BRIDGE OVER TROUBLED WATER

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THE ROLE OF INTERMEDIARIES IN DIFFUSING SOLAR POWER IN FINLAND

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Tiivistelmä – Referat – Abstract

Tämä tutkielma tarkastelee välittäjäorganisaatioiden roolia kestävissä rakennemuutos, erityisesti koskien energiatuotantoa. Tutkielma keskittyy välittäjäorganisaatioiden rooliin uusien ympäristöystävällisten sosio-teknisten niche-innovaatioiden levittämisessä ja tukemisessa kokeiluhankkeiden kautta. Teoreettisesti tutkielma ammentaa kestäviä rakennemurroksia käsittelevästä kirjallisuudesta, erityisesti stategic niche managment -teoriasta. Empiirisesti tutkielma keskittyy tapaustutkimukseen aurinkovoimaloiden yhteishankinnasta, joka toteutettiin osana ”Vähähiilisyydestä uutta innovatiivista liiketoimintaa ja kilpailuetua yrityksille ja kunnille” (Välke) –hanketta Lounais-Päijänteellä vuonna 2016. Välke on ”Kohti hiilineutraalia kuntaa” (HINKU) –hankkeen alahanke, joten tutkielman tapaustutkimus liittyy vastaaviin HINKU-hankkeen kokeiluihin.

Tutkimusmateriaali kerättiin toteuttamalla 9 puolistrukturoitua haastattelua kokeiluun osallistuneiden eri sidosryhmien jäsenten kanssa sekä käyttämällä jo olemassa olevaa sekundaarimateriaalia. Materiaali analysoitiin laadullisella sisällönanalyysilla ja käyttämällä analyyttista kehikkoa aiemmassa tutkimuksessa.

Tutkielman tulokset osoittavat, että välittäjät tukevat niche-innovaation kehitystä keräämällä, kierrättämällä ja soveltamalla oppeja yhteishankintakokeilujen aikana ja niiden välillä. Tämä toteutettiin tuottamalla ja levittämällä asiakirjoja, mutta ennen kaikkea välittäjien henkilökohtaisen kontaktin kautta. Välittäjien verkostossa esiintyi hierarkisia rakenteita, sillä HINKU:n koordinaattori, Suomen ympäristökeskus, ylläpiti oppien säilytyspaikkoja ja loi yhteyksiä muiden kunnallisten välittäjien välille. Lisäksi kokeiluhankkeiden aikana korkeamman profiilin välittäjät – pääosin SYKE – tarjosivat apua alemman profiilin välittäjille. Tämä apu sisälsi tietoa kokeilujen toteteutuksen tueksi ja lisäksi se kasvatti alemman profiilin välittäjien itsevarmuutta. Vastaavasti alemman profiilin välittäjät antoivat samanlaista tukea kokeilujen osallistujille. Eri välittäjäroolit eivät olleet kuitenkaan pysyviä, sillä kokeilujen aikana alemman profiilin välittäjät omaksuivat joitakin korkeamman profiilin välittäjien rooleja.

Tukeakseen aurinkosähkön kehitystä Suomessa, välittäjäorganisaatiot tekivät enemmän kuin vain keräsivät, kierrättivät ja sovelsivat oppeja kokeilujehankkeiden aikana ja niiden välillä. Ne panivat aktiivisesti aluilleen uusia muokattuja kokeiluja eri maantieteellisissä sijainneissa sekä tukivat lausunnoissaan aurinkosähköä. Tämä oli osittain seurausta välittäjätoimijoiden strategisesta luonteesta, sillä ne oli perustettu katalysoimaan toimia, jotka johtaisivat kasvihuonekaasupäästöjen vähenemiseen. Kuitenkin aktiivisen tuen osoittaminen yhdelle tietylle sosio-tekniselle innovaatiolle vaikeutti välittäjien pyrkimystä näyttäytyä neutraaleina ja uskottavina toimijoina. Osittain tämän seurauksena – mutta myös johtuen aurinkosähkön kehityksen vaiheesta Suomessa sekä välittäjien resursseista ja kiinnostuksen kohteista – SYKE päätti olla tekemättä tulevia aurinkovoimaloiden yhteishankintoja yksityisille toimijoille, mutta hyödyntää yhteishankintojen innovatiivista menettelytapaa tukemaan muita ympäristöystävällisiä niche- innovaatioita

Tutkielman tulokset osoittavat, että välittäjät voivat ainakin alueellisesti edistää kestävää energiamurrosta. Tulokset painottavat välittäjien yhteistyön ja niiden välisen henkilökohtaisen kontaktin tärkeyttä sekä välittäjien kykyä hyödyntää hallinnollisia innovaatioita. Lisäksi tulokset osoittavat, että välittäjien voimakkaampi sisällyttäminen politiikkatoimiin nopeuttaisi energiamurrosta sekä laajempien kestävyystavoitteiden saavuttamista. Toisaalta tulokset osoittavat, että etenkin julkiset välittäjäorganisaatiot joutuvat toimimaan epäselvien mandaattien alaisina.

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Tiivistelmä – Referat – Abstract

This master's thesis addresses the role of intermediary organizations in sustainability transitions, specifically in the field of energy. The thesis discusses how intermediary organizations can diffuse and support the development of novel sustainable socio-technical niche-innovations through experiments. Theoretically, this thesis draws mostly upon the sustainability transition literature, particularly strategic niche management theory. Empirically, this thesis focuses on a case study of joint procurement of solar power plants that was implemented as a part of "New and innovative low-carbon business generates competitive advantage for companies and municipalities" (Välke) project in South-western Päijänne during 2016. Välke is a sub-project of Carbon-neutral municipalities (HINKU) and therefore the case study of this thesis links to other similar experiments in the HINKU network.

The material of the thesis was collected through 9 semi-structured interviews with different stakeholders involved in the experiment and by using pre-existing secondary material. The material was analysed by qualitative content analysis using an analytical framework adopted from a previous study.

The findings show that intermediaries support niche development by aggregating, circulating and applying lessons learned between and within joint procurement experiments. This was done by producing and disseminating documents, but more importantly through personal contact between intermediaries. The network of intermediaries showed hierarchical features as the coordinator of HINKU, the Finnish Environment Institute (SYKE), maintained the repositories of the learned lessons and also formed a link between municipal intermediaries involved with the experiments. Also, during the experiments the more experienced higher profile intermediaries – mostly SYKE – provided assistance to lower profile municipal intermediaries. This support included providing knowledge, but also raising the confidence of lower profile intermediaries. Following, the lower profile intermediaries provided similar assistance to the participants of the experiments. However, the intermediary roles were not stable as lower level intermediaries were adopting some of the roles of the higher profile intermediaries after gaining experience during the experimentation.

In order to support the Finnish solar niche, the intermediaries went beyond mere aggregating, circulating and applying lessons between and within experiments. They were actively initiating new experiments in adjusted forms in new geographical locations and advocating the niche. This was partially linked to the strategic nature of the intermediaries, as they were established to catalyse activities that would lead to mitigation of greenhouse gas emissions. However, this active support for a particular socio-technical innovation contradicted the pursuit of intermediaries to be viewed as neutral and credible actors. Partially as a consequence – but also because of the phase of solar niche development in Finland and lack of resource and interest – SYKE chose to withdraw from future joint procurements of solar power plants for private actors. However, SYKE was planning to utilize the governance innovation of joint procurements in order to support other niche-innovations with sustainability gains.

The findings show that intermediaries can accelerate energy transitions, at least on a regional scale. They emphasize the importance of cooperation and personal contact between intermediaries and the ability of intermediaries to utilize governance innovations. Also, the findings support stronger inclusion of intermediaries in governance frameworks to hasten energy transition and achieve wider sustainability goals. However, the thesis shows that particularly public intermediary organizations have to work under unclear mandates.

