

Kessels, J.W.M. Verdonschot, S. De Jong, T. (2011) Characteristics of learning environments which support knowledge productivity and which facilitate innovation. In IPOB (ed.) *The future of knowledge intensive service work*. pp 221-232. Marburg: Metropolis-Verlag.

Characteristics of learning environments which support knowledge productivity and which facilitate innovation

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The research projects being reported on have been conducted at the University of Twente, The Netherlands.

July 2010

1 Introduction

Our society is gradually moving towards a knowledge economy: an economy in which the application of knowledge replaces capital, raw materials and labour as the main means of production (Drucker 1993). The essential ingredient of products and services is the inherent knowledge. The ability to gather information, generate new knowledge, disseminate and apply this knowledge to achieve improvements and innovations is an organisation's knowledge productivity (Kessels 2004). Knowledge productivity is increasingly regarded as the dominant economic factor in a knowledge society and it highlights the importance of a conducive learning environment that facilitates innovation. This paper summarizes two recent studies in the domain of knowledge productivity and innovation, trying to answer the following research questions:

1. If innovation can be regarded as the outcome of a learning process in a social network, what are the main characteristics of the supportive learning environments?
2. Which are the relevant design principles for developing a supportive learning environment for innovation?

The provisional answers to these questions follow from the results of the studies by De Jong, Verdonschot & Kessels (2008), Verdonschot (2009) and De Jong (2010) which examined the innovation practices in 35 cases in the period 2003-2009. The case studies have been conducted on the basis of a conceptual framework which will be presented in the following section.

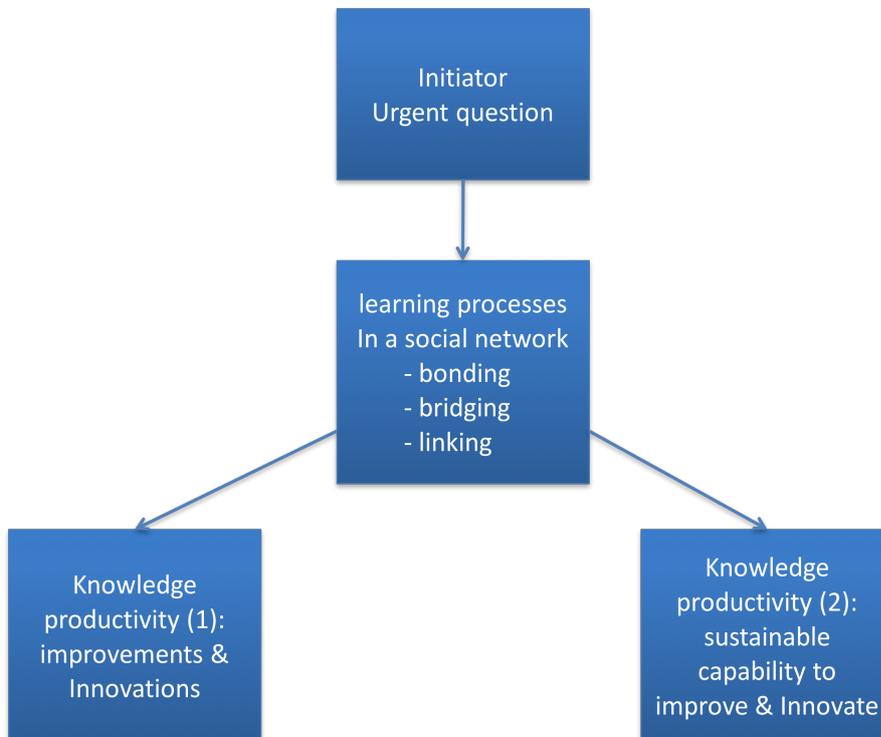
2 Theoretical framework

The main concept in the theoretical framework is knowledge productivity - the capability of an organisation or team to gather and interpret relevant information, to develop new capabilities on the basis of this information and apply them to the gradual improvement and radical innovation of work processes, products and services (Kessels 2004). In fact, knowledge

productivity can be observed in two dimensions: the improvements and innovations that have been achieved (KP1) and the increased, sustainable capability to improve and innovate in the future (KP2).

