

# Supporting the Sytematization of Early-Stage-Innovation by Means of Collaborative Working Environments

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**Abstract.** Research in the area of the early-stage of innovation concentrates on non-linear innovation environments constituted by the nature of the “fuzzy front end” of innovations in which there are no well-defined problems or goals at that point in time [1,2]. Early-stage-innovation requirements are the general applicability and the support of iterations within the software tools to be developed within future collaborative working environments (CWE). The research presented in this paper focuses on innovators’ every day work and the related needs in todays and future work environments to provide a highly flexible software solution supportive to the early-stage-innovation. The adaptability of the software tools to – which depends on the fulfillment of the users requirements - will be achieved by supporting the real-life work routines of innovation workers and teams; be they co-located or dislocated. In the actor-network theory [3] early-stage-innovation is seen as a social process. Therefore the participation of individuals will be encouraged by the usage of game dynamics to supporting idea generation related workflows. To equalize the dependences of people working together in one place, time zone and personal relationship a database of knowledge and object representations will be implemented in the CWE. The CWE tools support and guide innovators to get connected to the right people, produce ideas based on explored knowledge and evaluate them to achieve the goal of developing successful innovations. The approach presented in the proposed paper is basing on the work carried out by the European funded research project Laboranova.

## 1 Introduction

Nowadays a boom in innovation is taking place in society. Innovation is the key to the advantage of western economies against its competitors from today’s success-

ful economies and the upcoming competitors from Asia and other emerging countries. In order to achieve continuous strategic innovation and thus create persistent competitive advantage, organizations and companies need to increase their capacity for carrying out open-ended and nonlinear problem solving involving a wide participation of people in knowledge-rich environments. Companies are well aware of this issue and have implemented strong innovation processes which are often represented by the stage-gate model. Most of these innovation processes have the black box in the beginning of the process called idea generation in common. As the output of an innovation process depends on the given input, and therefore is one of the main success factors, the early-stage of innovation is worth looking at and thereby support the generation of quantitatively and qualitatively better input to the innovation process.

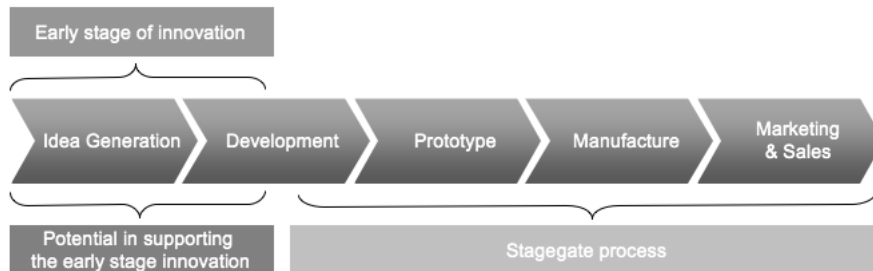


Fig. 1. The Innovation Process [4]

## 2 Theoretical Background of Early-Stage Innovation

### *Innovation in Theory*

Innovation can be understood as the process where something new and valuable to a society is created and an economic advantage can be taken. The definition of Schumpeter [5] constitutes innovation as a new combination of resources [5]. Within all definitions of innovation there is a consensus on the following points:

- Innovation is not identical to invention, the main difference being that innovation covers the whole process from a new idea to a realized product or process available to potential users or customers,
- Innovation is a result of a number of intended actions, and not just the spontaneous nearly evolutionary development of new products and processes,
- Basically innovation is related to change and the emergence of something new – and not only new but in some respects better (thus innovation is often seen as a form of problem-solving), Innovation can be based on adaptation and evolution, but is not identical although a series of spontaneous adaptations can appear as an innovation.

Latest developments in literature present a view from a sociological perspective upon innovation and the change from a linear process — from research to innovation — to a user centric approach where both the technological research and the sociological aspects of innovation are addressed equally. Additionally strategic management and innovation are no longer perceived as a linear but as a parallel develop-

ment. Innovation can be seen as learning/knowledge process within a community of practice.

#### *Ideation in Theory*

The ideation process, also called the “fuzzy front of innovation” is described to be the process of discovering what to make, for whom, understand why to make it and define the success criteria including the development of insights for answering these strategic questions [6]. Ideation as part of the overall innovation process is defines by Vaghefi [7] as the “ability one has to conceive, or recognize through the act of insight, useful ideas”. Therefore ideation represents a process with ideas as a result. The “fuzzy front end” of innovation is one main factor to the success of an innovation project. Idea generation is often seen as the inspiration or intuition of an individual [8]. But idea generation can also be seen as outcome out of a work process not only related to an individual but to a group of people working together in a network. Innovation takes place more and more in distributed teams where collaborative working environments support the communication between workers and provide “shared access to contents and allowing distributed actors to seamlessly work together towards common goals” [9].

