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KNOWLEDGE ABSORPTION TOOLSET FOR PRACTICE-BASED MODE 2A INNOVATION

Master's Thesis

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Examiners: Professor Vesa Harmaakorpi, D.Sc Satu Parjanen

ABSTRACT

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Keywords: Absorptive capacity, knowledge absorption, foresight, practice-based innovation, mode 2a innovation, Small and medium sized enterprises (SMEs).

This thesis is based on Melkas' and Harmaakorpi's theory of practice-based innovation. They take the concepts of open innovation and user-driven innovation and incorporate them into STI (science, technology, innovation) and DUI (Duing, using, interacting) bipartition paradigm of innovation. Modes of knowledge production are used to create new paradigm of innovation theory. Where mode 2b is typical development of organizations and their innovation capability overall. The main objective of the study is to find out *How to create knowledge absorption toolset for practice-based mode-2a innovation?* This main research question is further divided into three components:

- What is practice-based innovation and especially mode-2a innovation activity?
- How knowledge is absorbed in organizations and how the process can be enhanced?
- What tools exist and how they should be combined to build well-suited toolset for small and medium sized enterprises?

Practice-based innovation is close to employee or user-driven innovation. Mode 2a innovation activity is rather novel and evolving way of innovation activity. It includes certain aspects of open innovation where different organizations are co-operating for shared goal. It has heterogenous process nature where often workshop like few day assemblies are done for improvement of organizations and innovation.

Absorptive capacity (AC) construct explains how knowledge is incorporated into organizations. AC has four steps of acquisition, assimilation, transformation, and exploitation of information/knowledge. Assimilation and transformation phases of information are determined by knowledge structures of individuals, where assimilation occurs if prerequisites of knowledge structures are met and whereas transformation requires evolution of knowledge structures.

Tools have been searched in 2012 from different organizations and categorized with phases of AC. It is quickly notified that many organizations in Finland still focus on industrial (cluster based) development of innovation capability and following mode1 of scientific innovation. Thus, mode 2a innovation is neglected and there aren't many tools of transformative and explorative innovation yet.

TIIVISTELMÄ

Tekijä: Heikki Kurki

Työn nimi: Käytäntölähtöisen innovaation moodi 2a:n tiedon absorboinnin työkalupakki.

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Hakusanat: Absorptiivinen kapasiteetti, tiedon absorbointi, käytäntölähtöinen innovaatio, pk-yritykset, ennakointi.

Työ perustuu Melkaksen ja Harmaakorven uuteen käytäntölähtöisen innovaatiotoiminnan paradigmaan, jossa yhdistyvät avoimen innovaation ja käyttäjälähtöisen innovaatiotoiminnan piirteet. He käyttävät STI (tiede, teknologia, innovaatio) ja DUI (tehden, käyttäen, ja vuorovaikuttaen) innovaatiotoiminnan jaottelua, sekä tiedon tuotannon moodeja luodakseen uuden käytäntölähtöisen innovaatiotoiminnan paradigman. Heidän jaottelussaan moodi 2b edustaa perinteistä organisaatioiden kyvykkyyksien kehittämistä pitkässä juoksussa, kun taas 2a edustaa avoimempaan innovaatioon pohjautuvaa usein workshop-tyyppistä innovaatiotoimintaa, jonka prosessi on heterogeeninen ja usein projektityyppinen. Työn päätutkimuskysymyksenä ja tavoitteena on luoda tiedon absorboinnin työkalupakki moodi 2a innovaatiotoimintaa varten. Päätutkimuskysymys on jaoteltu seuraavasti kolmeen osaan:

- Mitä on käytäntölähtöinen innovaatiotoiminta ja erityisesti moodi 2a:n kyseinen toiminta.
- Miten tietoa absorboidaan organisaatioissa ja miten kyseistä prosessia voidaan tehostaa.
- Mitä työkaluja on jo olemassa ja miten niistä voidaan rakentaa PK-yrityksille soveltuva työkalupakki.

Absorptiivisen kapasiteetin (AC) konstruktio pyrkii vastaamaan toiseen tutkimuskysymykseen eli siihen, miten tieto jalostuu ja mukautuu organisaatioiden tarpeisiin. AC jakautuu neljä-osaiseen prosessiin, jotka ovat tiedon hankinta, assimilaatio, transformaatio ja hyödyntäminen. Assimilaatio ja transformaatio polut riippuvat yksilöiden tiedon omaksumisesta, jossa tieto assimiloidaan, kun tarvittavat perustietorakenteet ovat jo olemassa, kun taas tiedon transformoimiseksi yksilön tietorakenteiden täytyy muuttua.

Työkalujaottelu vuonna 2012 noudattelee AC:n vaiheita ja on nopeasti huomattavissa, että innovaatiopolitiikan nykytilanne perustuu klusteriajatteluun, jossa kyvykkyyksiä kehitetään tiedepohjaisesti (moodi 1), kun taas moodi 2a tyyppisen innovaatiotoiminnan työkaluja on olemassa hajautetusti ja rajallisesti. Hankintavaiheen työkaluja on helposti löydettävissä, mutta AC:n muihin vaiheisiin soveltuvia työkaluja on hankalampi kategorisoida, ja niihin perehtyminen vaatisi lisää tutkimusta.

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11.12.2017 Heikki Kurki

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ABBREVIATIONS

AC	Absorptive capacity
CEO	Chief executive officer
EK	Confederation of Finnish industries
ELY	Centre for Economic Development, Transport and the Environment
ETLA	The Research Institute of the Finnish Economy
EU	European union
EVA	Commission of trade
KEV	National foresight network
JRC	Joint research Centre
OSKE	Centre of expertise programme
R&D	Research and development
SHOK	Strategic top knowhow center
SMEs	Small and medium sized enterprises

SYKE	Finnish environment cent
TE-centres	Work and trade centres
Tekes	Finnish funding agency of technology and innovation
TEM	Ministry of work and trade
Sitra	The Finnish innovation fund
VTT	Technical research Centre of Finland

1 INTRODUCTION

As globalization progresses and industrial barriers are broken or reshaped more extensive resource bases are required even on bulk-industries. Information technologies have diffused into every business categories providing effectiveness and better overall user experiences, whereas automatization has improved quality and reduced costs in manufacturing industries. These widely recognized trends are intensifying competition all around the globe. This development is asking more from SMEs which can be called as the true backbone of European economy; 2/3 of jobs and over ½ of total value added in the European economy (Yrittajyys 2012). SMEs are generally known from their often-agile organizations but lack of resources. In this perspective it is crucial to assist and aid SMEs to grow and survive in this rigorous competition environment. Brynjolfsson envisions how IT will revolutionize and enable more efficient way of sharing small innovations. His view reifies the untapped potential of practice-based innovation:

"What we're going to see in the coming decade are companies whose whole culture is based on continuous improvement and experimentation-not just of specific processes, but of the entire way the company runs" (Brynjolfsson, 2010, p. 53).

Tekes - the Finnish Funding Agency for Technology and Innovation main objectives are according to Hyytinen et al (2012, p. 26) “to promote the development of industry and services by means of technology and innovations”. Their challenge is to utilize limited resourced with maximum potential for economic renewal and positive impact on Finnish society, thus Tekes is putting priority to innovative SMEs which are seeking growth especially in internationalization. This study is conducted for their project -analyzing of practice-based innovation activity methods under the organization of LUT Lahti School of Innovation.

The project’s target group is Finnish SMEs and goal is to aid them in utilizing growth potential of the rapidly progressing environment with modern methods of practice-based innovation. The project’s one significant perspective is on close link of foresight activities and innovation (Uotila et al. 2012, p. 29). They have built a conceptual model in attempt to bridge these two seemingly connected activities to utilize the novel potential. Mäkimattila et al. (2012, p. 12) disclosed that more studies are needed concerning tools, which help SME’s implicate foresight information into their activities. This is the main topic of thesis and focus is on the tools which enable and enhance absorption of new information in practice-based innovation. (Hyytinen et al. 2012, p. 11, 28)

1.1 Background

Innovation is now days seen as a powerful way of securing competitive advantage and defending strategic positions. Tidd and Bessant (2009, p. 16) present that innovation is a process of turning opportunity into new ideas and of putting these widely used in practice. They share the definition of innovation with following writers;

Table 1. What is innovation (Tidd and Bessant, 2009, p. 16)

• **"Innovation is the successful exploitation of new ideas – Innovation Unit (2004) UK Department of trade and Industry."**
• **"Industrial innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment – Chris Freeman (1982) The Economics of Industrial innovation, 2nd edition, Pinter, London."**
• **"Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things – Michael Porter (1990) The competitive Advantage of Nations, Macmillan London."**

The interest in twenty-first century innovation paradigm has moved from STI (science, technology), mode of innovation to DUI (doing, using, interacting) innovation which "relies on informal processes of learning and experience based knowledge" (Jensen et al, 2007, p. 680). The DUI-mode has been previously described in simultaneous ways with slightly different perspectives. The notable and related concepts are practice-based innovation, employee or user driven innovation and open innovation which was conceptualized by Chesborough (2003). Chesbrough's paradigm acknowledges today's information rich environment and thus bigger demands to be answered by more open development. It can be argued that Hippel is one of the pioneers of this progress because he developed a customer-active paradigm in (1978) which brought out an idea where customer develops new product idea for manufacturer. He highlighted users as the main source of innovations.

The concepts on innovation are constantly evolving because of its complex and multidisciplinary nature. Theories are considering more and more relevant approaches into innovation as Lane et al depict this development (2006, p. 836) “Theory building, and testing is the tool making of the social sciences”. In this study it is reasonable to disclose essential and related theories of innovation especially on practical aspects of innovation to better understand the concept and its roots figure 3.

