Towards Future-Oriented Innovation Management: Expert Knowledge Creation in Foresight Workshops

Mikko Dufva*

VTT Technical Research Centre of Finland, Tekniikankatu 1, Tampere, P.O. Box 1300, 33101 Tampere, Finland.
E-mail: mikko.dufva@vtt.fi

Toni Ahlqvist

VTT Technical Research Centre of Finland, Itäinen Pitkäkatu 4, Turku P.O.Box 106, 20521 Turku, Finland.
E-mail toni.ahlqvist@vtt.fi
* Corresponding author

Abstract: Foresight is one way to cope with the challenges of unfamiliar or unpredictable situations and diverse viewpoints that innovation management nowadays faces. Many foresight exercises use workshops. In this article we are interested in what types of knowledge there are in a foresight workshop process and how these types of knowledge are created, shared and synthesized. Our goal is to both improve the theoretical understanding of knowledge creation about the futures in participatory settings and provide a framework for practitioners to better plan foresight workshops. We argue that there are two competing rationales in foresight: a divergent futures rationale and a convergent managerial rationale. We propose four knowledge types relevant for foresight workshops and a conceptual model of a workshop process and illustrate these with two workshop sessions.

Keywords: innovation management; foresight; workshops; knowledge management; futures research; knowledge creation.

1 Introduction

Innovation management is nowadays often faced with unfamiliar or unpredictable situations and diverse or even conflicting viewpoints. The situation or environment of innovation management may change rapidly as new technologies disrupt existing value chains and business models (e.g. app stores for mobile devices, additive manufacturing). Because innovation is thought to be important for national growth or in tackling grand challenges, there are also many stakeholders involved such as regulatory bodies, large and small enterprises, non-governmental organisations etc. Dealing with uncertainty and unpredictability in the environment and a plurality of viewpoints on what should be done and what is the problem are some of the challenges of innovation management.

One way to manage uncertainty and diverse viewpoints has been foresight (Miles et al. 2008, Havas, Schartinger & Weber 2010). There are many definitions of foresight (Miles et al. 2008), but in this article we focus on action-oriented and participatory

process aiming to look into alternative futures (Havas 2005). Participatory means that the process must involve experts from at least two different stakeholder groups, and disseminate the results and seek feedback from a wider population. While a participatory foresight process usually includes workshops in some form, there is so far scarce analysis on the processes of knowledge creation and conversion from the viewpoints of experts participating in a foresight workshop (on foresight and expert knowledge, see Kuusi 1999, Brandes 2009, Tichy 2004).

There is also some tension between action-orientation and exploration of alternative futures. Focusing only on optimized action plans may leave a feeling of "we knew that already" or "there's nothing new in here". On the other hand, merely challenging deep assumptions and presenting a diversity of futures may leave managers and policy makers wanting to know "but what should we do?" Analysing how knowledge is created and synthesized in a foresight process may provide answers to how to both produce novel ideas and create plans that are relevant for the present situation.

Although the whole foresight process is important for the creation of knowledge about the future, in this article we focus only on a foresight workshop. By foresight workshop we mean a meeting between three to around twenty experts from different stakeholder groups, which aims at producing some relevant output for the foresight process, e.g. scenarios, common vision, action plan etc. The meeting has a facilitator, who usually only focuses on the process and takes care of the schedule and the application of different group work methods. The duration of the workshop can range from a few hours to a full day and there can be consecutive workshops. This type of working is common in many foresight processes and therefore it is one key element in understanding how experts produce knowledge about the future.

In this article we are interested in what types of knowledge there are in a foresight workshop process and how these types of knowledge are created, shared and synthesized. Foresight does not only produce codified outputs (e.g. scenarios) but also shared understanding of challenges and opportunities ahead (Salo 1999). To better understand the difference between knowledge in the process and its outputs we propose that there are four knowledge types in the workshop process: codified, articulated, embodied and "out-of-radar" knowledge. We relate these types of knowledge to a conceptual model of knowledge creation in foresight workshops. This conceptual model helps illustrate how a successful workshop process both broadens experts' views and narrows down the discussion and ideas to actionable outcomes. Our goal is to both improve the theoretical understanding of knowledge creation about the future in participatory settings and provide a framework which allows practitioners to better plan foresight workshops.

