
Anticipatory knowledge, epistemic communities, and future-oriented innovation practices

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Abstract: The paper aims at linking the ideas of epistemic community, anticipatory knowledge and innovation management. The paper has three core elements. Firstly, it discusses the idea of anticipatory knowledge in the context of epistemic community. Paper suggests that a notion of epistemic community could be applicable in the future-oriented innovation practices of organisations. There are two dimensions in epistemic communities: strategic objects and community dimensions. Secondly, the paper introduces a framework to integrate anticipatory knowledge and strategic activities in a research and technology organisation (RTO). Thirdly, the paper illustrates these notions by analysing two empirical cases in a Finnish RTO, VTT Technical Research Centre of Finland.

Keywords: anticipatory knowledge; foresight; epistemic community; future-oriented innovation practices; boundary crossing; strategic object; community dynamics; research and technology organisation (RTO); VTT Technical Research Centre of Finland

1 Introduction

The notions of systemic interrelatedness and complexity are increasingly discussed in the context of innovation policies. As Smits and Kuhlmann (2004: 11) argue, the entire practice of innovation can be conceptualised as a systemic activity. The literature also suggests that this interrelatedness sets challenges to the policy-making processes as such. For example, Weber et al (2009: 955) argue that policy processes have gone through a conceptual shift in which a linear model of policy-making has been replaced with a learning-based cyclical model. In this setting, anticipatory knowledge and foresight practices have catalysing roles (see Ahlqvist et al. 2012a; Ahlqvist et al 2012b).

The paper suggests that this systemic perspective is also relevant for practices of innovation management. The paper proposes that a notion of epistemic community could be applicable in the future-oriented innovation practices of organisations. The paper focuses particularly on research and technology organisations (RTOs).

The first goal of the paper is to elaborate the role of anticipatory knowledge in the context of systemic and future-oriented innovation practices. The second goal of the paper is to link the notion of epistemic community to the context of innovation management, through the idea of future-oriented innovation practice. Thirdly, the paper

builds a framework that integrates foresight, epistemic communities and strategic objects. This framework is illustrated by analysing two empirical cases at VTT Technical Research Centre of Finland.

The paper is structured as follows. In the following second section it discusses the linkages between anticipatory knowledge, epistemic communities and strategic objects. The third section outlines a model of future-oriented innovation practices. The fourth section presents two case studies. The final fifth section provides concluding reflections from the perspective of innovation management, and sketches avenues for future research.

2 Anticipatory knowledge, epistemic communities and practices of boundary crossing

The aim of the paper is to discuss how anticipatory knowledge can be utilised in fostering a future-oriented innovation management in an organisation. The notion of anticipatory knowledge builds on the conventional definition of foresight as action-oriented, participatory and focused on alternative futures (see e.g. Havas et al. 2010). However, anticipatory knowledge, as defined here, has some differences compared to this conventional definition. In addition to the participatory process orientation in foresight, anticipatory knowledge emphasises different forms of knowledge, e.g. codified, tacit, articulated, and combined. The anticipatory knowledge accentuates the role of knowledge in a certain spatial context and in a particular temporal context. Further, the notion of anticipatory knowledge emphasises practical aspects of knowing (see e.g. Anderson 2007: 158). In this frame, foresight is perceived as a practice that catalyses the formation of anticipatory knowledge.

The paper links the idea of anticipatory knowledge with specific sorts of epistemic communities in the organisation. There are different definitions of the epistemic community. For example, Dunlop (2010: 207) defines epistemic community as “a group of professionals with a legitimate claim on highly specified policy-relevant knowledge on scientifically complex issues”. Further, Håkanson (2010: 1809) defines epistemic community as “groups of people mastering the theories, codes, and tools of a common practice ... regardless of their geographical location and the intensity of mutual contact that they may maintain”. Accordingly, the basis of epistemic community is the development of an articulation circle, emphasising particular theories, codes and tools (see Håkanson 2007, Figure 1). The paper argues that the phases of the articulation circle can be used in the context of multi-technological RTO to facilitate practices of boundary crossing, like hybridisation of knowledge, construction of integrative future visions, and envisioning pathways towards sociotechnical transitions (see e.g. Geels and Schot 2007).

