MANAGING RADICAL CHANGE BY INTEGRATING A NOVELTY-ACTION DESIGN

Kiemen, Mixel, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium, info@mixel.be

Coenen, Tanguy, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium, tanguy.coenen@vub.ac.be

Abstract

Innovation can be split up in relation to the change it produces and the novelty it brings. Incremental growth is based on previous knowledge, but when radical change happens our knowledge system becomes restructured. Radical change disturbs the market and social-capital gets lost. To reduce the lost of social-capital and to support highly needed changes, we want to manage radical change. Radical change occurs now by "natural selection", could we do better? A bundle of state-of-the-art models on innovation raises the impression that we can. The models are not directly connected as they are created for different purposes and even come from different disciplines. The reason why the models are not connected has everything to do with duality. The distinction between theory & practice and knowledge & actions has to be replaced by a procedural approach of "before & after". By linking practical models to the theoretical models it becomes possible to reinforce each. The combination of the theoretical models becomes the "novelty-action design". The design will be the central element in this paper. The results of prior projects give some proof of the procedural approach. In total three innovation projects have been deployed. The paper concludes with a reflection on the design and the method.

Keywords: novelty, open innovation, radical change, social networking, science & technology studies, evolutionary cybernetics.

1 INTRODUCTION

Schumpeter (1942) introduces radical innovation as creative destruction: opening up to new markets revolutionizes the economic structure from within (p.83). To understand how the revolutionizing can occur it is necessary to understand when prior knowledge is a resistor or stimulator for change. For this reason a distinction is made between (established) knowledge and novelty. Knowledge will be well embedded by experience, while novelty lacks experience. Novelty is based on guessing and acting, where the actions will make unknown facts visible. Radical change can be seen as a sudden and large quantity of novelty that changes the prior motivation. When knowledge is rich it becomes hard to imagine a bunch of new relations, but easier to find loose ends. Experts in a domain are well positioned to solve the loose ends. Guessing is based on a weak body of knowledge but opens the opportunities to find hubs of new relations. Knowledge is a stimulator for incremental growth and a resistor for radical change, while novelty is a stimulator for radical change. In contrast to the expert, "the guesser who acts" is called the novice. When novices are newcomers in a market with entrepreneurial skills they can radically change the market. Experts or incubators are very rarely changing their own markets radically.

There are several good reasons why doing better than natural selection is wanted. Radical change may create a huge added value, but it seems to waste social capital and results in unwanted social and economical implications. Social capital refers to the advantage people obtain from being connected to others. It is originally defined by Bourdieu and Wacquate (1992) as:

> "Social capital is the sum of the resources, actual or virtual, that accrue to an individual or group by virtue of processing a durable network of more or less institutionalized relationships of mutual acquaintance and relationship" (p.119)

The disturbing of a market creates losers and winners. The losers result in restructuring the business, firing employees and lost of investments. The winners don't qualify for the transfer, as the speed of growth and the lack of experience requires social capital. Huge profits are invested improperly, an acute lack of staff and being unable to train employees can make the winning quite temporarily. Instead of having losers and winners it is more appropriate to create win-win situations, or to leverage a current situation in an attempt to save the social capital. Another good reason to create a more manageable radical change is to solve highly needed changes. For example Stuart and Clayton (2002) suggest applying radical innovation onto the North-South division of the world. Also the problem of carbon dioxide onto the environmental requires out-of-the-box thinking. Incremental growth leads to diminishing returns. Luckily the occurrence of radical change has been periodically enough to keep the innovation-engine going. There is however a problem in IT and especially in web-based IT. The speed of innovation on the web is a lot higher than any other innovation. The radical change is also more disturbing on the Internet than anywhere else. So radical change is common on the web and incremental growth is simply too short-term thinking. The need for managing radical change is a need to make IT more sustainable.

It has become more accepted in business that new models are necessary. The emerging models are "models for emersion". Such models focus on a structure that regulates instead of defining the change. In the double field of system theory & cybernetics several models for emersion are investigated. The business models however do not refer to cybernetics models, although several of the used techniques are described there. The gap is related to the origin of cybernetic models, it comes mostly from cognition and physics. In general Latour (1993) explains the gap as a problem of modernity. It seems that the force of incremental growth has made us blind to more radical opportunities, to creating theory & practice simultaneously. In this paper a recombination of theory & practice should reinforce each model. The paper introduces four business models, two science & technology models and our own research. The business models are: open innovation, a big-small design, best practices to compete for the future and agile software management. The analytical models are about: the history of technology, the anthropology of science and the cybernetics of novelty. The integration follows, the analytical models are combined to the novelty-action design and are used to elaborate the four business designs. As the novelty-action design is itself a novelty, it requires actions to get to facts. In total three prior projects on specific radical innovations are conducted. The first was an artificial intelligence problem to make creative agents. The second was a research-cartography and addresses IT transfer and diffusion. The latest was a project on using social-networking system for knowledge sharing.