The process of knowledge productivity is considered as inherently a learning process that includes information collecting, problem analysis, competency development and creative application of these competencies in new, unknown situations. These learning processes take place in teams or networks and can be described as social learning processes (Akçomak 2009; Kessels & Poell 2004). In these networks we can observe bonding, bridging and linking connections (Woolcock 2001). Bonding connections closely tie together people from a very similar background, like family members and close friends and, colleagues in a team. Bridging connections bring together people who are from fairly similar backgrounds but are more loosely brought together, such as members across teams with shared interests. Linking connections bring together people from different backgrounds, very often from different organisations.

Figure 1: Conceptual framework for Knowledge Productivity



In most instances, at the start of an innovation project, an initiator with a strong personal interest in a specific urgent question takes the lead, inviting colleagues to participate and starting the process of searching for relevant information, developing new competencies and experimenting with innovative practices. Often this process takes place away from where the day-to-day operations take place. Such a learning environment can be analysed in terms of (seven) learning functions of a corporate curriculum (Kessels 2001).

2.1. Subject-matter expertise

Acquiring subject-matter expertise and skill directly related to the scope of the innovation project at hand: the competencies related to acquiring subject-matter expertise have been the main objective of training and

development. Yet a highly specialised work force does not necessarily make a learning organisation that becomes knowledge productive.

2.2. Problem solving

Learning to solve problems by using subject-area-specific expertise: it is important to develop competencies with which existing subject-area-specific knowledge is applied to solving new problems. In addition to skill at remembering and calling to mind relevant knowledge already acquired, it also requires skill at applying knowledge: how does one act in new and ill-defined problem areas?

2.3. Reflective skills and meta-cognitions

Developing reflective skills and meta-cognitions that are conducive to locating paths leading to new knowledge and the means of acquiring and applying this asset. The main questions that we should answer here are: how can it be that we are good in solving a certain type of problems, and why do we perform so badly when factors of type x are involved? Where is our intelligence located? How can it be that we are making progress in a certain field, but lagging behind in neighbouring areas of activity?

2.4. Communication skills

Securing communication skills that provide access to the knowledge network of others and that enrich the learning climate within a workplace: knowledge productivity requires easy access to relevant sources of information and competence. Getting access to these networks relies heavily on proficiency in communication and social skills. It is not only a matter of polite behaviour. The main question here is: how do I make what I can contribute attractive in order to participate in the network of interesting knowledge workers? What can I offer and how well am I accepted? Highly developed social and communication skills promote a favourable learning climate.

2.5. *Self-regulation of motivation and affinity*

Acquiring skills that regulate the motivation and affinity related to learning: in a traditional economy a manager could say: 'Joseph, work harder, or run faster'. In a knowledge economy it is pointless for a manager to say: 'Joseph, be smarter or show more creativity!' Being smart and creative depend heavily on personal interest. Questions that are important here are: why do you get up so early to avoid the traffic jams? What is it that moves you to do what you do? What is your main drive? How is it that you put so much energy into that project? Why is it that you fully neglect the work of your colleague K? Favourable attitudes, affinities and emotions play an important role in knowledge work. I cannot be inventive in an area of activity which does not motivate me. What represents meaningful work for me, and how do I get to the stage where I am genuinely committed? Finding out what emotional and affinity-related driving factors employees have and how they can regulate them, will probably be an important aspect of human resource development in a knowledge economy.

2.6. *Calm and stability*

Promoting calm and stability, to enable specialisation, synergy, cohesion, and integration to develop: calm and stability are necessary for gradual improvement. How do I learn from the past and how can I apply this to my current work? Unfortunately, many employees work in an environment that is permanently disturbed by reorganisations, by projects involving the redesign of business processes or by rapid changes in management personnel. There is a lack of available scope and time to reflect upon and exploit existing (intellectual) resources, in order to utilize them specifically to generate new knowledge and new solutions. Lack of calm and stability results in impoverishment of intellectual assets.