1.2 Objectives

Role of the study in the project is to create knowledge absorption toolset for practice- based (mode 2a) innovation, therefore the main research question is:

- *How to create knowledge absorption toolset for practice-based mode-2a innovation.*

The mode 2a innovation activity is explained in chapter 2. The main research question is complex, and it can be further divided into three fields, which enables observation from different angles and wider perspective. Also, it illustrates the nature of the matter to find out the solutions required for the creation of the toolset. The dimensions of the main research question are shown in figure 1 and it indicates how the problem is approached first from theoretical background to get grasp into the subject, and then following by latter two questions, which are more relevant for finding of the solution.

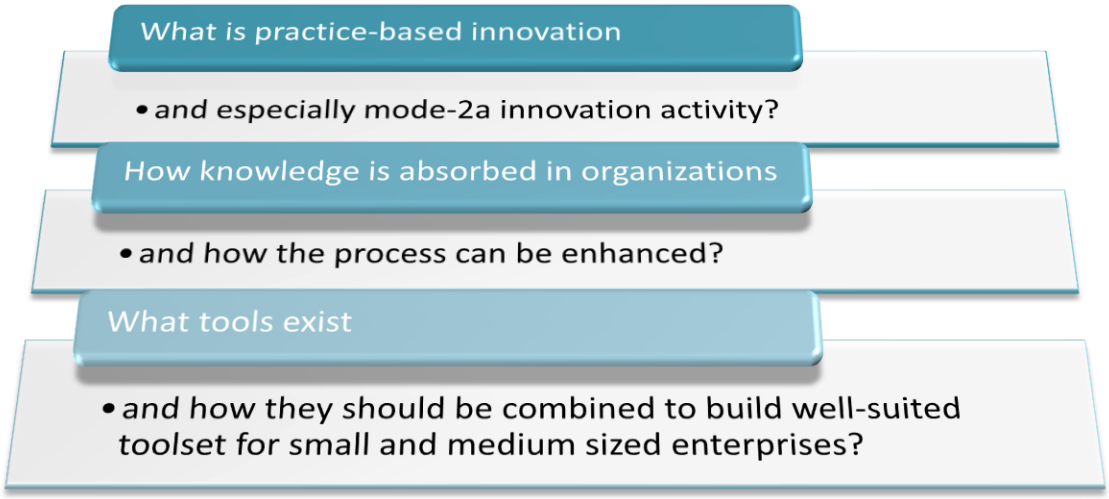


Figure 1. Three components of the main research question.

The research questions already limit the scope of the study, but the focus of theoretical background should be further highlighted. Theoretical construct of absorptive capacity is required to create understanding how organizations accumulate their knowledge base and how the knowledge creation process can be enhanced. Therefore, it can be assumed that this kind of theoretical study has potential for finding qualities and features of the appropriate knowledge absorption toolset (Figure 2).

1.3 Research methodology

Constructive approach to solving problems is originally used in engineering and mathematics, yet it has been applied in economic studies. Constructive approach in business studies follows the same pattern (Kasanen, Lukka & Siitonen, 1991, p. 328):

1. It is based on established theoretical background.
2. The solution for real-world problem is shown to work in practice and
3. At least has potential to be applied more generally. (Kasanen et al, 1991, p. 328).

Kasanen et al (1991, p. 329) notes that constructive approach is in the normative area of business sciences when the study combines theoretical and empirical analysis. They also state that the advantage in this kind of study is that constructions have more potential for practical use.

In this thesis constructive approach is used as a guideline while acknowledging project's aims. The solutions aren't necessary shown to work in practice. In this research the theoretical study is an efficient way of searching desirable attributes for the toolset and enables building of required knowledge. It is obvious that the main goal is to give functional toolset for the end users, which in this case are small and medium sized enterprises, thus considering the end users view is essential. There have been foresight workshops in the project and several interviews with experts (Mäkimattila et al. 2012, p. 4), hence the material is of course used in this study as well. The view will be incorporated with this material and further interview. The constructive approach is used as a precept and it is well-suited for this study which couples the need for theoretical background and the end users practical use.

1.4 Structure of the study

The thesis is divided in theoretical and empirical part as it is previously reasoned. One cannot build a robust building if adequate foundations are disregarded. The structure then includes the essential theoretical background and how it is situated in the widening innovation research arena, thus creating better understanding of the matter. In the empirical section of the work focus is on existing tools and interviews. With the knowledge of the theoretical background tools are gathered to create a toolset which is good in theory, but also in practice; small and medium sized enterprises views are considered. The described contributions and expected results are shown in (Figure 2). The thesis is built in such way that attention is paid to the whole picture and interactions are taken in notice when building the knowledge absorption toolset for practice-based mode 2a innovation.

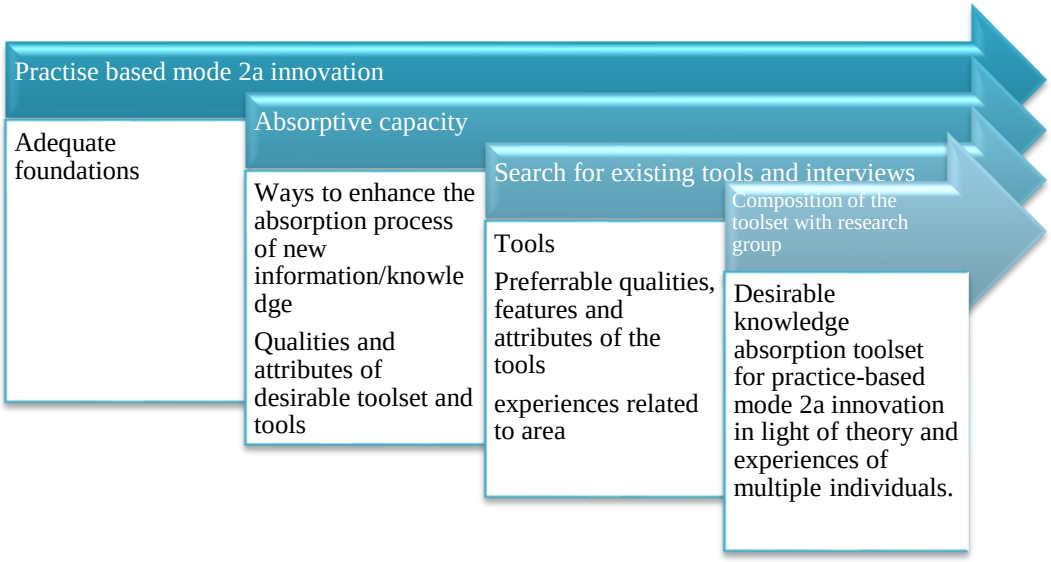


Figure 2. Contributions and expected results of the study

2 PRACTICE-BASED INNOVATION

In the twenty-first century more, practical approaches to innovation have been studied and applied. Melkas and Harmaakorpi (2012, p. 2) define practice-based innovation as *"innovation process triggered by problem-setting in a practical context and conducted in non-linear processes utilizing scientific and practical knowledge production and creation in cross-disciplinary innovation networks"*. In this activity combining of practical and theoretical knowledge is beneficial for innovation. (Figure 3) shows Melkas' and Harmaakorpi's model on practice- based innovation which is influenced by the foundations of past innovation research. They are taking the concept of Jensen et al about STI and DUI innovation activities and developing it further. The earlier concepts have had effects on the current views on innovation. In Melkas' and Harmaakorpi's model can be seen certain features of pre-existing concepts. For example, open innovation's aspect is considered in a co-development activity where value chains and even researchers from different organizations are utilized for superior performance.

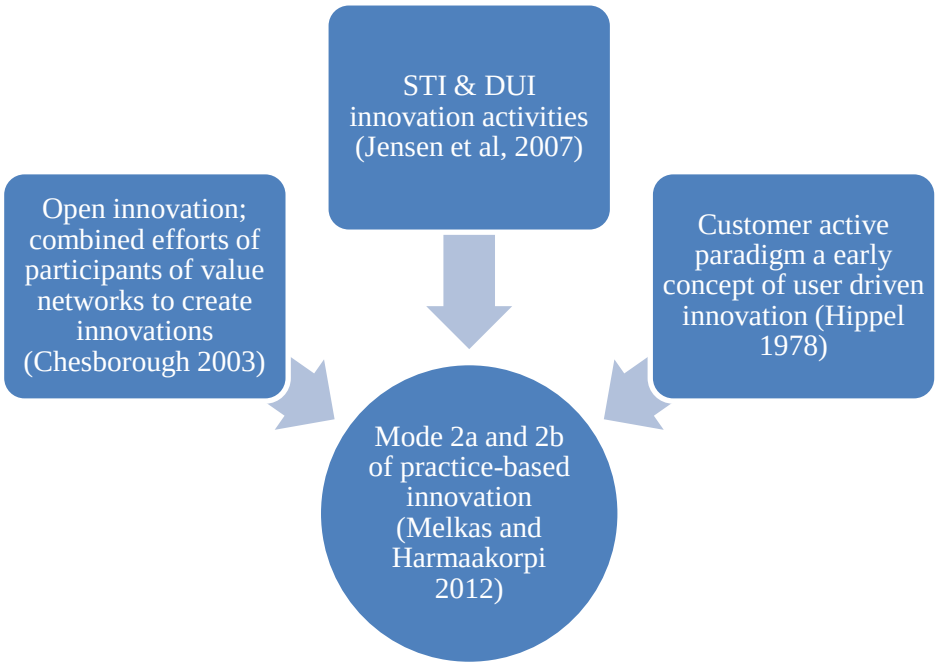


Figure 3. Mode 2a and 2b pratice-based innovation and its roots.

Practice-based innovation can be viewed from many different angles and there are many issues related to this as Harmaakorpi & Melkas state (2012, p. 437-438). For example, various researchers use this concept more or less as a synonym to user or employee driven innovation. Melkas and Harmaakorpi (2012) highlight the concepts roots in a pragmatist philosophy, where application is part of a learning process. This view can be incorporated into innovation as Noteboom (2012, p. 17-21) acknowledges. He also takes into consideration literatures shift to non-linear view of innovation where not only science and technology creates technology push, but also other industrial operations are considered as a part of innovation system where feedback should circulate through organizations, industries, practice and theory. It is of course a desirable state in theory.