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Forewords

This Master's Thesis is conducted as part of Finnish Environment Institute's (SYKE) research project "Intermediaries in the energy transition: The invisible work of creating markets for sustainable energy solutions" (TRIPOD). TRIPOD is a research consortium project led by Aalto University, with SYKE and the Consumer Society Research Centre (CSRC) of the University of Helsinki as partners. The research focus of TRIPOD is to *"empirically analyze innovation intermediaries and specify the concepts and analytical tools relevant for intermediation in the context of the ongoing energy transition, i.e., the shift to low-energy and distributed renewable-based energy systems".* In the consortium, SYKE research focuses on public intermediaries. The material of this thesis has also been used in the Smart Energy Transition (SET) project.

First and foremost I would like to thank Eeva Primmer for giving me the chance to work at SYKE as an external researcher and participate in the TRIPOD project. She also provided a lot of help and much needed critical comments during the process. At least as important were the supervisors of this thesis Paula Kivimaa, Karoliina Isoaho and Janne Hukkinen. From them I received advice and critique that were essential to this thesis. I would also like to thank Pasi Tainio who helped out with practical issues concerning the research material and Eva Heiskanen who provided me the basic outline of interviews through the SET project.

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Antti Seppälä

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1. Introduction

The risks of climate change call for urgent measures for decarbonizing our societies during the following decades (e.g. UNEP 2017, Rockström et al. 2017). In Finland, climate and energy policy aims to cut greenhouse gas (GHG) emissions by 40% in relation to 1990 by 2030 and 80-95% by 2050 (TEM 2014a, 2017). The GHG mitigation plans will have an effect on all sectors of society and require the development and implementation of novel technological solutions, but also bring about cultural, institutional and political challenges involving multiple stakeholders (e.g. Giddens 2009, Markard et al 2012). This Master's Thesis concentrates on the roles of particular actors, namely intermediary actors, in these societal transitions. These actors can be described as actors working between other actor, such as producers and users, entrepreneurs and adopters, idea generators and funders, bringing them together and facilitating joint activities (e.g. Steward & Hyysalo 2008, Kivimaa 2014, Kivimaa et al. 2017a, Matchoss & Heiskanen 2017).

In addition, this thesis deals with GHG mitigation efforts specifically in the energy sector in Finland. Recently, the advancements in renewable energy technologies have led many scholars to demand a substantial shift towards renewable and decentralized energy production both in Finland and globally (e.g. Valkila & Saari 2010, Jacobson & Delucci 2011, Geels 2014, Halme et al. 2014, Stirling 2014, Child & Breyer 2016, Connolly et al. 2016). Solar power is one of the promising new low-carbon technologies, but currently it serves a minimal role in the Finnish energy system and policy plans (TEM 2014a: 37, 2017:29, Haukkala, 2015, Saikku et al. 2017, Statistics Finland 2017). However, recent studies have shown that solar power development can have many alternative pathways in Finland and its role can be larger than current policy plans entail (Pasonen et al. 2012, Haukkala 2015, Ruggiero et al. 2015, Child & Breyer 2016, Varho et al. 2016). This Master's Thesis addresses the diffusion of solar power in Finland.

The current ambiguous state of solar power in Finland is not a unique phenomenon globally. Novel sustainable socio-technical innovations have difficulties in gaining ground as they are faced with a selection environment where established

(unsustainable) technologies are supported by e.g. consumer behavior, business models, infrastructure, regulation and institutional structures (e.g. Rip & Kemp 1998, Unruh, 2000, 2002, Markard et al. 2012). To address this problem and to hasten GHG mitigation efforts, the literature of sustainable transitions has sparked interest in a rising number of scholars during the past few decades (Markard et al 2012).

The sustainability transitions literature has emphasized the role of experiments in introducing and diffusing novel (more) sustainable socio-technical innovations (e.g. Schot & Geels 2008, Sengers et al. 2016). Experiments can be defined as *"an inclusive, practice-based and challenge-led initiative designed to promote system innovation through social learning under conditions of uncertainty and ambiguity"* (Sengers et al. 2016: 9). Previous studies in the field have highlighted the importance of experiments for the past development of solar energy in Finland (e.g. Heiskanen et al. 2015a, Matschoss & Heiskanen 2017, Saikku et al. 2017).

In addition to experimentation, the sustainability transitions literature has perceived interaction, cooperation and problem-solving between stakeholders as vital for the diffusion of novel sustainable socio-technical innovations (Schot & Geels 2008, Markard et al. 2012, Kivimaa 2014). Even though the importance of agency and cooperation has been identified, the role of intermediary actors in these processes has not received much attention in the field until recently, especially in energy transition (e.g. Hargreaves et al. 2013, Kivimaa 2014, Kivimaa et al. 2017a, Matschoss & Heiskanen 2017). In addition, the role and functions of intermediary actors in experiments is still poorly understood (Matschoss & Heiskanen 2017).

Intermediaries in the literature cover a large variety of actors ranging from individuals to different kinds of organizations, but this thesis focuses specifically on public intermediary organizations (e.g. Kivimaa et al. 2017a). Intermediary organizations are an interesting field of study in the context of sustainability transition, because they have been argued to play a part in emerging technological and scientific developments and catalyzing societal change (e.g. Boon et al. 2011, Kivimaa 2014). The focus on public organizations is relevant since private actors

may not be so eager to act as change agents for sustainability transitions (Turnheim & Geels 2012, Kivimaa, 2014).

Finland provides a particularly interesting setting for studying the role of intermediaries in sustainability experiments, because the current government explicitly promotes experimental culture in the country (Prime Minister's Office 2015: 28.). Among the variety of experiments in Finland, one especially interesting is the Carbon-neutral Municipalities (HINKU) network which is coordinated by the Finnish Environment Institute (SYKE), a public research institute. Established in 2008, HINKU is a coalition of Finnish municipalities that aim to reduce their CO_2 emissions by 80 per cent by 2030 in relation to emissions in 2007 (SYKE, 2013). In addition to well-articulated goals, the project relies on experimentation with low-carbon solutions in real-life environments in cooperation with local actors (e.g. Heiskanen et al. 2015a, Antikainen et al. 2017).

In the context of energy transitions, HINKU is interesting because the number of on-grid solar power plants in its member municipalities is much larger than on average in Finland (HINKU-foorumi 2016g). In this development, joint procurement experiments of solar power plants organized by SYKE and its partner organizations have been acknowledged as playing an essential part (Matschoss & Heiskanen 2017, Saikku et al. 2017). In addition, scholars have argued that the joint procurements experiments of HINKU have stimulated the development of the solar power business sector in Finland (Lovio 2017, Matschoss & Heiskanen 2017, Saikku et al. 2017).

Hence, this Master's Thesis focuses on the roles of intermediary organizations in energy transitions by using the joint procurement experiments of solar power plants in HINKU as its empirical context. These interactions are studied through a case study of one of the experiments that was implemented in the HINKU sub-project Välke in South-Western Päijänne during 2016. The aim of the thesis is to answer the following research questions:

1. How do intermediary organizations aggregate, circulate and apply lessons within and across sustainability experiments?

2. What kind of other relevant roles or characteristics of intermediary organizations emerge in the context of sustainability transition studies?

The thesis is organized as follows. Section 2 reviews previous literature on sustainability transitions – particularly Strategic niche management theory (SNM) – and examines it especially from the perspective of experimentation and the role of intermediaries. Section 3 provides an insight into the Finnish energy regime with a special focus on the electricity sector and solar power and reviews the relevant previous research about HINKU. The analytical framework of this thesis is presented in section 4 followed by material and methods in section 5. Section 6 presents the result that are discusses in section 7. Section 8 concludes the thesis.

2. Sustainability transition studies

This Master's Thesis draws its theoretical basis mostly from the literature of sustainability transition studies. This section reviews the relevant literature in the field in the context of this thesis. Section 2.1 focuses on strategic niche management theory (SNM) – an individual strand of sustainability transition studies – which is the main theoretical approach applied in this thesis. Following, section 2.2 reviews the literature concerning the role of experiments in SNM and more broadly in sustainability transition studies. Lastly, Section 2.3 focuses on the role of intermediaries in sustainability transition literature. This section first presents the general picture and essential concepts of the sustainability transition literature.