2 A COMPREHENSIVE REVIEW ON THE MODELS

All the models are solving problems with radical innovation differently. It is not yet the intention to explain how they are related, that will happen in the next section. To keep it simple and short only few references are used, as entry point to the research. For the business models a reference to the authors of the model is possible. For the science studies the work by authorities in the field is given.

2.1 Open innovation

Chesbrough (2003) describes open innovation in contrast to closed innovation. Open innovation draws the attention to achieve important innovation with external knowledge. Closed innovation applies a strong top-down decision-making process. Projects set on hold were allowed to leave the company. As a result the company breeds its own competition. Two examples illustrate how the collectivity of spin-offs exceeded the market value of their parent company: Xerox-PARC (p.10) and IBM Hard-disk-drive companies (p.36).

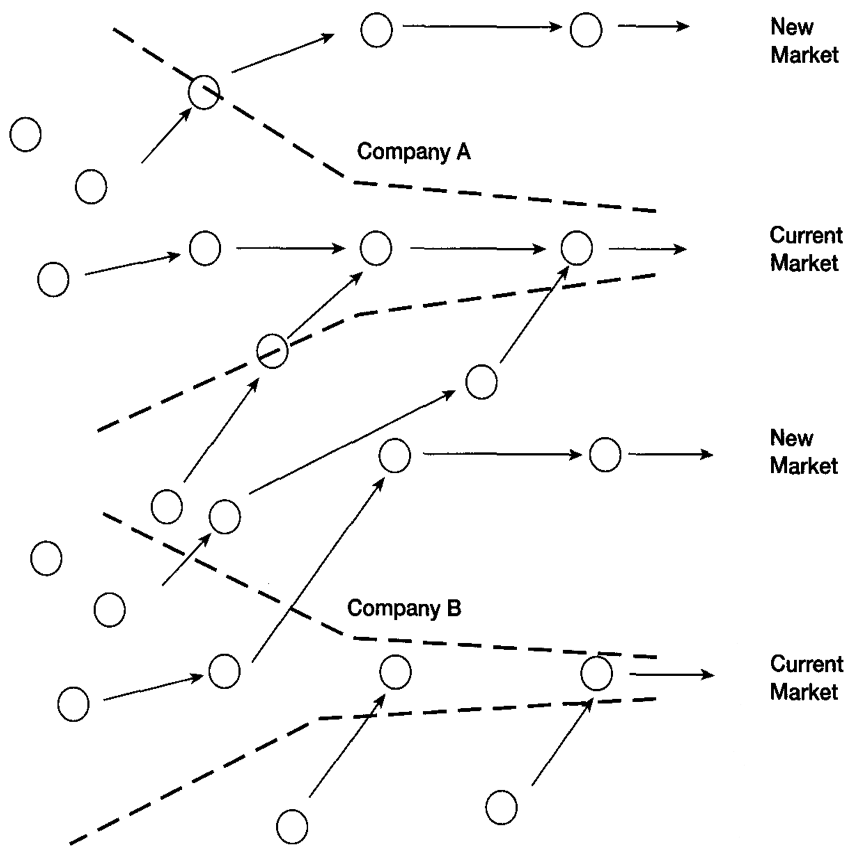

Figure 1 *Knowledge landscape in the open innovation paradigm, Chesbrough, 2003, p.44*

2.2 Big-small design

Applegate et al. (2003) introduce their big-small design. It comes from combining the benefits of a big organization with the benefits of an entrepreneurial organization. The design contains three levels (figure 2). In a large organization model the leading, managing and operational levels would exist as well. Adding a parallel track of engaging, learning and innovation to deal with the growth is inspired by an entrepreneurial organization. In the design the innovation is at the operational level. That kind of innovation works best keeping it close to the daily practice. The engaging is described as "visionary but pragmatic leadership" and it is the responsibility of top-level management. The description fits the requirements to engage to radical change. The learning can be seen as the intermediate layer between radical change and incremental growth.

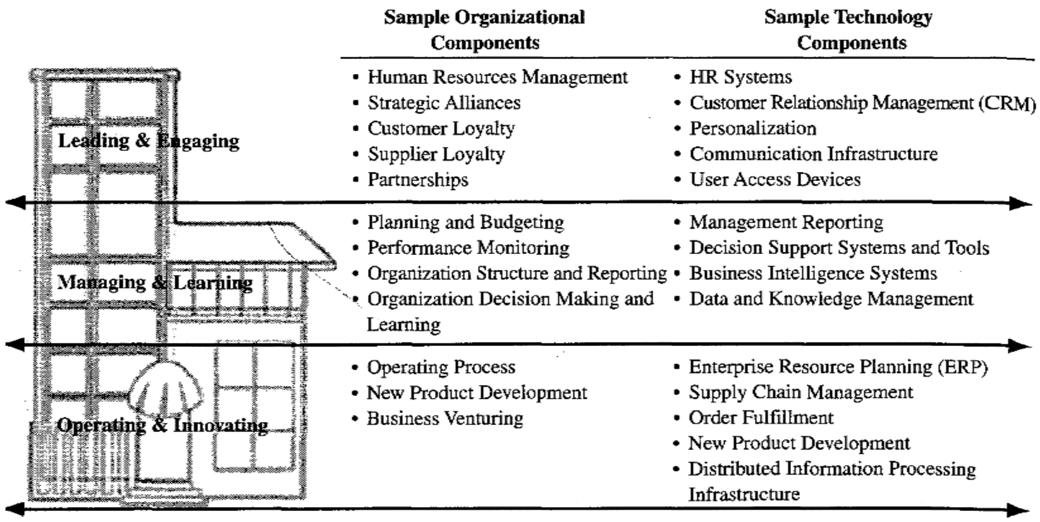

Figure 2 *Blueprint of "Big-small" Business. From Leading & Engaging over Managing & Learning to Operating & Innovating from Applegate et al, 2003 p.323*

