Enterprise innovation planning with social software

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Abstract: Enterprise Innovation Planning (EIP) is proposed to manage discontinuous innovation. Discontinuous innovation happens through creative destruction and requires a method of discontinuous learning. In this paper we will use a theoretical and interdisciplinary model of discontinuous learning called Novelty-Action (NA). NA refers to the necessity of acting, in general, to learn the inherently unknown. Within the NA-model two auxiliary learning processes play a major role: mastering and reflection. Reflection allows imagination but may break the link to reality. Mastering allows creation, but that may alter your worldview. The interaction between mastering and reflection creates an iterative incremental learning process. The NA-model is the backbone of the EIP's structure and function. To make EIP concrete, we align it with social software. Where social software is used to harvest experience, EIP should deal with the resisting effect expertise can have on learning novelty.

Keywords: discontinuous innovation; social software; complex-systems and cognitive-cybernetics; actor-network theory

1 Introduction

The understanding that ideas can come from anywhere and that management should be able to cope with this makes the management of innovation a hard problem. Especially if a sustained flow of innovation requires the management of discontinuous innovation. Discontinuous innovation was first described by Schumpeter as "creative destruction" [1]. According to Mokyr [2] long-term industrial growth is based on such Schumpeterian growth and traces can be found over our entire history of technology. The term discontinuous innovation has been more explicitly used by Hamel and Prahalad [3].They suggest incremental development processes to manage it. Chesbrough's book on open-innovation [4] shows how innovation needs to be taken out of the general business

strategy to understand its potential strength. Some innovation will need emerging markets and customers, partners and shareholders. Christensen suggests theory as a solution to discontinuous/disruptive innovation, because data on profit only provides feedback about the past [5]. By creating an epistemological basis as a backbone to discontinuous innovation, we see new opportunities, like the concept of a disruptive growth engine [6].

While creative destruction may primarily be a concern in innovation management, there are plenty of other disciplines that are working on the same topic for different reasons and by different names. From a system and cybernetic perspective there is the "Complex Adaptive Systems" paradigm of Holland [7] and theories on “the artificial” by Simon [8,9] that both deal with discontinuity and fabrication as a natural phenomena. Also science studies of Latour [10, 11] and his actor-network theory [12] are highly relevant to understand the behavior of emerging socio-technical systems. The relation between socio-technical systems and social software is addressed by Ackerman [13]. We have also been experimenting with new methods to research creative destruction. The first model was an artificial simulation to understand the limits and the control for an agent to produce a creative action [14]. The work has led to a theoretical analysis resulting in the NA-model [15, 16].

For the purpose of this paper, we define learning only as the modification of the learner's knowledge base. Discontinuous learning, then, is situated learning where a large gap exists between the knowledge before and after the learning experience. Such leaps in knowledge occur when creativity takes place. Indeed, these are the situations where sudden new insights arise that are hard to match to the learner's knowledge before the creative insight and discontinuous learning thus takes place. We will refer to these gaps as “the inherently unknown” or “novelties”. The gap is recognized at a certain moment and can lead to virtual knowledge, it still needs to be tested to become useful. We will refer to the combination of gap, imagination and (early) testing as novelty in contrast to new knowledge that is verified and useful. The new knowledge may be quite different from the novelty that has triggered the learning in the first place. To this end, we introduce the concept of Novelty-Action (NA), or the act of discovering new knowledge.

The NA-model is a theory and far from practical for application in innovation management. The management problem is to create business processes to support discontinuous innovation. The organization starts with a creativity team, but the business should formalize the business processes. When this is not done, creative people need to be hired continuously, making the undertaking too expensive and not scalable. We see this as a failure based on the lack of understanding of discontinuous innovation. As soon as more theoretical understanding is present, it becomes possible to think of systemic solutions, like Christensen’s disruptive growth engine. Although the new system is radically different from creating classical business processes, it is in line with the current solution for discontinuous innovation. Even after transforming the NA-model as part of the Enterprise Innovation Planning (EIP) model we still have a problem of usefulness that can only be overcome if social software is used to support the EIP-model. A problem with innovation is that experience has two faces. While experience can help to imagine new opportunities, it can equally be a resistor that blocks opportunities from sight. This is an inherent problem of experience and situated learning [17]. We need to use experience but have a system that overcomes the resistor part. Social software can harvest experience

and opportunities in a situated setting, while the EIP system should reduce the resisting effect.