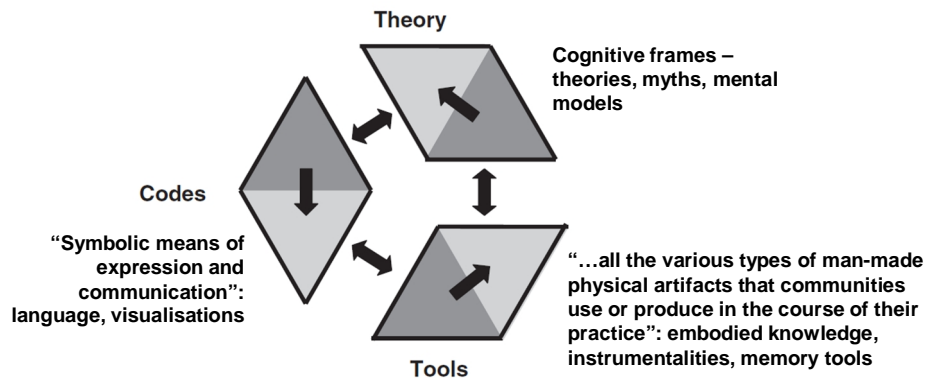


Figure 1 The phases of articulation circle (adapted from Håkanson 2007: 64).

The paper widens the notion of an epistemic community towards organisational direction. The paper suggests a particular notion of epistemic community that builds on Håkanson's articulation circle:

In an organisation, epistemic community is a coalition of actors that aim at building common practices through deploying different theories, codes and tools, and by applying different knowledge processes (articulation, replication, combination, integration). The epistemic community is explicitly oriented towards future(s), and anticipatory knowledge plays a specific role in fostering new practices.

This working definition is structured through two levels. The first is the level of strategic objects that is premised on the notion of "boundary object" (see Star & Griesemer 1989; Star 2010). According to Star and Griesemer's (1989: 393) definition, boundary object is an

[A]nalytic concept of those scientific objects which both inhabit several intersecting social worlds ... and satisfy the informational requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. ... The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds.

Boundary objects are "based on action", and "subject to reflection and local tailoring" (Star 2010: 603). The objects grant "interpretive flexibility" that allow "different groups to work together without consensus" (Star 2010: 602). Another aspect of boundary objects is that they always contain specific "anomalies" (Star 2010: 606–610). The first anomaly is a tension between the purified outcomes and the actual messiness of processes. The second anomaly is the tension between so-called amateur voices and expert voices. The third anomaly is formed by the use of analogies to enrich the arguments by the different social actors. The fourth anomaly is formed by the things,

issues or topics that escape the formal categories of the process. The fifth anomaly is the “conflation of future and present”.

On this basis, the paper proposes that epistemic communities have two dimensions (Table 1). The first dimension is *strategic objects*. Springing from the idea of boundary object, strategic object can be defined as a boundary object that is deliberately constructed to form the basis of an epistemic community. Strategy object is thus a created to integrate knowledge in a new way, to cross the existing organisational silos. In this context, anticipatory knowledge can be deployed through three foresight practices: (1) foresight for orienting the development activities, (2) foresight for stimulating the creation of strategic research objects, and (3) future-oriented processes for managing the strategic research objects. These practices are realised, following Håkanson (2007), through different theories, codes, and tools. The theories emphasise a distinctive strategic perspective. The perspective is put into action through shared codes, such as documents, strategic visualisations, and strategic concepts. These codes are produced through collaborative tools, such as dialogue, workshops and jointly crafted strategy projects.

The second dimension of the epistemic communities is *community dynamics*. The aim of this dimension is the creation of collaborative community based on the shared strategic object. The roles of anticipatory knowledge are explicitly connected to the visionary planning of the community. The theories emphasise different aspects of organisation theory aligned with strategic perspective and concomitant visionary organisational practices. The codes highlight strategic concepts and documents, as well as co-created targets and aims. A wide range of tools can be used for community facilitation, like knowledge repositories, workshops, ideation sessions, and different practices of embedding.

