REHEARSING FOR THE FUTURE
Scenarios as an Enabler and a Product of Organizational Knowledge Creation

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Abstract: This paper discusses conceptual basis for facilitating knowledge creation through the rehearsal of plausible futures in the scenario process. We discuss the foundations for creating knowledge in an organizational context and propose a concrete context that supports and stimulates the conversion of personal knowledge organizational knowledge and decisions. Based on the discussion and our experiences with the scenario process, we argue that the scenario process facilitates creation of organizational knowledge. We propose that the scenario process acts as a vehicle for exploring and creating organizational knowledge.

1 INTRODUCTION

Knowledge and knowledge sharing are important to any modern organization. The quality of decision making depends on creation, transformation and integration of knowledge across individuals and organizational groupings. Knowledge enables effective decision making and management. As organizations have become larger and more diversified, and as individual roles and tasks have become more specialized, there is a growing need to convert personal knowledge to common usage.

Every decision situation in organizational decision making involves a decision maker or decision makers, desired outcomes or objectives and goals, at least two decision alternatives, and an environment or a context. In addition, an implicit assumption of every decision situation is the future oriented conception of time; decisions are meaningful only with reference to the future. They are made for future not for past or present.

The rapid rate of technological, economic and social changes that have an effect on organizational environment has increased the need for foresight. Because the future in absolute term is always at least partly unknown, it cannot be predicted exactly. The external environment is not under the control of the organization and therefore the environment is a

source of uncertainty. Still, every organization can practise foresight. The ability to see in advance is rooted in present knowledge and in partially unchanging routines and processes within an organization. The quality of attempts to foresee is finally grounded on our knowledge and ability to understand deeply enough the present position.

A class of such foresight action is the process aiming to produce plots that tie together the driving forces and key actors of the organizational environment (Schwartz, 1996), i.e. scenarios. Although future oriented, scenarios are also projections of the known, extensions of the present situation over into the unknown future. Nevertheless, even if scenarios are projections of the known, they still have value as representations of organizational knowledge.

Concepts like the community of practice (Lave and Wenger, 1991) and networks of practice (Brown and Duguid, 2001a) are used to explain the organizational conditions favoring knowledge creation and sharing and innovation. The most favorable contents of these arrangements certainly depend on factors such as the organizational context, the experiences and other capabilities of the members, and management style.

This paper discusses the theoretical basis for creating conditions to support formation of a community to enable knowledge sharing and goes

on to propose such a condition or an artifact. The paper presents a possible means to support knowledge transfer and creation through the scenario process. We argue that the electronically mediated scenario process can act as a community and enable the participants to share their knowledge while exploring the future. In this paper, the potential value of the proposed approach is evaluated mainly by epistemological criteria.

The question to which we seek answer is: 'What kind of organizational arrangements are capable to increase organizational knowledge creation?' and also more specifically 'Can the scenario process support organizations in their strive towards knowledge creation?'.

The remainder of the paper is organized as follows. The second section discusses knowledge and its creation in organizational contexts. The third section presents the scenario process and discusses its properties as a venue for knowledge creation. The fourth and last section discusses the results and presents conclusions at theoretical and practical levels.

2 CONCEPTUAL BACKGROUND

2.1 Knowledge and Knowing

Knowledge is traditionally interpreted as a singular, independent object. Another, procedural interpretation of knowledge is to see it as a path of related steps (Carlile and Rebentisch, 2003). When defining knowledge, Tsoukas and Vladimirouv (2001, p. 979) relate knowledge to a person's ability to draw distinctions: "Knowledge is the individual ability to draw distinctions, within a collective domain of action, based on an appreciation of context or theory, or both." According to this definition, a person who can draw finer distinctions is more knowledgeable. Making distinctions and judgments, classifying, structuring, placing order to chaos, are capabilities of an expert who has knowledge.

If decision making is not a synonym for management, as Simon (1960) has argued, decision making is still undoubtedly at the core of all managerial functions. When a decision is made, the epistemic work has been done and the physical work to implement the decision can start. The value of knowledge and information is ultimately evaluated by the quality of the decisions made. Making decisions involves also making distinctions, categorizations and judgments – we need to search

for and structure alternatives. According to Emery (1969, p. 67) information has value only if it changes our view of the world, if our decisions are sensitive to such a change, and if our utility is sensitive to difference in decisions. Thus, information is valued through decisions and because information and knowledge are relative, the same logic can be used to value knowledge, too. Kivijärvi (2008) has elaborated the characterization of knowledge further and defines knowledge as the individual or organizational ability to make decisions; all actions are consequences of decisions. Also Jennex and Olfman (2006, p. 53) note that "...decision making is the ultimate application of knowledge".