2.7. *Creative turmoil*

Causing creative turmoil to instigate innovation: creative turmoil generates the dynamic which pushes the process towards radical

innovation and leaves traditional paths behind. Creative turmoil requires a certain amount of existential threat. It should really matter whether those involved prevail or are defeated. In a sense, calm and stability on the one hand and creative turmoil on the other hand are two contrasting learning functions. Some employees will do better in an environment characterized by calm and stability, while others feel spurred on by creative turmoil. We think that both are necessary, but must be used in a balanced way.

The policy and the activities which an organisation develops to promote these seven learning functions form its *corporate curriculum*: the plan for learning to increase knowledge productivity by applying new competencies to be adapted flexibly.

3 Method

Data has been collected in a series of related case studies. 18 reconstructions have been made of innovation practices that took place in The Netherlands, Indonesia and China (reported in Verdonschot 2009). Interviews and document studies were used as the main procedures for data collection on the urgent question which started off the innovation practice, factors and interventions; these elements, in their turn, supported the innovation process, the characteristics of the work environment in which the innovation took place and the outcome of the innovation process. In addition 17 case studies in The Netherlands have been followed over a time span of 6 to 12 months (reported in De Jong 2010). The researchers observed network activities, followed participants during their interactions at the workplace and interviewed the participants. Based on the data collection, several meetings were organized for the purposes of reflecting on the findings and validating the results. Specifically, the following characteristics have been observed: the role of the initiator and the urgent question that is at the basis of the innovation process; the social learning processes, specifically the bonding, bridging and linking relationships in the networks; and the interventions that supported the innovation process.

4 Results

What led to the necessity to improve and innovate?

When innovation originates from an urgent problem, organizations face a problem that they cannot solve by their current way of working. It could be a problem for which they have already tried several alternative solutions that did not work. Such an urgent problem creates time pressure and dedication which contribute to the development of both improvements and innovations.

No correlation was found between the kind of problems that were encountered and the output of the innovation process. What seems to matter most is the strong resolve of the organization and the participating employees to come up with innovative solutions.

What was the outcome of the innovation process?

The subsequent output of innovation processes which start with an urgent question may be either a gradual improvement or a radical innovation. Time pressure clearly played a role in the outcome of the process. Instances in which there were time restraints, and the necessary expertise was available within the organisation, mostly led to gradual improvements. In cases where time was available to search for sources of expertise outside the organisation, participants needed to further develop and adapt these external solutions for their own situation. In these cases radical innovation was more likely to occur.

What factors and what interventions enhanced or inhibited the learning processes that led to the improvement or innovation?

Creative turmoil stimulates the innovation process: the sense of urgency that participants feel to develop something new, and some form of external pressure, lead to the motivation to start the process, to continue and not to give up.

The freedom to experiment with new ways of working and problem solving seems to generate energy and creative scope for new perspectives. On many occasions the process got stuck. In these instances, organizing something new, making a product or doing an experiment, helped the participants to overcome that impasse.

Autonomy and responsibility played an important part. Participants feel responsible for the objective of the network and share ownership of the task of reaching it. Apparently, participants need the freedom to make their own choices and to decide on their own way of working. However, participants need the communication skills to do this successfully. Sometimes support was needed to develop these skills. Then, the network can invest in a collective ambition to learn from each other by creating an environment in which everybody can speak and think freely. So the network gradually builds on trust and actively supports a safe learning environment.

The development of subject-matter expertise was at the heart of most of the studied practices.

In the rush to make progress with the project, it was often difficult for the participants to find time for reflection. When reflection did take place they focussed on the next specific steps in the process; hardly ever did participants reflect on their own learning process.

In the social context of the teams, care, mutual respect, and tolerance of people making mistakes were important characteristics of their work environment.

It appeared to be favourable for the process when participants were passionate about the theme central to the innovation process and when they also had a clear stake in the outcome. Most network participants have a strong personal drive and participate in a voluntary way. Reward and recognition from management or sponsors had a positive effect on the process. When management shows trust in the network by granting freedom to act, this is beneficial for the outcome.