Table 1 Two dimensions of epistemic communities

	<i>Strategic objects</i>	<i>Community dynamics</i>
Aim	Creation of strategic boundary object that integrates knowledge in a new way	Creation of collaborative community around the strategic object
Roles of anticipatory knowledge	Foresight for orienting the development activities; Foresight for stimulating the creation of strategic research objects; Future-oriented processes for managing the strategic research objects	Visionary planning of the community; Foresight for stimulating community practices; Future-oriented practices for managing the communities
Theories	Strategic perspective; Anticipatory knowledge	Organisation theory aligned with strategic perspective; Visionary organisational practices
Codes	Documents; strategic visualisations; strategic concepts	Strategic concepts and documents; co-created targets and aims
Tools	Dialogue; workshops; strategy projects	Knowledge repositories; workshops; ideation sessions; practices of embedding

3 Future-oriented innovation practices through epistemic communities

Future-oriented innovation practices are collaborative reflective endeavours that take into account the short to long term temporal horizons and temporally cumulating effects of innovation processes. The practices are about applying so-called foresight rationale (see Georgiou and Keenan 2006) to innovation management settings.

The paper suggests an ideal framework to activate future-oriented innovation practices in a RTO (Figure 2). The framework starts with the mapping of an organisational knowledge pool consisted of different components. These components are of varying magnitude and size, they are at different stages of development and they interact in different ways. These components could be codified, i.e. components that can be explicitly identified (like competencies in electronics or forest industry), or they could be tacit, i.e. combinations of more “silent” components (like an organisational capacity to effectively manage multidisciplinary projects).

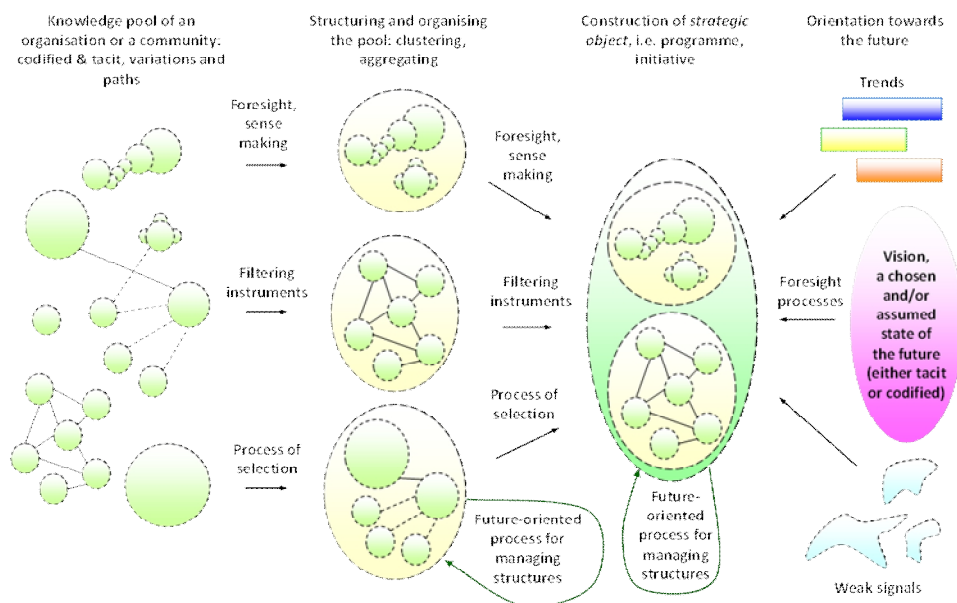


Figure 2 An ideal framework for structuring future-oriented innovation practices through epistemic communities.

There are three levels through which the foresight practices, and the related anticipatory knowledge, is connected to the framework. The first level is the *foresight for orienting all development activities towards the future*. This level emphasises the construction of explicit visions at the scale of an organisation, aimed proactively to change the future. The futures orientation should be realised through systemic analysis of trends and weak signals, and through positioning the organisation accordingly. Using Håkanson’s (2007) terminology, the theories at this level are about identifying key external trajectories that could have significant impacts on the organisation. The codes emphasise codified knowledge, such as strategic documents. The tools emphasise foresight methods at the organisational level, such as organisational scenarios or Delphi exercises.