When Polanyi (1966) talks of knowledge in his later works, especially when discussing tacit knowledge, he actually refers to a process rather than objects. Consequently, we should pay more attention to tacit knowing rather than tacit knowledge. Zeleny (2005) characterizes the relationship of explicit and tacit knowledge much in the same way as Polanyi. He (Zeleny, 2005) sees that knowledge is embedded in the process of 'knowing', in the routines and actions that come naturally for a person who knows. Cook and Brown (1999) also emphasize that knowing is an important aspect of all actions, and that tacit knowledge most easily becomes evident when it is used, that is, it will manifest itself during the knowing process.

Polanyi (1962) tied personal dimension to all knowledge and his master-dichotomy between tacit and explicit knowledge has shaped practically all epistemological discussion in knowledge management field. According to Polanyi tacit knowledge has the two ingredients, subsidiary particulars and focal target (proximal and distal, Polanyi, 1966, p. 10). Subsidiary particulars are instrumental in the sense that they are not explicitly known by the knower during the knowing process and therefore they remain tacit. Thus, "we can know more than we can tell" (Polanyi, 1966, p. 4) or even "we can often know more than we can realise" (Leonard and Sensiper, 1998, p. 114) and we cannot directly convert tacit knowledge to explicit knowledge.

Tsoukas and Vladimirou (2001, p. 981) write "Organizational knowledge is the set of collective understanding embedded in a firm". It is "the capability the members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations (propositional statements) whose application depends on historically evolved collective

understandings and experiences" (Tsoukas and Vladimirou, 2001, p. 983). Similar to the way the definition of personal knowledge was extended, the above definition of organizational knowledge has been extended as the capability the members of an organization have developed to make decisions in the process of carrying out their work in organizational contexts (Kivijärvi, 2008).

2.2 Contexts for Knowledge Creation and Sharing

Lave and Wenger (1991, p. 98) introduced the concept of community of practice and regarded it as "an intrinsic condition for the existence of knowledge". Communities of practice have been identified as critical conditions for learning and innovation in organizations, and they are formed spontaneously by work communities without the constraints of formal organizations. According to Lesser and Everest (2001, p. 41) "Communities of practice help foster an environment in which knowledge can be created and shared and, most importantly, used to improve effectiveness, efficiency and innovation". In other words, a community of practice can form the shared context, which supports the recipient decoding a received message with the same meaning the sender has coded it (Gammelgaard and Ritter, 2008). Although the communities develop informally and spontaneously, the spontaneity can be structured in some cases (Brown and Duguid, 2001b).

When people are working together in communities, knowledge sharing is seen as a social process, where the members participate in communal learning at different levels and create a kind of 'community knowledge'. According to the studies on communities of practice, new members learn from the older ones by being allowed to participate first in certain 'peripheral' tasks of the community. Later the new members are approved to move to full participation. After the original launching of the concept of community of practice, a number of attempts have been made to apply the concept to business organizations and managerial problems (Brown and Duguid, 1996). Recent studies on communities of practice have paid special attention to the manageability of the communities (Swan, Scarbrough, Robertson, 2002), alignment of different communities, and the role of virtual communities (Kimble, Hildreth, Wright, 2001). Gammelgaard and Ritter (2008), for example, propagate virtual communities of practice, with certain reservations, for knowledge transfer in multinational companies.

To sum up, the general requirements for a community are a common interest, a strong shared context including own jargon, habit, routines, and informal ad hoc relations in problem solving and other communication (Amin and Roberts, 2008). An important facet of a community of practice is that the community is emergent, and is formed by individuals who are motivated to contribute by a common interest and sense of purpose. A cautious researcher might be inclined to use the term quasi-community or some similar expression in the case of artificial set-ups, but in the interest of being succinct, we use the word community in this paper also for non-emergent teams.

