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Developing a platform for serious gaming: open innovation through closed innovation

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Abstract

In this paper, we draw on open innovation paradigms and Activity Theory to describe how a research organization operates and manages the development of a platform for serious gaming. In particular, we focus our efforts on the relationships formed within the research organization and across the gaming community, and consider whether open innovation practices followed. While open innovation has been explored considerably in relation to its business value and its wide application in gaming, what misses in the literature is a micro-analysis of why and how it occurs through discursive activities. The paper addresses this gap in the literature by offering an understanding of how dialogues develop between individuals that have never developed a gaming platform before neither do they have a working history on this specific field. Discourse analysis is performed to study the initial interactions of actors with each other and the mediating tools they have at their disposal until they manage to develop a platform for serious games which will then attract contributions from the gaming community. The case study provides an instructive example of the innovation process and shows that the innovation process can be comprehensively examined as a shared activity. Addressing the scope of the conference, the paper suggests that Activity Theory, a multi-disciplinary approach, can support organizations and entrepreneurs in developing an effective design strategy for serious applications of games and virtual world technologies and thus addressing the challenges raised by the shift towards immersive world applications.

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Keywords: Open Innovation; Gaming Platforms and Tools; Organizational processes; Activity Theory

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1. Introduction

This paper reports on a research project in progress undertaken by a research organization, which attempts to develop a platform for serious games. Its main objectives are to attract the gaming community to contribute with ideas for new serious games, to support the information and experience exchange within the gaming community, and ultimately to foster innovation in the serious games industry by achieving commercial agreements among contributors. As such, the platform developed will follow the open innovation paradigm to accomplish these objectives. In this paper, we focus on the relationships formed within a research organization and across the gaming community, and consider whether open innovation practices followed when developing the platform for serious games (henceforth, the PSG).

Drawing on open innovation paradigms and Activity Theory, the paper describes how a research organization operates and manages the development of PSG. The PSG will rely on the contribution of the gaming community members to offer customized serious applications and games. While open innovation has been explored considerably in relation to its business value and its wide application in gaming, what misses in the literature is a micro-analysis of why and how it occurs through discursive activities. The paper addresses this gap in the literature and offers an understanding of how interactions develop between individuals that have never developed a gaming platform before neither do they have a working history on this specific field.

Discourse analysis is performed to study the initial interactions of actors with each other and the mediating tools they have at their disposal until they manage to develop a platform for serious games which will then attract contributions from the gaming community. The case study provides an instructive example of the innovation process and shows that the innovation process can be comprehensively examined as a shared activity. Revisiting the operational framework of a research organization, innovation can be encouraged and further assisted, which can in part result to increased and improved production of serious applications and games, respectively.

Addressing the scope of the conference, the paper shows how Activity Theory, a multi-disciplinary approach, can support organizations and entrepreneurs in developing an effective design strategy for serious applications of games and virtual world technologies and thus addressing the challenges raised by the shift towards immersive world applications.

2. Literature review

2.1. *Open Innovation Literature*

Following von Hippel's [1] groundbreaking work on lead users, the importance of users as a source of open innovation is being widely recognized [2, 3, 4]. In 2003, Henry Chesbrough coined the term "open innovation" to describe innovation processes in which firms interact extensively with their environment, leading dynamically to a significant amount of external knowledge exploration and exploitation [5, 6]. Open innovation has been originally defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" [7]. Open innovation can be considered as one of the most promising applications of the Internet era, not least because of the unparalleled opportunity to connect previously disconnected individuals to engage in common practices, actions and projects, thereby fostering innovation to extents that are often unknown to us.

Already, a number of theoretical and empirical studies have been conducted to investigate the process of innovation which at the same time, directly or indirectly address the change in the redefined relationship between technology developers and end-users. Reference [8] has described the evolution of technology through incremental improvement within an existing community of practitioners. Reference [9] adds that user-led

innovation is particularly effective mainly for reducing costs of gathering “sticky” information about user preferences. This is enabled by the consumer freely revealing information about an innovative product or process to the manufacturers, which may then improve upon it and/or, assuming economies of scale in production, offer it at a price lower than users’ in-house production costs [10; 11, 12]. This is particularly important, especially, as this information may be costly to acquire, transfer and use [9]. In this sense, users have been also acknowledged as playing a key role in influencing the direction of innovation [13].