#### *Design as the Science related to Ideation*

The scientific discipline related to the ideation process is the theory of design methodology. According to Charles Eames [10] design is described as “a plan for arranging elements in such a way as to best accomplish a particular purpose”. Design is seen as a discipline dealing with the early-stage of innovation.

Wolfgang Jonas [11] claims that today’s efforts heading for the development of planning practices and methodological approaches without having the pretence of planning everything complete. This is consistent with Akin’s [12] theory that states that “no quantifiable model is complex enough to represent the real-life complexities of the design process”.

One reason for this issue is that one of the specific aspects of the working process of designers is the constant generation of new task goals and redefinition of task constraints [12]. In relation to information technology (IT) support Rahe [13] states that the problem with the most planning instruments is the inattention on the fact that during a development process new knowledge is achieved that changes the project. This underlines the thesis of non-linearity in the early-stage-innovation. In this context a proposal from Schön [14] comes into play who states to search for an epistemology of practice implicit in the worker, intuitive proceedings. The user centric approach is becoming more and more important to organizations.

Moreover organisations can utilise their internal resources better by making the implicit knowledge of employees available for the organisation. Approaches in this field are the so called “skunk work” where 10 - 20 % of the working time is dedicated to employees own projects.

#### *Current Support of Ideation*

Because of its fuzzy nature, where details and even goals are not defined exactly the early-stage-innovation can not take place in a linear process. Iterations are the na-

ture of the related workflows. Traditional project management is all about linearity. But in the early-stages of innovation, one rarely has a well-defined problem, and so iterations between problem, solution and possibilities are needed [1].

Existing Collaborative Working Environments (CWEs) [15,16] mainly focus on supporting traditional working paradigms of linear workflows by providing IT-based platforms for planning, scheduling and executing tasks [17]. When comparing the theoretical foundation and the state-of-the-art in organizational innovation methods and approaches it seems to be obvious that today's software tools often represent a conversion of one methodology or the integration of a couple of these but they won't fulfill the requirements of future within a more open innovation culture. The usage of these tools is very seldom [18].

#### *Requirements for successful Ideation Support Tools*

However, in order to achieve continuous strategic innovation and thus create persistent competitive advantage, organizations need to increase their capacity for carrying out open-ended and nonlinear problem solving involving a wide participation of people in knowledge-rich environments. This must be supported by the next generation CWE's, which in turn, requires new paradigms for managing the knowledge transfer, the social dynamics, and the decision processes involved in the front-end of innovation.

With respect to this the actual research in the field of early-stage-innovation focuses on the real requirements of innovators in distributed working environments and the solving of the occurring challenges.

### **3 Research Approach**

Looking at how systematization in early-stage-innovation takes place in companies one recognizes that workflows are based on an individual level or at least on group dynamic level [14]. The acceptance and usage of methods and tools in this field is very weak. Specific tools to support companies' processes in the early-stage of innovation are used seldom [17]. This is caused on an individual level by the evaluation of one regarding the benefit on the one hand side and the usability on the other hand side are parameters for the usage of tools [17]. If the effort of learning and using a tool and align with that change ones work process is higher than the expected gains to use it a tool will not be used [18].

To build a successful software solution that will be adapted and used in companies and networks of innovators one needs to build upon every day requirements and workflows people are already used to and are not willing to change. Therefore the all day work of ideators — knowledge workers in the field of innovation — is evaluated in research.

The ongoing work is based on the knowledge about the state-of-art in innovation and design theory and insides of best practice analysis of innovative companies.

To gather the information needed ideators and groups working together are observed and interviews are accomplished. Within the observation this individuals and groups are accompanied through their daily business. All activities are monitored

and captured and put into the context of the actual task and workflow. In relation to this their organization of data and information – digital and physical representation – is observed. The usage of physical elements and IT tools is investigated. Further data is gathered by interviewing innovative workers lead by a questionnaire.

Based on this information workflows and routines can be identified and represented. Conclusively generic elements to support within an innovation environment and software tools supporting the early-stage-innovation can be extracted.

## **4 An Approach for the Support of Early-Stage Innovation**

Results of the observation and interviews clearly show that creating and developing ideas is based on iterative routines of representing an idea, sharing it with others, getting feedback and communicating about the object (the representation). The approach presented supports the creation and development of ideas, viewing ideation as a working process rather than moments of divine inspiration. It will identify explicit routines for team-based ideation work, together with a technological infrastructure that allows for communication about, and experimentation with more or less finished ideas, early stage innovations and concepts not yet realized.