2.3 Scenarios and the Scenario Process

Kahn and Wiener (1967, p. 33) define scenarios as "Hypothetical sequences of events constructed for the purpose of focusing attention to causal processes and decision points", with the addition that the development of each situation is mapped step by step, and the decision options of each actor are considered along the way. The aim is to answer the questions "What kind of chain of events leads to a certain event or state?" and "How can each actor influence the chain of events at each time?" This definition has similar features as Carlile and Rebentisch's (2003) definition of knowledge as a series of steps as discussed above.

Schwartz (1996) describes scenarios as plots that tie together the driving forces and key actors of the environment. In Schwartz' view the story gives a meaning to the events, and helps the strategists to see the trend behind seemingly unconnected events or developments. The concept of 'drivers of change' is often used to describe forces such as influential interest groups, nations, large organizations and trends, which shape the operational environment of organizations (Schwartz, 1996; Blanning and Reinig, 2005). We interpret that the drivers create movement in the operational field, which can be reduced to a chain of related events. These chains of events are in turn labeled as scenarios, leading from the present status quo to the defined end state during the time span of the respective scenarios.

The scenario process is often considered as a means for learning or reinforcing learning, as discussed by Bergman (2005), or a tool to enhance decision making capability (Chermack, 2004). Chermack and van der Merwe (2003) have proposed that often participation in the process of creating scenarios is valuable in its own right. In their view (Chermack and van der Merwe, 2003) one major product in successful scenarios is a change in the

participants view to the world and the subject area of the scenarios. This is another feature that has echoes in knowledge management field, as Emery (1969) proposed that one of the conditions information has to fulfill to have value, is that it changes our worldview, and here Chermack and van der Merwe (2003) argue that participation in scenario process will potentially change the participants worldview. They argue further that even the most important aim of scenario process is to challenge the participants' assumptions of the future and let them to re-examine their assumptions analytically. In short, they argue that a learning process enables the participants to examine their assumptions and views, challenges them and as a result, improve the existing mental structures.

When we contrast these properties of scenarios as a product and a process to the discussion about knowledge, we will notice that knowledge is manifested in knowing, decision making and action. Scenarios on the other hand enable simulation of action, through analysis of the current situation and analytical projections from the assumptions. So we can propose that scenarios 1) as a process can be a learning experience, but scenarios 2) as projections of future can be manifestations of knowledge about the present and future, and lastly scenarios 3) as stories of plausible futures can act as a rehearsal for the future, testing of present knowledge and routines in different environments.

To put these proposition to plain terms: Firstly, the process forces the participants to think about the present, the drivers of the situation and where does it evolve, and through critical discussion in the group the process guides the participants to critically examine their mental models and to converge toward a commonly agreed statement of futures. Secondly, the scenarios as a product codify and make the assumptions explicit and illustrate the created knowledge of the future at that given point of time. And thirdly, when the group creates plausible stories of the world of tomorrow, they can be used as a framework for reflecting existing knowledge and mental models, and their fitness to the new situations.

2.4 Linking the Conceptual Elements

We proposed that in its deepest sense knowledge is and manifests as capability to make decisions. Scenarios, as discussed above, can be linked to organizational learning and knowledge on multiple levels. Scenarios aim to increase the organizational capability to make decisions and are thus, by

definition, a type of organizational knowledge and most of all projections of present knowledge. Knowledge is also tied to action and scenarios are a kind of 'quasi-action' where knowledge items can be tested in relation to other items.

In addition to the scenarios, the process of creating them helps the members of the community to use their deepest, subsidiary awareness of the future. All foresights have a tacit, hidden dimension, which is like all tacit knowledge partly consciously known, whereas the other part is instrumental and is known only at the subsidiary level. Subsidiary awareness forms a background or context for considering the future. It is a part of our foresights that cannot be directly articulated in explicit form but when those foresights are used in the knowing process their content will be manifested. Thus, the scenario process is a foreseeing process where the subsidiary awareness of each participant is transformed into organizational scenarios. The final measure of scenarios is how well the subsidiary and focal awareness of the community members are stimulated. Organizational scenarios are a future oriented type of organizational knowledge grown from the individual as well as organizational knowledge concerning the past and present.

If we accept these premises, we can argue that scenarios enable 'rehearsing for the future' and presenting knowledge of the present as well as future. The remaining question is then how to manage the process effectively to organize and transform available knowledge to logical scenarios. One question is whether the process satisfies the conditions of being a community, and if the community in the case is not emergent, but purposefully set up, is still a community? The answer of Amin and Roberts (2008) would most likely be 'yes and no', and the short-lived community this paper presents would be classified as a 'creative community', where the base of trust is professional and the purpose is to solve a problem together.