User integration into the various phases of an innovation process has been analyzed by researchers from other perspectives as well, mainly regarding roles, chances, and risks [14, 15] involved in developer-end user interactions. Besides their role as consumers, users are being considered as active promoters of specific technologies and innovation. Therefore, their perceptions of their own needs and their own understanding of the product qualities that fulfill these needs are shaped strongly by particular experiences.

Reference [16] has looked at the diffusion of innovations either as a collective process or an authority decision. Reference [17] and [18] have looked at technological innovation, as a socially constructed process in which social groups continuously negotiate different meanings (see also [19, 20, 21]). Researchers such as [22, 23, 24] have attempted to explicate the interpretative dynamics involved in the process of the introduction of an innovation and later in the process of IT change. Reference [20] has used the concepts of ‘interpretative flexibility’ and ‘technological frame’ to look at the design stage of innovation. Reference [25] has researched the video game industry to understand the potential benefits and possible limitations of open innovation from the viewpoint of firms making consumer goods. Reference [25] has specifically looked at how user-led innovation increasingly involves peer-to-peer interaction and collaboration among consumers in the Internet era.

A recently provided definition of open innovation that links the open innovation framework to literatures such as knowledge management, organizational learning, and collaboration practices is the following: Open innovation is defined as systematically performing knowledge exploration, retention, and exploitation inside and outside an organization’s boundaries throughout the innovation process [26] (see also [27, 28]). However, as the author argues even the successful firms have to overcome major challenges at the beginning of their open innovation initiatives [29, 54], since there are major inter-organization differences in how open innovation is successfully managed.

Reference [26] believes that there are firms that experience severe challenges in actively managing the processes of open innovation and others that appear to have achieved some great benefits, such as Procter & Gamble and Eli Lilly. In this sense, there is lot to be learnt on turning open innovation into best practice and transferring it across an organization. Despite the various perspectives open innovation has been looked at, there is still a gap in addressing the discursive micro-processes of enabling open innovation. While a tentative systematization has been provided to suggest four lines of open innovation – namely, technology transactions, user innovation, business models, and innovation markets – we will draw upon the second stream of research studies, which is user innovation. This stream primarily examines how firms may collaborate with users in the external exploration of new knowledge and ideas [26]. Having reviewed the relevant literature on this stream of open innovation, we feel there is still limited understanding of its potential applications and benefits. Thus, practitioners and academics alike would benefit from a better understanding of the communication practices of open innovation processes, in order to grasp the benefits of acquiring new knowledge while avoiding potential negative side-effects such as falling into a chaotic or poor communication. To shed light to this, we argue that offering an understanding of open innovation by focusing on discursive practices will be necessary to analyze how open innovation actually takes place. In order to do this, we suggest the use of Activity Theory.

2.2. Activity Theory

Activity Theory has its foundation in the Soviet cultural historical school of psychology that was founded by L. Vygotsky during the first decades of the 20th century [30]. The focal point of Activity Theory is an activity system where action is mediated; this draws on the idea that cultural means or artifacts – that is, mental constructs or physical entities – operate in a mediating role between human agents and the object. These cultural means or artifacts can be either signs or tools that they are internalized by individuals when participating in common activities with others [30, 31]. Activity Theory's concepts have been extended recently with more emphasis being given to the importance of analyzing the interactions between three additional elements of the activity system. These additional elements include rules (the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system), community (which comprises multiple individuals and groups who share the same general object) and the division of labor (all the horizontal division of tasks between the members of the community and the vertical division of power and status) [32]. By doing so, they examined the activity systems at the macro level of the collective and the community rather than the micro level of the individual actor functioning with tools [33].