The second level of foresight practice is the *foresight for stimulating the creation of strategic objects*. At this level the organisation is perceived as a variegated knowledge pool, constructed of different kinds of knowledge entities, such as different thematic units and teams, and knowledge forms, such as codified, articulated and tacit. There are three relevant entangled foresight practices at this level. The first practice emphasises the aspects of theories and codes in Håkanson's terminology and uses foresight for sense-making. The sense-making processes aim at forming alternative views on the future at the level of the knowledge entities. The practices of filtering and selection accentuate the tools aspect in Håkanson's approach. The filtering and selection are needed to structure and aggregate the organisational knowledge pool in novel ways. Eventually, the aim is to construct strategic objects, such as programmes or initiatives.

When the processes of clustering and aggregating advance and strategic objects begin to emerge, the third level of foresight practice becomes useful: *future-oriented processes for managing the structures, in this case the epistemic communities*. This means that the managerial processes are articulated through explicit future visions and alternatives. Again, this level of foresight is connected to the tool aspect. These managerial processes can be realised either by making structural changes in the organisation, or they could be realised, as discussed in this paper, by forming internal epistemic communities. The future-oriented management of epistemic communities requires tailored processes for network management and continuous experimental practices.

4 Case studies: construction of two epistemic communities at VTT Technical Research Centre of Finland

As empirical cases, the paper discusses future-oriented construction of two epistemic communities at VTT Technical Research Centre of Finland: service science and business network (SSB) and the foresight network (FORNET).

4.1 Service Science and Business Network (SSB network)

The first example depicts the process of establishing a service research network at VTT. Service research is an emerging field of research requiring cooperation across disciplines and the varied lines of business. At the initial phase in 2009, some 30 VTT researchers and management representatives built shared understanding of the field. In order to create the Service Science and Business (SSB) network, foresight and organisational learning methods were integrated through a workshop process. The workshops were designed to facilitate dialogue between the users of the research, potential collaborators such as universities, funding agencies and the societal actors in the field of service science (Halonen, Kallio, and Saari 2010a).

The process of setting up the SSB network was based on a combination of methods. The methodology rested on the theory of expansive learning (Engeström 2001). In the process, two practical methods were integrated to the perspective of expansive learning (Figure 3). First, impact evaluation was used to gain a systematic view of the past. Second, roadmapping was used to trigger participatory, future-oriented thinking. The resulting LIFE (learning by foresight and evaluation) model consisted of five phase phases: (1) identification of the need for change, (2) impact evaluation of past research

projects, (3) creating and developing a new model, (4) testing and implementing the new model, and (5) spreading and consolidating the new practices.

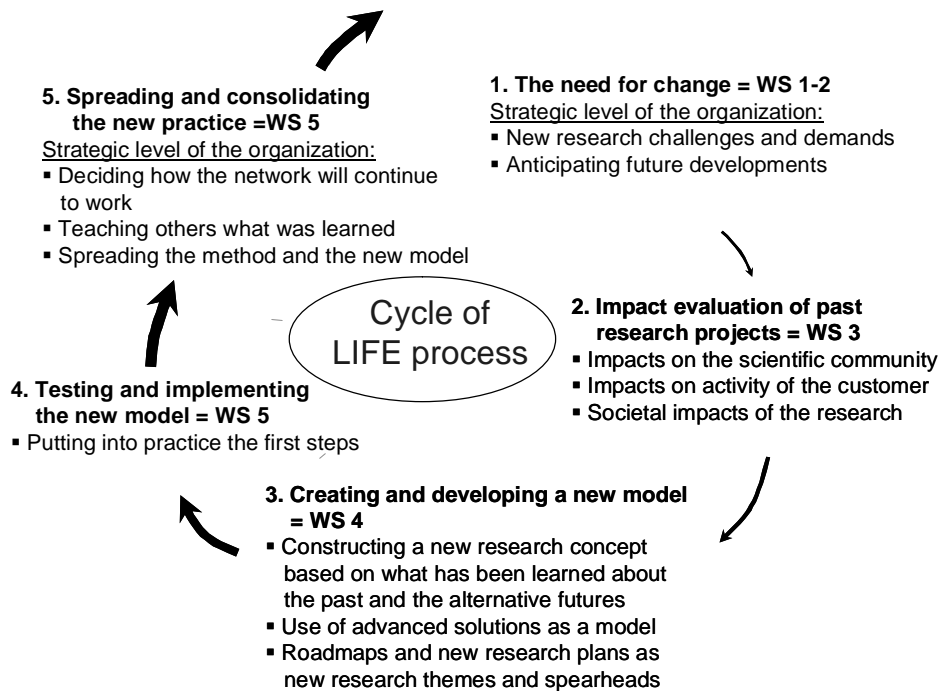


Figure 3 The LIFE process (Halonen et al 2010a: 133).