The experimental community we propose in this study is a group support system facility, which is used to mediate the interaction and to support the community in the task of composing scenarios. The method adopted in this study is the intuitive decision-oriented scenario method, which uses Groups Support Systems (GSS) to mediate group work in the process. The method is introduced by Kivijärvi, Piirainen, Tuominen, Kortelainen and Elfvengren (2008) and later labeled the IDEAS method (Piirainen, Kortelainen, Elfvengren, Tuominen, 2010).
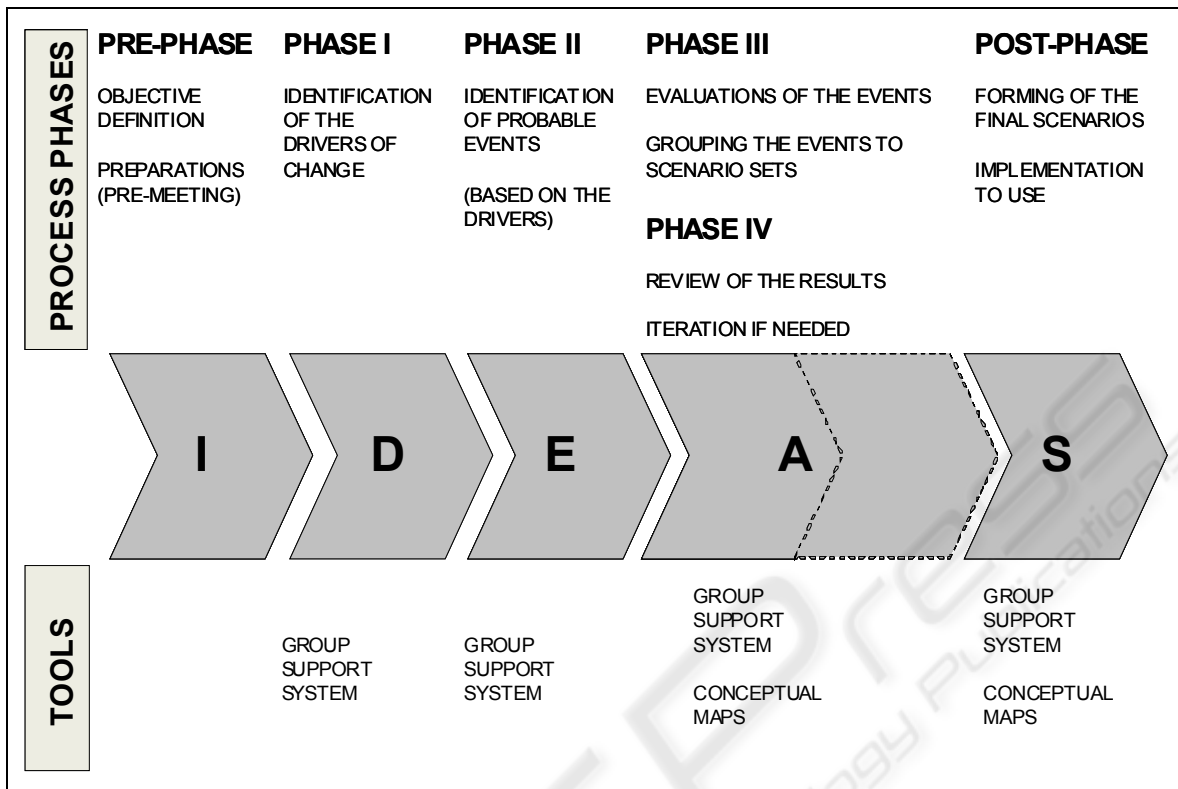
PROCESS PHASES	PRE-PHASE	PHASE I	PHASE II	PHASE III	POST-PHASE
	OBJECTIVE DEFINITION	IDENTIFICATION OF THE DRIVERS OF CHANGE	IDENTIFICATION OF PROBABLE EVENTS	EVALUATIONS OF THE EVENTS	FORMING OF THE FINAL SCENARIOS
	PREPARATIONS (PRE-MEETING)			GROUPING THE EVENTS TO SCENARIO SETS	IMPLEMENTATION TO USE
			(BASED ON THE DRIVERS)	PHASE IV	
				REVIEW OF THE RESULTS	
				ITERATION IF NEEDED	

I D E A S

TOOLS		GROUP SUPPORT SYSTEM	GROUP SUPPORT SYSTEM	GROUP SUPPORT SYSTEM	GROUP SUPPORT SYSTEM
				CONCEPTUAL MAPS	CONCEPTUAL MAPS

Figure 1: The IDEAS scenario process and support tools (adapted from Lindqvist, Piirainen, Tuominen, 2008).