An activity system is usually illustrated following [32] pyramid (in Figure 1) with key features being a) the active role of the subject, b) the mediating role of an artifact on the relationship of the subject with the object, and c) the interaction of all the activity system elements with each other [34]. Researchers such as [35] and [33] suggest that this model looks at the activity from the point of a goal-directed subject and its actions, but it also brings into focus the interrelations between the individual subject, the activity in which the subject is engaged and the social structure within which the activity takes place.

Furthermore, [32] advocates that the principles of historicity and of the central role of contradictions as sources of change and development may help to summarize in some way Activity Theory. 'Historicity' means that activity systems are shaped over extended periods of time and their problems and potentials can only be understood against their own history, which needs in turn "to be studied as local history of the activity and its objects and as history of the theoretical ideas and tools that have shaped the activity" [32]. Historically accumulating structural tensions within activity systems are developed into contradictions, which often take place when a new element from the outside (for instance, a new technology or a new object) is introduced into an activity system. This introduction can lead to an aggravated contradiction where the existing elements collide with the newly introduced element. According to [32], such contradictions generate disturbances and conflicts but also innovative attempts to change the activity.

Finally, Activity Theory considers human activity as a three level hierarchy: activities realized through series of actions, which are carried out through operations. Human activity is always directed toward a tangible or ideal object to satisfy a need and the subject's expectation to this object determines the motive (or motivation) of the activity.

Activity Theory has a wide audience and applications in a number of fields, including technology development and computer interaction (e.g., [36, 37]. This section establishes that it is possible and logical to use Activity Theory as a theoretical framework, while advancing on Miettinen's [30] arguments and on previous Activity Theory studies examining the innovation process [53, 55].

Drawing on Activity Theory [36, 38; 39, 40], we aim to explore in situ how dialogues develop between individuals that have never developed a gaming platform before neither do they have a working history on this specific field. We employ Activity Theory to explain the development of the PSG by examining all the elements of the Activity system and will attempt to achieve a micro-analysis of why and how open innovation occurs through discursive activities.

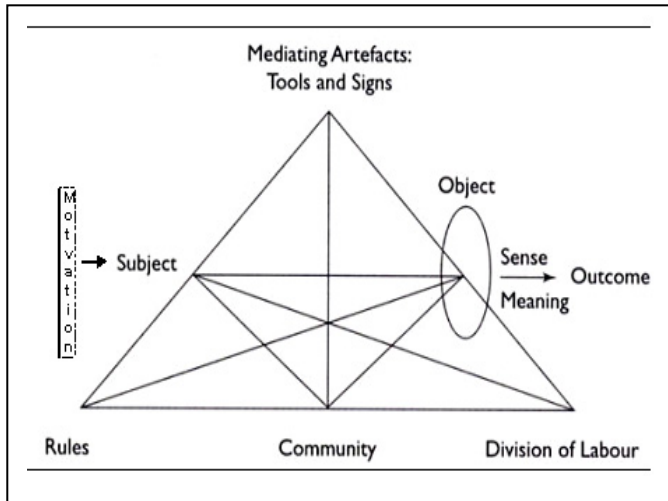


Figure 1. The mediational structure of an activity system (Source: Engestrom, 1987)

3. Methodology

A wide range of studies (e.g. [33, 41, 42]) have applied Activity Theory and it can be said that the general pattern emerging is investigation over time through a variety of methods rather than specific research methods. As a result, data collection was conducted through discourse analysis to study the initial interactions of actors. Discourse analysis is the systematic study of talk and text. As such, data collection was conducted through analysis of electronic documents and electronic traces (e.g., emails, logging in stamps, etc.), minutes of meetings and organizational documents such as contracts and project management documentation. With regards to the study of talk, participant observation was conducted as well as participation in meetings. The collection of multiple forms of data took place during the period between October 2011 and June 2012. The use of multiple methods to corroborate data sources ensures the reliability and validity of the research.