2.3 Best practice to compete for the future

Hamel and Prahalad (1994) describe a best practice to compete for the future. When their work talks about radical innovation, it starts with an undeniable fact. They show two lists of businesses. On the one hand businesses that where expected to become big, on the other hand a list of businesses that actually became big (p.127). The table illustrates the impossibility of forecasting and demonstrates again the dual nature of knowledge (resistor or stimulator). One schema is about incremental versus radical innovation. The first list describes existing innovation management the other list adds new challenges (p.24):

- Reengineering processes, organizational transformation and competing for market share.
- Regenerating strategies, industry transformation and competing for opportunity shares.

All three challenges are clearly related to the "revolutionizing" Schumpeter describes. One concept not put in a table, but quite relevant to this paper is the notion of stretch:

> "The only vaccine for success is a renewed sense of stretch. Industry leadership is something to be aimed for; neither Janitor nor sales rep nor chief executive should ever believe it has been achieved. … *Stretch gives birth to the motive for resource leverage* "(p157).

The authors continue with defining four possible situations. Those who have: vision & no resources (dreamers), no vision & resources (sleepers), no vision & no resources (losers) and vision & resources (winners). In the introduction a problem about the winners and losers related to the lost of social capital was described. This issue of winners and losers is about leverage and social capital.

2.4 Agile software management with SCRUM

Agile software management SCRUM uses several short iterations for project development. The name SCRUM comes from DeGrace (1990). The development is divided into sprints (15-20 days) and each day a SCRUM meeting defines the daily work. The work is put and fetched out of a backlog. There are two backlogs, the product backlog containing higher-level documentation and the sprint backlog for the daily meetings. SCRUM solved the problem of observing a process in realtime by creating a time leap. This way two feedback systems make the managing more robust. The development only predicts into the near future. Predicting the near future is like the weather forecast, it is changed and updated daily.

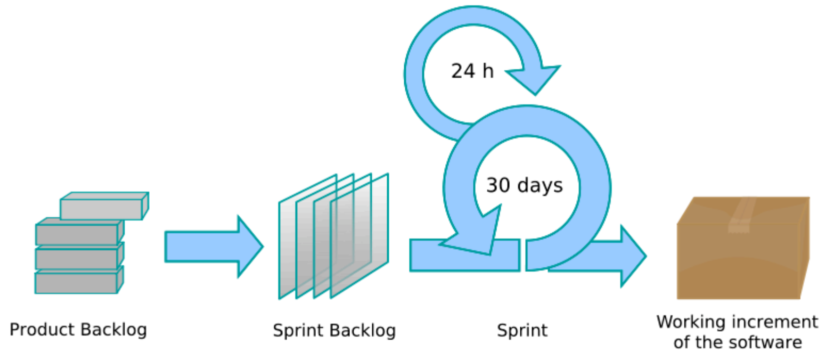

Figure 3 *The SCRUM process, from wikipedia on January 9th 2008*

2.5 The history of useful knowledge

Mokyr is an authority on the history of technology, two of his books will be used. In "The level of rise" (1990) concepts similar to incremental and radical innovation are described as micro and macro innovations. The book gives an review of the evolution of technology. The second book "The gift of Athena" (2002) is more directed towards knowledge. Each radical change in history is accompanied by a mentality shift and new technology, for example the change from classic to medieval. During the classical period innovation was not related to mechanical devices (1990, p.20). When Rome was serving the public, it did so on the back of slaves, therefore it was less inclined to adopt laborsaving machinery (1990, p.174). In the early medieval period, the Benedictine Rule recognized penitential labor as salvation (1990, p.204). Only after intelligent and educated people engaged in physical labor, did they get ideas on how to replace physical labor by machines (1990, p.205). In popular writings mechanization is always related to the industrial revolution, but it is actually an innovation of the middle ages. During the late middle ages, mills were used for sawing, drilling, papermaking, silk throwing, etc. Pollard (1968) mentions three large British plants, each employing more than 500 employees before 1750 (2002, p.123).