Melkas and Harmaakorpi (2012, p. 444-445) adopt the prominence of proximity and distance in innovation, where proximity in any form is seen to reduce uncertainty and whereas distance (TABLE 2.) brings out ambiguity but creates novel potential. In current innovation activities different forms of closeness are appraised while ignoring the difficult side of innovation and its ambiguity where state of efficient balance between proximity and distance should be pursued. There are many types of distances in innovation networks and crossing these distances contains innovation potential (Parjanen et al, 2011, p. 930; Adapted from Harmaakorpi et al, 2006):

Geographical distance simply comes from physical distance between actors. In practice certain issues arise from human interaction and Noteboom explains these collaborational issues with cognitive distance. Cognitive distance can be described as differences between views of life, which is a bit of generalization. Noteboom reasons cognitive distance with development of cognitive structures through different life paths and environments. It can emerge between people and groups of people like organizations, and between theory and practice. Cognitive distance brings out potential and issues when people are trying to understand each other; when distance is simply too great individuals can’t understand each other to utilize the potential of learning and novel connection for innovations. Simply said when something is combined in a new way it is more probable that novel value is added. (Noteboom, 2012, p. 17-21)

Communicative distance originates from differences in concepts and professional languages. Organizational distance arises from different ways of coordinating the knowledge. Functional distance comes from the actor’s different areas of expertise for example functionally close actors can work in the same industry. Social distance inherits in relationships and the amount of trust included. Temporal distance comes from differences in the ability to imagine future and its potential outcomes thus also considering use of foresight information. (Parjanen et al, 2011, p 927-930)

Table 2. Distances in innovation networks (Parjanen et al, 2011, p 927-930)

Types of distances in innovation networks	Explanation
• **Geographical**	Physical distance between actors.
• **Cognitive**	Cognitive distance can be described as differences between views of life
• **Communicative**	Originates from differences in concepts and professional languages.
• **Organizational**	Arises from different ways of coordinating the knowledge
• **Functional**	comes from actor's different areas of expertise
• **Cultural**	Differences in the societal culture
• **Social**	Inherits in relationships and the amount of trust included
• **Temporal**	differences in the ability to imagine future and its potential outcomes

Melkas' and Harmaakorpi's vision was to collect wide set of perspectives, thus getting opportunity to better connect structural holes (Burt 1992), create novel value and exploit distances in innovation policies and activities. Concept of structural holes is related to cognitive distance and its significance lies in utilization potential of unconnected communities which have novel potential. In result of Melkas' and Harmaakorpi's exploration into innovation they realized advantages and necessities of dividing practice-based innovation activities into two new sub-categories. This new categorization of the concept is reasoned with better understanding of prerequisites of the activities and to better support them in practice. Their categorization is based on Gibbons et al (1994) definition of knowledge production, which combines two Modes of knowledge production. In this division knowledge production is divided into two categories (Melkas & Harmaakorpi, 2012, p. 17-21,441-443; Gibbons et al, 1994):

- Mode 1 knowledge production is often a hierarchical process, where form of knowledge remains similar throughout the process. Theoretical basis for this knowledge production is homogenous and it follows certain patterns or codes of practice. It is an academic approach.

- Whereas Mode 2 of knowledge production is a more occasional process based on multidisciplinary heterogeneous knowledge. Teams are brought together to solve real world problems and very often the knowledge production is project oriented.

These two modes of knowledge production are related to STI and DUI innovation activities. These two activities support each other to better respond to real world problems and needs. They can enhance each other by interaction, when DUI innovation activity implements STI-generated knowledge. In traditional R&D approach there is much weight given to STI approach, thus many inventions for example might miss priorities of customer needs, which this kind of a more practical approach can consider. From this basis two new subcategories for practice-based innovation are argued to give more practical benefits and utility (Melkas & Harmaakorpi, 2012, p. 443-444):

- Mode 2a knowledge production in practice-based innovation combines scientific and practical expertise and is enhanced with intellectual cross-fertilization. For example, innovation activities use creative methods of ideation in given circumstances to create product or process innovations. Mode 2a has certain aspects of open innovation and is a rather novel and evolving way of innovation activity (Figure 4) illustrates this.

- Whereas Mode 2b knowledge production contains more heterogeneous development of organizations overall. This activity is close to employee or user-driven innovation and can be aiming at organizational or social innovations.

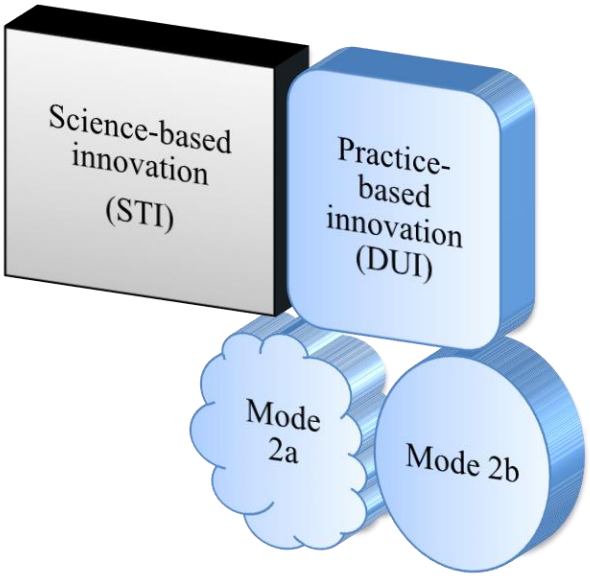


Figure 4. Three different innovation activities. (based on Melkas & Harmaakorpi, 2012, p. 447)

The new division of practice-based innovation is further explained in (TABLE 3.) with typical characteristics of the two activities. There are few similarities in the activities which make them practice-based innovation and separate them from scientific innovation activities. The innovation process happens in a practical problem-setting and the knowledge production is heterogeneous but as can be seen there is clear divergence in the two modes of practice-based innovation. Practice-based innovation activities usually utilize combinations of employees, customers, and partner networks. (Melkas and Harmaakorpi, 2012)

Table 3. Characteristics in two modes of practice-based innovation according to Melkas and Harmaakorpi (2012, p. 447)

Perspective	DUI mode 2a	DUI mode 2b
Innovation methods	Intellectual cross-fertilization	Problem-based learning
Origins of innovations	Networks, serendipity, customers	Staff and customers
Innovation types	Radical concept innovations and technological system innovations	Organizational innovations, social innovations, service innovations
Innovation environments	Arenas of intellectual cross-fertilization in value networks	Arenas of developing organizational innovation capability
Fuels for innovation	Distance	Near distance
Typical logics	Related variety, innovation platforms	Development of innovation capability
Capital	Social and institutional capital	Social and structural capital
Knowledge transfer mechanisms	Scanning and absorbing technology and market signals	Organizational learning
Similarities	Heterogeneous knowledge production, interpretative innovation process, brokering, problem setting in practical context	

3 KNOWLEDGE ABSORPTION IN ORGANIZATIONS

When technological change or radical disruption impacts on organizations or industries, which haven't invested in associated technological fields, they often fall into problems, because they might not be able to assimilate new knowledge and would have to transform their knowledge structures. Getting locked into old technologies can be a result of not investing in acquisition of new external knowledge. (Cohen and Levinthal, 1990, p. 138)

Cohen and Levinthal notify a tradeoff between external and internal knowledge, when long-lasting organizational structures tend to weaken the use of more diverse knowledge sources. It is the widely recognized not-invented-here (NIH) syndrome. It is also generally accepted that organizations need to overlap their functions at least to some degree to enable more effective knowledge transference and breadth of knowledge. It can be concluded that there are benefits for knowledge diversity across organizations but also within individuals, when both prerequisites are met it is more likely that knowledge will be assimilated or transformed in novel ways to create innovations. (Cohen and Levinthal, 1990, p. 134)

3.1 Absorptive capacity

Absorptive capacity (AC) has become widely acknowledged framework when concerning internal and external transfers of information and knowledge in organizations. AC context can be applied to understand nature of the information processes within organizations and to be able to enhance them. The concept is crucial especially when pondering future oriented knowledge adaptation problems (Uotila, Mäkimattila, Harmaakorpi and Melkas, 2012, p. 36).

Originally Cohen and Levinthal (1990, p. 128) describe absorptive capacity as a firm's ability to recognize, assimilate and apply new external knowledge into use. They also suggest that this capability is dependent on the firm's prior related knowledge, thus leading into assumption that development of absorptive capacity is path dependent, which predicted that companies should invest in strategic R&D areas to enable future possibilities.

In traditional context Cohen and Levinthal (1990, p. 139- 142) emphasize R&D to improve AC and they noticed that ease of learning in a specific industry would affect the level competitors could imitate or use the R&D findings that spill out. This results in that R&D investment also helps to imitate competitors. In their research R&D is a source for capacity to assimilate and exploit new knowledge. Since then there has been much use of the concept in literature but the focus has been on the R&D-related contexts because of the original view and weight on knowledge recognition and acquisition (Lane et al. 2006, p. 854). Lane et al disclose that Absorptive capacity is much more than R&D and expect it would have not yet reached its potential.

The evolution of the concept unveils its complex nature. As Lane et al (2006, p. 859) put it "studies have been statistically significant but scattered". However, the wide use of the concept has demonstrated its potential as a theoretical framework to better understand knowledge creation in organizations. Zahra and George (2002, p. 186) made contributions to the concept by reconceptualizing it after a wide research: *"a set of organizational routines and processes by which firm's aquire, assimilitate, transform, and exploit knowledge to produce a dynamic capability".* They also recognized AC's as an origin for sustaining competitive advantage. Because of the nature of AC, it has influence throughout knowledge creation into building of competencies. Zahra and George's assumption were that (Figure 5) these four dimensions of AC are combinative but Todorava and Durisin (2007) have made notifications with support of more empirical research that the assimilation and transformation are alternative processes before exploitation (figure 6).