An interpretive approach was the underlying perspective used to guide this research. Data were collected in line with procedures informed by previous Activity Theory studies (e.g. [34]) and by following [43] guidelines about case study research. Initial data were analyzed based on inductive analytical methods suggested by [44] to identify themes and repeated patterns regarding the process of innovation. Discourse analysis was performed to study the initial interactions of actors with each other and the mediating tools they have at their disposal until they manage to develop a platform for serious games which will then attract contributions from the gaming community. The case study provides an instructive example of the innovation process and shows that the innovation process can be comprehensively examined as a shared activity.

4. Data analysis and findings

The research project that forms the focus of this case study endeavors to develop a platform for serious games which will then attract contributions from the gaming community. The sensitivity of the data gathered has meant that anonymity is a condition of publication.

The development of the PSG is still under process, so what will be presented here is part of the interactions held within the activity system. Data will be presented from the introductory phase (in which the research organization signs up to the project) and the development phase (in which the research organization proceeds to the development of PSG). While it is difficult to present all interactions, for analytical convenience, the following section provides an activity theory examination of the innovation process in the research organization.

4.1. Motivation and Object

The initial motivation for a project on serious games can be traced back to 2009-2010 when the idea existed in an embryonic and abstract form. However, due to organizational and practical affairs the prospects of the project were not comprehensively examined. The idea for the project re-manifested itself more than a year later when funding for parts of the projects became available and the project was then officially initiated. From then, as somewhat extensive research in the field of serious games emerged, expectations increased and the established motivation became to produce quality research in the field, and to foster innovation and knowledge transfer within the gaming community through commercial agreements among contributors of ideas for new serious games.

4.2. Subject

The subject for this activity system is the Principal Investigator from the research organization, who presented the very initial inspiration and led the project through its first phase.

4.3. Motivation and Object

The subject worked very closely with a number of partners (community) to achieve the object of the innovation activity. The community consists of a collective phenomenon of individuals within the research organization, which includes two researchers, the director for research, two developers, and several administration members of staff.

The community of the system also refers to the collection of those individuals and organizations that the Principal Investigator interacted with. That includes a complex sub-network of organizations from the gaming industry, entrepreneurs engaged with mobile application and software development, mobile media and communication technology experts, non-professionals/game players, and other commercial organizations.

4.4. Tools

The main conceptual and physical tools that mediated the interactions between the subject and the community of the system were oral communication and traditional mediums such as email, telephone and meetings. These ranged in use depending on the context. Electronic documents were exchanged through email. Few non-traditional interaction tools were utilized within the research organization. Information management tools, online collaboration systems, and micro-sites were used to a trivial extent for the purpose of the project, although all individuals in the research organization were using them for other purposes.

The communication with members of the community external to the research organization was mediated primarily by traditional mediums. In 2012 the research organization facilitated an event that attempted to bring together the community of the activity. That produced the emergence of new mediating tools such as websites and social media. While introduced late in the development phase, these tools can be viewed as a strategic instrument to generate meaning of the innovation.

4.5. Rules and Norms

This collection of individuals and organizations are defined by their shared norms and expectations. There were a number of rules and norms surrounding the innovation activity and particularly the relationships formed. These are important in explaining the emergence of the partnerships. These were not formally articulated rules but rather habitual routines of behavior. For instance, for dealing with entrepreneurs and mobile media experts the basic principle was that relationships were often formed on an unplanned basis. The difficult financial environment meant that it was challenging for the members of the community within the research organization to form routines of behavior that persisted on the expansion of the community rather than focusing purely on the financial merit and prudence of their actions. What was, perhaps, more interesting was the emphasis placed on the facilitation of the event that aimed to create strong relationships with the community of the activity despite the financial constraints.

There were also a number of organization rules and norms that the innovation activity was required to follow during the trajectory of the development of the PSG such as technical guidelines and standards concerning data encryption, firewalls and security as well as multiple exporting functionalities.