To understand the industrial revolution another mentality shift is required. The importance of access-cost reduction to knowledge has been essential in the process. Like the creation of indexed descriptions: from dictionaries in 1674 to the first encyclopedias in 1728. In 1754 institutes like the "Society of Arts" were created. The change adds a technical education next to the classic education (social and moral). While reducing access helps practical people get in action and create technology, technology becomes a focusing device for academic people (2002, p.96). It is however the continuous mutual reinforcement that is new (2002, p.96). An example of reinforcement is the science of atmosphere and technology of the engine[1]. In 1760-1790 the occurrence of radical change was sufficiently periodical to create sustainable growth (2002, p.80). So it is the invention of the duality “science & technology” that is new for the modern times. For Gille (1978 p.1112) science aims at comprehension, where technology aims at utilization (1990, p.167). Related, Mokyr proposes categorization of useful knowledge into propositional and prescriptive. The category can be best understood in relation to the novelty: new prescriptive knowledge is innovation and new propositional knowledge is discovery (2002, p.12).

[1] The whole innovation was a process. Mostly Newcom atmospheric engine is seen as the origin 1712. But pistons where invented by Papin in 1680. While Watt's improvement by separation of condensing chamber in 1775 made all the difference.

2.6 The anthropology of Science blood flow

The complexity of science & technology grows tremendously when we turn to anthropology. Latour (1987) describe the science in action. For this paper his later work (1999) is used. The example of Joliot and his nuclear change reaction illustrated how science is not restricted to the laboratory (p.81-84). In 1939 Joliot suggested the possibility of using deuterium as moderator to slow down the chain reaction. The only company producing deuterium was the Norwegian company Norsk Hyro Elekrik (p.83). On the eve of World War II in Europe, political powers suddenly became very interested in deuterium. The transportation of deuterium to Joliot's lab required mobilization of the army, so external resources were needed to continue the research. Many other examples where the system is clearly not restricted to the laboratory alone can be given. Latour calls it "A collective of humans and nonhumans" and claims: "Only corporate bodies are able to absorb the proliferation of mediators" (p.192). The added example provides clarification: "Boeing 747s do not fly, airlines fly". To understand how science is open, a design of science blood flow is proposed (figure 4).

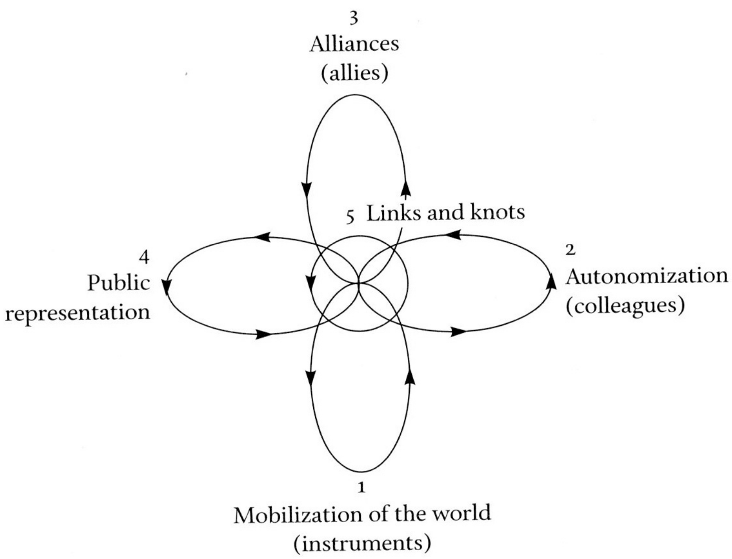

Figure 4 The Circulatory System of Science Facts.

2.6.1 Mobilization of the world (instruments):

Loop 1 is what happens when scientists act. It is a system of circulating references: from very raw registrations to refined papers. It requires an interaction between humans and instruments, equipment, expeditions, reviews, etc.

2.6.2 Autonomization (colleagues):

Loop 2 is blackboxing the artifact: making it an autonomous entity. It is achieved on both social, and technological level. The social level ensures colleagues to collaborate on the topic. Like solving loose ends, repeating an experiment, getting feedback, etc. The technologies can contribute to the artifact's autonomy by automating it, making it more visible with instruments, building control systems to make it more sustainable to variation, etc.

2.6.3 Alliances (allies):

Loop 3 can be seen as the higher-level control of science. It can provide continuous funding by making the research useful for other interest groups, like the benefits of economics, politics, society, etc. It can make a totally unexpected alliance by suddenly uncovering new added value. Like with the nuclear science, it created an added value for the deuterium and uranium. Uranium made a company like the Belgium Union Minière du Haute-Katanga committed to the research.

2.6.4 Public representation:

Loop 4 is the external factor, connected by reporters and journalist to address the collective (the woman and man in the street). The collective has its own motivations. For example, the nuclear science made nuclear power possible (nuclear power plants or atomic bombs). The collective clearly has issues with it and tries to ban nuclear power. The public can temper or reinforce science. An example of reinforcing the science can be found in telecommunication; like assimilation of GSM, Internet and GPS. The public has used these technologies in a creative way. The public pushes research like social networking systems, bottom up control and user center designs.

2.6.5 Links and knots:

Loop 5 may not be a loop at all. It is where it all comes together. A good way to understand it is that all the other loops create several possibilities, but the possibilities still need to get connected to what comes from the other loops. Loop 5 can be seen as a medium for the other loops. Latour calls it the hardest loop and does not pretend to crack it yet (p.106).