SSB Network's target was to build a shared understanding of service research and to create a collaborative future vision at VTT (Halonen et al 2010b: 9). Halonen et al have interpreted the development of network through a model presented in Figure 4. The model emphasises seven elements of network building.

The first element is *instruments*. At the initial phase in 2009, instruments consisted of internal communication tools and workshop methods. In 2010, the instruments widened towards multilateral communication, tools for evaluation, foresight and understanding customers' world, and raising awareness of VTT's service research. In the future, the target would be a wide-ranging co-creation between network participants and customers.

The second element in the model is the *object*. In 2009, the object was constructed of the early versions of service visions. At the later stage in 2010, it widened towards understanding service as a relevant part of VTT technology strategy and towards creation of boundary crossing service projects.

The third element is *subjects* that referred to the actual realisers of the process. At first, the most active participants were the VTT's research coordinator, research director and process facilitators. At the later stages, the whole range of internal experts joined the network: researchers, customer managers and directors, technology managers, cluster directors, research directors, and other facilitators.

The fourth element is *rules*. In 2009, the first goal was to get committed presence of internal experts in the workshop. The communication was also in Finnish. In 2010, there was more heterogeneous participation, and the language of the workshops was switched

to English. The future aims would be to raise the amount of ad-hoc meetings and endorse videoconferencing between geographically distributed network branches.

The fifth element is *community*. In 2009 the community was based on some 30 internal workshop participants. In 2010, there was wider participation: also external visitors as potential partners and so-called “silent” network members. The future aim would be to “escalate” of active membership beyond VTT.

The sixth element is *division of labor*. In 2009, the running of the workshops was the responsibility of the initial project facilitators. In 2010, the participants of the network have taken more responsibility of the workshop settings. The future aim is that the participants would take active roles as the new facilitators of the network.

The seventh element is *outcome*. The initial aim was to get acquainted with the participants and form initial visions of the meanings of service. In 2010, there were first project proposals and a decision to recruit a research professor on service innovation and business. The aim already then was to get VTT recognized as a service research institute.

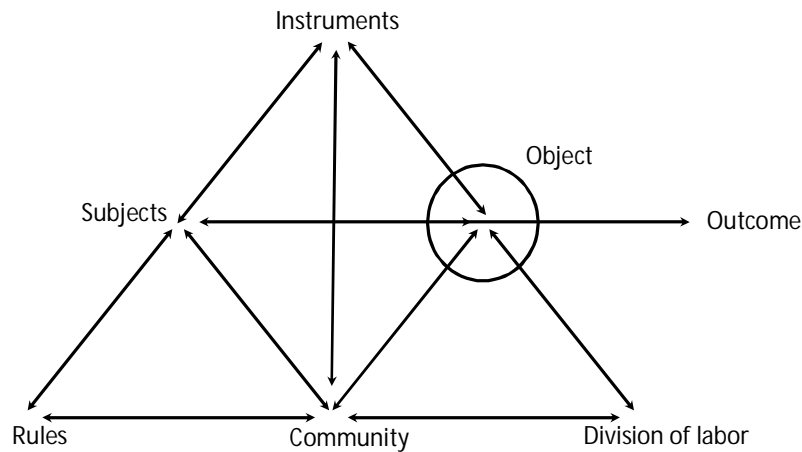


Figure 4 The elements of SSB network (Halonen et al 2010b).

4.2 Foresight Network (FORNET)

FORNET is an emerging network at VTT started in 2012. The network is aimed at stimulating foresight expertise across the technology fields. This is to be realized through a tailored workshop process that facilitates the building of a network with differentiated expert roles: core experts, “agents”, and technology experts.