2 The NA-model, Mastering and Reflection

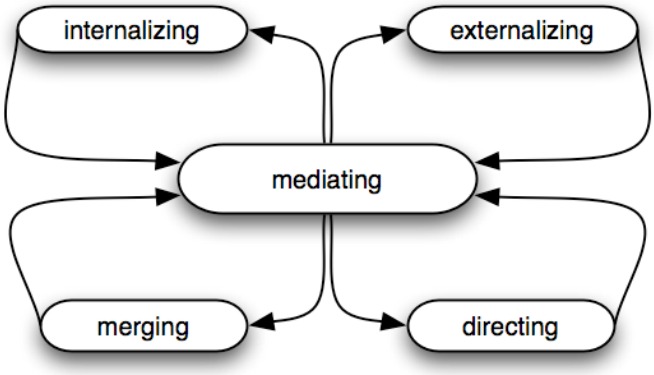
Learning takes place in a person or in a group, resulting in creativity at the individual level or innovation at the collective level. Where an individual can imagine concepts and create behavior, organizations can imagine markets and create services. We take the approach of general systems theory and address a learning-system that can represent the individual or the collective. Two learning processes play a major role in the NA-model: reflection and mastering. Reflection denotes the internal learning taking place in a learning system. Connections are made based on the connections that already exist within the system. As reflection is an internal process, the internal learning does not necessarily result in a knowledge model that is consistent with the external world. During mastering, the internal knowledge model of the learning system is applied to the external world. The external world produces feedback, which in turn causes learning, bringing the knowledge model in line with the world outside the learning system.

Our NA-model consists of five parallel processes. By acting on the cognitive network of the system, each of these processes contributes to the production of situated discontinuity. Each process is going trough the cognitive network based on their semantic relation between concepts. For each process those semantic relations are unique. Two concepts may have no relation when we stick to one semantic context, but can suddenly appear together as a consequence of the other processes. This is a situation where novelty is the experience of missing relations. Together, the processes connect what would be impossible to connect by any process separately. The five parallel processes of the NA-model are: internalizing, externalizing, directing, merging and mediating. Each process has its semantic relation to the information in the cognitive network. The mediating process connects all the links and creates nodes that result in situated concepts. Such a situated concept can be composed of tags, associations, motivations and experience.

The externalizing process adds tags to the concepts. Tags are placeholders to the observed world, corresponding to what Whitehead calls proposition [18, 19]. Tags can sometimes be quite literally labels, sometimes they are merely virtual markers, only visible to the observing system. Internalizing will associate the concepts to other concepts, creating a rich knowledge landscape relevant to the situation the system is in. The mediating processes add several nodes that share associations or tags. These nodes may result in the recognition of a pattern that has a motivational relation, of which we will see some examples later on. Such a motivation may start dominating or directing the system. Without clear motivation the tags and associations are linked based on default relations. With a motivation such tags and associations may get a different meaning. For example a cup is by default used to drink, but in many offices they are used to put pencils in. The directing will as such filter how tags and associations are linked based on a specific motivation or, when no motivation is present, by default categorization. Tags, associations and motivations only exist to the extent that there has been prior experience and that experience has been categorized, abstracted or merged into these three categories (tags, associations and motivations). This is the merging process that works on experience. The mediating process may create relations between nodes, just because the

situation makes them appear together. However, it may happen that no experience exists of such a situation, so the output of the merging is blank, resulting in novelty. The merging process will only record the experience in case no prior experience existed. When the merging has a relatively similar prior experience, it can strengthen the relations and learn what stays static and what is dynamic.