4.6. Division of Labor

The innovation activity was largely undertaken by key individuals within the research organization. The participation of the Principal Investigator ensured that executive support was available and a champion existed to drive forward the innovation activity. This is especially important in an activity that is not expected to produce an immediate financial outcome and only limited resources can be associated to the activity. The division of labor run horizontally since tasks were shared rather than distributed from top to down.

4.7. Open innovation Outcome

The outcome of the activity system is that the innovation process will be concluded with the launch of the PSG by the research organization investigated.

5. Discussion and Contribution

The focus of an activity system is on how the subject shapes their objects, the reasons underlying the creation of the object, and the outcome of the activities that have taken place. However, although the central line of the activity systems (motivation – subject – object – outcome) is very important, the rest of the elements in the activity systems have a comparable significance. This is because the components of activity systems are not static components; instead, they are in a dynamic and continuous interaction with the other components through which the activity system is defined as a whole [45]. That said, identifying how the system components

mediate the activity as well as the interactions between them is fundamental to understand the human-centered system explored.

In our attempt to understand the activity system in its entirety, and thus the process of innovation surrounding the platform for serious games examined, three key interactions were identified:

- The relationship between the Principal Investigator and the power [formal] and influence [informal] that he had within the research organization (Division of Labor) and to the rest of the community.
- The relationship between the Principal Investigator (Subject) and the individuals within the research organization, the gaming industry, entrepreneurs engaged with mobile application and software development, mobile media and communication technology experts, non-professionals/game players, and other commercial organizations (Community). The more exchange of information and experience the subject could achieve with the community, the more open the innovation process could become and a bigger part of the community would be involved. At this point, it was revealed that there was no formal “stage” where the gaming community could share experiences and discuss issues related to the development of new applications and new technologies in the field of serious games.
- The interactions between the Principal Investigator (Subject) and the tools that mediated the activity: the Principal Investigator was operating in an organization which is very familiar to the exploitation of research for further research and sometimes for commercial purposes, and so he would be expected to make use of any research related to open innovation and serious games. Yet, the tool that was often employed was personal intuition. Beneficially, his intuition is based on extensive experience in technology development and so not exploiting research related to open innovation and serious games seems not to have affected the development of PSG so far. Traditional information technology tools were used but more advanced instruments such as online and web-based applications were not employed during the innovation process. Clearly, this has hindered somewhat the innovation process as the Principal Investigator and the community had to spend more time and effort to converse ideas and documents through personal interaction.

6. Conclusion

Through the lens of Activity Theory, we realize that the activity system was a complex sub-network of individuals within the research organization, the gaming industry, entrepreneurs engaged with mobile application and software development, mobile media and communication technology experts, non-professionals/game players, and other commercial organizations. Therefore, the innovation activity can be described as a ‘shared activity’. As observed, community members ranged in their level of involvement and often not all members of the community contributed to the development of PSG.

This raises the issue of open-innovation, and lends support to the need for wide collaboration in developing platforms and tools for gaming, and also to the importance of open innovation. This approach might become instrumental in the adoption choice of certain technologies. For instance, there might be a risk where PSG is not adopted by the gaming community because of narrow scope of PSG. This explains why some variants of a platform and tool for gaming will be eliminated while others will succeed [17].

This open-innovation approach is a new paradigm for serious gaming innovation and provides an important lesson for other research organizations. Up to now, open innovation research up to now has either focused on theoretical considerations and single case studies or it has focused on very specific issues in large-scale studies [26]. More general work has usually focused on either external knowledge exploration or exploitation without taking an integrative perspective (e.g., [46, 47,48]. The reasoning behind this ‘open’ approach is to overcome financial constraints and build on an extensive collaboration [49, 50]. However, while this is an interesting area it does have its shortcomings. For instance, it was observed that a limitation of an open-innovation approach is that the coordination and configuration of the community cannot be easily managed, which may have then

repercussions to the quick and effective development of the PSG. In addition, there might be risks for the various partners involved as the platform for serious games is not expected to produce an immediate financial outcome and only limited resources can be associated such an activity.