Representations of ideas can be e.g. sketches, renderings or maps. Work routines show that individual ideators represent their ideas in an “easy to access” way, meaning that CAD or rendering software is used in a basic way, more often ideas are sketched or presented in PowerPoint. The interviewees stated that the rational for using Microsoft (MS) PowerPoint is based on the one hand on the generic usage and on the other hand the exchange with others because of its status as a de facto standard of the product. The representation is distributed to stakeholders by mail for getting feedback in general, comments, further ideas, and the development of the original idea.

### **Example of an Idea Development Routine**

The initial moment is the occurrence of an idea. This is not further specified. Within the time of one to eight hours the idea is represented as a sketch rendering or text. There might be variations of the idea but not an entirely different concept. Pictures are pasted in common media programs like MS PowerPoint or MS Word.

The document is sent out by e-mail to the recipients who have an interest in the idea. Usually they are well known. The reply by email occurs during two days otherwise there will be no reply at all after that. Alternatively feedback can be gathered by phone. Feedback is usually given in an unstructured way.

The feedback is extracted from the individual sources (text, comments to the pictures/text, phone calls) and than gathered. The feedback is then used to transform the original idea.

With this developed idea as the objective the routine starts again. The overall time frame for the described routine is about three to four days in total.

Core of this routine is the representation thereof its exchange with others. The interviewed person states that he stops thinking about how to developing the idea when not interacting with others.

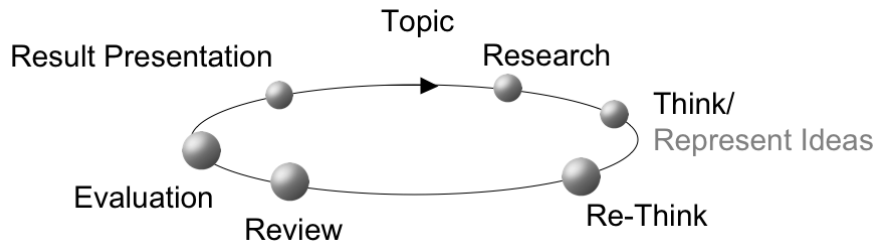


Fig. 2. Example of an Idea Development Routine

### Example Idea Generation Routine Group Perspective

Within the observed group the first step is to show the discussion topic. It is visualized to a whiteboard or flipchart (large representation plane). The topic is discussed within the group to achieve a common understanding (verbal).

To generate ideas, brainstorming takes place supported by “Post Its” which are randomly placed on the representation plane. Ideas are affected by former thoughts and experience of the participants.

The next step is the structuring of the ideas to higher aggregation levels. This is done by discussing the ideas and finding group during that discussion. Within the discussion the ideas are usually evaluated on best guess basis. The ideas are clustered on the wall. For this step lots of space is needed to develop clear clusters. The possibility to edit the visualization with e.g. connecting lines with a marker is given when using a whiteboard.

The representation is captured by taking a photograph.

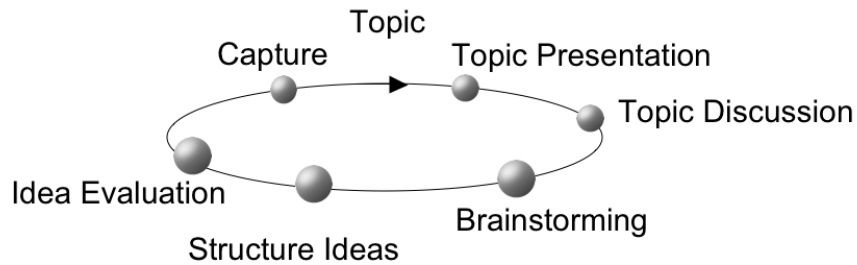


Fig. 3. Example of an Idea Generation Routine by a Group

Common to both of the examples is the importance of representing the idea one has and the exchange. People need feedback to further develop their idea. The externalization of ideas is mostly supported by generic media, like sketching on paper or - by means of IT support - the usage of MS PowerPoint.

People who are not physically work together or don't have the opportunity to have a meeting with other stakeholders regarding the idea send them out by email to provide the represented idea to them.

The represented object and the communication regarding it take place in several proprietary software solutions which might cause the loss of information or data inconsistency.

By means of transferring this knowledge in an innovation environment which merges the representation and the communication regarding the represented object to support innovators with their daily work a successful software solution can be developed.

The network of people working in the field of idea generation are neither not necessarily located in one place, even not in one company, nor do they work in one time zone. New connection mechanisms need to be developed and implemented to bring the right people together who share a specific interest. As much as participating in the idea generation process the motivation of individuals is key to success.

But creating connections is not only a matter of bringing the right people together. They can be instantiated between ideas to describe the intellectual lineage of an idea (e.g. where it is coming from) or to keep together related ideas. Connections transform a collection of ideas into a structure that can be browsed and filtered according to innovators' needs.