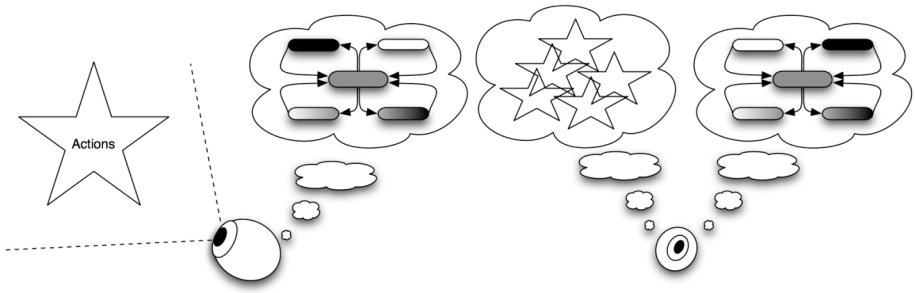
Figure 1 The five interacting processes of the NA-module.



The five processes can result in a specific state that produces mastering and reflection. Mediating is a static process as it always acts the same. It connects concepts and drops the ones that are less connected. Merging has one variable: the novelty of the experience. The variable can go from very disconnected (too novel), so that it is incomprehensible, to trivial, so that it won't be noticed. To illustrate this, think of driving a car. The first time too much needs to be learned; the driver has several blind spots for danger and needs a co-driver to guide him through the first attempts. Still, when driving a same route for years the driver starts doing it on "auto-pilot" and can be left with no memory whatsoever of the event. Directing also has one variable, being the focus of the motivation. It can vary from no interference to total domination. This is related to the control executed onto the tagging and associating. When the focus is strong we can alternate between mastering and reflection.

Both mastering and reflection have a similar behavior. They harvest the novelties out of experience. For mastering, the experience contains external mediators or variables, which need to be tagged to control the motivation. For reflection, internal mediators have to be constructed by as few building blocks as possible. We end up with a cognitive network containing tags and associations to solve a particular problem in a particular context. The motivations can also be harvested out of the experience. You can be confronted with rather pragmatic problems, but by this, create a rich knowledge base of problems and motivations. For example, we can have bad and good experiences that may be transformed to a pragmatic motivation to avoid or enhance a peculiar behavior. Still, motivations like fooling someone or verifying some information, is a more refined motivation that does require a more refined experience of problems. So, in the end, motivations seem to be harvested, quite similarly to tags and associations, by a constructive learning process.

Figure 2 Two learning processes and their NA-module state (see figure 1 for details): left mastering, right reflection. The grey level indicates the degree of activation of each module. From white, being 0% active to black, being 100% active.



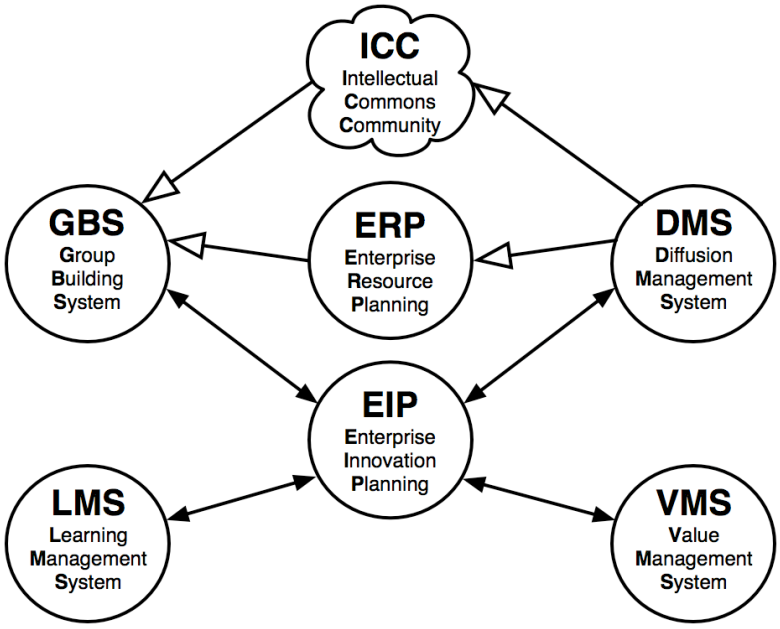
3 The EIP-model and its Management Systems