Figure 5. Combinative process of Absorptive capacity (based on Zahra and George, 2002)

Cohen and Levinthal's notion that learning is cumulative results in; that the ability to assimilate information depends on pre-existing knowledge structures. It implicates that knowledge diversity should be encouraged in organizational level, because it enables individuals to create novel associations. Two alternative processes of AC (AAE and ATE) are shown in (Figure 6) and are justified with cognitive sciences where development of new cognitive structures follows these two alternative processes of assimilation and transformation (Todorava and Durisin, 2007; Piaget, 1952).

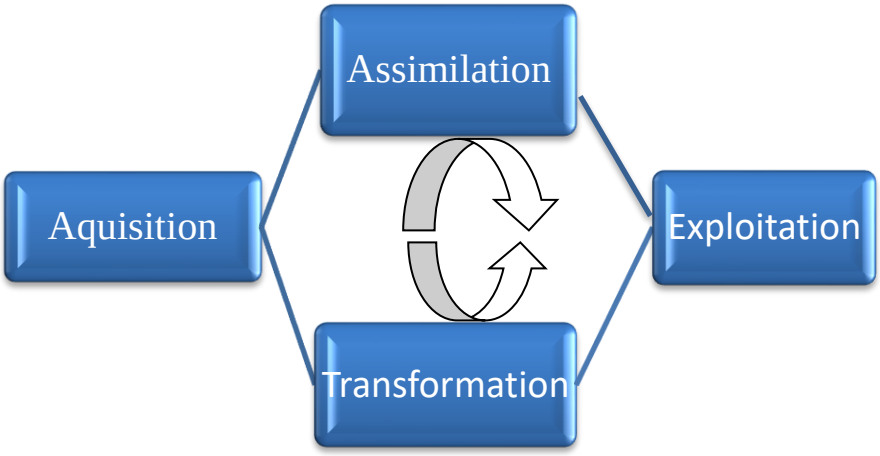


Figure 6. Two paths of Absorptive capacity; AAE and ATE (based on Todorova and Durisin, 2007)

These two processes can be distinguished from each other by the learning process; when new idea fits existing cognitive structure well the idea is only slightly altered to fit into existing structures and thus assimilated whereas process of transformation is triggered by inability to assimilate new knowledge. Therefore, when transformation of knowledge occur cognitive structures of individuals must change to adapt to the idea (Todorova and Durisin, 2007, p. 778). Todorova and Durisin favor in part Cohen and Levinthal's model (1990, p. 128) which recognizes the value of new external knowledge because learning depends to a great extent on the prioritizing of new external knowledge. They also suggested (2007, p. 779) that knowledge may move back and forward between assimilation and transformation processes until it is incorporated into knowledge structures and ready for exploitation.

As individual absorptive capacities constitute to organizational AC, absorptive capacity is also limited by organizations ability to exploit its growing knowledge base and transfers between subunits. Information transfers considering technically challenging information which is hard to assimilate is affected by Cohen and Levinthal's gatekeepers who translate the information. Communication between staff is influenced by participant's competencies. When knowledge structures of the competition environment are highly differentiated and versatile there are needed many individuals to observe the environment. Kallio (2012, p. 16) highlights literatures shift in observation of the environment from just gatekeepers to a company-wide duty. (Cohen and Levinthal, 1990, p. 130-134)

Flatten, Greve and Brettel (2011) conclude that SMEs with well-developed AC can enhance firm performance by using AC as an instrument for improving effectiveness of strategic alliances.

3.2 Elements enhancing absorptive capacity

Mäkimattila et al (2012) research and workshops support; Major and Cordey-Hayes (2000) results regarding SMEs foresight knowledge absorption, where translations and interpretations have a major role in the process. Facilitating and brokering seems to be important for knowledge absorption process. Expressive presentations (play, drawing, stories and drama) also seem to have positive effect on information sharing and facilitate creation of new knowledge (Oikarinen and Kallio, 2012, p. 15). Oikarinen & Kallio conclude that assimilation is more instinctive process than transformation of knowledge which requires special cherishing.

3.2.1 Social integration mechanisms and power relationships

Zahra and George (2002) noted that social integration mechanisms could enhance information sharing by lowering its barriers. Todorova and Durisin (2007) also approve social integration mechanisms (Figure 7) which they see building shared meanings in social networks and thus influencing on knowledge absorption process. Their other surplus to the construct is concept of power relationships, which has effects on cognitive processes. These relationships effect on resource allocation, valuing, exploitation and overall process of new knowledge absorption in organizations. By acknowledgement of power relationships and certain manners of facilitation and especially brokering it is possible to reduce these effects and thus improve information sharing. (Todorova and Durisin, 2007, p. 780-782)

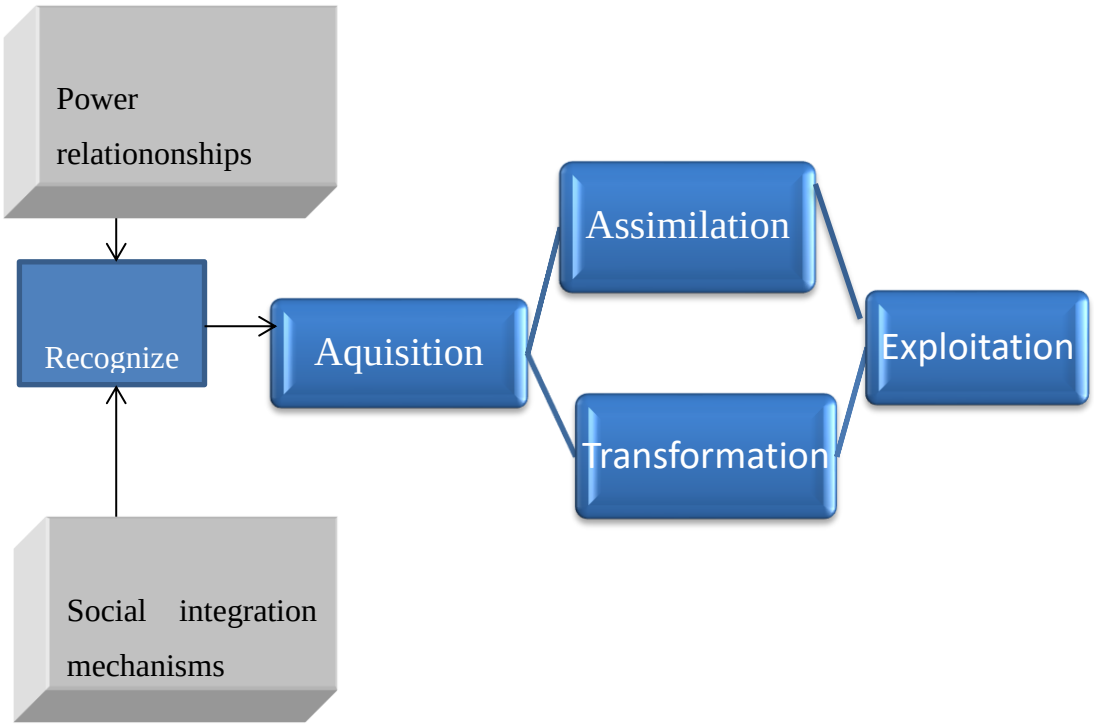


Figure 7. AAE and ATE with power relationships and social integration mechanisms (based on Todorova and Durisin, 2007)

Kallio (2012, p. 40) claims that individual absorptive capacity is likely to happen in the first phases of AC whereas organization assimilates or transforms that into realized absorptive capacity. It is individual responsibility to recognize opportunities. With good leadership organization can show where to look with appropriate vision. The organization can facilitate communication by providing channels and arenas of sharing knowledge. Kallio (2012, p. 43) presents knowledge types during phases of Todorova and Durisin's absorptive capacity. In the acquisition phase there must be explicit knowledge whereas tacit knowledge comes along between assimilation and transformation phases because of knowledge how things are done. Self-transcending knowledge also enters dialogue before assimilation or transformation steps in form of a hunch or vision of someone. Knowledge starts to take shape in an organization and it becomes more codified in form of an explicit knowledge before exploitation of knowledge.

3.2.2 Social capital

Tura and Harmaakorpi (2005) conceptualize social capital as a field-specific social resource of an actor: “A social relation between a and b, R (a, b) is part of a’s social capital if and only if a has such action opportunities or access to such resources he/she would not have without this relation R (a, b). In other words, b accepts or attributes certain action opportunities to a, because of this relationship between them”.

Social capital is mediator theory between assimilation and transformation of knowledge (Figure 8). Social capital lies in human relationships and their structures. Social capital can be divided to bridging and bonding of social capital where bonding describes internal integrity of a group and whereas bridging describes linkages to environment. Bonding is based on strong links and network structure is dense while bridging is based on weak links in sparse networks. (Kallio, 2012, p. 44)

Strong connectedness helps forming trust and thus easier knowledge exchange and exploitation of knowledge. Exploitation occurs easier in dense and stable knowledge structures. There is a dilemma because strong connectedness seems to hinder acquisition of new knowledge and even can create collective blindness. People who are near structural holes (Burt, 2004) get easier access to new knowledge and they are called as brokers or gatekeepers. Their position is optimal for recognizing good ideas and important knowledge. Negative affect discarding brokers comes from expectation that these so-called brokers bring new knowledge into the organization when others might abandon this task as not their responsibility. (Kallio, 2012, p. 44-45)

Creative social capital was introduced by Harmaakorpi (2004) as a resource that combines bridging and bonding elements of social capital whose personal form Kallio et al (2010) use as a brokering ability. According to Tura and Harmaakorpi (2005, p. 1122) Creative social capital is the most important capital in the innovation process. Prerequisites for creative social capital can be established but many things can prevent it. It is easy to tell when a group has achieved it because it feels like group flow. (Kallio, 2012, p. 46)