It became clear that the innovation process could not be managed in a direct way, as neither the participants nor the managers knew which steps need to be taken at the outset. Careful planning and control do not seem to be possible in such a process. Inviting employees and encouraging them to engage in the process of innovation appeared to be a more successful strategy.

The innovation practices that are successful in developing an increased capability for innovation in the future all show specific improvements and innovations. The links between the network and the external world appear to be necessary for achieving improvements and innovations. However they are not decisive for developing an increased capability for innovation. Here it seems that the presence and the quality of the social learning processes in the team do indeed matter.

The initiator plays an important role in bringing relevant participants together, mainly by being passionate about the topic at hand and thus showing enthusiasm and drive to work towards a specific goal. The initiator needs the freedom of choice in inviting team members, on the basis of their personal characteristics and competencies.

5 *Conclusions*

An urgent matter

In the various case studies it is often an urgent matter or question that fuels the innovation process. Teams do often face a problem that they cannot solve by just applying known approaches. In many instances such a problem creates time pressure and dedication which contribute to the development of both incremental improvements and sometimes even radical innovations.

Time to reflect

However, as time pressure plays an important role in fuelling activities that lead to improvements, it is the time for reflection and an outward-looking orientation that makes radical innovation possible. Here, the linking relations, as part of the structural dimension of social capital, facilitate the development and adaptation of external solutions to one's own situation. However, in many organisations, due to the urgency of the problem at hand and in the rush to make progress with the project, there is little time either for reflection on the learning process in the network or

for taking an opportunity to explore unconventional approaches. On the one hand creative turmoil is favourable for urgency and it serves as a driving force towards finding solutions; on the other hand calm and stability are conducive to reflection. In general the freedom and autonomy to experiment appeared to be conducive to innovation.

Action or reflection

In several cases the innovation process got stuck. Often this was preceded by long discussions and exchanges of opinions and information. Breaking this process of talking and analyzing by taking action, creating something new, making a product or doing an experiment: these approaches helped participants to overcome such an impasse. It was observed that a team could get stuck in energy-draining discussions when it lacked the communication skills and capability for deliberate reflection. Working on an urgent matter often creates a very strong focus on the subject-matter expertise.

The importance of subject-matter expertise

Subject-matter expertise is at the heart of innovation. Colleagues find each other on the basis of a shared interest in a specific domain of expertise. They value and appreciate each other's know-how and experience when it comes to the urgent matter at hand.

Communication and learning

Successful innovation processes are often supported by specific communication skills. These skills are needed to handle freedom, autonomy and responsibility for achieving innovative results. Specifically this applies to innovative teams, often acting as self-directed teams without formal leaders or hierarchical structures. Sometimes, a strong focus on the content and the subject-matter expertise makes itself felt at the expense of the communication skills; yet it is in fact these

communication skills which facilitate the open exchange of opinions, creating a collaborative working atmosphere and supporting both collective learning and the building of trust and a safe learning environment. In such a favourable learning environment there is room for experimenting and unleashing the talents of each of the participants. The important issue is that team members care for each other and show respect, leading to a tolerance of mistakes.

Planning and Control

Careful planning and managerial control do not appear to contribute much to the success of an innovation team. Moreover, trust, recognition and reward from management are important in the process of exploring new and unconventional approaches. Furthermore, it is primarily the initiator who plays an important role in bringing together the team and organizing the work in a passionate way, with this dynamic serving as the driving force for the success of a team.

Personal drive and social learning

Strong personal drive and passion for the theme of innovation are crucial for building a successful innovation team. Personal drive and passion are qualities evident in the initiator who selects and invites his or her own team members. However, the indications are that, to achieve breakthrough, improvement and innovation (KP1) it seems to be necessary to have linking connections, especially across companies and institutions. Apparently, the influx of information, experience and expertise from different contexts is important for innovation. When it comes to the further development of the capability to create breakthroughs in the future, a team seems to develop this sustainable capability (KP 2) - we were able to observe the following aspects: merely having been innovative in the past seems to be insufficient; however the sustainable capability to be knowledge-productive did emerge in cases where there is a combination of a high level of social learning (where a shared language and codes can develop) with a lively exchange of experiences being able to take place in a safe environment.

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