Today, discontinuous business processes are created by open business models that have never been seen before, but are emerging all around us. We propose EIP based on the emerging methods and combine it with the NA theory. We need to translate the NA-model to a management system for New Businesses Development (NBD). In order to do so, we propose five management systems to act as the five NA processes. The first three management systems are based on emerging business models, while the last two are based on the NA-model:

1. Internalizing: Group Building System (GBS) to create NBD groups.
2. Externalizing: Diffusion Management System (DMS) for spin-offs.
3. Directing: Value Management System (VMS) to define the focus of the NBD.
4. Merging: Learning Management System (LMS) to reduce the resistor effect of experience.
5. Mediating: The EIP-system to connect all previous four management systems.

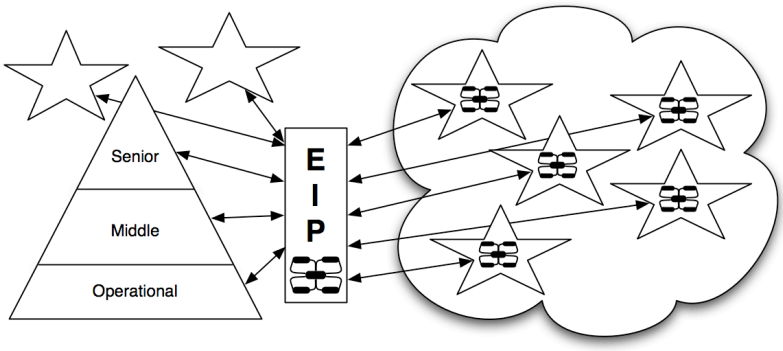
To create a full picture, figure 3 schematically represents what is external to the EIP. There is the company (ERP) as well as an Intellectual Commons Community (ICC). ICC is a general term grouping all existing specific public interest groups like NGO's, academic groups, grassroots and development communities. We may refer to ICC simple as 'community'. The specific input-output relation is based on the concept that an organization should nurture its business ecosystem. Moore [20] describes the ecosystem as the production of goods and services for customers, who are part of the system themselves. In such a setting, customers become partners and employees become customers. The role of an organization is to expand or open up its leadership to the common good of the ecosystem. Figure 3, depicts the interactions between each system. The groups consist of resources (people, ideas ...) from both company and community. The diffusion of the innovation should also benefit (from?)both. A classic example is found in open source communities where the best developers are recruited by companies, but part of the work time can be attributed to community contributions by the developer.

Figure 3 Schema of EIP input-output to ICC and ERP



To host multiple cultures and contradictory processes, Tuchman and O'Reilly [21] have suggested and outlined ambidextrous organizations. In such organizations, NBD is the responsibility of senior management. On the other hand we see incremental innovation being pushed at the operational level and see good practices emerge in a self-organizing way. The emerging innovation solutions seem to cut out the middle management. Now, middle management is expected to make the system scalable. However, middle management can only be deployed when we understand the problem. We ask the question how to be an ambidextrous organization and still distribute responsibility to middle management. Applegate and colleagues created a Big-Small Business design [22] to combine the business and NBD in a similar way as ambidextrous organizations. In their design, middle management is responsible for the learning process. This maps well with our NA-model. Novelty was defined as "the inherently unknown". The difficulty of the learning depends on the degree of novelty. When the novelty is low, learning fits well with the existing knowledge base. Such learning is often referred to as operational innovation and can best be executed on the operational level as well. When most of the problem is unknown, we are entering a realm of disruption and discontinuity. Gifted insight and engaging leadership is required to deal with such problems. Such capacities are found in senior management. However, both very low and very high novelty are exceptional, so we expect that middle management can do most of the learning. The degree of novelty will result in the amount of management types (operational, middle and senior) in each NBD group in figure 4.

Figure 4 The interaction via EIP between the company and NBD groups.