3 KNOWLEDGE CREATION IN THE SCENARIO PROCESS

The discussion above presented the argument that scenarios can enable knowledge creation and storing it. We already referred to the IDEAS method which has been developed to enable efficient scenario creation with electronic mediation. The method uses a group support system to facilitate group work and to enhance interaction.

The often cited benefits of using a GSS are reduction of individual domineering, efficient parallel working, democratic discussion and decision making through anonymity on-line and voting tools (e.g. Kivijärvi et al., 2008; Fjermestad and Hiltz, 2001; Nunamaker, Briggs, Mittleman, Vogel, Balthazard, 1997). These features are important features where the subjects may be sensitive or controversial to some of the participants. The mechanical details of the process has been described and discussed in detail in previous publications (Piirainen, Tuominen, Elfvengren, Kortelainen, Niemistö, 2007; Kivijärvi et al., 2008).

3.1 The Scenario Process

To illustrate how the scenario process works, we walk through the main tasks. The phases are also illustrated in Figure 1.

The phases I-IV are completed in a group session under electronic mediation, preceded by common preparations and after the session the collected data is transformed to the final scenarios. The phases from III-post-phase can be also supported by mapping tools beside GSS.

The first main task during the process is to identify the drivers of change, the most influential players, change processes and other factors, which constrain and drive the development of the present. The second is to identify events, these drivers will trigger during the time span of the scenarios. As a third task, the group will assign an impact measure on the events based on how much they think the event will affect the organization or entity from whose point of view the scenarios look upon the future, and a probability measure to tell how probable the realization of each event is. These measures are used to group the events to sets as the fourth task, which make the scenarios. The grouping is inspected and discussed in the session and consistency of the

events is inspected. The event and drivers will act as a base for the final scenario stories that will be written outside the session.

When we compare the process to the discussion about learning process and knowledge presented above, we learn that the process follows the formula where the participants articulate their assumption when generating the drivers that change the world. The subsequent discussion will subject the assumptions to scrutiny and the group mover toward new critically chosen set of assumptions when they vote for the most important drivers. Then they extrapolate assumptions when identifying the future events and when evaluating the events the participants effectively have to picture plausible actions and their effects. This makes for two of the three suggested uses of scenarios. The final scenarios are presented outside the session.

3.2 Cases

The conceptual discussion above presented the premises for the argument that using a scenario process would form a community that encourages knowledge creation and sharing within an organization. To pave the way for the evaluation of our argument, we preset two concise case descriptions to illustrate the process. The first case focuses on strategic planning and positioning in a university (Piirainen et al., 2007). The second case is taken from a project where the objective was to develop measures to identify and assess business opportunities at an intersection of industries (Piirainen et al., 2010). The cases both use the same process context although the communities are different.

The members of the semi-virtual community in the first case hold personal knowledge and experience in a number of areas such as research, teaching, and administration in different departments and in the administration of the whole university. The purpose was to discover new opportunities for the future position and operational environment of the university over the following ten years. The community was composed of individuals most of whom had met but who were not very familiar with each other. Thus, the most apparent link between most of the individuals was the presented problem of creating scenarios for the organization.

After the preparation, definition, and briefing of the problem, the actual work within the community started by brainstorming the key external uncertainties and drivers of change. The drivers form the backbone of the scenarios. This phase comprised an idea generation with a brainstorming

tool, followed by a period for writing comments about the ideas and clarification of the proposed drivers. The discovered events they were grouped into initial scenarios by qualitative graphical clustering and discussed during the meeting. The GSS-workshop phase of the process ended in the evaluation of the events and graphical grouping, from which the data was moved to the remainder of the process.