Using the concepts of sustainability transition studies, energy supply can be understood as a socio-technical system that consists of multiple networks of actors (e.g. individuals, firms, officials), institutions (e.g. societal and technological norms, regulations), material artifacts and knowledge (Geels 2004, Markard 2011, Markard et al. 2012). The system concept highlights that the different components are highly interrelated and dependent: it is the interaction of the parts that provides a service for society (Markard 2011, Markard et al. 2012).

Because of the risks of climate change, the current energy regime is under pressure to change (e.g. Giddens 2009, UNEP 2017). The challenges of decarbonizing the energy sector are faced with strong path dependencies and lock-in in the established structures ranging from consumer behavior to technological and political structures (e.g. Rip & Kemp 1998, Unruh 2000, 2002). Because prevailing structures resist change, established socio-technical systems typically go through incremental rather than radical change (Dosi 1982, Markard & Truffer 2006, Frantzeskaki & Loorbach, 2010). The pace of this kind of change for the energy supply is too slow against the background of climate change (Markard et al. 2012, Rockström et al. 2017). To face this challenge, sustainability oriented innovation and technology studies – sustainability transition studies[1] – have gained a growing amount of attention during the past two decades (Markard et al. 2012).

As a process, a sustainability transition can be understood as a long-term, holistic and fundamental shift in socio-technical systems towards more sustainable modes of consumption and production (Markard et al. 2012). Sustainability transitions can be conceptualized as socio-technical transitions with sustainability gains: they involve changes in technological, material, organizational, institutional, political, economic, and socio-cultural aspects of the system (Geels & Schot 2007, Markard et al. 2012).

Central concepts of the sustainability transition studies are the socio-technical regime and the niche (Markard et al. 2012). The concept of the socio-technical regime highlights that scientific knowledge, engineering practices and technologies are socially embedded, meaning that they are intertwined with the cognitive routines, belief systems and practical skills of the users of technology; institutional structures; regulation and broader infrastructure (Kemp et al. 1998, Schot & Geels 2008). The niche is a "protective space" for novel socio-technical innovations, i.e. specific markets or application domains, where radical innovations can develop without the selection pressure of the regular market environment of the regime and where actors can learn about innovations and ways for using them (Kemp et al.

[1] Sustainability transition studies focus also on other sectors than energy, such as transport and food production (Markard et al. 2012)

1998, Markard et al. 2012). Transition scholars see that through processes of social learning in a variety of experiments, articulating promising expectations, networking with different actors and gaining broad advocacy, (sustainable) niche innovations can gain momentum and challenge the established (unsustainable) socio-technical regime (Geels & Raven 2006, Markard et al. 2012, Raven et al 2016).

All in all, sustainability transition scholars see the replacement of dominating polluting technologies as a holistic process that does not involve merely economic and technological factors but also social, cultural and political issues, i.e. socio-technical transitions with sustainability gains. In this thesis, from the multiple strands of sustainability transition studies, SNM theory is applied as the main theoretical basis for this thesis. I chose the SNM theory because of its strong focus on experiments and niches. Other transitions approaches, like the multilevel perspective (MLP), which operates on a higher level, do not connect as strongly the transition processes at the scale of a city or a region, which are the focus of this thesis (Hodson & Marvin 2009).

2.1 Strategic niche management

This section covers the core ideas and development of SNM theory. The profound question SNM seeks to answer is what factors lead to the replacement of old and established environmentally harmful technologies with new more sustainable alternatives. The technology itself is seen only as a tool to sustainability, not the goal. SNM research is oriented towards socio-technical innovations that are (1) socially desirable for serving long-term beneficial goals such as sustainability and (2) that do not match with the prevailing regime. (Schot & Geels 2008) Besides a research theory, SNM has been applied as a policy tool to guide sustainability transition experiments (Schot & Geels 2008, Raven et al. 2010).

Since its introduction, SNM scholars have been focused on innovations that happen in niches. A core assumption of SNM is that sustainability innovation journeys can be facilitated by guiding the development of socio-technical innovation in protected niche spaces that enable experimentation and nurturing with the complementary evolution of technology, user practices and regulatory frameworks. This maturation of innovations is expected to happen partially through different kinds of real-world experimental projects and demonstrations, i.e. experiments. (Schot & Geels 2008, Sengers et al. 2016) During this process, the niche is selectively exposed to market pressures and as the innovation matures, protection falls away progressively (Schot & Geels 2008, Smith & Raven, 2012). However, during the development of the theory, SNM scholars have gradually acknowledged the importance of niche-external factors and the interaction between different experiments for innovation journeys (Schot & Geels 2008¸ Raven et al. 2016). Thus, Schot and Geels (2008) make a distinction between "early" and "later" SNM.

In the early years of SNM, sustainable socio-technical innovations were expected to emerge as a bottom-up process from niche spaces and eventually replace the dominant environmentally harmful technologies. Against this background, SNM scholars have created a hypothesis of three niche internal processes that are critical for successful niche building: the articulation of expectations and visions, the building of social networks and learning (and exploration) processes at multiple dimensions. These assumptions are sustained when outcomes of different sustainability experiments have been evaluated ex-post (Schot & Geels 2008, Raven et al. 2010). However, even early SNM scholars identified that niche-internal development in individual experimental projects could not solely bring about more profound regime shifts (Hoogma et al. 2002, Schot & Geels, 2008).

The later work of SNM shifted its focus from individual to multiple experiments (Raven et al. 2010). Raven (2005) made a distinction between local experiments and "the global niche-level", the former consisting of an emerging community that share cognitive, formal and normative rules. The global niche-level can act as a resource and give guiding frames for local projects, but still leave room for interpretations and adjustments in the local context (Geels & Raven 2006). According to SNM scholars, separate local experiments can build on each other

over time as social learning processes eventually add up to a technology trajectory at the global niche-level (Geels & Raven 2006, Raven et al. 2010). Geels and Raven (2006) describe this as a gradual process where diffuse, broad and unstable niche rules and expectations become more articulated, specific and stable. The transformation of local lessons into generic rules does not happen spontaneously, but requires so called aggregation activities such as standardization, model building, the formulation of best practices, and the circulation of actors between experiments (Geels & Raven 2006). However, creating these synergies between experiments is far from easy, as networking and participatory processes do not guarantee cumulative learning between projects (Seyfang & Longhurst 2013, Heiskanen et al. 2015b).

Geels and Raven (2006) argue that different kinds of outcomes in experiments explain the reasons behind the linearity and non-linearity of technological trajectories. Positive outcomes of learning processes in local experiments can initiate developments where shared cognitive rules are refined and made more specific in line with the preceding (positive) expectations. In addition, positive outcomes attract new actors and make it easier to find resources for future projects. However, if outcomes surpass the expectation, the consequences are the opposite resulting in non-linearity or decline in the innovation journey course. (Geels & Raven 2006)

The later work of SNM has also empahasized niche external factors in sustainable innovation journeys. Geels & Raven (2006) pointed out that external factors such as oil price swings or the liberalization of the electricity market can have an effect on the fate of specific niche-innovations. Also Schot and Geels (2008) highlighted the importance of the wider exogenous environment for niche development by combining the concepts of SNM to another strand of sustainability transition studies, the MLP. According to them, niche innovations need external support to change the wider regime. In addition to the concepts of the niche and regime, the MLP includes a third level, the socio-technical landscape, to analyze socio-technical transitions (Geels 2002). This level forms the exogenous background for niche and regime, consisting of deep cultural, macro-economic and macro-political development that takes decades to unfold and change (Geels 2002, Geels & Schot

2007). The core notion of the MLP is that transitions happen through the interaction of the three levels.