Group Building System (GBS)

The GBS is expected to create new groups or reinforce existing groups by organizing events. There are top-down and bottom-up group creation events. For top-down group creation the problem is already defined, whereas bottom-up creation includes the definition of a problem. Top-down events are classical conferences, where the organizations are in full control of the topics at the conference. Bottom-up group creation can be done through open-space events or so called un-conferences. The structure of such an event allows maximum self-organization by the attendees. The self-organization can partly shift to a pre-event organization by using wiki's or other collaborative website tools. This helps organizations without limiting the brainstorming effect of the event itself. The shift to wiki's is a good example of how we see social software supporting the EIP.

Diffusion Management System (DMS)

Diffusion happens by creating spin-offs. To illustrate the reason for a Diffusion Management System we may look on how closed innovation models have shifted to open ones. In closed models there would be little relation with ICC and NBD. We have seen a shift from "contracts" to "partnership" between ICC and NBD. This has happened with university spin-offs. A good business case is the collaboration between IBM and Apache. IBM helped in building the legal structure of the Apache foundation [23] and built its property software on top of the open-source license. Today, with the concept of business ecosystems, we see organizations creating a partnership between ICC and NBD. For example the yearly "Google summer of code" initiative helps nurturing the open source community by giving student scholarships over a three month period. This initiative is done in full partnership with the open source community. We expect innovation diffusion methods, such as change management, to be adapted to the new rule of partnership.

Value Management System (VMS)

To do anything useful with the Group Building System and Diffusion Management System we need a constant supervision of the value creation and capturing. With open innovation and the business ecosystems we expect co-value-creation being a gentleman's agreement between the partners. This can be reinforced by the creation of non-profit

organizations as a foundation for the business ecosystem. This protects the value between the partners by Intellectual Property regulation. Today Intellectual Property has a limited lifespan but is quite static when we look at the current adaptation speed of the market. The non-profit foundation can change and protect Intellectual Property more dynamically and we expect, with the trend continuing, that Intellectual Property may become a process instead of a value. The awareness has risen in many literatures, all based on mistakes made with value creation and capturing. This is the case in the Xerox PARC case or the IBM case that both created value but didn't capture it. This is also true for Apple that lost leadership and became a niche player.

Learning Management System (LMS)

For the Learning Management System we do a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to the specific situations. Table 1 summarizes all the management systems in relation to the NA-model processes. Through table 1 we obtain a good overview of the indicators of the situation. We can apply a SWOT analysis to each of the five processes in each of the three semantic levels: management system, business & actors and knowledge. (Let us elaborate this for each.) For the management system we create and diffuse NBD-groups. Related questions could be: Did we have an agreement on the value? Do we have a good team? Do we know how to diffuse it? Each of these questions will give us a better understanding of what state the NBD is in and what the direction of learning (mastery or reflection) will be. This is the learning SWOT. We expect that during the learning the above questions will constantly be in motion and be reformulated. A similar SWOT can be applied to the specific NBD-group (business & actors). Now we have questions as: What is our market? What is our core competence? Who are our partners? Again, these questions will define the growth state of the NBD and define the learning direction.

Table 1 Relation between the management systems and the NA-model

MS	*Business*	*Actors*	*NA-model*	*Knowledge*
Group Building System	Strength	Resources	Internalizing	Associations
Diffusion Management System	Market	Public sphere	Externalizing	Tags
Learning Management System	Opportunity	Allies	Directing	Motivations
Value Management System	Growth	Competitors	Merging	Experiences
EIP	NDB	Entrepreneurs	Mediating	Nodes

The last semantic level is knowledge. When the NBD-group is merely formulated, we have no knowledge. However, knowledge can be developed through learning, starting with a novelty and resulting into expert knowledge. Although novelty can contain isolated concrete examples, it is vague and abstract.. Part of the learning process will be transforming the examples into general and expert knowledge. Novelty can only be expressed as tags, associations and motivations. Questions like: What can we mark as new features? How do we associate it with our strength? What should be our driving

motivation and why? The expert knowledge is expressed in a much richer way so that it can be followed as declared business processes. Now we have questions as: Is there a good manual? Do we have a profile of people we need to do this business? Do we know how to measure the risk? Indeed, these are audit questions and the output of the Diffusion Management System.