Bridging social capital in the transformation phase of AC is important across sparse networks because transformation requires making of new knowledge combinations where as strong links in bonding of social capital is useful. Creative social capital occurs and balances between assimilation and transformation steps and it is a combination of sparse and dense networks (Figure 8). (Kallio, 2012, p. 46-47)

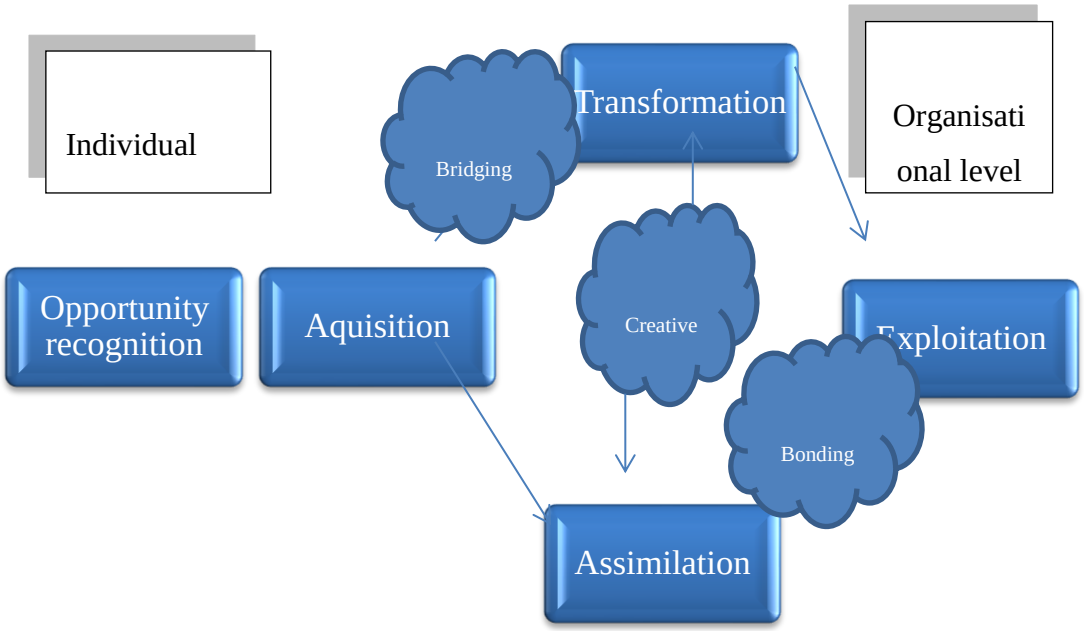


Figure 8. AC according to Kallio (2012, p. 46)

3.2.3 Facilitation

Individual absorptive capacity on the shop floor level is an important channel for facilitation of knowledge absorption and improving working practices. They have important prior knowledge of the processes and practices which aid in recognition and absorption of the right knowledge (Kallio & Bergenholtz, 2012, p. 12)

Mäkimattila et al. (2012, p. 6-7) confirmed during foresight workshops that the foresight information is not systematically processed and even the basic knowledge on foresight is lacking and it is a side task of sales in SMEs. SMEs prioritized only on the signals that were fit to their current processes and thinking, thus often following the AAE path of absorptive capacity and disregarding possibilities of transformative and explorative learning. They confirmed that the role of intermediary organizations should be more on knowledge facilitation than overloading the SMEs after seeing two workshops and information sharing between experts. They brought out some qualities (Table 4) of SMEs and issues regarding foresight activities (Mäkimattila et al. 2012, p. 6-7):

Table 4. Qualities of SME's in foresight activities

• **CEO often thinking alone**
• **Reliance of own information sources**
• **Limited resources**
• **Stuck on certain sector especially sub conductors**

• **Dependent on few main customers**
• **Fulfilling needs of main customers with often incremental innovations**
• **No willingness to find new business opportunities**
• **Future oriented information doesn't reach practice**
• **Interested in information that fits directly on current business activities**
• **Need to form data into more practical shape**

3.2.4 Brokering

Brokering is a supportive activity which helps information to flow in innovation networks by removing obstacles and barriers of information sharing with decreasing of distances (Uotila et al. 2012, p. 43). "Knowledge broker is like a key account manager, whose goal is to make cooperation among different actors as easy as possible so that creativity, know-how and other resources can be gathered and channeled to develop regional innovative capability" (Parjanen et al. 2011, p. 936). Knowledge broker's responsibility lies in development of cooperation relations and customer relations. "They need to be able to support bringing out the creativity of individuals by helping to build a working climate and community that supports creativity" (Parjanen et al. 2011, p. 937).

Knowledge brokers also can tie elsewhere produced foresight information into regional development thus they have a regional impact and are in very important position at knowledge production. They interpret foresight information and tie it into regional innovation processes. They give ideas and inspire but don't necessary push activity into certain direction. In practice-based innovation setting brokerage functions can create possibilities for collective creativity which results in (Parjanen, 2012, p. 120)

- Raw material for different types of innovation
- Social networking
- New connections at organizational level

Knowledge broker can enhance relationships of research and education organizations to the public sector in the area (Parjanen et al. 2011, p. 935).

Knowledge broker has many ways to cross the distances (Parjanen et al. 2011, p. 941):

- Free from biases
- Using analogies and metaphors
- Provocation and preparation
- Multiple experts and co-operation
- Systematic, flexible, and clear strategy
- Exploiting communicative closeness with ability to dig out best from everyone

In (TABLE 5). Phases of AC and their problems and solutions regarding information processes are presented.

Table 5. Enhancing information processes

Phase of AC	Problems, threats	Solutions	Opportunities, benefits
Aquicition	-Locked into old technologies (Cohen and Levinthal) -Tradeoff between external and internal knowledge, NIH (Chen and Levinthal) -Collective blindness (Kallio, 2012) -Prioritizing of new external knowledge -Power relationships (Todorova and Durisin, 2007) -CEO often thinking alone (Mäkimattila et al. 2012) -Limited resources(Mäkimattila et al. 2012) -Future oriented information doesn't reach practice (Mäkimattila et al. 2012)	-Investing in acquisition of new external knowledge (Cohen and Levinthal) -Many individuals to observe the environment (Cohen and Levinthal) -Improving organizational structures and avoiding long lasting structures (Cohen and Levinthal) -Social integration mechanisms (Zahra and George, Todorova and Durisin) -Facilitation and brokering help from governmental organizations -Expressive presentations (play, drawing, stories and drama) have positive effect on information sharing and facilitates creation of new knowledge (Oikarinen and Kallio, 2012; Heron and Reason, 2001)	-Learning (Cohen and Levinthal) -Agile organizational structures (Cohen and Levinthal) -More effective information sharing
Assimilation	-Not able to assimilate new knowledge (Cohen and Levinthal) -Information transfers considering technically challenging information (Cohen and Levinthal)	-Pre-existing knowledge structures needed for assimilation (Cohen and Levinthal) -Knowledge diversity (Cohen and Levinthal)	-Novelty (Cohen and Levinthal)

		-Gatekeepers to transfer information-> all participate (Cohen and Levinthal, Kallio) -Innovation activators can support implementation of ideas (Kallio and Bergenholtz, forthc. p. 11) -Bonding social capital (Kallio et al, 2012)	
Transformation	-Technological change or radical disruption (Cohen and Levinthal) -Inability to assimilate new knowledge (Todorova & Durisin, 2007) -Interested in information that fits directly on current business activities (Mäkimattila et al. 2012)	-Transform knowledge structures (Cohen and Levinthal) -Overlapping of functions to gain knowledge transference and breadth of knowledge (Cohen and Levinthal) -Cognitive structures of individuals must change to adapt to the idea (Todorova & Durisin, 2007) -Brokering can help management to understand what the idea is about (Kallio and Bergenholtz, forthc. p. 11) -Bridging social capital (Kallio et al, 2012)	-Novelty (Cohen and Levinthal)
Exploitation			Flexibility, innovation, performance (Todorova & Durisin, 2007)

Absorptive capacity	-Path dependent (Cohen and Levinthal) -Future oriented knowledge adaptation problems (Uotila et al, 2012) -R&D spills (Cohen and Levinthal)	-Invest in strategic R&D areas (Cohen and Levinthal) -Social capital (Kallio) -Creative social capital (Harmaakorpi, 2004)	-Knowledge creation and building of competencies -Sustaining competitive advantage -Reinforce, complement and refocusing of knowledge base (Lane and Koka, 2006)

4 KNOWLEDGE ABSORPTION TOOLS FOR SME'S

At first it is important to know what kind of foresight activities and actors are in Finland, they are presented in (Table 6). First at national level and at last personal level. These actors are shortly described in the table and what they do. There is plenty of foresight information available, but the common user might get lost in acquisition of this knowledge, thus common system for interpreting this information would be in need. These data sources are searched and presented knowledge absorption tools from these actors. The toolset was built in year 2012 and some of the tools are no longer existing or might be modified. There are also newer tools added later, any organization wishing to use tools based on AC should invest time in choosing tools for each phase of AC.

Table 6. Foresight actors

Levels from top to bottom; National, organizational, personal		
Foresight actor	What	How
EU • **The Institute for Prospective Technological Studies (IPTS) is one of the seven scientific institutes of the European Commission's Joint Research Centre (JRC).**	EU founded research and development activities based on political drivers. Projects financed by EU mechanisms often in networked environment and results leading to reports created by experts in various fields.	Economic and prospective analysis on the consequences for Europe of an intensified globalisation of knowledge production and R&D. Political aspects often present in analysis and interpretation context.