In the paper, we combine selective views from foresight and knowledge management literature to pave the way towards future-oriented innovation management. As we here define it, future-oriented innovation management takes into account the short to long term temporal horizons and temporally cumulating effects of innovation processes, and aims at applying so-called futures rationale to innovation management settings. By this way, the approach aims at opening the horizons of the innovation management to more long term strategic perspectives that result from the accumulation of several innovation processes. We propose that understanding the long term accumulation of parallel innovation processes could prove useful, for example, in the formation of disruptive business model innovations.

The article is structured as follows. Section 2 relates different definitions of foresight to innovation management and presents two rationales of foresight: the futures and

managerial rationale. Section 3 discusses the types of knowledge in foresight and workshop processes. Section 4 presents the conceptual model based on theories of knowledge creation. Section 5 uses the conceptual model to describe and illustrate a real world case study, and section 6 concludes with a discussion on the implication for policy makers, practitioners and researchers.

2 The two modes of foresight

In this section we review different definitions of foresight and futures studies and frame them to innovation management context. We suggest that there are two complementary rationales in foresight that are relevant to future-oriented innovation management. The first is the "managerial" rationale concerned with action, near future, decisions, consensus, plans and coping with uncertainty. The second is a "futures" rationale embracing the plurality, alternatives, conflicts, paradoxes, ambiguity, novelty and strangeness presented by the contingent but unexpected future. However, these rationales need not be in conflict and they can be present simultaneously in a workshop process.

Emphasis on the managerial rationale can be found in many definitions (e.g. Miles et al. 2008, Irvine, Martin 1984, Georghiou 1996). However, there are also definitions that emphasize debating and challenging the existing mental models. For example, Cagnin and Keenan (2008) present two "modes" of foresight: "mode 1" is about optimising and improving the existing system while "mode 2" foresight aims to "debate and promote fundamental changes to established paradigms" (Cagnin, Keenan 2008, p. 5). These modes are similar to what Slaughter (2002) calls "problem-oriented futures work", which seeks to produce practical responses to the challenges of the near-term future, and "critical and epistemological futures studies", which aim to "probe beneath the surface".

"Mode 2" foresight or futures rationale challenges the perhaps more common "mode 1" or managerial rationale by emphasizing dissensus and paradoxes in foresight. Staton argues that foresight should "chase blindly after monsters" (2008 p.61) and focus on producing new knowledge about the future, although not necessarily applicable in the present situation. Likewise, Kuosa (2011) states that the emerging mode of futures studies is dialectical thinking embracing paradoxes, challenging mindsets and presenting new options. From an innovation management perspective, the value in dissensus and paradoxes is in widening what is thought to be possible in the future and therefore discovering new challenges and opportunities. To better understand what the futures and managerial rationales mean in a workshop process, we relate them to the types of knowledge in a workshop process in the next section.

3 Types of knowledge in workshops

In a foresight process and especially in workshops there are many types of knowledge. In the SECI-model (Nonaka, Takeuchi 1995, Nonaka, Toyama & Konno 2000) the creation of knowledge is described in a spiral where tacit knowledge is converted into explicit, explicit knowledge is synthesized and finally internalized back into tacit knowledge. Although widely used, the division of knowledge into tacit and explicit is problematic (Karlsen and Karlsen, 2007). In table 1, we propose a classification of the futures knowledge when adapted in a workshop situation. The division is not absolute and some

knowledge in workshop can be categorised as for example either codified or articulated, depending on the situation.

Table 1. Types of futures knowledge in a workshop situation.