3 Supporting EIP by Social Software

Social software is software that triggers the social reflexes of the user. Examples are social tagging, social networking systems, forums, wiki's or content management systems. Best practices of the different types of social tools illustrate that the tool is specific to the social reflex [24, 25]. For example blogs are good for storytelling, where forums are better to ask questions and a wiki is most useful for collaborative publishing. In some cases a critical mass will result in making the system more sustainable. Good examples are Wikipedia and Face book. Social software is as much an engineering challenge as a managing challenge. For example, the success of Wikipedia makes it a target for information manipulation. As a result it requires supervision to ensure the level of quality and objectivity of the content. Some social software doesn't require face-to-face events, like Wikipedia. It is opposite to the open space-wiki's we have introduced earlier. Such wiki's only exist for the face-to-face event. Wikipedia and open space-wiki's are opposite ends of the spectrum. In between we see the social software co-evolution with face-to-face events. It all depends on the need the social software is supporting.

We look at social software to harvest experience and opportunities in a situated setting, while using the NA-model to reduce the resisting effect. The resisting effect can be overcome face-to-face when people open their minds. Indeed, face-to-face communication, in which people can use the full richness of human communication [26], is beneficial to the collaborative creativity process, in which new ideas are floated, criticized and fine-tuned rapidly. This produces a fast, iterative and effective way to bounce around ideas and sustain the mastery and reflection processes which are important to discontinuous learning. The ideas resulting from the personal reflection phases, during which internal knowledge is created within people, can be quickly exposed to the judgement of others, resulting in personal mastering of the ideas and again in refection by all the participants that have been exposed to the idea. It is not always practical or possible to organize work when participants are living in different geographically locations or have different agendas to account for. The web as an asynchronous communication medium allows keeping the work practical. However, the mediating process becomes weaker as the merging process becomes stronger. This will increase the resisting effect experience has. The face-to-face event is situated in time and space. The discussion will thereby produce a mediating process, which can result in the recognition of the novelty. With the web we lose needed restrictions, at least the situated setting can confront us with observations that disrupt our knowledge. This is a lot more difficult in a virtual setting. Instead of having the needed reflection-mastering interaction, we may end up building reflections upon reflections and lose track with reality. This might lead to a virtual knowledge wall that is hard to penetrate.

The resisting effect can also occur in face-to-face events and many creative processes have been invented to reduce the resisting effect. A general trend is to restrict the people

in their thought to stimulate creativity and problem solving. Our goal is to do something quite similar: restrict the user to ensure that the correct processes are present. The proposed social software system resembles a project development tool mixed with creativity problem solving techniques to stimulate discontinuous innovation management. We will use table 1 as a restriction of how to define the elements of the project as well as defining a learning state of the project. Depending on the state only certain actions are possible, in order to focus on the task ahead. The users will be the ones who create the semantic relations between all the elements. In the back the NA-module process is running, so the users will get a situated setting where some unexpected elements are present and some expected elements are absent.

Discussing ideas, that still need development, is also something which needs to be done in an environment in which one feels safe enough and where one knows that one will not be negatively perceived for the possibly preliminary state of the discussed idea. Therefore, we argue that it is important to have a private part for each NBD-group to transform a vague idea to a concrete one, before communicating it to the other groups. This tool is currently in the concept phase. Although many other elements look appealing to us, we are well aware that the only way of validating the tool is to test it. The current description should provide directions for future development. The full functionalities should be created in a user-centric way. Also, the development process should be iterative and should alternate between reflecting about it and between testing it, which results in mastering.