2.7 The cybernetics of higher-level cognition or novelty

Models of emersion are topics for cybernetic research. Heylighen works on themes as Self-organization and Emerging of complexity (1989- 2008) and global brain (1997). The global brain is a self-organizing system coming from the emerging World-Wide-Web. The cybernetic research on novelty is an instance of evolutionary cybernetics concept by Heylighen (1992). Evolutionary cybernetics is an attempt to understand how complexity grows and is controlled. With computer simulations Kiemen (2003, 2006) creates a model of higher-level cognition. In a neurological study by Dehaene et al. (1998) a design for the entries to the global workspace had a structure remarkably similar to the computer model. The global workspace is a part of our brain that can deal with abstract information. It is possible that this is how the brain deals with novelty and it's seen as a reinforcement of the cybernetic design. Novelty is not only a problem of cognition, but also related to innovation. Simon (1969) with his research of artifact bridged the cognitive and economic discipline and stimulates a cybernetic study of innovation. Kiemen (2008) describes the relation between the cybernetic model, the neurological model and the model of Latour (figure 4).

To explain the model of higher-level cognition figure 4 can be reused, the cybernetic meaning of each loop needs to be described, as done in table 1. Where Latour's model addresses real people the cybernetic design simply looks at how to control the relation between information. The intention is only to understand how novelty can exit by an information processing system. In the design each processor can create input elements or output elements: the input is a new relation, the output is an existing relation. All four processors work in a distributed and parallel way. Taking and pushing elements to the working memory connects all the processors. The internal loop may take up a concept out of the working memory and push the related concept to it. For example "round" can be associated with "ball". By taking up several concepts a new instance can be pushed to the working memory representing an abstraction of the bundle of concepts. For example water, tea and coffee are all "drinks". The external processor works on the environment, it will measure actual values, but first it makes an estimation of what the expected value may be. The directional processor may fix a motivation by observing the working memory and once a motivation is fixed it can filter the working memory accordingly. The adaptation also observes the working memory and stores it as experience. For the output there may be experience of what the system is observing and it can highlight the difference between the two.

Loop relation	Input	Output
Loop1 = internal processor	Abstract concepts	Associate concepts
Loop2 = adaptation processor	Add experience	Store experience
Loop3 = directional processor	Fix motivation	Control evaluations
Loop4 = external processor	Measuring values	Map expectations
Loop5 = working memory	Medium for the other loops	

Table 1. The input output relations of the higher-level cognition.

The model shifts the problem of control to the information it is processing. This is common for processors of programming langue, the system should be able to parse the language, it is not needed to understand the meaning of what is parsed. To get to the meaning a shift from action to learning is needed. For the learning the pattern of the processors (over time) needs to be looked at. The model can produce two types of learning behavior: mastery and reflection.[2] The reflection abstracts the world and builds internal models. The mastery tries out newfound virtual concepts, which require linkage to the world. Reflection is the classical school type of learning, while mastery is skill training.

3 TOWARD AN INTEGRATED MODEL

With the previous section several models have been introduced. By combining the models, each model should become more robust. Each model takes on a part of the task, so the whole can be seen as one system. We will work backwards now, starting by building the novelty-action design with integrating Latour's and Mokyr's work. Next we take on the business models. Using such a theoretical design for making a business model is unusual and may question the soundness of the approach. There are two reasons why it seems safe. The defense of the theoretic design is by independent research, facing a same problem of novelty, which came to a similar design. Still this fact was a recent discovery. A better defense for now is to see the new business model as an optimization of existing models. Optimizing business models by combining the benefits of several models to a new design is common practice.

3.1 The novelty-action design

The higher-level model would be just a gadget, a nice toy to understand the relation between feedback and novelty. Latour and Mokyr clarify facts, which is interesting but not applicable. The structure of Latour's model and the higher-level model are similar and so it is expected that the facts can actually be used to build a tool. A business cannot control political or other external powers of Latour's model, but the higher-level model only works on information processing. The hypothesis is that both models are the same. The model may be used to manage the information in an organization. The higher-level model was also investigating the transition from action to learning. The control is embedded in the information, so the problem of novelty shifts. The learning can be associated with Mokyr's categories: reflection creates propositional knowledge and mastery makes prescriptive knowledge. Mokyr shows how a weak body of

[2] The theoretical architecture may bring the impression more combinations are possible. However it has to be over a period of time as a result only the pressure on external or internal are possible. The other combination can still trigger one of the two types of learning.

knowledge in one category leads to new knowledge in the other category. Reentering this fact to the tool means creating a simple strategy: when a problem arises, check for a relation in the opposite knowledge categories and mutually reinforce both categories. Notice that this strategy is applied to the novelty research. It has been stated before: the research on novelty is novel. So the technique discovered is the technique applied, this phenomenon is called bootstrapping. Bootstrapping is a task that looks impossible in principle: to lift oneself up by the straps of one's boots. It is an impossible task for natural objects, but it is a powerful tool for information processing. Bootstrapping is one of the state-of-the-art topics researched in cybernetics. The cybernetic studies can elaborate advanced feedback systems, by reinforcing them with science and technology studies they become a practical tool. The previous higher-level model was solving a cognitive problem. To indicate the newfound synergy with innovation it seems more appropriate to call it a novelty-action design.