Even if the right individuals and the right ideas have been brought together and a quantity of ideas are generated in the provided environment, there are differences in the quality of ideas and the chance of success later within the market launch. In order to select the ideas which have the greatest chance of becoming a successful innovation evaluation is necessary. To achieve this goal the "intelligence of many" will be used by implementing a prediction market into the innovation environment.

## 5 Collaborative Working Environments

As early-stage-innovation takes place in diverse environments (e.g. on individual level, in groups, SME, companies, open innovation, Living Labs [19]) the CWE tools which will be developed need to be based upon a scaleable system. The tools can both be used integrated as well as single solutions related the needs of an individual, a group or company working in the field of early-stage-innovation (e.g. idea generation tools, evaluation tools).

The main modules within the innovation environment in Laboranova will be:

### *Idea Database*

Ideas as outcome of early-stage innovation and also as working objects will be handled within an idea database. Implementations of editing and evaluation tools will lead to developed ideas. The idea generation will be supported by idea generation games for example based on the method of "Reframing the Question". Additional games in the field of idea generation will be developed.

### *Idea Evaluation*

The Laboranova idea evaluation space aims at developing a group decision support system supporting decision makers in taking knowledgeable decisions. To do so, the idea evaluation space should support effective collaboration between decision makers in order to build consensus and collaboratively select the best ideas. Moreover, the Laboranova idea evaluation space will provide mechanisms for providing decision makers with the necessary knowledge to select the best ideas. This will be supported by a prediction market.

### *Connection Space*

Laboranova will provide a user database with user profiles for describing the experts interests and abilities. The proposed User Profile for use in Laboranova is a modular one. It consists of standard modules which are fixed (always present in a user's profile) and extensible modules which are modules that can be dynamically added by the system to the profile. These latter can be displayed on the User's Profile (visible) or hidden (invisible - only accessible by the system). The connection with experts one user might not know will be supported by connection games.

### *User engagement by game dynamics*

For generating ideas games will be used for shorter, specific work routines. The game approaches for idea generation will be designed from the assumption that (good) ideas do not just come into existence but involve some analytical and explorative work. The objective of these ideation games is to promote and support innovative work. Most games available for companies are simulations mainly focusing on learning or team-building. For games to be used in ideation, and not just in training people in ideation work, the game should provide insights as well as make the participants able to act on these insights by coming up with ideas for new products, services and strategies.

The notion "game" is an ambiguous term – for some it signals energy, entertainment and creativity, while for others it signals a lack of seriousness and value. This implies that the diffusion and implementation of innovation games should focus on the productive side of the process. The message should be clear that while being a game the process is still work and should be taken seriously.

The follow-up process should be an integral part of the design of a game. Knowledge developed during the game should be documented and presented to the participants. Competences developed should be followed-up with action plans for further development, implementation and integration into ordinary practices. If the game is supposed to create input to decision processes in the organization, feedback to the participants about how the feedback should be communicated should also be part of the game's results.



## 6 Conclusions

To support early-stage innovation in distributed teams CWE need to be developed which support non-linear work processes. These iterative processes will be supported by the innovation environment in a way that does not change the habits and routines of people working in the field of innovation but provides tools and methods to them which augment the efficiency of their way of working. Important to this concept is the support of object related communication. It can be seen in the routine examples idea development is based on the representation of the idea, exchange of its representations and gathering feedback and get input to further develop the idea.

An IT based innovation environment with rated ideas on several development levels will support innovation workers with presenting and communicating their ideas to stakeholders, developing their ideas further, finding related ideas and people and will be the backbone to enhance companies ability to generate successful innovations.

Creating connections is not only a matter of bringing the right people together. Connections provide the backbone for ideation. They can be created between ideas to describe the intellectual lineage of an idea or to keep related ideas together. Connections transform a collection of ideas into a structure that can be browsed and filtered according to innovators' needs.

Even if the right individuals and the right ideas have been brought together and a quantity of ideas are generated in the provided environment, there are differences in the quality of ideas and the chance of success later within the market launch. In order to select the ideas which have the greatest chance of becoming a successful innovation evaluation is necessary. To achieve this goal the "intelligence of many" will be used by implementing a prediction market into the innovation environment.

The objective of the game is to make the work routine of generating ideas more effective through the use of games. The outcome of the game intended to be initial ideas but could also be broader and imply "options", e.g. ideas for solutions for specific problems. However, with focus on the fuzzy front end of innovation, the very early part of a project when the idea has not been found and the criteria for selecting a good idea are unclear and it is not sure that the idea will lead to a new product. The challenge of introducing and developing a game is that it should be possible to use it in a productive way, i.e it should be included in the work flow in generate

The overall goal is to provide CWE tools related to early-stage-innovation collected in an innovation environment which can be used easily; where innovators see the advantage of usage and by using it enhance the environment in its quality.

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