4 Conclusions

The paper relates to the problem of creative destruction and discontinuous innovation. We propose an NA theory based on interdisciplinary research. It is impossible to know exactly what kind of discontinuous innovation will occur. What we can do, based on the NA-model, is understand the context and the conditions of discontinuous innovation. It has already been accepted that incremental iterative development processes are necessary for discontinuous innovation. According to the NA theory, iterations should be an interaction between mastering and reflection. The NA theory has its background in cognition and can be useful to understand discontinuous learning. We have subsequently used the theory to build a similar structure of discontinuous innovation management of NBD-groups. The theory brings more context to the creation of knowledge and groups as schematized in table 1. This is useful to apply SWOT analyses to find the weak links in the existing context. The theory can also give information of the duration between the cycles of SWOT-analysis and action-plan. When novelty is high we need faster interaction. When novelty is low, we can use longer development cycles. We believe the proposed theory may help to manage discontinuous innovation.

The goal of this paper was to outline the theory and propose a possible useful application (EIP). For future research we are preparing to apply EIP and in doing so obtain empirical data on the theory. Many problems exist that can compromise the experiment. We are currently in the process of experimenting with social software to understand how to trigger a discontinuous learning reflex.

References

1. Schumpeter J. (1975) *Capitalism, Socialism, and Democracy*, New York: Harper.
2. Mokyr J. (1990) *The level of riches*, New York: Oxford university press.
3. Hamel G. and Prahalad C.K. (1994) *Competing for the future*, Boston: Harvard Business School Press
4. Chesbrough W. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston: Harvard Business School Press
5. Christensen C.M (1997) *The innovator's dilemma*, Boston: Harvard Business School Press
6. Christensen C.M (2003) *The innovator's solution*, Boston: Harvard Business School Press
7. Holland J.H. (1995) *Hidden order: how adaptation builds complexity* Redwood: Addison Wesley Longman Publishing Co.
8. Simon H.A.(1969) *The Sciences of the Artificial*, Massachusetts: MIT Press, first edition.
9. Simon H.A.(1996) *The Sciences of the Artificial*, Massachusetts: MIT Press, third edition.
10. Latour B. (1987) *Science in action: How to follow scientists and engineers through society*, Massachusetts: Harvard University Press.
11. Latour B. (1999) *Pandora's hope*, Massachusetts:Harvard University Press.
12. Latour B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford: Oxford University Press
13. Ackerman, M. S. (2000) *The intellectual challenge of CSCW : The gap between social requirements and technical feasibility*, Human-Computer Interaction, Vol. 15, No. 2, pp.179-203.
14. Kiemen M. (2003) *Het appropriatiegedrag*, Brussels: Vrije Universiteit Brussel.
15. Kiemen M. (2006) *A triple loop model to ground higher-level cognition*, In In Proceedings of the 18th European Meeting on Cybernetics and systems Research, Vol. 18, No. 2, pp.369–374.
16. Kiemen M. (2008). *Artificial Meta-System Transition to clarify useful Novelty Control*, In Proceedings of the 19th European Meeting on Cybernetics and systems Research, Vol. 19, No. 1, pp.289–294.
17. Carlile (2002). *A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development*, Organization Science, Vol. 13, No. 4, pp. 442-455.
18. Whitehead A.N. (1925). *Science and the Modern World*, New York: Macmillan.
19. Whitehead A.N.(1967). *Science and the Modern World*, New York: The Free Press.
20. Moore J. (1996) *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*, New York: HarperBusiness.
21. Tushman, M. and O'Reilly III, C.A. (1996) *Ambidextrous organizations: managing evolutionary and revolutionary change*, California Management Review, Vol. 38, No. 4, pp. 8–30.
22. Applegate L., Austin R. and McFarlan W. (2003) *Corporate Information Strategy and Management: The Challenges of Managing in a Network Economy*, New York: McGraw-Hill, 6th Edition.
23. The world is flat
24. Coenen T. (2006) *Knowledge sharing over social networking systems,* Brussels: Vrije Universiteit Brussel.
25. Coenen, T., Van den Bosch, W., Van der Sluys, V. (2009). *An Analysis of the Socio-Technical Gap in Social Networking Sites*, Handbook of Research on Socio-Technical Design and Social Networking Systems.
26. Daft, R. L., and Lengel, R. H. (1986). *Organizational information requirements, media richness and structural design*, Manage. Sci., Vol. 32, No. 5, pp. 554-571.