3.2 NA-SCRUM

In SCRUM two types of feedback exist by creating a time-leap, the sprint (15-20 days) and the daily meetings. Similar time-leaps occur in the novelty-action design, between the processing of the actions and the evaluations of the learning. In contrast to SCRUM only the evaluation of the actions is fixed. When the learning has to be checked is defined by the information. The flexibility of the novelty-action is much higher than the SCRUM, but it needed a parallel evaluation of four processors. With SCRUM the process was one incremental process, splitting it up as a parallel system does make it harder to follow the whole process. With the incremental version is seems doable to make a novelty-action version (NA-SCRUM). For example the code tests is now a best practice technique in SCRUM, but it may be part of the design in the NA-SCRUM. Code tests is a development tool, it are functions created only to test the development. With NA-SCRUM the creation of the code testing would be engaged by the directional-module, while the applying of the code testing would be part of the adaptation-module.

3.3 Novice best practices

Moving back, we get to a system of best practices to compete for the future. In one scheme by Prahalad & Hamel (1994, p.117) the failing of great companies comes down to the inability to escape the past and the inability to invent the future. It is one of many schemes built up by experience in business, but without epistemic evidence. By including the novelty-action design the problem can be explained as inability to separate concerns: the jobs (novices & experts), the knowledge (prescriptive & propositional) or the business structure (operational & emerging). Separating concerns is necessary to allow a distinct type of learning (master or reflection). This last claim is something that should be provable by the theory.

In the introduction a distinction was made between experts and novices. Via the novelty-action design a novice is an expert on novelty, this can expand the best practices to compete for the future. Table 2 compares the expert with the novice by looking at the common aspects. In the last columns of table 2 a relation with the big-small design (figure 2) is made.

<table>
<tr><th>Aspect</th><th>Expert</th><th>Novice</th><th>Organization & Emerging</th></tr>
<tr><td>development</td><td>few long cycles</td><td>many short cycles</td><td rowspan="2">operational & innovating</td></tr>
<tr><td>instrument</td><td>flowcharts</td><td>blackboards</td></tr>
<tr><td>risk management</td><td>reduce anomalies</td><td>stimulate creativity</td><td rowspan="2">managing & learning</td></tr>
<tr><td>knowledge</td><td>use to apply it</td><td>adapt to learn it</td></tr>
<tr><td>added value</td><td>consultancy & service</td><td>stretch & leverage</td><td rowspan="2">leading & engaging</td></tr>
<tr><td>control by</td><td>expertise</td><td>novelty-action</td></tr>
</table>

Table 2. The relation between expert and novice.

3.4 Big-small design and novelty-action integration

The expert and novice are not part of a level in table 2, but are integrated over the whole business structure. The organizational part comes from large companies and employs experts. The emerging or entrepreneurial part employs novices. A similarity between big-small and novelty-action is by the three levels each imply. Kiemen (2008) outlines three levels of cognition: lower-level, higher-level and meta-level. Each level is related to the power of emerging: the lower-level is conditioning, the higher-level is mastery & reflection (constructive) and the meta-level is cultural & social. The novelty-action design is not part of any level, but it is fully integrated in the entire system. By the similarities the novelty-action design may give some direction on how to build a structure to support the emerging of the business. The innovation can be structured by integrating the earlier outlined NA-SCRUM. Tools to stimulate the learning have been applied in an earlier project (see KnoSoS later on). It would be the intention here to make such tools directed more to the two types of learning (mastery & reflection) and relate them to the NA-SCRUM. On the top-level there needs to be clarity on strategy, resources, competence, etc. Instruments like George's (2000) management cockpit already ensure visualization of the resources and competence. The cockpit is a meeting room surrounded with screens filled to display all relevant measures. The restructuring of strategy can be made more concrete by visualizing: the practices of novices, the opportunities of novelty, etc. To make novelty visible the activities on the operational level need to get to the top-level management.

The big-small design also brings a solution to the weakness of novelty: the absence of experience. By separating operational and emerging part of the organization, the operation does not suffer from contra-productive innovation. Having the investigation embedded in a large company body a wrong guess may create spill over effects instead of bankruptcy, as it does in entrepreneurial companies. The operational part is both a buffer and a filter for the innovation. When it is applicable for its own core business the novelty can get absorbed[3], when it is not, the open innovation paradigm can be applied. Notice it requires social capital to get the novelty to the right position and ensure return of investment.