Type of knowledge	Description	Form / expression	Access
Codified knowledge	Knowledge that is somewhat generic, that is, not contextualised	Documents, papers, databases	Accessible in written or visual form to larger group than workshop participants
Articulated knowledge	Knowledge that is explicitly fixed to some context	Narratives that position knowledge explicitly to some context	Accessible in written or visual form to workshop participants
Embodied knowledge	Knowledge embodied by expert, skills, know-how, expertise	Action, mental models, intuition	Accessible in conversations or interaction in workshop
"Out-of-radar" or self-transcending knowledge	Knowledge that seems irrelevant in the context, knowledge that is ignored or outside the scope	"Wild cards", free associations	Not accessible in the workshop context, requires changing the context

Codified knowledge is somewhat generic and is expressed in written or visual form. Examples of a codified knowledge include background material such as reports and databases, written outcomes such as scenarios and recommendations for action, and standardised pictorial presentations. Karlsen and Karlsen (2007 p. 43) define codifiable implicit knowledge as something that "can be understood in terms of concepts previously developed and applied". This means that it can be converted into a form that can be understood also by others. Translating this to a workshop situation, the meaning can be transferred to a larger group than just the experts of a workshop. Although codified knowledge uses common codes and concepts, it is not universally interpretable, because the interpretation is dependent on the shared context.

Articulated knowledge can be contextualised explicit knowledge or explicated embodied knowledge. It can be presented as pictures or words. However, the meaning is harder to transfer, because it is more reliant on the context in which it is expressed or articulated. To understand its meaning requires the knowledge of the context and usually participation in the process in which it was created. It is more susceptible to misunderstandings than codified knowledge, since the codes it uses are tied to the context of the process and not as standard as in codified knowledge.

Embodied knowledge is knowledge about "things we do" as opposed to explicit knowledge about "things" (Scharmer 2001, p. 141). It is close to what Nonaka et al. (2000, p.7) call tacit knowledge and define as "subjective insights, intuitions and hunches". In the context of foresight it means the ability to anticipate and to take a future-oriented viewpoint. In workshops it is presented by the actions, mental models and implicit assumptions of experts.

"Out-of-radar" or self-transcending knowledge is knowledge about "the sources or "place" from where thought and action come into being" (Scharmer 2001, p.141). Uotila

and Melkas (2008, p.225). describe it as "the ability to sense the presence of potential, to see what does not yet exist". In workshops, these can be wild, illogical ideas, or taboos. "Out-of-radar" knowledge is similar to what Staton (2008) calls "monstrosities". Their value from a management rationale is to challenge the status quo and to further expand the range of possible futures.

The managerial rationale of foresight emphasizes codified and articulated knowledge, while the futures rationale emphasizes embodied and "out-of-radar" knowledge. While there are approaches that aim to combine all of these types of knowledge (see for example Slaughter 1999 and Inayatullah 1998), they do not describe the process in which these types of knowledge are created and converted to each other. Next we will define a conceptual model that illustrates the process of future-oriented knowledge creation in workshops.

4 Process of knowledge creation in workshops

Our model presupposes that the futures rationale is divergent in nature, while the managerial rationale is convergent. In workshops the process goes through multiple cycles of divergence and convergence in the diversity of possible knowledge. In our conceptual model (figure 1) the divergent phase consists of tuning and exploring while the convergent phase includes sense-making and packaging. The divergent phase broadens the space for possible knowledge in the process and also gives new ideas to the experts, therefore broadening their boundary of possible knowledge. In the convergent phase the boundary of knowledge in the process narrows to the process outcome, while the boundary of experts' possible knowledge may remain widened.