This study has tried to do a micro-analysis of open innovation and offer an understanding of the process of innovation in a research organization through the employment of Activity Theory. By drawing on this framework, the findings of this research produced an insight into the process of innovation in a research organization developing a platform for serious games. This study revealed the key contributors, the underlying reasoning behind their actions, and the social, organizational and environmental factors influencing and mediating their actions. The findings also pointed out that the process of innovation in such organizations is not a linear process but one with multiple dimensions. In order to control and/or moderate these interactions, three key inter-relationships of the activity systems formed require particular consideration; the relationship between the subject and the division of labor; the relationship between the subject and the community; and the relationship between the subject and the mediating artifacts (or tools) employed during the innovation process.

Addressing the scope of the conference, the paper suggests that Activity Theory, a multi-disciplinary approach, can support organizations and entrepreneurs in developing an effective design strategy for serious applications of games and virtual world technologies and thus addressing the challenges raised by the shift towards immersive world applications. The paper is still under progress so the data that has been presented is very limited. The study will continue to explore in depth the kind of opportunities that appear for the developers. More interactions within the activity system will need to be analyzed to understand the reasoning and scope behind activities, the people involved, the people affected (see also [51]). Following [52], the ultimate aim of the researcher is to transform the innovation process of the PSG to a serious game itself.

References

- [1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. *J Sci Commun* 2000;163:51–9.
- [2] Strunk Jr W, White EB. *The elements of style*. 3rd ed. New York: Macmillan; 1979.
- [3] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. *Introduction to the electronic age*, New York: E-Publishing Inc; 1999, p. 281–304
- [4] Fachinger, J., den Exter, M., Grambow, B., Holgerson, S., Landesmann, C., Titov, M., Podruhzina, T., 2004. "Behavior of spent HTR fuel elements in aquatic phases of repository host rock formations," 2nd International Topical Meeting on High Temperature Reactor Technology. Beijing, China, paper #B08.
- [5] Fachinger, J., 2006. Behavior of HTR Fuel Elements in Aquatic Phases of Repository Host Rock Formations. *Nuclear Engineering & Design* 236, p. 54.
- [1] von Hippel, E. Lead Users: A Source of Novel Product Concepts. *Management Science* 1986; 32, no. 7 (July):791-805.
- [2] Olson, E. L. and Bakke, G. Implementing the lead user method in a high technology firm: A longitudinal study of intentions versus actions. *Journal of Product Innovation Management* 2001; 18: 388–395.
- [3] Lilien, G. L., Morrison, P. D., Searls, K., Sonnack, M., and von Hippel, E. Performance assessment of the lead user idea-generation process for New Product Development, *Management Science* 2002; 48 (8), pp. 1042-1060
- [4] Bonner, J. M. and Walker, O. C. Selecting Influential Business-to-Business Customers in New Product Development: Relational Embeddedness and Knowledge Heterogeneity Considerations. *Journal of Product Innovation Management* 2004; 21: 155–169.
- [5] Chesbrough, H. *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press; 2003.
- [6] Van de Vrande, V., Lemmens, C., Vanhaverbeke, W. Choosing Governance Modes for External Technology Sourcing, *R&D Management* 2006; 36, 3, pp. 347-363.
- [7] Chesbrough, H., Vanhaverbeke, W. and West, J. *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press, pp. 1-12; 2006.
- [8] Constant, E.W. The social locus of technological practice: community, system, or organization? In W.E. Bijker, T.P. Hughes, & T.J. Pinch (Eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. (pp. 223-242). Cambridge, MA: The MIT Press; 1987.