3.5 Open radical innovation

The big-small design almost completes the integration of previous models and the novelty-action design. The open-end is at the top-level management. Open innovation underlines the need for collaboration and alliances with other organizations. Thus, the organization should not only look at itself for sources of innovation, but it should build a capacity for integrating internal and external knowledge in its business model. In previous design internal knowledge and actions were addressed. To get to external knowledge and actions a shift is needed. In previous design the employees were the actors, now the business as a whole is the actor in a business-to-business setting. The actor may be more generally described as cooperated bodies. A research institutes can also be seen as a possible actors. To illustrate the shift an earlier model of Latour's science blood flow (figure 5) may be appropriate. The earlier model tells how the system grows in numbers, in figure 5 three shifts are drawn to illustrate the growth. In relation to the novelty-action design open innovation seems to focus mostly on the workspace or loop 5 (links and knots). The workspace is relevant to reduce the access cost and increase collaboration. The other four loops may be wanted too, how this may be done is unclear. Next to the openness only the directional is seen for huge projects (fusion reactor, space station, hadron collider, etc). Such institutes ensure collaboration for research, industries, and politics.

[3] The term absorbed is used deliberately to refer to the statement of Latour in 2.6 that only cooperated bodies can absorb the novelty.

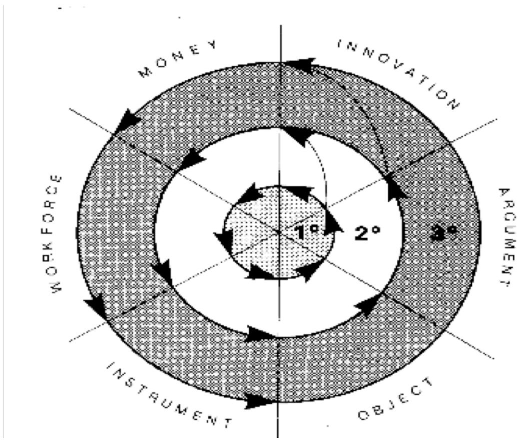

Figure 5. Transitions of science blood flow Latour 1987 p.160.

4 PRIOR PROJECTS

In this section prior projects for radical innovation are addressed. The first project by Kiemen (2003) was a pure computer science project. The goal was to build an agent simulation to research creativity. The thesis proposed to create an agent simulation that would produce at least one creative action. After a quick swap of the literature no satisfiable references were found and a radically different approach was put forward. The SCRUM method was used, creating several small goals (sprints) and the reflection after the sprint would define the new sprint. The outcome was a simplified version of what later became the higher-level cognition design and is now called the novelty-action design. The weak link in the design was the simulated environment. It had to contain the relation that could be learned. Continuing the development would shift the research from novelty to embodied cognition and motorical coordination. To keep the research focused on novelty the discipline got shifted to innovation management.

4.1 Cartography of Research Actors in Brussels (CRAB)

The intention of the CRAB-project (2004-2005) was to make a map of the research in Brussels, but in such a way that it reduced the access cost for interdisciplinary research. Van de Velde (2004) designed a theme (figure 6) to make research-based knowledge reachable for a broad audience. The theme has two categories the operational (prescriptive) and the narrative (propositional). Each category has subcategories, organized from technical to general, linked to the two parent categories. The most technical link is projects-research, the most general link is vision-visibility.

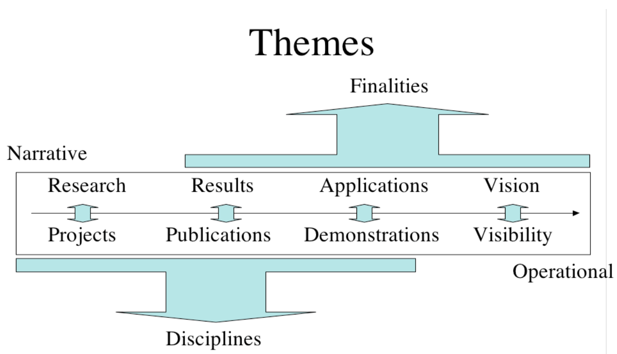

Figure 6 The theme and its components as hyperlinked information. Van de Velde, 2004, p.5

The data came from the R&D database, the university policy obligated researchers to put their data in the database. The data was created for a totally different reason, making it improper for the theme. The researchers were not involved but forced, which made it impossible to collaborate and construct the missing links. The direction of using web technology and real people to investigate novelty was however a good idea. The theme was a good example of how hyperlinked information in the working memory would link to each loop of novelty-action design. The project however only included the data, not the collaborating people.

4.2 Knowledge Sharing over Social Software (KnoSoS)

The idea behind the KnoSoS project (2005-2007) was to support knowledge sharing between SME's and institutes of higher education in Flanders. These entities do not always find each other easily when it comes to knowledge sharing, yet having them share knowledge is a high prize target in a SME-driven economy in Belgium (and the whole of Europe). Coenen (2006) elaborates the research on knowledge sharing over social software. Social networking systems allow the creation and maintenance of relationships over the Internet. They aim to support specific types of relationships between people, to visualize and increase their social capital.