Thus, the MLP reformulates the idea of early SNM that anticipated transitions to be solely bottom-up processes (Geels 2002, Schot & Geels 2008). Schot and Geels (2008) argue – like Raven et al. (2016) – that niche innovations and their internal development are still important, but in order to diffuse they must be linked to wider development at the regime and landscape level. In addition to shielding innovation from mainstream selection environments and nurturing it in protective spaces, scholars see that niche innovations must be empowered by linking the development of technology to a larger societal context, such as employment and sustainable development. Especially the empowerment process requires niche-external support (Smith & Raven 2012, Raven et al. 2016). Also, the current SNM literature acknowledges multiple optional transition pathways for niche innovations where regime and niche actors can have different roles. For example, transitions can happen cumulatively or by contributing symbiotically to the existing regime. (e.g. Raven 2006, Geels & Schot 2007, Smith 2007, Schot & Geels 2008)

In sum, the SNM framework has been able to identify vital factors affecting sustainable innovation journeys. During its development the SNM framework has been influenced by other strands of transition literature such as the MLP and vice versa (Schot & Geels 2008, Markard et al. 2012). The niche-internal processes identified by early SNM research are relevant, but the trajectories of socio-technical innovations are strongly influenced by niche-external regime and landscape developments. Socio-technical transition entails development on all three levels of the MLP to enable the regime to accept new radical niche-innovations. (Schot & Geels 2008, Raven et al. 2010, 2016)

2.2 Experimentation

This section covers the relevant literature and concepts of experimentation in relation to this Master's Thesis. As mentioned in the previous section, besides having an interest towards specific kinds of socio-technical niches, SNM scholars also emphasize real-life experimentation (e.g. Schot & Geels 2008). The interest towards experimentation does not solely concern SNM, but the whole field of sustainability transition studies.

According to Sengers et al. (2016), the concept of "experimentation" in sustainability transition literature includes a large variety of different kinds of activities, but they can in general be conceptualized as *"an inclusive, practice-based and challenge-led initiative designed to promote system innovation through social learning under conditions of uncertainty and ambiguity".* In SNM, experiments are seen to serve as protective spaces for promising niche-innovations, where they can be shielded, nurtured and partially empowered (Smith & Raven 2012). In the broader sustainability transition literature, experimental projects are viewed from an engaged and social constructivist position as a "laboratory in society", since experiments bring together various real-world actors around alternative technologies and practices with the intention to consciously shape social and material realities (Sengers et al. 2016). According to Raven et al. (2008), the variation of experiments can attach different kinds of actors, interests, meanings and institutions to innovations and nurture the complementary evolution of technologic, economic and social aspects around them.

However, experiments are not seen as silver-bullet solutions for sustainable regime shifts, but more as *"seeds of change"* (Sengers et al. 2016). According to Sengers et al., experiments serve two valuable functions for socio-technical transition: (1) they make visible the structures that prohibit the diffusion of new solutions and (2) they act as catalysts initiating structural change on a small scale. However, experiments should not be seen merely as neutral technology testbeds, as they more or less aim to challenge dominant institutions and contest the existing sources of authority (Bulkeley & Castán Broto 2013, Kivimaa 2014).

The building of the niche and the aggregation of lessons learned in experiments can happen through more formal ways (e.g. guidebooks, reports, conferences) or more informal interaction between actors (e.g. face-to-face sharing of tacit knowledge or buzz) (Geels & Deuten 2006, Asheim et al. 2007, Hargreaves et al. 2013, Heiskanen et al., 2017). Heiskanen et al. (2017) argue that formal evaluation and dissemination of knowledge are not enough to transfer and share lessons between experiments. According to Heiskanen et al. (2017), they need to be complemented with the sharing of tacit knowledge and inspiration via personal meetings and cooperation with other ongoing projects.

Recently, Sengers et al. (2016) distinguished five different types of experiments that can be identified in the sustainability transition literature. The different types of experiments discussed in the literature have different kinds of theoretical backgrounds and normative orientations but the main characteristics of the five different kinds of experiments are presented in Table 1 below. The SNM literature deals mostly with niche experiments, but the boundaries with different transition theories and experiment types are not strict.

Table 1. Types of sustainability transition experiments (modified from Sengers et al. 2016)

Type of experimentation	Definition
Niche experiment	A protective space for a niche innovation, where it is shielded from the selection environment of the prevailing regime and nurtured.
Bounded socio-technical experiment	A project that aims to introduce an innovation. Emphasizes the social component, is limited in space and time and is recognized as an experiment at least by some participants.
Grassroots experiment	A bottom up project carried out by networks of activists and organizations that are motivated by social needs and ideology. Covers many organizational forms and different technologies
Transition experiment	An innovation project that proactively explores new ways of meeting societal (sustainability) needs, such asenergy. Not limited to technological change or environmental issues.
Sustainability experiment	A planned and goal oriented project that focuses on highly novel socio-technical innovations that are likely to lead to significant sustainability and other societal gains. The projects can be top-down or bottom-up and they draw on transnational linkages.

In addition to the five categories, Sengers et al. distinguish a sixth category called "emerging conceptualization on urban experimentation". These encompass

emerging, but not yet established, forms of experimentation in the sustainability transitions literature, including governance experiments. As a concept, governance can understood as the patterns that can be observed from the governing activities of social, political and administrative actors (Kooiman 2003). In the context SNM, governance experiments can be understood as experiments that emphasize decision-making configurations rather that serving as mere technology push projects, which has been a matter of critique of experiments in the previous literature (Schot & Geels 2008, Bos & Brown 2012, Bos et al. 2013, Sengers et al. 2016, Kivimaa et al. 2017b). Governance experiments can be viewed as more "social/civic" experiments than just "techno/managerial" (Sengers et al. 2016).

Kivimaa et al. (2017b) argue that governance experimentations are relevant for sustainability transitions as they can contribute to policy[2] innovations that are expected to strongly affect behavior, practices, investments and social and technological innovation. Governance experiments can develop new practices through demonstrations, provide evidence on the application potential of niche innovations, challenge dominant values, bring in new actors, create co-operative networks or visions, identify governance problems and encourage further experimentation (Kemp et al. 2007, Kivimaa et al. 2017b). Overall, governance innovation can be understood as a broad concept including both process (the plurality of governance means and ways of create outputs and outcomes) and their outputs (novel strategies, policy design, instruments and targets) (Jordan & Huitema 2014, Upham et al. 2014, Kivimaa et al. 2017b). In their study, Kivimaa et al. (2017b) identified four types of governance-related experimentation. The main characteristics of the different types are presented in Table 2 below.

[2] Following Kivimaa et al. (2017b), in this Master's Thesis policy is undersood as *"a relatively stable, purposive course of action followed by an actor or a set of actors dealing with a problem or a matter of concern"* (Anderson 2006, p. 6).

Table 2. Types of governance-related experiment (modified from Kivimaa et al. 2017a)

Type of experimentation	***Niche creation experiment***	***Market creation experiment***	***Spatial development experiment***	***Societal problem solving and change experiment***
Aim	To test a particular technology and create a new innovation around it	To stimulate new markets or change market conditions to favor more sustainable technologies	To generate long-term spatial development with sustainability benefits	To solve large-scale problems and support change processes
Spatial scale	Initially local rural/urban but with an aim to expand	Regional, national or broader	Local or regional	Local, regional or national
Setting	Protected niche	Several niches or policy	Concrete use of space and land	Policy level

All in all, the multitude of different kind of experiments – whether conceptualized as sustainability or governance experiments – have one common goal: to guide the wider regime towards a more sustainable direction (e.g. Markard et al. 2012, Sengers et al. 2016, Kivimaa et al. 2017b). According to sustainability transition scholars, experiments can provide wider sustainability gains through the mechanisms of deepening, broadening and scaling up[3]. By deepening, scholars refer to the (effective) learning processes during the experimentation about the possibilities and the supportive and restricting conditions. The mechanism of broadening means the repetition of an experiment in an adjusted form in another location and context. The last and most important mechanism, scaling up, refers to the embedding of an experiment to the existing structures of the prevailing regime. (Grin et al. 2010: 146, Van den Bosch 2010: 187, Sengers et al. 2016)

Scholars have argued that in order for experiments to challenge the existing regime, they should result in (rapid) broadening and upscaling. This can create a new

[3] This conceptualization has been created in Transition management (TM) literature, a individual strand of sustainability transition literature (e.g. Grin et al 2010: 146)

dominant (technological, social and institutional) design that can be observed in a novel constellation of culture, practices and structures that gradually gain stronger influence and stability. (Grin et al. 2010, Kivimaa et al. 2017b) However, Kivimaa et al. (2017b) argue that sustainability experiments rarely succeed in having a strong impact on the wider regime. In the 29 experiments evaluated by them, the experiments seemed to be able to produce deepening more than broadening, while scaling up was the most uncommon outcome.