The differentiated expert roles are based on an “onion model” (Figure 5). The model aims at positioning the foresight expertise in a RTO, where the majority of the experts are engaged in research and development work based on engineering approaches and which also hosts its own cross-disciplinary innovation studies unit with a foresight team.

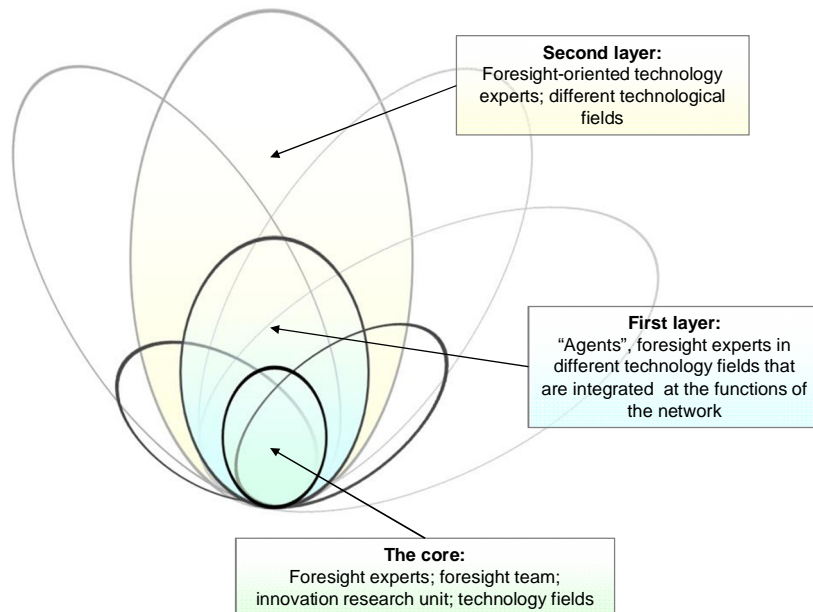


Figure 5 Foresight network's "onion model".

In 2012 there has been a survey to gather information for the construction of foresight network (Leinonen 2012). The survey was targeted to the potential participants of the network, spotted across the VTT. According to the survey, the following four are perceived as the key functions of foresight at VTT: (1) foresight as a support for strategy and business development, (2) foresight as a set of instruments and methodological tools, (3) foresight as a set of backing information and as a process to crystallise future views, and (4) foresight as a practice of prediction.

The survey also collected perceptions about the core competencies of a foresight expert. Accordingly, the foresight expert mediates foresight knowledge in an organization, realizes and facilitates foresight projects, identifies and recruits experts in other fields to foresight projects. The respondents characterised the foresight expert also in following ways: a guru that produces futures knowledge on technologies through discussion; a salesman that acts on the customer interface and provides foresight services to companies and public organisations; an idea generator that identifies foresight needs in the projects, and knowledge mediator that collects, filters and shares anticipatory knowledge for projects. Also, when reflecting on the survey responses, the roles of the organizational foresight expert seem quite varied (Figure 6).

It can be assessed that the multiplicity of roles that are attached to foresight experts, and also to foresight function, are crucial for understanding the foresight practices as a strategic boundary object. Thus, it can be claimed that the foresight practices and related competencies form the initial boundary object on which to anchor the emerging FORNET.