The conceptual model has four parts. First, we will describe different phases of the divergence-convergence cycle. Second, we will define two boundaries, the boundary of knowledge in the process and the boundary of expert knowledge, and relate different types of knowledge to these boundaries and phases of the process. Third, we will look at the knowledge conversions in the process and how the boundaries of knowledge broaden or narrow. Finally we consider the different space or *ba* (Nonaka, Toyama & Konno 2000) where the conversions take place.
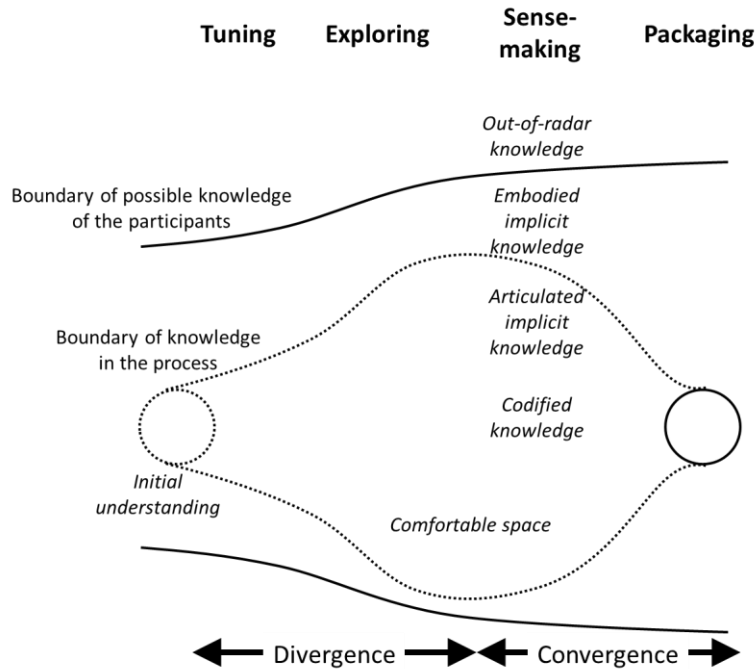
Figure 1. The conceptual model

Phases of the divergence-convergence model

In order for experts to feel comfortable presenting their own ideas in a diverse crowd, as is usually the case in a foresight exercise, a comfortable space is needed. This is created in the tuning phase, in which experts are oriented and energized to start exploring the topic. In this phase explicit rules about the process may be presented (e.g. minimize critique in the beginning, build on other's ideas). Tuning usually takes place at the start of the workshop.

The exploring and sense-making phases are intertwined and happen usually at the same time. However, it is useful to distinguish them as they have different aims. Exploring is about listening, finding or imagining new ideas and possibilities. This happens in conversations with other experts but also by studying background material or other codified knowledge. In this phase different, even conflicting, ideas are presented informally. Sense-making is about reflecting on the ideas, connecting them into context and thinking of the consequences. In this phase conflicting statements are debated and clarified but the disagreement is not necessarily solved.

The final phase of the process is the packaging, in which articulated knowledge is codified into an artefact representing the outcome of the process, such as a set of drivers, different scenarios, or a roadmap.

Knowledge boundaries

We define two boundaries that describe the amount and diversity of knowledge in our conceptual model: one related to the process and the other to the experts. The boundary of knowledge in the process broadens and narrows along with the diverging and converging phases. It describes the knowledge that is "present" or "alive" in the process. Sharing knowledge and creating new knowledge broadens the boundary. During exploration and sense-making there is a diversity of ideas and different types of knowledge in the process at the same time: embodied knowledge is being articulated and the background material discussed. In the packaging phase the discussions abate and the boundary narrows to include only the outcomes of the process.

The boundary of knowledge the experts have describes knowledge that is available or possessed by the experts collectively. Simply sharing knowledge does not affect this boundary, but gaining new viewpoints to existing knowledge, discovering "out-of-radar" knowledge and creating new knowledge broadens it. Experts may remember these new viewpoints and knowledge also after the workshop, and therefore the boundary does not necessarily narrow after the workshop. This describes the process as a learning opportunity.

In the workshop context, codified knowledge can usually be accessed by all experts. Therefore it lies inside the boundaries of process knowledge, as does articulated knowledge, which in a workshop context means mostly discussions. Embodied knowledge is outside the boundaries of process knowledge, but may be articulated and shared with other experts. Finally, "out-of-radar" knowledge is outside the experts' boundary of possible knowledge, since it describes something that is hard to reach or is usually ignored. It is worth noting, that different experts have different boundaries of possible knowledge, and here we have looked at the group collectively.