- [9] von Hippel, E. Innovation by user communities: learning from open-sources software, *MIT Sloan Management Review* 2001; 42(4), 82–86.
- [10] Kotha S. Mass Customization: Implementing the Emerging Paradigm for Competitive Advantage, *Strategic Management Journal* 1995; Vol. 16, pp. 21-42.
- [11] von Krogh, G., K. Ichijo, I. Nonaka.. Enabling KnowledgeCreation_ How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation. Oxford University Press, New York; 2000.
- [12] Harhoff, D., Scherer, F.M., Vopel, K.. Citations, Family Size, Opposition and the Value of Patent Rights - Evidence from Germany, *Research Policy* 2003, 32, pp. 1343-1363.
- [13] Porter, M. and Mariko Sakakibara. Competition in Japan. *Journal of Economic Perspectives* 2004; 18(1): 27-50.
- [14] Brockhoff, K. Customers' perspectives of involvement in new product development, *International Journal of Technology Management* 2003; 26(5-6), pp. 464-481.
- [15] Enkel, E., Gassmann, O., & Chesbrough, H.. Open R&D and open innovation: Exploring the phenomenon. *R&D Management* 2009;; 39(4), 311–316.
- [16] Rogers, E. M. Diffusion of innovations (5th ed. ed.). New York; London: Free Press; 2003.
- [17] Bijker, W. E., & Pinch, T. J. The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. In W. E. Bijker, T. P. Hughes & T. J. Pinch (Eds.), *The social construction of technological systems: new directions in the sociology and history of technology* (pp. 17-50). Cambridge, Mass; London: MIT Press; 1987.
- [18] Bijker, W. E. Of bicycles, bakelites, and bulbs: toward a theory of sociotechnical change. Cambridge, Mass.; London: MIT Press; 1995.
- [19] Sproull, L. S., & Goodman, P. S. Technology and organizations: Integration and opportunities. In P. S. Goodman, L. S. Sproull, and Associates (Eds.), *Technology and organizations*. San Francisco, CA: Jossey-Bass; 1990.
- [20] Kline, R., & Pinch, T. J. The social construction of technology. In D. Mackenzie & J. Wajcman (Eds.), *The Social Shaping of Technology*. Buckingham: Open University Press; 1999.
- [21] Wilkins, L., Swatman, P., & Castleman, T. 'More than just a transaction': Conceptualising industry-based networks for virtual trading communities. *School Working Papers Series 2002* Retrieved 16th June 2010, from http://www.deakin.edu.au/buslaw/infosys/docs/workingpapers/archive/Working_Papers_2002/2002_16_Wilkins.pdf; 2002.
- [22] Prasad, P. Symbolic Processes in the Implementation of Technological Change - a Symbolic Interactionist Study of Work Computerization. *Academy of Management Journal* 1993; 36(6), 1400-1429.
- [23] DeSanctis, G., & Poole, M. S. Capturing the Complexity in Advanced Technology Use - Adaptive Structuration Theory. *Organization Science* 1994; 5(2), 121-147.
- [24] Orlikowski, W. J., & Gash, D. C. Technological Frames - Making Sense of Information Technology in Organizations. *ACM Transactions on Information Systems* 1994; 12(2), 174-207.
- [25] Aoyama, Y. and Izushi, H. User-led Innovation and the video game industry, Submitted to IRP Conference, London, May 22-23, 2008.
- [26] Lichtenthaler, U. Open Innovation: Past Research, Current Debates, and Future Directions, *Academy of Management Perspectives*, February 2011, Vol. 25 Issue 1, p75-93; 2011.
- [27] Grant, R. M., & Baden-Fuller, C. A knowledge accessing theory of strategic alliances. *Journal of Management Studies* 2004; 41(1), 61–84.
- [28] Santos, F. M., & Eisenhardt, K. M. Organizational boundaries and theories of organization. *Organization Science* 2005; 16(5), 491–508.
- [29] Chesbrough, H. The market for innovation: Implications for corporate strategy. *California Management Review* 2007; 49(3), 45–66.
- [30] Miettinen, R. The Riddle of Things: Activity Theory and Actor-Network Theory as Approaches to Studying Innovations. *Mind, Culture, and Activity* 1999; 6(3), 170-195.
- [31] Vygotsky, L. S. *Mind in society: the development of higher psychological processes*. Cambridge, Mass., Harvard University Press; 1978.
- [32] Engeström, Y. *Expansive Learning at Work: toward an activity theoretical reconceptualization*. Taylor & Francis; 2001.
- [33] Daniels, H. *Vygotsky and Pedagogy*. London: RoutledgeFalmer; 2001.
- [34] Hasu, M., & Engeström, Y. Measurement in action: an activity-theoretical perspective on producer-user interaction. *International Journal of Human-Computer Studies* 2000; 53(1), 61-89.
- [35] Blackler, F., Crump, N., & McDonald, S. Managing experts and competing through innovation: An activity theoretical analysis. *Organization* 1999; 6(1), 5-31.
- [36] Engeström, Y., R. Miettinen, & R.-L. Punamäki. *Perspectives in Activity Theory*. Cambridge: Cambridge University Press; 1999.
- [37] Korpela, M., Mursu, A., & Soriyan, H. A. Information Systems Development as an Activity. *Computer Supported Cooperative Work* 2002; 11(1-2), 111-128.
- [38] Vygotsky, L. *Thought and Language*. Cambridge, MA: MIT Press; 1986.