The authors of the scenarios reflected on the cause and effect between drivers and events inside the scenario through systems thinking. Using systems analogy, the drivers of the scenarios form a system with feed-back relations, and the event are triggered by the interaction and feedback between the drivers. After mapping the drivers and the data cleanup, the events were organized into a concept map and tied together as logical chains with appropriate linking phrases; these described the connection and transition between the events. The names for the scenarios were picked after examining the general theme in the scenarios. In this case, in order to test the reactions and validate the logical structure of the maps, after the initial maps were drawn they were presented to some of the closer colleagues familiar with the sessions in the form of a focus group interview.

The final scenario stories were written around the logic of the concept maps. Other than some minor adjustment to the maps, the writing was a straightforward process of tying the events together as a logical story, from the present to a defined state in the future. The process might be characterized as iterative, a resonance between the drivers and the scenario maps conducted by the writer.

The purpose of the second case was to discover new opportunities at the intersection of a manufacturing and a complementary industry. For this case, the members of the semi-virtual community were selected from each industry, as well as from academics and general experts in the field. The working process followed the same outline as the previous case described above. The process outline was similar and the community was able to produce plausible scenarios also in the second case. Regarding this paper, the contribution of the second case was to confirm the observations together with the first case, following the replication logic.

Table 1: Epistemological criteria for evaluating scenario processes.

Theoretical concept	Evaluation criteria for the support system
Personal knowledge	*The support system has to*
1. Object	Support in making categories and distinctions and organizing primary knowledge elements from the huge mass of knowledge and information overflow.
2. Path	Support creation of procedural knowledge by related steps.
3. Network	Help to create new relations between the knowledge elements and to relate participants over organization.
4. Tacit	Stimulate sharing and usage of tacit knowledge by providing a shared context for social processes; accepts personal experience.
5. Explicit	Support codification and sharing/diffusing of explicit knowledge assets.
6. Knowing	Integrates subjective, social, and physical dimensions of knowledge in the epistemic process of knowing. Support the interplay between the different types of knowledge and knowing.
Organizational knowledge	
1. Knowledge	Support creating organizational knowledge within the organization and with value chain partners.
2. Knowing	Support organizational decision making by applying organizational rules of actions.
Context	
1. Participation	Allow equal opportunity for participation.
2. Spontaneity	Diminish bureaucracy but allow to structure spontaneity. Keep the feeling of voluntarity.
3. Self-motivation	Support self-determination of goals and objectives. Allow the possibility to choose the time of participation. Explicate clear causality between personal efforts, group outcomes and personal outcomes.
4. Freedom from organizational constraints	Manage participants from different organizational units at various organizational levels.
5. Networking	Allow traditional face to face communication to promote mutual assurance between participants. Allows freedom of expression, verbal and non-verbal communication. Maintain social networking among participants.
Scenario	
1. Subsidiary awareness	Engage subsidiary and focal awareness of the past and future.
2. Focal awareness	
3. Foreseeing	Support the continuous process to integrate past, present and future.
4. Driver	Enable electronic discussion voting tools to identify of important drivers.
5. Event	Enable discussion and voting tools.
6. Chains of events	Provide maps and other representations to organize the knowledge of future drivers and events to scenarios.
7. Phases of the process	Accumulate information about the future and converge toward shared knowledge toward the end of the process.

3.3 Evaluating the Proposed Approach

Reportedly, the presented scenario method has served adequately in each context. The participants of the sessions have generally reported the approach as a viable tool for large and important decisions, even with its flaws. In addition to the concrete scenarios, some interviewees also saw the process as a kind of learning experience, promoting open-minded consideration of different options and ideas, and as a possibility to create consensus on large

issues and goals in a large heterogeneous organization. However, the knowledge production properties have not been explicitly investigated in the reported cases.

The answer to the question of whether knowledge has been created is not straightforward. One factor influencing the outcome was that the definition of 'knowledge' or knowledge creation was none too familiar to the subjects and the definitions were somewhat equivocal. In any case, the results still point to the fact that the subjects in

the sessions were forming a community, exchanged and diffused knowledge through the system, which in effect supports the argument in the paper. If we accept that conceptually scenarios are an embodiment of organizational knowledge, then a process which produces scenarios successfully indeed does create knowledge. Together with the fact that the reported satisfaction to the results and general buy-in to the scenarios is high, we can at least suggest that the scenarios done with the IDEAS method do have properties of organizational knowledge.

The results may also apply to other scenario methods, as long as there is a group of people who actively participate in creating the scenarios, so that the conditions for community and knowledge can be satisfied. IDEAS is in that sense a well representative example, because the main substance in the scenarios is essentially a product of group discussion, where the group expresses their views, discusses and reiterates the scenario material towards a consensus where they can agree upon the drivers and sets of events.