Government: • **Committee for future** • **Governmental foresight network** • **Ministries (inter alia TEM, OPM, YM)** • **Administration under ministries (inter alia SYKE)**	Committee for the future doesn't work in daily legislation. Their task is to evaluate long term future possibilities.	They report once in electoral term.
R&D and innovation organizations: • **Tekes** • **Finpro** • **Sitra** • **FinNodet (Venäjä, Kiina, USA ja Japani)** • **SHOK:t (mm. Cleen Oy)** • **Finnish academy**	Tekes updates their strategy policies in every three years. TEM-trendwiki for service example (Finpro, Tekes, FinNodet, VTT, TEM, ELY-keskukset) Signalsessions a tool developed by Tekes. Finpro offers foresight services for example insight service which is customized on a customer basis. Finnode produces future sessions.	United signal collection analyzation. Signals are used in actor's own projects, strategic processes and foresight services for customers. (LTYP) In signal sessions for example Finnodes collected project signals are brought to usage of Finnish companies.
Universities and polytechnics: • **Future research center, Turku school of economics** • **Future research network academy** • **Aalto university of technology** • **Lappeenranta university of technology** • **Joensuu university, anticipation unit** • **Corporate foresight group, Laurea Polytechnic**	Turku future research center researches different scenarios of future and challenges and possibilities included in them. They have future focus services and radical futures networking tools. For example LUT has Innosession method.	They offer analytical future knowledge for supporting of their customers future related work. For example, they got CID-lab service which help companies to unite foresight knowledge in branding etc. Innosession is based on assumption that greatest innovation potential lies in structural holes and weak links nearby.

Research units: • **VTT** • **Consumer research center** • **ETLA**	VTT for example offers cluster related foresight information. ETLA makes economic forecasts and consumer research center makes consumer related forecasts.	VTT offers information mainly on project basis. ETLA publishes their forecasts on their business cycle magazine on quarterly basis.
Advantage and industrial associations: • **EVA** • **EK** • **Inter alia TEK**	EVA investigates and estimates important trajectories for Finnish society. EK is focused on the business sector.	EVA is a think tank whose goal is to improve success of Finnish society. EK makes business cycle forecasts based on monthly basis inquiries.
Regional organizations: • **Economic life and traffic- and environmental bureaus(ELY-agency, TE-centre)** • **Regional unions (inter alia Uudenmaas union)** • **Board of trades (anticipation chamber in Uusimaa region)** • **Municipalities and federations of municipalities, OSKEs**	ELY-agencies task is to give advice and monetary and developing aid to companies. Anticipation chamber does regional foresight work for Uusimaa region. OSKEs serve their target clusters.	They monitor environmental factors. Anticipation chamber goal is to become regional permanent actor of anticipation activity. They do workshops on industry basis. OSKEs provide expert services on their target clusters.

Corporations: • **Corporations own foresightactivities (Nokia, Kone)** • **Foresight concultants (Advansis Oy now under Ramboll, CID Group, Future Studies Mannermaa Oy, Gaia Group Oy, Susinno Oy, What's next consulting)** • **Thinktanks (Demos Helsinki)**	Big corporations have their own foresight acivities they also might use concultants on projects. Demos research topics are future cities, wellbeing and low carbon society. Susinno OY has wide set of tools which are based on intellectual cross fertilization. For example Susdiagnosis, Sus plan & indicator and Susactor.	Demos was developed in mind of normal people changing the world. Susinnos tools are based on universital top research.
Anticipation networks: • **National foresight network (KEV)** • **Future research association**	KEV makes foresightdatabanks they have http://www.foresight.fi web-page up to get people conversating and meeting about foresight knowledge. Future research association is founded on 1980.	On KEV there is future associated debate on blogs and raports. Future research association makes different scenarios of possible futures.
Personal level • **Social networks, coincidents and intuition**		

4.1 Recognition, acquisition, and analyzation tools of new information

As seen in (Table 6) Foresight actors are scattered in Finland and many actors are doing the same thing and still focusing on mainly on cluster or industrial basis of doing things. As earlier brought up; innovation activities should be a mix of bonding and bridging social capital because industry as a definition is getting old. Industries are constantly reshaped, or barriers are broken, and multidisciplinary knowledge is required to survive in the market now days.

At first tools are collected from different foresight actors and presented. Absorptive capacity framework is used to categorize and formulate the toolset for practice-based mode 2a innovation. In creation of the toolset several interviews of SMEs are also used to get practical view. The theoretical and practical views are incorporated to build the construct. Next tools are presented (Table 7) as following AC first step also known as the acquisition phase:

Table 7. Acquisition phase tools of knowledge absorption.

Tool	**Phase/phases of AC**	**Explanation**	**Source**
Signal hunt	Acquisition	What's next consulting offers this method of weak signal searching. In practice Hiltunen searches signals from the internet or expert interviews. Assignments vary between weeks to few months.	(Whatsnext 2012) http://www.whatsnext.fi/
TEM-trendwiki	Aquisition	Shared collection of signals and analyzation and clusteratization of them.	By Finpro, Tekes, FinNodes, VTT, TEM and ELY-centres.
Institute for the future Map of the decade every year	Acquisition	Forecasts big trends of the decade and big impacts	(Iftf, 2012)http://www.iftf.org/fileadmin/user_upload/downloads/tyf/IFTF_2014TYF_MotD_reader.pdf
Foresight at Arup Drivers of change	Acquisition	Drivers of Change investigates the key global issues and trends driving change in our societies and markets	(Driversofchange, 2017)http://www.driversofchange.com/tools/doc/

7see	Acquisition	A combined economic and physical approach that looks at systematic interactions of an entire economy. Forecasts how economy will evolve over 20 years.	(Driversofchange, 2017)http://www.driversofchange.com/tools/7see/
Inspire	Acquisition	It enables improved knowledge sharing across the organisation, increasing our awareness and understanding of case-studies and benchmarks across different markets and themes	(Driversofchange, 2017)http://www.driversofchange.com/tools/inspire/
Signaalisessions	Aquisition	A tool created by Tekes which includes bringing of FinNode projects signals from world to serve Finnish companies.	(Tekes, 2012)www.tekes.fi
Trendmap	Aquisition	Shows important trends in x and y map where y presents power and x probability of the trend.	(KEV, 2012):www.foresight.fi.
Knowledge Café / Treasure Hunt	Acquisition and assimilation	Interactive method to reach tacit knowledge	(Grapepeople 2012)http://www.grapepeople.fi/
GPS for enterprises	Acquisition	GPS-session consists of three rounds • Round 1: creation of ideas. Participants figure out ideas with groups of two by trends and trajectories that are presented on board. • Round 2: Selection of ideas. Group chooses best ideas. • Round 3: Extension of ideas. Participants extend best ideas in small groups and create projectcard.	(Thinkkit, 2012)http://www.thinkkit.eu/fi-fi/gps-for-enterprises/tool
Value and attitude researches of Finnish society	Acquisition	EVA has surveyed finnish values and attitudes since 1984. Inquiries of twenty years have build up a wide material of changes in finnish values and attitudes.	(EVA, 2012)http://www.eva.fi/hankkeet/arvo-ja-asennetutkimukset/2425/

Technology barometer	Acquisition	Technological indicator of people's attitudes towards information society.	(Tehnology barometer, 2012)http://www.tek.fi/cmis/browser?id=workspace%3A//SpacesStore/5f3803f1-b483-409b-8192-44e1a7b56896%3B1.0&type=popup&caller=widget
ETLA-trend	Acquisition	ETLA publishes economical forecasts twice a year on their trend publication	(Ennuste, 2017)http://www.etla.fi/ennusteet/suhdanne/
Future sessions	Acquisition	Theme based tangible foresight information from world to finnish corporations.	(Futuresessiot, 2012)http://www.finnode.fi/future_sessiot/

4.2 Learning tools for improving assimilation of new knowledge

Second phase of the absorptive capacity is assimilation or transformation depending on the process nature; whether change in knowledge structures is required or not. Tools for assimilation path are presented (Table 8) and argued as following:

Table 8. Assimilation phase tools of knowledge absorption.

Tool	**Phase of AC**	**Explanation**	**Source**

Future window	Assimiliation	Future window shows weak signals in organizations café or lunch rooms. They encourage future oriented thinking. The tool is good for information sharing and thus assimilation of knowledge.	Elina Hiltunens tool for using of weak signals in corporations. (Whatsnext, 2012) http://www.whatsnext.fi/
Futuropoly	Acquisition and asssimilation	A two-day session game that consists of going through trends and weak signals and wild cards. Different future scenarios are thought with future matrix and business concepts are created for different scenarios. This game enhances incorporation of foresight knowledge and thus mainly enables assimilation of foresight knowledge.	(Whatsnext, 2012)http://www.whatsnext.fi/
Innosession	All phases	It is a method for renewing corporations' business activity. The thought behind the method is that innovation potential lies in interfaces of different industries or expertises. Developers are Lahti science and enterprise center and LUT. Innosession consists of different methods that enhance absorption of knowledge in the different steps of AC.	(LUT, 2012)www.lut.fi
5DOI	ALL phases	The **5DOI** workshop is a mix of learning and doing. Our objective is to introduce you to a new way of working and provide you with an innovation toolbox that you can apply back home	(Yrityksille, 2017)http://www.tut.fi/fi/yrityksille/osaamisen-kehittaminen/taydennyskoulutus/koulutustarjonta/the-five-disciplines-of-innovation-workshop/index.htm
Creative Problem Solving, CPS	Assimilation transformation	Creative problem-solving tool for innovation.	(Susinno, 2012)http://www.grapepeople.fi/

SusFuture	Assimilation and transformation	Have methods to help with absorption of future oriented knowledge.	(Susinno, 2012)http://www.susinno.fi
SusSessions	Assimilation and transformation	Is a toolset for intellectual cross fertilization, where distances are crossed with different methods. This tool helps with absorption of foresight knowledge whether its assimilation or transformation.	(Susinno, 2012)http://www.susinno.fi/
Idealogue	Assimilation and transformation	A method for deepening groups' interaction, ideation, and creation of action plans. A group method of creation shared reality and commitment.	(Grapepeople 2012)http://www.grapepeople.fi/
Biomimicry	Assimilation and transformation	Imitate natures best ideas by designs and processes to solve human problems. Make biological prototypes to get ideas for engineering solutions.	(Creativity-innovation tools, 2017)https://www.slideshare.net/ramonvullings/27-creativity-innovation-tools-final
Reverse brainstorming	Assimilation or transformation	Reverse the problem to what is causing it and try to find preventive solutions.	(Creativity-innovation tools, 2017)https://www.slideshare.net/ramonvullings/27-creativity-innovation-tools-final
SIT (systematic innovative thinking)	Assimilation	• Subtraction, remove components or attributes. • Multiplication, make copies of an existing product component and alter those copies in some important way • Division, divide the product into its component parts. • Unification, assign a new task to an existing element of the product or its environment.	(Creativity-innovation tools, 2017)https://www.slideshare.net/ramonvullings/27-creativity-innovation-tools-final

		• Attribute dependency change, involves the dependent relationships that exist between attributes	

4.3 Transformation tools of new information/knowledge

Transformation path requires specific cherishing from the sufficient tools to start the process of knowledge structures transition. Expressive presentations (play, drawing, stories, and drama) have positive effect on information sharing (Oikarinen & Kallio, 2012). Tools for this process alone are currently quite few (Table 9) and are presented:

Table 9. Transformation phase tools of knowledge absorption.