Knowledge conversions

The different types of knowledge are converted to each other in the workshop process. We describe these conversions using the articulation circle (Håkanson 2007) of theory, codes and tools. Theory describes the cognitive frames and mental models used in articulation. Codes mean the "symbolic means of expression and communication" (Håkanson 2007, p. 66), such as language, pictures or physical objects. Tools are the instruments – white-boards, pens, post-its etc. – used in the articulation.

Articulating "out-of-radar" knowledge means challenging own cognitive models, i.e. theory is not given. There are also no common codes or tools. This is the domain of feelings, hunches, something that is quite hard to express. The articulation of embodied knowledge requires creating codes by which embodied knowledge is articulated. The codes may be workshop-specific. The tools used are from the facilitators toolbox; different pictorial presentations, post-its, storytelling etc. Articulated knowledge can be turned to codified knowledge by using more generic codes to present it.

Above we have briefly described how knowledge can be converted from one type to another. It is however clear that it does not happen by itself, but always through the actions of experts. The descriptions above describe knowledge about the future in-the-making, i.e. how individuals convince first themselves and then others to take up on their ideas. Experts may ignore, modify, deflect, corrupt or transfer the ideas of others (c.f. Latour 1987). The conversions happen in the interactions between experts. However,

while important, the discussion about the group dynamics and social interpretation is outside the scope of this article.

Spaces of knowledge conversions: ba

Knowledge conversions require the right space, atmosphere and place to happen. Nonaka et al. (2000) call this ba and distinguish four different ba corresponding roughly to four knowledge conversions: originating ba (tacit to tacit knowledge), dialoguing ba (tacit to explicit knowledge), systemising ba (explicit to explicit knowledge) and exercising ba (explicit to tacit knowledge). Uotila and Melkas (2008) add two more: futurising ba (tacit to self-transcending knowledge) and imagination ba (self-transcending to tacit knowledge).

In the originating ba, individuals share experiences, feelings, emotions and mental models. Creating this ba requires respect among the experts, permission to be inspired and openness towards new ideas and perspectives. In our conceptual model, the originating ba is situated at the tuning and exploring phases. It overlaps with imagination and dialoguing ba.

In the imagination ba, the boundaries of both knowledge in the process and of the experts are pushed further by exploring new ideas and challenging old beliefs and worldviews. It is also in this ba that "out-of-radar" knowledge can be reached by questioning mental models and cognitive frames. It can be described as a feeling and emotion ruled space accessed through generative dialogue (Scharmer 2001). It requires an open mind and the willingness to challenge own mental models.

In the dialoguing ba, embodied knowledge is articulated in discussions among experts. It is more structured than originating or imagination ba. This space can be constructed of facing chairs, whiteboards, post-its and other objects enabling discussions and the drawing and writing of ideas. In the conceptual model it lies mainly at the sense-making phase.

The final phase of packaging takes place in the systemising ba, where different explicated and codified knowledge is combined. This space is fuelled by a common vision or goal. In systemising ba the experts are more aware of the time limits and the focus of the exercise than in e.g. the imagination ba.

Exercising ba and futurising ba seem to be absent from the description above. We propose that they do not play as big a role in the workshop process, but they have an important part when using the results of the workshop. They may also be present in the exploration when using methods such as roleplaying.

5 Case example: Preparing a foresight project for Antofagasta, Chile

We will now use the knowledge types and conceptual model to illustrate and analyse two workshop sessions held in September 2012. The workshop was part of a joint project between CICITEM (Centro de Investigación Cientifico tecnológica para la mineria) in Chile and VTT Technical Research Centre in Finland. The project aims to enhance innovation-driven and sustainable economic development of Antofagasta region in northern Chile and includes building innovation and knowledge management framework, foresight model and an evaluation and impact assessment framework. The two workshop sessions were part of a weeklong visit by nine persons from CICITEM to Finland. The

aim of the sessions was to come up with a theme for a foresight exercise to be done in Antofagasta during the spring 2013.