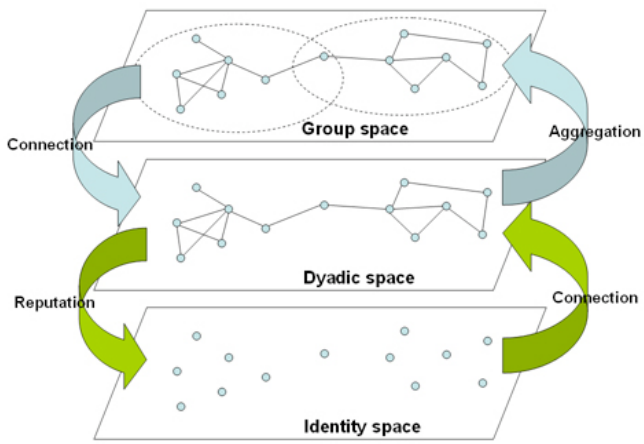

Figure 7 The structure of online social networking systems, Coenen 2006 p.82

In figure 7, three subsystems of a social networking system can be recognized. The identity space contains information about users. The dyadic space contains user-to-user information or one-to-one relations. The Group space contains one-to-many and many-to-many relations. The KnoSoS project approaches the novelty-action design:

4.2.1 Mobilization of the world (instruments):

The goal was to ensure knowledge sharing. On the user level, blogs can be made to tell stories. Between users messages are produced and in groups forums are used to help each other out. The goal is to share knowledge; it is communication that gets mobilized. The mobilization is possible by instruments like blogs, messages and forums that allow comments to be posted. The comments create the desired feedback that stimulates the knowledge sharing.

4.2.2 Autonomization (colleagues):

The subsystems are interconnected. The user can make connections and users can start groups. From the group the users relations are visible and user-to-user relations can change the reputation of the user. Each subsystem reinforces the other subsystem. Also tools like user points and rating stimulate the trust between relations.

4.2.3 Alliances (allies):

Coenen's (2006) social software analysis concludes that closed communities share more. Open communities grow faster. A user based access control (bottom up access) tries to get the benefit of both systems. The tool was however disconnected form the alliances to support the project. At the project management level SCRUM was used and a user committee was assembled a few times a year.

4.2.4 Public representation:

The public representation was the specific pilot target group (SME and high schools). The main line of communication to the public was via the Web. Also offline knowledge sharing events were organized, with the intention to continue the discussion online. From a technology perspective it was needed to make the site easily accessible. By applying interface studies the structure of the site was optimized.

4.2.5 Links and knots:

The project incorporated a pilot project to make the system go live. In the first phase only the project developer used the site. The user base needed to incorporate SME and high schools. Here an unforeseen problem arose. High schools thought of the system as an e-learning platform and didn't want a new one. The SME also looked at the tool but didn't see a reason to use it. Still by offline event several individuals of both SME and high schools did get enthusiastic. The inflow of the pilot was slow. The pilot was integrated late in the innovation, while the tool was worked out for a whole year. It is clear now the pilot should have been more involved in the development process. It should look like the nice circular movement of figure 5.

5 CONCLUSION

From creative agents, to CRAB, to KnoSoS the embedding of the research became more important. In a way the problem is similar to the one with the creative agents: a complex environment and embodiment is required. Well-established organizations would be ideal to support the need. The big-small design has drawn our attention to fulfill that need. From first project to last, SCRUM has been showing its value. In the last project the open innovation idea has been approached by social networking systems for business. The creative agent was not funded, CRAB was a one-man project for one year. KnoSoS had the support of a small team for two years. Still the integration of the new design as described in section 3 is of an even larger magnitude. The development is clearly experiencing the spiral movement of figure 5. The approach did not change over the projects. Both research & technology need to be developed simultaneously in order to reinforce each other.

New projects are worked out to investigate the NA-SCRUM and the full integration of novelty-system. The research on the other hand needs to work out the design in detail. The simple design after the creative agents has become a complex design, but it is not yet autonomous. Interesting is how the facts are emerging by themselves. For example, Latour (2005) made an actor-network-theory, which seems a continuation of the research on "science blood flow". His work is now a more technical tool that has been incorporating agent theory and network systems. Simply by the focus on each research the epistemology of novelty is getting tighter. For both the research as the project it will be a change to get more collaborative while crossing disciplines. The interdisciplinary does cause the need for a bigger effort for people with different vocabularies to communicate.

In the introduction a need to manage Web-based IT was addressed. The role of novelty-action design for web-based IT is related to the profound openness (coming back in each model) in IT. The openness has manifested on Web by open source (OS) communities. Original OS was as a freedom-fight of programmers, to break loose from intellectual property right. From a business perspective open source was seen as a competitor that had to be conquered. Today businesses embrace open source, many established IT firms don't see OS as a threat but as an opportunity. The combined strength of openness and growth creates an advantage and may reduce IT cost. The most recent change is the explicit acknowledgement of OS usage, as the illustration of the company's fitness in the market. It is interesting to see how OS is making businesses fitter. Once the software licenses are no longer an advantage, the strength of the business has to be the service it delivers. Carr (2003) sees it as: "IT is becoming a cost of doing business that must be paid by all, but provides distinction to none". Still it is not the end of IT business, just as OS was not the end of IT business, in contrast it seems to demand more IT than ever before. For example in the KnoSoS project the system was entwined with the development of the web application. For the new project, a strong relation between software development and business is seen. In a metaphor with cognitive systems, IT is like the complex neural network. Notice that more advanced living systems have more cognition, not less.

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