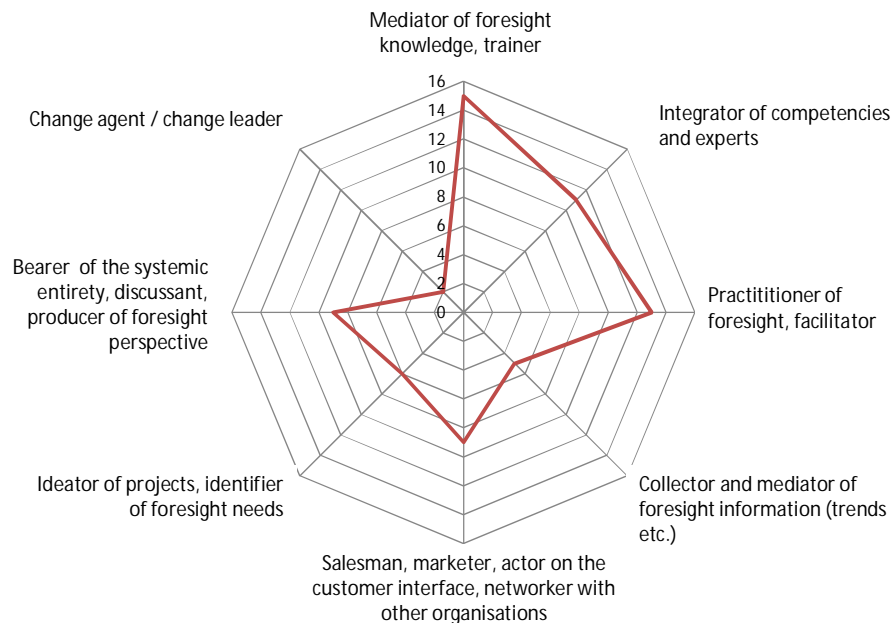


Figure 6 Perceived roles of the foresight expert (Leinonen 2012)

The first action steps of the FORNET have been taken in 2012. There are several *network facilitation instruments* under development that are aimed stimulation of the boundary object of foresight. The first of these is the *foresight case clinic* that is focused on in-depth methodological reflection of selected on-going R&D projects. The second instrument is the *internal training sessions*. These are directed to the experts that could potentially engage the network. The training sessions are planned to cover up different aspects from theoretical and methodological issues to the facilitation and construction of foresight projects. The third instrument for the network facilitation would be the *actual research projects* realised by the network participants.

4.3 Strategic objects and strategic communities in the case studies

In the paper, both of the case networks are assessed as organisational epistemic communities that have particular strategic objects and specific community dynamics.

The SSB Network was built around the *strategic object* of service research (Table 2). The service research represents a novel trajectory in a RTO with engineering emphases, like VTT. In the SSB network, anticipatory knowledge was used for constructing the object, building the coalition of organisational actors, and for formation of strategic research agenda. The theories endorsing the construction of a specific multi-technological competence structure accentuated service system research, service innovations, organisational learning and system dynamic modelling (Vähä 2009). The particular codes in this context were, for example, documents and visualisations that endorsed integrative strategic concepts. The distinctive tools were shared documents, building of a common agenda, and joint project development among the participants.

At the level of *community dynamics*, the aim was to create an organisational community that could endorse and develop the emerging strategic object of service research. This was realised through series of linked future-oriented workshops used for facilitation of the community, stimulation of new strategic emphases, and for building novel visionary practices for community management. The theories behind the community dynamics were based on foresight, organisation theory and strategic network management. The codes of this community were backed up by shared theories and methods. New analytical frameworks and new strategic concepts were activated through the following tools: series of workshops, shared knowledge repository, practices of embedding and, eventually, joint project proposals.

Table 2 SSB Network as an epistemic community

	<i>Strategic object</i>	<i>Community dynamics</i>
Aim	Strategic object: <i>service research connected to technological and engineering perspectives; a novel trajectory in a RTO with engineering emphases</i>	Creation of an organisational community endorsing and developing the strategic object
Roles of anticipatory knowledge	Foresight used for constructing the object, building the coalition of organisational actors, and the formation of strategic research agenda	Visionary practices for community management realised through series of linked future-oriented workshops used for facilitation and stimulation of the community
Theories	Service system research; service innovations; organizational culture; service business enabled by technology development; system dynamic modelling	Foresight (novel facilitation methods combining foresight and organisation development); Organisation theory (novel model of organisational learning: LIFE); strategic network management
Codes	Documents; visualisations; integrative strategic concepts	Shared theories and methods; new analytical frameworks; new strategic concepts
Tools	Shared documents; building of a common agenda; seven elements of the network; joint project development	Series of workshops; shared knowledge repository; workshop data and presentations; embedding: joint project proposals

In the FORNET, the *strategic object* is the promise of horizontal foresight approach that could integrate VTT's technology competencies in new ways. The theories emphasise foresight theories combined with organisational learning and transition management. The codes are documents, strategic visualisations, and strategic concepts. The tools highlight shared documents and meetings aimed at development of common agenda, and in the later phases, project development. One could also count the variegated expert roles in the foresight network as a specific tool.