The first session was held in the afternoon of September 25th. In addition to seven experts from CICITEM (two were absent) there were two foresight and two innovation management experts from VTT and one foresight expert from Impetu Solutions in Spain via Skype. The session started with the presentations of three groups, who had prepared a draft plan for a foresight exercise on the themes of Water, SMEs and Education. After the presentations there was a general discussion about the theme. The foresight experts facilitated the discussion, which started by each person stating what they thought would be a good topic for the foresight exercise. These were written on a whiteboard and the facilitators asked clarifying questions. The facilitators summed up the discussion and the session ended.

The plans for the foresight projects are an example of codified knowledge used in the workshop process (see table 2). The presentations of the plans acted as the tuning phase (figure 2). The experts had embodied knowledge about the local situation and based on that articulated ideas about a topic for a foresight exercise. However, the sense-making phase did not fully succeed, as the experts did not build on each other's' ideas. This may be due to language difficulties, wrong questions from the facilitators or the use of group discussion as a method. The summing up can be seen as the packaging phase, although it did not produce a codified artefact. The process did not achieve its goals, since it did not build a common understanding on which topic could be chosen.

Table 2. Types of knowledge in the two workshop sessions

| Type of knowledge	First workshop session	Second workshop session
Codified knowledge	Foresight plans	Results of stakeholder analysis
		Stakeholder needs and competences presented by post-its on whiteboard.
Articulated knowledge	Suggestions for topic	Ideas on stakeholder needs and competences
Embodied knowledge	Knowledge of current activities, culture and environment of Antofagasta	Knowledge of current activities, culture and environment of Antofagasta
"Out-of-radar" or self-transcending knowledge	-	Using local special features as advantage: water research in desert
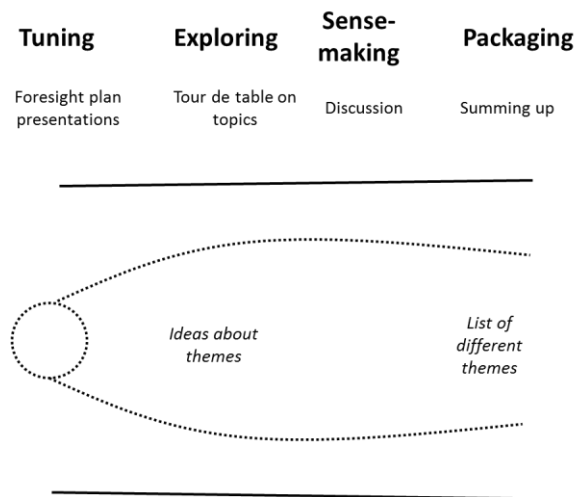
Figure 2. Illustration of the first workshop session

The second session was held in the afternoon of September 27th. Now all nine experts from CICITEM were present, as well as one foresight expert and two innovation management experts from VTT. The foresight expert acted again as a facilitator and started the session by summing up a stakeholder analysis that the group had done on September 24th. After presenting the stakeholder analysis the facilitator asked "what theme would be interesting to all the key stakeholders (regional government, funding agencies, universities and industry)"? This time the nine persons were divided into two groups in which they discussed the questions and came up with three themes: water, energy and education. Water was chosen as a topic to explore further, because majority of experts thought it to be the most important. The two groups wrote the interests and competences of different stakeholders regarding water on post-its and attached them to a whiteboard. The result was discussed and the education theme was explored in a similar way. The session ended with a general discussion on the themes and reflection on the process.