In sum, the concept of "experimentation" has been utilized in many ways in the sustainability transitions literature (Sengers et al. 2016, Kivimaa et al., 2017b). However, the common goal of experimentation is to catalyze wider change towards a more sustainable regime. Experiments provide valuable learning possibilities and can create momentum around niche innovations. Still, they cannot by themselves cause a profound change without exogenous support from the regime and landscape (Schot & Geels, 2008, Sengers et al. 2016).

2.3 Intermediary actors

This section concentrates on the main focus of this Master's Thesis – the intermediaries. The section summarizes the relevant literature on intermediaries and their roles in SNM and the wider literature of sustainability transition studies. In addition, this section draws from the literature of innovation studies, since according to Kivimaa (2014), the literature on intermediaries is most established in the context of innovation intermediaries (or innovation brokers) (e.g. Howells 2006, Steward & Hyysalo 2008, Klerkx & Leeuwis 2009).

In the context sustainability transition literature, Kivimaa et al. (2017a: 4) define "transition intermediaries" as *"entities that mediate a sector (such as electricity, transport, or agriculture) or a region (such as city or even a country) to move towards new and more sustainable (or socially just) system configurations"*. This definition differs from traditional innovation intermediaries, as they can also

facilitate unsustainable innovation processes (e.g. Howells 2006). In the literature on innovation studies and sustainability transitions, actors conceptualized as intermediaries include a homogenous group ranging including from peer-to-peer-support internet groups, consultants, research institutes to public-sector organizations, but they all share the common denominator of acting as mediators between other users (Besant & Rush 1995, Hyysalo et al. 2013, Fischer & Newig 2016, Kivimaa et al. 2017a, Matschoss & Heiskanen 2017).

Even though all transition intermediaries share the same agenda on a general level, they differ in other ways. Intermediaries are usually created after the emergence of a new socio-technical innovation, but the lifespan of individual intermediaries can be shorter or longer than a particular niche (Geels & Deuten 2006, Kivimaa et al. 2017a). Also, their role can change during the development of socio-technical systems. In general, their emergence and evolution is linked to socio-institutional pressures and technological development. (Kivimaa et al. 2017)

In addition, the act of intermediation can be carried out in a more casual or deliberate manner. Some intermediaries can be even unaware of their intermediation function and some engage in intermediation as a side job, which has led some scholars to demand a more refined definition between "intermediaries" and the wider process of (undeliberate) "intermediation" (Stewart and Hyysalo 2008, Klerkx and Leeuwis 2009, Moss 2009, Hargreaves et al. 2013, Kivimaa et al. 2017a). Still, some "strategic intermediaries" are specifically set up to mediate between different kind social and technological interests in order to produce effective outcomes that would be out of reach in their absence (Hodson & Marvin 2009). Hodson and Marvin (2010) argue that new kinds of (strategic) intermediary organizations should be established in order to create governance structures that support sustainability transition processes, especially in the urban scale. There are also implications that intermediary actors can steer the (energy) transitions of more sparsely populated areas (Matschoss & Heiskanen 2017, Lukkarinen et al. 2018).

Despite the heterogeneity among intermediaries, one common feature usually shared by them is the intention to be viewed as credible and neutral by other actors. As a result, some intermediaries may prefer to be technology-neutral, which might

make it difficult for them to protect or empower a particular niche. (Kivimaa, 2014). However, the neutrality of intermediaries can be seen as a paradox as they often take a more active role in influencing the form of the innovation and information flows between actors (e.g. Laschewski et al. 2002, Kleerx and Leuuwis 2009, Kivimaa 2014, Matschoss & Heiskanen 2017). Still, the activities of intermediaries vary from clear political activism to more reformist and incremental ways of promoting (sustainability) transitions (e.g Hargreaves et al. 2013, Kivimaa, 2014, Kivimaa et al. 2017a). The neutrality or bias of intermediaries can depend on political or financial issues, technological orientation and origin of intermediaries or the role they serve in transition processes (Kivimaa 2014, Kivimaa et al. 2017a). Still, no matter what level of agency intermediaries show, their influence is limited as they cannot fully control how the innovation is designed or eventually used, which essentially sets them apart from other actors (Steward & Hyysalo 2008).

The literature on sustainability transitions has seen intermediaries having potentially an essential role in transition processes (e.g. Geels & Deuten 2006, Hodson & Marvin 2009, Kivimaa et al. 2017a). The activities of intermediary organizations have been seen to have an effect on the economic and technological aspects of innovation and to shape consumer attitudes (Moss 2009, Rohracher 2009, Backhaus 2010, Barnes 2016, Kivimaa et al. 2017a). Also, as intermediary actors are boundary crossing, they may set up networks that shake and rearrange the existing structures (Laschewski et al. 2002, Boon et al. 2011). Kivimaa (2014) has argued that intermediary organizations may have an influential role at least in niche building, but also possibly in regime destabilization (or lock-in). Still, intermediary actors have received little attention in the sustainability transition literature until recently – especially in the context of energy transitions –and their role in experiments is still poorly understood (Kivimaa et al. 2017, Matschoss & Heiskanen 2017).

In the context of SNM, Kivimaa (2014) has created an extensive list including 23 roles on how intermediary organization roles contribute to niche internal nurturing (and some external empowerment) processes. Between experiments, intermediaries' work involves connecting local experiments to one another in order to support the development of a particular niche (Moss 2009, Hargreaves et al.

2013). Since intermediary actors are situated between other actors and individual experiments, they are seen important for niche development as they can observe common problems faced by different projects and use this accumulated knowledge to assist future niche development (Geels & Deuten 2006, Hargreaves et al. 2013). Also according to Matschoss and Heiskanen (2017), intermediaries contribute to experiments by disrupting existing practices through providing alternative ways of action and by helping the experiment to have an effect beyond the local context, for example by removing administrative barriers (also) for similar future activities.

Between the niche and regime, intermediary actors form links by helping to build alliances, bringing in support within the existing (unsustainable) regime and by providing a translating function between actors in the field (e.g. Geels & Deuten 2006, Hargreaves et al. 2013, Kivimaa et al. 2017a) According to Geels and Deuten (2006), regime destabilisation and the development of a global niche does not happen by itself, but requires *"dedicated socio-cognitive work"* by intermediary actors working on different local-global niche levels.

Individual intermediary organizations can participate in different niche-internal and niche-regime interactions and phases of transitions (Kivimaa 2014, Kivimaa et al. 2017a). Kivimaa et al. (2017a) have identified five different intermediary types and their main characteristics are presented in Table 3 below. Kivimaa et al. (2017a) argue that in the context of sustainability transitions, systemic and niche intermediaries play the most important roles and they should be taken into account in innovation governance frameworks.