At the level *community dynamics*, the aim is to create a vibrant community that could endorse the horizontal foresight approach both through theory development and through collaborative practices. The expertise in the community would be differentiated according to the "onion model". The role of anticipatory knowledge is to foster visionary

practices for community management and new theoretical, methodological and practical approaches to foresight tailored particularly to the context of multi-technological RTO. The theories accentuate foresight connected to organisation theory, strategic management and system theories. The codes are built upon shared theories and methods and new strategic concepts. The tools emphasise shared documents, construction of knowledge repositories, and workshops, foresight case clinics and training sessions. The ultimate target for foresight network is a boundary crossing organisational capacity for realising different kinds of foresight projects, flexibly combining the different facilitative and technological competencies at different levels of magnitude.

Table 3 FORNET as an epistemic community

	<i>Strategic objects</i>	<i>Community dynamics</i>
Aim	Strategic object: <i>a robust horizontal foresight approach that integrates VTT's technology competencies and catalyses development projects</i>	Creation of a community that endorses the horizontal foresight approach both through theory development and through collaborative practices
Roles of anticipatory knowledge	Foresight is the core: theoretical and methodological development related to horizontal foresight approach	A visionary practices for community management; new theoretical, methodological and practical approaches to foresight in a multi-technological RTO
Theories	Foresight theories combined with organisational learning and transition management theories	Foresight connected to organisation theory, strategic management and system theories
Codes	Documents; strategic visualisations; strategic concepts	Shared theories and methods; new analytical frameworks; new strategic concepts
Tools	Shared documents; meetings aimed at building of a common agenda; project development (in later phases); variegated expert roles in the network	Series of workshops; repositories; workshops; foresight case clinics, training sessions; cross-organisational foresight projects

5 Concluding remarks

The paper suggested an approach of future-oriented innovation management based on anticipatory knowledge and the construction of epistemic communities. It provided a theoretical outlook on this topic, and depicted two case studies of epistemic communities in a Finnish RTO, VTT Technical Research Centre of Finland.

From the perspective of innovation management, the first point to be proposed is that both the practices of constructing strategic objects and catalysing community dynamics are context-dependent and meta-level activities. Hence, if the aim is to form a novel competence trajectory in a multi-technological context of a RTO, as in the cases of the paper, the forming of strategic objects should not be too locked or top-down a process. Quite the contrary, the building of strategic objects can be time-consuming, and this

lengthy gestation actually helps the process. There are, at least, three reasons for this. Firstly, when the community building is based on in-depth “boundary work”, it usually provides solid grounds for finding joint strategic concepts. Secondly, when the strategic object is defined through the “boundary work”, the community potentially has more variety and space for integrating different competencies. Thirdly, the “boundary work” itself is a practice of embedding that creates commitment to the emerging structure.

The second point to be raised is that the formation of epistemic communities should not be perceived as straight-forward development practice aimed at strictly predetermined goals. Rather it should be perceived as a collaborative learning process, with varied twists and turns. When the process advances, the future targets of the community will also evolve and change. Hence, the building of the communities should also include reflective evaluation phases, during which the basic premises of the communities could be discussed.

Thirdly, it could be assessed that the epistemic communities are most suitable for wide-ranging strategic transitions that happen at the watersheds, that is, when the organisation strives to “renew its skin”. Thus, the epistemic community could be too sticky structure for situations that call for rapid responses. In these situations, it might be more practical to build on the existing organisational structures and initiate changes through swift incremental steps.

Following three lines can be sketched as interesting avenues for future research. The first line of research could be to dive deeply into the dynamics of epistemic communities, and to provide comparative views on the micro-sociologies of the communities. The second line of research could analyse further the structural dimensions of the epistemic communities, such as aspects of temporal and spatial contexts, and aspects of competence composition. The different communities are based on unique views of past, present and future, and these temporal interpretations are organically connected to the spatial setting and the expert composition. The third line of research should glance outside the organisational box, and study how the different spatial contexts, like that of municipalities, regions, nations-states and transnational polities, affect the dynamics of epistemic communities.

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6 References

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