Table 1 summarizes the evaluation of the scenario process by epistemological criteria discussed in section 2. Generally, the properties of the semi-virtual community and the scenario process meet the conceptual criteria set up for the scenario process The GSS in general and also reportedly in this case allows democratic participation to the process and enables people to share their knowledge. The properties of GSS also support transfer of the input to the rest of the process quite conveniently. The properties of GSS as a tool for the scenario process are discussed in the cited cases and the system has been evaluated as suitable.

Here we would like to conclude that the properties of the IDEAS-method as a community will also facilitate knowledge creation. However, we must leave a reservation that these conclusions are based on theoretical reasoning and two cases, and thus our results serve to highlight an interesting direction for further research in scenarios as both as a product and enabler of knowledge creation in organizations.

4 DISCUSSIONS

We started the paper by arguing that scenarios are a piece of organizational knowledge and can be linked to knowledge creation in different levels. The main premise was that knowledge is capability to make decisions. A further premise is that the shared context can be provided in a community of practice, or in the absence of a community of practice, in a semi-virtual facilitated community. We also presented a method to create scenarios and examined a case study which offers some support to our argument. Generally, proposed approach fits to the conceptual requirements and the empirical experiences with the system suggest that the process is able to promote knowledge creation, sharing.

Examination of the results suggested that the cases supported the theoretical propositions about supporting the semi-virtual community. In the light of the results, it seems that the concept of utilizing the supported scenario process to create actionable knowledge is feasible. Nevertheless, we would like to be cautious about drawing definite conclusions, but instead we would like to encourage further research in to knowledge creation in the scenario process and scenarios as a product of knowledge creation.

In the academic arena, the paper has contributed to the discussion about communities of practice and tested the use of communities for promoting knowledge creation. As for practical implications, the results suggest that the scenario process can facilitate integration and embodiment of organizational knowledge otherwise left tacit.

The subject of scenarios as an embodiment of organizational knowledge can be studied further in a variety of directions. One interesting question is that how much we can in fact know about the future, and how much scenarios are representations of current knowledge. Also the properties of scenarios as a way to rehearse for future actions would be an interesting subject for further study.

To conclude the paper, we propose that as far as knowledge is capability to make decisions, managers can raise their knowledge and capability to make decisions by undertaking the scenario process. Altogether, the case experiences suggest that the approach was at least partially able to engage the group in a semi-virtual community and to facilitate knowledge creation in the organizational context. The proposed scenario process seems to be a feasible way to integrate multidisciplinary groups to create knowledge in the form of the scenarios, which can be used to promote knowing future opportunities and decision options. The properties of scenarios promote and even require open minded consideration of the plausible beside the known and probable, which raises situation awareness and improves ability to act. With these conclusions, we would like to encourage further study into scenarios as a product and enabler of organizational knowledge creation.

REFERENCES

Amin, A., Roberts, J., 2008. Knowing in action, beyond communities of practice. *Research Policy*, 37, 353-369.

Bergman, J-P., 2005. *Supporting Knowledge Creation and Sharing in the Early Phases of the Strategic Innovation Process*. Acta Universitatis Lappeenrantaesis 212. Lappeenranta University of Technology. Lappeenranta FI.

Blanning R. W., Reinig, B. A., 2005. A Framework for Conducting Political Event Analysis Using Group Support Systems. *Decision Support Systems,* 38, 511-527.

Brown, J.S., Duguid, P., 1996. Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation. In *Cohen, M. D., Sproull, L. S. eds. Organizational Learning,* 58-82, Sage Publications. Thousand Oaks, CA.

Brown J. S., Duguid, P., 2001a. Knowledge and organization: A social-practice perspective. *Organization science*, 12(2), 198-213.

Brown, J. S., Duguid, P., 2001b. Structure and Spontaneity: Knowledge and Organization. In: *Nonaka I. Teece, D. eds. Managing Industrial Knowledge*, 44-67, Sage. London.

Carlile P., Rebentisch, E. S. 2003. Into the Black Box: The Knowledge Transformation Cycle. *Management Science*, 49(9), 1180-1195.

Chermack, T. J., 2004. Improving Decision-Making with Scenario Planning. *Futures,* 36, 295-309

Chermack, T. J., van der Merwe, L., 2003. The role of constructivist learning in scenario planning. *Futures*, 35, 445-460.