Table 3. Types of transition intermediaries (modified from Kivimaa et al. 2017a)

Intermediary type	Scale of action	Origin	Agency
Systemic (or strategic) intermediary	Niche, niche-regime, regime	Usually established to intermediate	Pursues a given (sustainability) goal on a system level and aims towards disrupting the existing regime
Regime intermediary	Niche-regime, regime	Pre-existing actor adapts intermediary role/ sometimes established to intermediate	Pursues a given (sustainability) goal usually through more incremental or political aims
Niche (or grassroots) intermediary	Niche, niche-regime	Emerges to intermediate as a niche develops	Pursues a given (sustainability) goal(s) for a particular niche
Process (or project) intermediary	Niche, niche-regime, regime	Established to intermediate	Facilitates interaction between other actors
User intermediary	Niche, niche-regime, regime	Emerges amongst users and consumers	Facilitates, represents, configures or brokers end-use or end-users

In addition to connecting other actors and building bridges between niches and the regime, intermediaries themselves can form dynamic ecologies with each other. These networks can create co-operation but also competition among intermediaries. (Steward & Hyysalo 2008, Hargreaves et al. 2013, Kivimaa et al. 2017a) The ecology of intermediaries modifies the ways how information is exchanged or translated, how learning takes place and how advocacy is created towards a particular niche (Geels & Deuten 2006, Hargreaves et al. 2013, Kivimaa et al. 2017a).

In sum, much like experimentation, intermediation should not be understood as a neutral act nor do intermediary actors as mere facilitators. Intermediary actors make (more or less) conscious decisions which affect transition processes. Intermediary actors might even try to control these processes and they usually have some sort of biases. (Laschewski 2002, Hargreaves et al. 2013, Kivimaa 2014, Kivimaa et al. 2017a). Still, intermediaries cannot fully control the direction of the development and utilization of a particular niche-innovation (Stewart & Hyysalo 2008). Intermediaries can catalyze and stimulate transition processes, but like experiments, they are not the sole force of sustainable regime shifts. However, this does not mean

that intermediaries cannot have a vital role in sustainability transition (e.g. Kivimaa 2014).

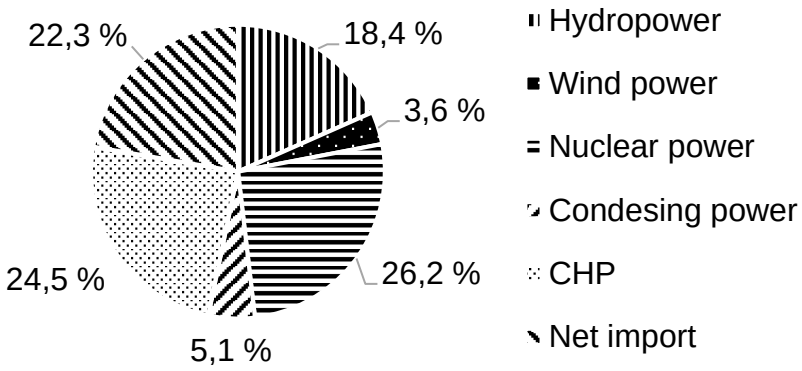
3. Finnish energy regime and HINKU

This section gives a general picture of the Finnish energy regime and scrutinizes prior studies about HINKU, which are also relevant for Välke. Section 3.1 biefly describes Finnish energy policy and production, focusing on electricity production and solar energy as they are the focus of this thesis. Section 3.2 presents relevant prior studies of HINKU with a focus on joint procurements of solar power plants.

3.1 Finnish energy regime and the solar power niche

Finland has followed the same path as other industrialized countries relying on centralized systems in its electricity production (Unruh 2000, Kivimaa & Mickwitz 2011, Ruggiero et al. 2015). During the past decades, the main focus of Finnish energy policy has been to ensure cheap energy for the energy-intensive industries, which has also influenced the centralized structure of Finnish energy production infrastructure (Kivimaa & Mickwitz 2011, Huttunen 2014, Nissilä et al. 2014). The role of novel renewable technologies – particularly solar power – has been and remains low in the Finnish electricity sector, even though their relative amount has increased rapidly during the last decade. In 2016, Finland's electricity production was 85 150 GWh – including 18 951 GWh of net import – of which solar power provided only 18 GWh. (Auvinen et al. 2016, Statistics Finland 2017) The relative amount of different fuels in the Finnish electricity mix is depicted in Figure 1 below.

Figure 1. Percentage distribution of Finland's electricity production by fuel source in 2016 (Statistics Finland 2017)



Finnish energy policy can also be described as centralized since it has been led by a small energy elite and the role of civil society has been rather modest in expert-led policy making (Ruostetsaari 2010, Kivimaa & Mickwitz 2011). Also, prior studies have shown that the Finnish energy intermediary network is not particularly strong. Hodson et al. (2009) have described the energy efficiency intermediary network to be *"somewhat sparse and patchy"* and energy efficiency being mostly promoted on a project basis. In addition, Martiskainen (2014) has discovered a clear lack of active solar energy intermediaries in Finland.

However, especially during the current decade, an increasing amount of studies have shown the possibilities of a low-carbon energy system that is based more on renewable technologies and decentralized production systems in Finland (e.g. Valkila & Saari 2010, Pasonen et al. 2012, Ruggiero et al. 2015, Child & Breyer 2016, Connolly et al. 2016). Solar power is one of the novel sustainable technologies that has been drawing attention in academia. According to a life cycle analysis by Saikku et al. (2017), solar power can lead to an average of 750-800g of CO_2e emission reductions per kWh in Finland.

The official governmental climate and energy strategies anticipate a substantial relative rise in solar power during the following decades, but it's significance in the energy system as whole is expected to stay low, i.e. below one TWh by 2030 and by 2050 0,2-18 TWh (TEM 2014a: 37, 2017: 29). However, recent studies have shown that solar power development in Finland has many alternative pathways (Haukkala 2015, Ruggiero et al. 2015, Varho et al. 2016) and its role in the energy

mix could be much larger (Pasonen et al. 2012, Child and Breyer 2016). Haukkala (2015) has observed vested interest and a lack of political will towards solar power development in Finland. Currently, the policy support for solar in Finland is low compared to other European Union countries and investments are complicated by scattered policy frameworks (Haukkala, 2015, Auvinen et al. 2016). However, there is a growing interest towards solar in Finland, even partially among the energy elite (Haukkala 2015, Ruostetsaari 2017). According to Saikku et al. (2017), the development of storage technologies and load shifting is essential for the diffusion of solar power in Finland in the long run.

In Finland, the first solar power experiments were initiated already in the 1980s and despite occasional negative outcomes and non-linearities in the technological trajectory of Finnish solar power, experiments have paved way for niche development during the past decades (Heiskanen et al. 2015a). During the beginning of the current decade, joint procurement experiments became one of the main ways of purchasing solar power systems in Finland. Ten cases of joint procurement[4] studied by Saikku et al. (2017) covered 40% of all installed on-grid solar power in Finland during 2012-2014 and have therefore had a clear impact for solar power development and diffusion in the country.

One of the most important factors of joint procurements is their economy of scale that lowers the price of individual systems and makes solar power a more economically viable investment in Finland. (Ruggiero et al. 2015, Saikku et al. 2017). In addition, according to Saikku et al. (2017) joint procurements provide essential peer-support in purchasing a niche technology and a push-factor for unsure participants. As for the actors involved, the role of the coordinator of the joint procurement is seen as vital for the experiment. Still, many factors such as economic issues, lack of information, practical issues and regulation (e.g. electricity transfer fees of small-scale production) create a barrier for joint procurements of solar power plants (Saikku et al. 2017).

[4] Two of the studied cases were related to HINKU.

3.2 HINKU

HINKU is a sustainability experiment established in 2008. According to the description of HINKU, it *"brings municipalities, businesses, citizens and experts together to create and carry out solutions to reduce greenhouse gas emissions"*. The experiment aims to cut the emissions of the participating municipalities by 80 percent by 2030 in relation to 2007. (SYKE, 2013) Initially, HINKU started with 5 small participating municipalities, but in August 2017 it encompassed 36 small- and medium-sized municipalities (Antikainen et al. 2017, HINKU-foorumi 2017a). Like many other local climate initiatives, HINKU aims to implement several low-carbon technologies and other ways of reducing GHG emissions instead of nurturing just one specific niche-innovation (Quitzau et al. 2012, Matschoss & Heiskanen 2017). HINKU is coordinated by SYKE and its partner organizations are the Association of Local and Regional Authorities, Motiva Ltd, Sitra, Tekes, The Ministry of Agruculture and Forestry, The Ministry of the Environment, The Ministry of Employment and the Economy and other partners. The HINKU organization is financed by The Ministry of the Environment, The Ministry of Employment and Economy, Tekes, Sitra, and companies. (SYKE 2013).