- [39] J Leont'ev, A.N. *Activity, Consciousness, and Personality*. Englewood Cliffs, NJ: Prentice-Hall; 1978.
- [40] Wertsch, J.V. *Voices of the Mind: A Sociocultural Approach to Mediated Action*. Cambridge, MA: Harvard University Press; 1991.
- [41] Jarzabkowski, P. Strategic Practices: An Activity Theory Perspective on Continuity and Change. *Journal of Management Studies* 2003; 40(1), 23-55.
- [42] Nardi, B. A. *Context and Consciousness: activity theory and human computer interaction*. Cambridge, MA: MIT Press; 1996.
- [43] Yin, R. K. *Case Study Research: Design and Methods* (3rd ed. ed.). Thousand Oaks, California: Sage Publications; 2003.
- [44] Miles, M. B., & Huberman, A. M. *Qualitative data analysis: an expanded sourcebook* (2nd ed.). Thousand Oaks, London: Sage Publications; 1994.
- [45] Shin, D. H. Distributed inter-organizational systems and innovation processes. *Internet Research* 2006; 16(5), 553-572.
- [46] Cassiman, B., & Veugelers, R. In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science* 2006; 52(1), 68–82.
- [47] Cohen, W. M., & Levinthal, D. A. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 1990; 35(1), 128–152.
- [48] Fosfuri, A. The licensing dilemma: Understanding the determinants of the rate of technology licensing. *Strategic Management Journal* 2006; 27(12), 1141–1158.
- [49] Bragge, J. and T. Tuunanen. Developing Innovative Information Systems Services Together with Wide Audience End-Users. Paper presented at the 38th Hawaii International Conference on System Sciences Hawaii, USA; 2005.
- [50] Arakji, R.Y. and K.R. Lang. Digital Consumer Networks and Producer-Consumer Collaboration: Innovation and Product Development in the Digital Entertainment Industry. Paper presented at the 40th Hawaii International Conference on System Sciences, Hawaii, USA; 2007.
- [51] Engeström, Y. Developmental studies of work as a testbench of activity theory: The case of primary care medical practice. In Chaiklin, S. and Lave J. *Understanding Practice: Perspectives an activity and context*. Cambridge University Press; 1996.
- [52] Pallot, M., Trousse, B., Senach, B., & Scapin, D. Living Lab Research Landscape: From User Centred Design and User Experience towards User Cocreation. Paper presented at the Living Lab Summer School, Paris, August 2010.
- [53] Vardaxoglou G. "Understanding IT Innovation in Law Enforcement Organizations: a Case Study of a Location Technology in a UK Police Force" in S.Mercado-Kierkegaard (ed.), *Business and Law: Theory and Practice* (pp.289-306), New York, USA; 2008.
- [54] Laursen, K., & Salter, A. Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal* 2006; 27(2), 131–150.
- [55] Vardaxoglou G., and E. Baralou "User-led innovation in virtual organizations. A dialogical approach". Paper presented at the 27th European Group for Organization Studies (EGOS) Gothenburg, Sweden; 2011.