Going through the stakeholder analysis oriented and tuned the experts to think about the interests and needs of other actors in the area (figure 3). In the group discussions embodied knowledge was articulated and articulated knowledge embodied, but the process also produced new viewpoints for the experts, because they had to look at the theme from the perspective of different stakeholders. This also positioned the theme to the region and produced the idea of using the local specialities such as Atacama Desert as an advantage in water research. This can be seen as an example of an "out-of-radar" knowledge, since some of the experts commented after the workshop that they never thought of the desert as an advantage. In group work the needs and competences of different stakeholders were articulated on post-its and the packaging was done in general discussion with the help of post-its and whiteboard. The session produced codified presentations of two themes.
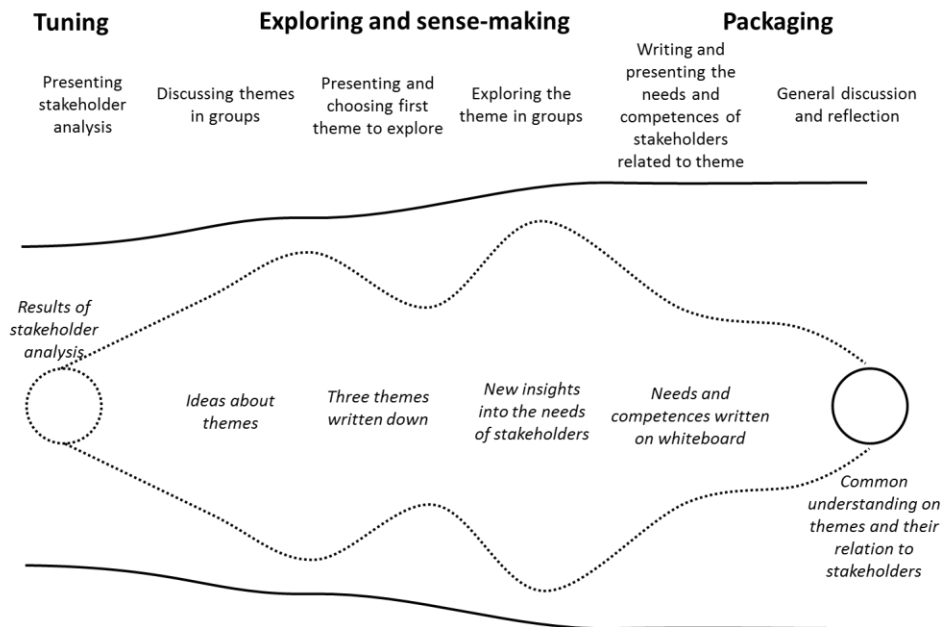
Tuning   **Exploring and sense-making**   **Packaging**

Presenting stakeholder analysis

Discussing themes in groups

Presenting and choosing first theme to explore

Exploring the theme in groups

Writing and presenting the needs and competences of stakeholders related to theme

General discussion and reflection

Results of stakeholder analysis

Ideas about themes

Three themes written down

New insights into the needs of stakeholders

Needs and competences written on whiteboard

Common understanding on themes and their relation to stakeholders

Figure 3. Illustration of the second workshop session

6 Implications for practitioners, policy makers & researchers

The case example shows how our conceptual model can be used to describe the knowledge creation process in a workshop and to provide a visual presentation of it. The model illustrates the divergent and convergent cycles of a workshop process and the knowledge types and conversions. This framework may be useful for scholars to describe or hypothesize about the knowledge creation in workshops and possibly in a broader context. It can also increase the understanding of how the outcomes, such as scenarios or common vision were achieved.

The conceptual model also describes the role the two different rationales have in knowledge creation and how they can be combined. The message for the managerial rationale is that the tuning and exploring – the divergent phase – requires time and an encouraging space. Therefore the goals and aim for consensus should not be emphasized too much at the beginning of the workshop. However, this does not mean that there should not be goals and consensus but that the converging phase should not enter the picture too soon.

While the process should be allowed to diverge and embrace ambiguity, at some point new ideas need to be articulated and codified in order for the process to produce something that is transferrable to other people. Using foresight and workshops in innovation management brings the benefit of drawing from the diversity of people and the empowering possibilities of futures, but also the challenge of bridging the gap between imaginative concepts and action. In this article we have presented one conceptual model to help in crossing that gap.

Acknowledgements

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