Tool	**Phase of AC**	**Explanation**	**Source**
Innosessions	All	It is a method for renewing organizations business activity. The thought behind the method is that creates innovation potential lies between different expertises or industries.	(LUT, 2012)www.lut.fi
Polarity management	Transformation	A process for understanding of complex challenges and decreasing of resistance.	(Grapepeople, 2012)http://www.grapepeople.fi/
SusFuture	Assimilation or transformation	Have methods to help with absorption of future oriented knowledge.	(Susinno, 2012)http://www.susinno.fi/
SusSessions	Assimilation or transformation	Is a toolset for intellectual cross fertilization, where distances are crossed with different methods. This tool helps with absorption of foresight knowledge whether its assimilation or transformation.	(Susinno, 2012)http://www.susinno.fi/

SusActor	Transformation	Removing of organizational bottlenecks and to decrease or remove silos. In SusActor theatre method and working stories are exploited in creating meanings and change.	(Susinno, 2012)http://www.susinno.fi/
5DOI	ALL phases	The **5DOI** workshop is a mix of learning and doing. Our objective is to introduce you to a new way of working and provide you with an innovation toolbox that you can apply back home	(Yrityksille, 2017)http://www.tut.fi/fi/yrityksille/osaamisen-kehittaminen/taydennyskoulutus/koulutustarjonta/the-five-disciplines-of-innovation-workshop/index.htm
Flower association	Transformation, assimilation	Determine core concepts which are going to be inspected and further evaluated. Questions about the concepts. What do you associate this concept with? What type of aspects does the concept have? What does the concept remind you of?	(The innovation expedition, 2017)http://innovationmanagement.se/wp-content/uploads/2013/11/Chapter-9-The-Innovation-Expedition.pdf)
Challenge assumptions	Transformation	This technique aims at overcoming current thinking habits in order to create new perspectives on a given topic. • Take a critical part or term of problem or topic. • List assumptions on the topic and challenge them; What if it was not true. • Answer this question and get new ideas	(Creativity-innovation tools, 2017)https://www.slideshare.net/ramonvullings/27-creativity-innovation-tools-final
Redefinition	Transformation	Clarifies the space around originally stated problem. The basic idea idea is to ask ”why” and ”what’s stopping” questions, thus broadening and narrowing the initial problem. The outcome of repeated questions is a hierarchical list of problem definitions.	(Creativity-innovation tools, 2017)https://www.slideshare.net/ramonvulli

			ngs/27-creativity-innovation-tools-final

Exploitation of knowledge is the last phase of AC and tools (Table 10) for enhancing it are following:

Table 10. Exploitation phase tools of knowledge absorption.

Tool	Phase of AC	Explanation	Source
Test Drive – **idea testing (Finpro)**	Exploitation	Get relevant market knowledge for product idea before big investments. Avoid error estimates and maximize your business potential. Test Drive –service is made for testing of new idea or product in foreign markets. The service can be used to existing product if targeted market information is wanted before wide scale sales. The tool is clearly good for exploitation of knowledge.	(Finpro, 2012)
SusFlow	Exploitation	includes method arsenal which is capable of increasing innovation activity of the staff. There should be two tasks for every person of a company to create product and think how it's done better.	(Susinno, 2012)http://www.grapepeople.fi/
The sequence game	Exploitation	motivates the participants to quickly co-operate with each other and at the same time learn. something new about one another.	(The innovation expedition, 2017)http://innovationmanagement.se/wp-content/uploads/2013/11/Cha

			pter-9-The-Innovation-Expedition.pdf)
SCAMPER	Exploitation	S: Substitute. What can I replace of the product C: What I can combine of the product to improve it A: Can I adapt the product to something else from different sector perhaps. M: How the product can be modified P: Can the product be put to different uses E: Eliminate R: Can I rearrange or reverse something about the product or idea.	(The innovation expedition, 2017)http://innovationmanagement.se/wp-content/uploads/2013/11/Chapter-9-The-Innovation-Expedition.pdf)

4.5 Interviews of SMEs about foresight activities

Interview one chairman of Visual data Kempas says that first place to find foresight information is customer base and secondary larger scale changes of society must be notified. On their company foresight information is gathered on daily routine and is seen very important. They acknowledge competitor knowledge and customer needs and customer's public economic information as foresight information. In their company foresight information is formulated on routine and used on medium term 1 to 3 years strategic decisions.

Interview two Scancool CEO Asplund says that foresight information is important, and some legislative changes must be followed because of the allowed product features etc. They get the foresight information on daily basis within sales and marketing activities. He says that there are no resources for more specified foresight activity. They use the information they gain on daily basis on a case basis on board of director's meetings. For example, they evaluate the products on technological, price and value added compared to competitors. They use the foresight information mainly on decision making of new products.

Interview three Neovica Oy CEO Kaukola says that understanding current trends is important task. On the other hand, he says that their company is so small and agile that changes on direction on quick pace is possible and one mistake won't knock over the enterprise. Their product development follows technological change and sales follow economic indicators. They communicate in close co-operation with clients and partners about the changes etc. Internet is the main source of information. They also use magazines and business newspapers. Information is shared between workers daily.

Interview four; Finnish family company CEO says that foresight information is critical for SMEs but there is no customized service for SMEs. He says that in their company doesn't exist an established foresight activity but rather monitoring of business cycle indicators. He is the one who modifies the foresight information and management group executes. They use the information to forecast production output, sales, marketing activities and product development.

In conclusion foresight activities are mostly focused on CEOs or board of directors' task and there aren't established routines. One expectation was case one where foresight activity was done on daily basis and was companywide duty and used as basis for strategic decision making of medium term 1-3 years. First place for foresight information is customer base and secondary larger scale changes of society and global economy must be notified.

4.6 Creation of the toolset

Desirable knowledge absorption toolset for practice-based mode 2a innovation considering theory and practical experiences was built in 2012 (Table 11). There are difficulties for finding and choosing tools suitable for each phases of AC known to public. Some consulting houses have more tools, but they aren't sharing information as eagerly as these governmental organizations. Practice-based mode 2a innovation is suggested in call for many problems related to information sharing and enhancing information processes. For example, observing the environment should be companywide duty as Kallio (2012) presented and it can be pursued with project style sessions of practice-based mode 2a innovation companies should invest more time in information absorption rather than just collection to help this it is suggested to choose 1-3 tools of each phase of absorptive capacity best suited to needs of the project and build a workshop to engage people and enhance breadth of knowledge. There are chosen tools from each phase as an example toolkit, but every organization should invest time to choose particularly fit tools for their needs.

TEM-trendwiki is chosen as first preferable tool for acquisition phase because it has many developers behind it, thus it answers to most of the problems. It brings many individuals from different organizations to observe the environment, so the chosen information is more objective. ETLA-trend provides economic indicators for improving short term economic performance. Future sessions provide tangible examples and coded information. Innosessions brings facilitation and brokering and expressive presentations in acquisition phase; it is a mix of tools and methods. These three methods/tools together bring solutions to acquisition phase problems found in theoretical study. It would be recommended that customer agent took part in Innosessions because of the interview result that customer base was the most important source for foresight information.

Assimilation phase prerequisite is pre-existing knowledge structures. It can be assisted with multiple individuals' participation because people have different knowledge structures. Innosessions and brainstorming helps with it if certain demanded experts are taken into action. Bonding of social capital is for example achieved with strong connectedness to customers or sub conductors. At the same time collective blindness is evaded with TEM-trendwiki and knowledge diversity is supported. In Innosessions' there is potential for achieving state of creative social capital or certain group flow because of creative expressive presentations.

Transformation phase of AC is rather challenging and for example it requires special cherishing (Kallio, 2012), thus tools for such action are still lacking. For ATE path to take place translation and interpretation are important (Mäkimattila et al, 2012). There are plenty and versatile foresight activities in Finland, but new kind of brokering and involvement is needed to remove problems in information sharing (Oikarinen et al, 2012).

Table 11. The construct of knowledge absorption toolset.