An important characteristic of HINKU and its sub-projects, like Välke and PK-HINKU[5], is that they are initiated and coordinated by SYKE and its partner organizations, but their activities are carried out by involving municipalities and local residents and businesses in low-carbon experiments (Heiskanen et al. 2015b, Antikainen et al. 2017). Since participation is optional, Heiskanen et al. (2015b) see local actors as participants, not subjects, in HINKU. Municipalities can join the network free of charge by committing to an energy efficiency agreement, but individual experiments can require investments to be paid by the participants themselves (Heiskanen et al. 2015b, Lukkarinen et al. 2018). Hence, in the context of experiments in HINKU, SYKE and its partner organizations can be conceptualized as strategic intermediaries (Hodson and Marvin 2009).

[5] An experiment called Towards oil-free and low-carbon North Karelia (SYKE 2016).

The individual experiments in HINKU share common characteristics. Heiskanen et al. (2015b) see HINKU as focusing on diffusing well-established technological solutions with win-win outcomes, rather than promoting radical niche-innovations[6]. Kivimaa et al. (2017b) see the general experimenting in HINKU close to piloting or prototyping ideas in order to develop practices. HINKU has also adopted operating models from other projects and modified them to match the local needs in its municipalities (Matschoss & Heiskanen 2017). Heiskanen et al. (2015b) noted that HINKU municipalities, their residents and companies participated mostly in "reasonable" experimentation, i.e. made investments that were guaranteed to pay off and proceeded with projects that were sure to succeed.

Despite the somewhat moderate nature of experimentation, HINKU still seems to have some sort of influence on the regime-level in Finland (Heiskanen et al. 2015b, Antikainen et al. 2017, Lukkarinen et al. 2018). In addition to successful experiments, Antikainen et al. (2017) see HINKUs influence stemming from ambitious and well-articulated goals and reported successes that attract new (influential) actors to the network. According to Kivimaa et al. (2017b), HINKUs influence on the wider regime is dependent on the successful duplication of experiments and "iconic examples" that can be utilized in policy development.

The lessons gained in the experiments of HINKU are shared on websites and workshops and also through "intensive informal lessons-sharing" in the network (Antikainen et al. 2017, Heiskanen et al. 2017). According to Heiskanen et al. (2017), the experiments of HINKU produce multiple types of learning (e.g. social knowledge production and reshaping actor roles), creating forms of sharing and transferring lessons (e.g. study visits and exemplary cases) and identifying missing competences (e.g. integrating new practices in public administration). These characteristics mostly apply to the joint procurement experiments that are dealt with in more detail later in this section. In addition, Lukkarinen et al. (2018) see that the experiments of HINKU stimulate entrepreneurial experimentation, market

[6] The study by Heiskanen et al. (2015b) covered only the first 3 ½ years of the HINKU-project (2008-2012). As Heiskanen et al. acknowledge, things may change as the projects develop. However, my argument is that this conclusion is still relevant, at least in the context of this Master's Thesis viewpoint. This topic is further discussed in sections 6, 7 and 8.

formation and resource mobilization and also provide legitimation and develop positive externalities particularly for the cleantech sector.

Very recently, the joint procurement of solar power plants in HINKU hasreceived interest from the academia. Matschoss and Heiskanen (2017) have even called it the "flagship" experiment of HINKU. However, the original idea was adopted from a civil society based joint procurement project with a do-it-yourself focus. In HINKU, the concept was modified into a more suitable form for non-technologist citizens, companies and municipalities by offering turnkey solutions of solar power plants (Matschoss & Heiskanen 2017). Heiskanen et al. (2017) have seen the limited required infrastructure essential for the broadening of the experiments. By March 2017, there had been in total 9 solar power plant joint procurement experiments in HINKU, which are presented in table 4 below.

Table 4. Joint procurements of solar power plants in HINKU and its sub-projects (modified from Seppälä 2017[7])

Joint procurement of PVs	Time	Organizing partners of SYKE	Customers	Combined power
A. Joint procurement of municipalities and private households	2013-2014	Municipalities of Mynämäki and Masku, Mynämäki region small residential building union ltd and MTK of Finland Proper	4 municipalities ja approximately 30 private households	over 150 Kwp
B. Joint procurement of II's municipality	2014-2015	Iilaakso ltd	Municipality of II and 6 private households	31 kWp
C. Leasing joint procurement of municipalities	2014-2015	Municipalities of Padasjoki, Asikkala, Laitila and Mynämäki	4 municipalities	60 kWp
D. First joint procurement of VÄLKE project/ South-Western Päijänne	2015-2016	Municipality of Asikkala	34 private households	130 kWp

[7] This list is adopted from a case study report written by the author. It was based on numerous secondary sources (such as Saikku et al. 2017 and news from the HINKU-foorumi) and emails and discussions with relevant informants. Before publishing, its correctness was checked with the employees of SYKE working in HINKU.

E. Second joint procurement of VÄLKE project/ South-Western Päijänne	2016	Municipality of Asikkala	Municipality of Asikkala and 2 companies	150 kWp
F. Third joint procurement of VÄLKE project / West-Uusimaa	2016	Novago ltd	4 companies ja 15 private households	78 kWp
G. Joint procurement of PK-HINKU project*	2016-2017	Provincial federation of North Karelia	Mostly private households, but also companies ja organizations	?
H. Nationwide joint procurement*	2016-2020	KL Kuntahankinnat ltd	40 municipalities, federation of municipalities, congregation or publicly owned companies	1 MWp (2017)**
J. Joint procurement for private households*	2017	Valonia and Mynämäki region small residential building union ltd	Private households	?

** The joint procurement was still under implementation during the time of the writing (21th of March, 2017) ** The procurement is still growing. At the point of 82 PV systems, the total power of the procurement was 1,2 MWp*

The joint procurement experiments of HINKU have been able to grow solar capacity and diffuse solar technology to novel locations in Finland, especially in HINKU municipalities (HINKU-foorumi 2016g, Tenhunen et al. 2016, Saikku et al. 2017, Seppälä 2017). In addition, scholars have seen the joint procurements as important in accelerating the Finnish solar power markets and stimulating them qualitatively, through increasing the supply of turnkey solutions (Lovio 2017, Matschoss & Heiskanen 2017). Also, the media attention gained by the joint procurements[8] has provided room for Finnish solar activist to influence the wider regime e.g. by presenting their views on desirable policy measures (Saikku et al. 2017). The experiments have also been taken into account in official government documents (e.g. TEM 2014b: 73-74).

With regards to intermediaries, Antikainen et al. (2017) make an interesting observation about experimentation in Finland. One success factor for broadening and in some cases upscaling experiments was the involvement of a public actor in varying roles, for example as coordinators (i.e. intermediaries). According to

[8] Including other procurements than exclusively the ones conducted as a part of HINKU

Antikainen et al, especially in Finland vertical relationships to public actors are important for experiments, since sustainability goals have been traditionally pursued by government-led top-down policies. Lukkarinen et al. (2018) see the activities of intermediaries in HINKU as complementing national policies by driving experimentation and mobilizing human resources in the member municipalities, but also by creating markets and references for domestic cleantech companies. However, this process requires the commitment of the participants. Also, Lukkarinen et al. discuss the activities of intermediaries as challenging weaker national policies. With a special focus on the joint procurement experiment, Matschoss and Heiskanen (2017) argue in their study that the intermediaries of HINKU contribute to disrupting existing practices through empowering consumers by pooling the demand of several buyers. In addition, Matschoss and Heiskanen argue that HINKU has been able to stimulate solar markets in Finland especially through co-operation with other intermediaries.