Cook, S. D. N., Brown, J. S., 1999. Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. *Organization Science*, 10(4), 381-400.

Emery, J. C. 1969. *Organizational Planning and Control Systems, Theory and Technology*, Macmillan Publishing Co. Inc. New York, NY.

Fjermestad, J., Hiltz, S. R., 2001. Group Support Systems: A Descriptive Evaluation of Case and Field Studies. *Journal of Management Information Systems*, 17(3), 115-159.

Gammelgaard, J., Ritter, T., 2008. Virtual Communities of Practice: A Mechanism for Efficient Knowledge Retrieval in MNCs. *International Journal of Knowledge Management*, 4(2), 46-51.

Jennex, M. E., Olfman, L., 2006. A Model of Knowledge Management Success. *International Journal of Knowledge Management*, 2(3), 51-68.

Kahn H., Wiener, A. J., 1967. *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years*, Collier-Macmillan Ltd. London, UK.

Kimble, C., Hildred, P., Wright, P., 2001. Communities of Practice: Going Virtual. In *Malhotra, Y. Knowledge Management and Business Model Innovation*, 220-234, Idea Group Inc. Hershey, PA.

Kivijärvi, H. 2008. Aligning Knowledge and Business Strategies within an Artificial Ba. In *El-Sayed Abou-Zeid ed. Knowledge Management and Business Strategies: Theoretical Frameworks and Empirical Research*, Idea Group Inc. Hershey, PA.

Kivijärvi, H., Piirainen, K., Tuominen, M.,. Elfvengren, K., Kortelainen, S., 2008. A Support System for the Strategic Scenario Process. In *Adam, F., Humphreys, P. eds. Encyclopedia of Decision Making and Decision Support Technologies*, Idea Group Inc. Hershey, PA.

Lave, J., Wenger, E., 1991. *Situated learning: Legitimate peripheral participation*. Cambridge University Press. New York, NY.

Lesser, E., Everest, K., 2001. Using Communities of Practice to manage Intellectual Capital. *Ivey Business Journal*, March/April.

Leonard, D., Sensiper, S., 1998. The Role of Tacit Knowledge in Group Innovation. *California Management Review*, 40(3), 112-132.

Lindqvist, A., Piirainen, K.., Tuominen, M., 2008. Utilising group innovation to enhance business foresight for capital-intensive manufacturing industries. In *the Proceedings of the 1st ISPIM Innovation Symposium*, Singapore.

Nunamaker, J. F. Jr., Briggs, R. O., Mittleman D. D., Vogel, D. R., Balthazard, P. A., 1997. Lessons from a Dozen Years of Group Support Systems Research: A Discussion of Lab and Field Findings. *Journal of Management Information Systems*, 13(3), 163-207.

Piirainen, K., Tuominen, M., Elfvengren, K., Kortelainen, S., Niemistö, V.-P., 2007. *Developing Support for Scenario Process: A Scenario Study on Lappeenranta University of Technology from 2006 to 2016*, Research report, no. 182, Lappeenranta University of Technology. Lappeenranta, FI. Available at: http://urn.fi/URN:ISBN:978-952-214-369-3

Piirainen K., Kortelainen S., Elfvengren K., Tuominen M., 2010. A scenario approach for assessing new business concepts. *Management Research News*, 32(7) – in press

Polanyi, M., 1962. *Personal Knowledge*, University of the Chicago Press. Chicago, IL.

Polanyi, M., 1966. *The Tacit Dimension*, Doubleday & Company Inc., Reprinted Peter Smith. Gloucester, MA.

Schwartz, P., 1996. *The Art of the Long View: Planning for the Future in an Uncertain World*, Doubleday Dell Publishing Inc. New York, NY.

Simon, H. A., 1960. *The New Science of Management Decisions,* Harper Brothers. New York, NY.

Swan, J., Scarborough, H., Robertson, M., 2002. The Construction of `Communities of Practice' in the Management of Innovation. *Management Learning*, 33(4), 477-496.

Tsoukas, H., Vladimirou, E., 2001. What is Organizational Knowledge? *Journal of Management Studies*, 38(7), 973-993.

Zeleny, M., 2005. *Human Systems Management: Integrating Knowledge, Management and Systems*, World Scientific Publishing.