Phase of AC	Solutions	Preferrable tool or source of solution
Aquicition	-Investing in acquisition of new external knowledge (Cohen and Levinthal)	TEM-trendwiki
	-Many individuals to observe the environment (Cohen and Levinthal)	ETLA-trend
	-Improving organizational structures and avoiding long lasting structures	Future sessions
	(Cohen and Levinthal)	Innosessions

	-Social integration mechanisms (Zahra and George, Todorova and Durisin) -Facilitation and brokering help from governmental organizations -Expressive presentations (play, drawing, stories and drama) have positive effect on information sharing and facilitates creation of new knowledge (Oikarinen and Kallio, 2012; Heron and Reason, 2001)	Customer base
Assimilation	-Pre-existing knowledge structures needed for assimilation (Cohen and Levinthal) -Knowledge diversity (Cohen and Levinthal) -Gatekeepers to transfer information-> all participate (Cohen and Levinthal, Kallio) -Innovation activators can support implementation of ideas (Kallio and Bergenholtz, forthc. p. 11) Bonding social capital (Kallio et al, 2012)	Innosessions Future window SusFuture Creative problem solving Idealogue Facilitation
Transformation	-Transform knowledge structures (Cohen and Levinthal) -Overlapping of functions to gain knowledge transference and breadth of knowledge (Cohen and Levinthal) -Cognitive structures of individuals must change to adapt to the idea (Todorova & Durisin, 2007)	Innosessions SusSessions Brokering

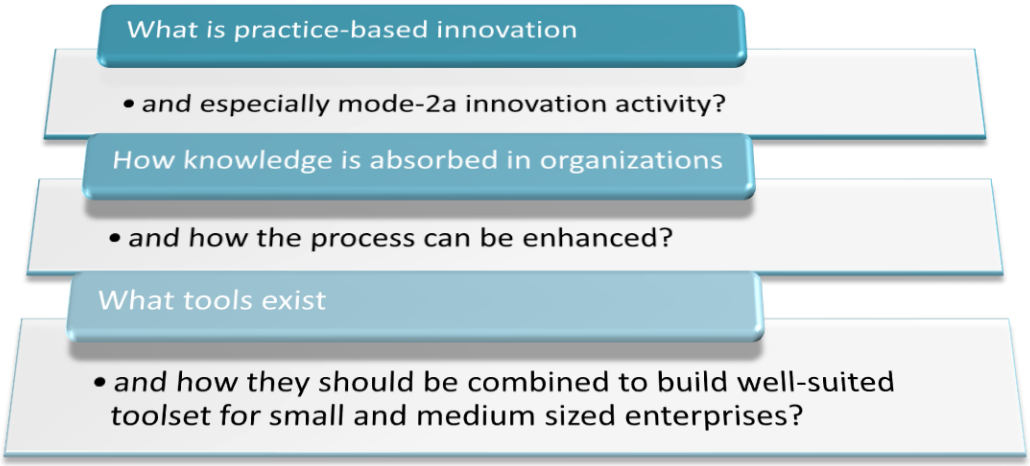
	Brokering can help management to understand what the idea is about (Kallio and Bergenholtz, forthc. p. 11) Bridging social capital (Kallio et al, 2012)	Polarity management
Exploitation		Test drive
Absorptive capacity	-Invest in strategic R&D areas (Cohen and Levinthal) -Social capital (Kallio) -Creative social capital (Harmaakorpi, 2004)	With good leadership organization can show where to look with appropriate vision. Facilitation of communication by providing channels and arenas of sharing knowledge

5 CONCLUSIONS

"Innovation is the successful exploitation of new ideas". The main research question of the thesis is

How to create knowledge absorption toolset for practice-based mode 2a innovation

The research question was further divided into 3 components and answering these components (Figure 9.) would give solution to the main research question. The toolset was built following absorptive capacity theory and interviews of SMEs.



Practice-based innovation is evolving towards open innovations paradigm. Practice-based innovation can be defined: *"Innovation process triggered by problem-setting in a practical context and conducted in non-linear processes utilizing scientific and practical knowledge production and creation in cross-disciplinary innovation networks"*. This development is seen in participation of mediator organizations. Researchers are participating and building more practical constructions more often. Their involvement has created new roles of facilitation and brokering in project based settings. It is noticed that these unfamiliar players to organizations have better prerequisites for being objective facilitators thus avoiding NIH-syndrome or collective blindness. Mixing of different types of knowledge or intellectual cross-fertilization is source of novelty or innovation potential.

Goal in mode 2a practice-based innovation is all about balance between strong connectedness and sparse networks. Braking silos between organizations and bridging over structural holes for innovation potential is different from mode 2b innovation activity where innovation capability is being built inside organizations overall thus mode 2b innovation activity is closer to user- or employee-driven innovation. Mode 1 innovation or the STI (science, technology, innovation) differs from mode 2 knowledge production mainly on process nature which is homogenous vs. heterogenous where process is more project oriented and certain codes of practice are missing from mode 2 knowledge production. There are brought in new ways of cherishment for creativity in mode 2a innovation activity. Expressive presentations (play, drawing, stories, and drama) have positive effect on information sharing.

Absorptive capacity (AC) and its four steps divide the two paths of AAE and ATE where assimilation occurs in SME context naturally and ATE requires special cherishment. Assimilation happens when current knowledge structures support new information or knowledge to be incorporated whereas transformation requires change in knowledge structures for new information to be incorporated. Absorptive capacity of individuals should be supported with knowledge sharing manners and daily routines rather than just being task of brokers or individuals. Firms' absorption of new knowledge to avoid getting locked into old technologies or keeping long lasting structures should be avoided by companywide duty of acquisition of new information or knowledge.

There exist many acquisition phase tools and it can be said that there are plenty of foresight activities in Finland (Table 12) but he problem is that the activities are scattered, and many are doing same tasks in different organizations in Finland. SME's don't often have the resources or will to hire multiple consultants for foresight activities thus they should be more hand on hand supported rather than just pushing a lot of information through different channels. There should be more centering in innovation policies and cluster-centered policies should evolve because developing of innovation capability in a "silo" is forgetting possibilities of more sparse networks where brokers help in with innovation potential. Other than acquisition tools following AC constructions phases are still less or more lacking or hidden in different organizations strategic information or consultants don't market them, this calls for action for consultants and governmental organizations maybe even in co-operation to create more specific tools for SME's to interpret information not just gather it.

Table 12. Summary

Chapter	Practice-based innovation	Absorptive capacity	Elements enhancing absorptive capacity	Knowledge absorption tools for SME's
Background	Innovation paradigm based on modes of knowledge production: Science technology innovation (STI), doing using, interacting (DUI).	Organizations absorptive capacity is the sum of individuals knowledge capabilities limited by the opportunity recognition of the individuals whom collect foresight knowledge for the organization and what should be a companywide duty.	Facilitation and brokering are elements in practice-based innovation whom help bridging or bonding new knowledge into use.	Foresight knowledge is widely gathered in Finland but is mainly built for industries where industrial barriers are now days nearly non-existent or at least are reshaped quite often.

Summary	Where DUI mode 2a practice- based innovation is based on intellectual cross-fertilization and happens usually in workshop based environment in networks and is fueled by scanning and absorbing technology and market signals.	Absorptive capacity can take two paths based on whether organization is able to assimilate knowledge based on individual's knowledge structures or to transform knowledge structures if needed, which might require special cherishment.	Combination of dense and sparse networks would help in assimilating or transforming new knowledge, whereas assimilation happens more naturally for SME's and where they might need help from networks to be able to transform knowledge structures.	This calls for action; SME's require common platform from foresight actors.

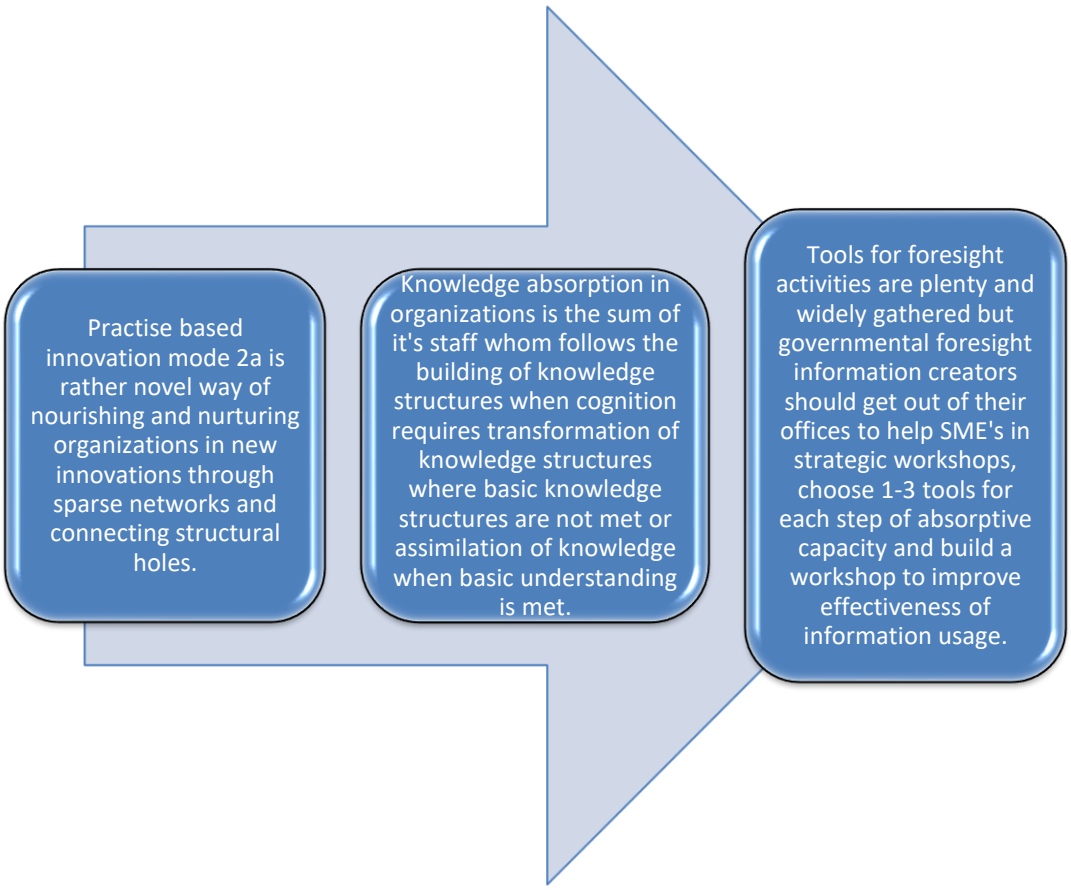


Figure 9. Findings of the study

Future research of absorptive capacity fitting tools should focus especially on whether an innovation tool is sufficient for improving knowledge absorption's assimilation or transformation phase, thus achieving opportunities for knowing how to achieve transformation in information processes, and thus gaining potential for more radical/disruptive innovations.

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