, In K.R.E. Huizingh, M. Torkkeli, S. Conn and I. Bitran (eds). *Proc. of the 1st ISPIM Innovation Symposium - Managing Innovation in a Connected World*, ISBN 978-952-214-665-6.
17. 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. 37 s
18. Santonen, T., Kaivo-Oja, J., Suomala, J., (2008), *Brief Introduction 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, ISBN-10: 1-934272-48-5 (Volume III), pp.126-131.
19. Santonen, T., Suomala, J., Kaivo-Oja, J., (2008), *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*.
20. Stevens, G.A., Burley, J., (1997). *3000 raw ideas equals 1 commercial success!*, *Research Technology Management*, Vol. 40 No. 3, 16-27.
21. Taatila, V., Suomala, J., Siltala, R., Keskinen, S., 2006. *Framework to study the social innovation net-works*. *European Journal of Innovation Management*, Vol. 9; No. 3, 312-326.
22. Taloustieto Oy, (2009), *Evaluation of the Finnish National Innovation System – Full Report*, ISBN 978-951-628-491-3, Helsinki University Print, 2009, Taloustieto Oy (on behalf of the Ministry of Education and the Ministry of Employment and the Economy)
23. Tapscott, D., Williams, A.D., (2006), *Wikinomics: How Mass Collaboration Changes Everything*, Portfolio Hardcover, ISBN 1591841933
24. World Economic Forum, (2008), *The Global Competitiveness Report 2008-2009*
25. Yin, R.K., (1990), *Case Study Research: Design and Methods*. Newbury Park, CA: Sage Publications