In sum, HINKU is a well-established sustainability experiment in Finland that has been able to grow and have an effect on the Finnish regime to a degree. Especially in the context of Finland, solar capacity growth in HINKU has been significant because of experiments organized by intermediary organizations (HINKU-foorumi 2016g, Matschoss & Heiskanen 2017, Saikku et al. 2017). This makes it an excellent case for studying the roles of public intermediary organizations in experiments and thus in wider sustainability transitions processes.

Previously, intermediation in HINKU and the joint procurement experiments of solar power plants have been studied by Lukkarinen et al. (2018) Matschoss and Heiskanen (2017), Heiskanen et al. (2017), and Saikku et al. (2017). However, this thesis provides a different viewpoint on intermediation in the experiments, especially by focusing on the interaction of different intermediaries involved. Thus, this thesis contributes to the understanding of intermediary actors in HINKU and in general in sustainability transitions. Also, to my knowledge this is the first detailed case study of the joint procurement of solar power plants in HINKU, excluding my own case study report (Seppälä, 2017), which was written based on the research material of this thesis.

4. Analytical framework

This section presents the analytical framework of this thesis. My aim is to analyze the roles of intermediaries in sustainability experiments, particularly in the field of energy. However, the research questions of this thesis are not simple to answer in a straightforward manner. Therefore, in order to address them, I am utilizing an analytical framework from a previous study.

The analytical framework of this thesis is adopted from Hargreaves et al. (2013), who suggest four roles for intermediaries in sustainability experiments. The framework was chosen because it provides analytical tools to address the research questions of this thesis. In addition, Hargreaves et al. applied the framework in an empirical setting that differs vastly from the one in this thesis. This provides a possibility to compare how the roles are carried out in different contexts. According to my knowledge, this is the first time the framework is used in another study.

In short, Hargreaves et al. focused on intermediation the field of community energy[9] in the UK. The projects studied by Hargreaves et al. varied in their focus (renewable energy production, energy efficiency, and behavioral change), utilized technologies (wind and solar energy, etc.) and goals (carbon reduction, community development, overcoming fuel poverty, general sustainability) as well as in their plans to diffuse and grow. Contrarily, the joint procurement of Välke concentrated on one particular technology and the experiment as a whole involved clear top-down appointed goals. More specific differences are further highlighted in the results.

Building partly on Geels and Deuten (2006), the four roles suggested by Hargreaves et al. are:

[9] In short, community energy can be described as grassroots (renewable) energy projects that emerge from the civil society. Community energy projects are inclusive and local citizens have (collectively) some ownership of the means of production which are physically near their homes. (Walker & Devine-Wright 2008)

1. Aggregating lessons from individual local experiments[10]

According to Hargreaves et al., intermediaries are involved in multiple local experiments giving them an exceptional situation to *''compare experiences in different locations, reflect on differences and draw general conclusions''* (Geels & Deuten 2006: 267). This enables intermediary actors to transform lessons from local experiments to context-free knowledge and circulate them across different local experiments and the global niche.

2. Establishing institutional infrastructure for local experiments

The concept of institutional infrastructure is understood as a repository and a forum for storing, exchanging and circulatingpreviously aggregated knowledge. In practice, this can mean conferences, seminars, workshops, technical journals, proceedings and such. This institutional infrastructure makes possible *"the gathering and interaction of actors, the exchange of experiences and the organization of collective action"* (Hargreaves et al. 2013: 870)

3. Framing and coordinating action on ground

The third role can be seen as a reversal role of the first two. First, lessons are aggregated from individual local experiments and made sufficiently context-free and stored in the established institutional infrastructure. Second, these lessons are used to coordinate and frame local experiments by providing *"advice, guidelines or even templates for how subsequent local projects should develop"* (Hargreaves et al. 2013: 870). Furthermore, Hargreaves et al. argued that in addition to transferring knowledge, intermediaries have an important role in building confidence and the capabilities of local experiments.

4. Brokering and managing partnership

The last role of intermediary actors is to broker and manage partnerships between local experiments and other actors. In more detail, this means for example linking actors to one another, helping to overcome distrust between actors and drawing up

[10] Instead of the word "experiments", Hargreaves et al. use "project". As Hargreaves et al. used SNM as a theoretical framework, these projects can be understood as experiments.

the terms of co-operation or business. In addition, Hargreaves et al. also see intermediaries having a potentially important role in lobbying policy makers to promote hoped-for policy development for the niche. However, this seemed to be difficult to achieve.

5. Materials and methods

This section presents the materials and methods used in this thesis. Section 5.1 discusses the case study research method in general, whereas section 5.2 presents the research material of this thesis and describes its collection process. The characteristics applied to the data collection and analysis methods are described in the sections 5.3 and 5.4. Before presenting the results in section 6, a description of the case is provided in section 5.5

In addition to presenting the material and methods of this thesis, their validity and reliability are discussed in this section. According to Miller (2008a), validity in qualitative research is in general understood as the "goodness" and "soundness" of the study. Validity can be broadly seen to describe the degree to which the study measures what it should measure and whether the interpretations made are identified and described carefully enough (Miller 2008a). The meaning of reliability is in general viewed as the dependency, replicability and consistency of data collection and analysis, i.e. avoiding the haphazard subjectivity in research (Miller 2008b). Three commonly cited criteria for reliability in qualitative research are methodological coherence (appropriate and thorough data collection, analysis and interpretation), researcher responsiveness (co-operation and verification processes with fellow researchers) and audit trails (transparency and exhaustive documentation of the process of the study). In other words, this section also provides a critical look to the limitations of the methods and findings of this thesis.

5.1 Case study as a research method

Since empirically I concentrate on one particular joint procurement of solar power plants, this thesis is essentially an application of the case study research method. The case study research method has no common design: the method encompasses many data collection and qualitative and quantitative analysis methods, but the common nominator is its focus on one or more technically distinctive events (Saaranen-Kauppinen & Puusniekka 2006, Blatter 2008, Yin 2014). Despite this limited focus, a case study does not represent a "sample" (Yin 2014: 21). According to Yin (2014: 21) the aim of a case study is "*to expand and generalize theories (analytical generalizations) and not to extrapolate probabilities (statistical generalization*s)". In this thesis, the aim is focused on the roles of intermediaries in experiments and wider sustainability transitions.

According to Yin (2014: 14) a case study approach is in order when the researcher asks a "how" or "why" question about a contemporary phenomenon that the researcher has almost none or no control over. In more detail, Yin (2014: 16-17) defines case studies as a research method through its scope and features. As for the scope, Yin sees case studies as an empirical inquiry that focuses on a contemporary set of events, i.e. "the case", in-depth and within its real-world context. In case studies, the phenomenon under study and its context may not be clearly separated. As for the features of a case study, Yin defines it as an inquiry focusing on a technically distinctive phenomenon that includes many variables of interests. Therefore, Yin defines case studies needing to utilize data from multiple sources, in other words triangulation (see section 5.2), and as a result benefiting from prior development of theoretical propositions that can be used in designing data collection and analysis. In short, case study research covers the logic of the design of the study, data collection techniques and ways to analyze the data. (Yin 2014: 17)

This Master's Thesis can be defined as a revelatory single-case study. According to Yin (2014: 53), a revelatory single case study is in order when a researcher has the opportunity to observe and analyze *"a phenomenon previously inaccessible to*

social scientific inquiry". I chose to study joint procurements of solar power plants in HINKU, since they seemed to be a viable case for studying intermediary organizations, which had successfully enhanced the diffusion of solar energy in Finland. Therefore, these intermediaries were contributing to an energy transition, as understood in the TRIPOD research consortium. As the single joint procurement of Välke is one of many joint procurements of HINKU (see table 4), I could have also conducted a multi-case study involving two or more cases. The reason for focusing on a single joint procurement as the unit of the study was mostly pragmatic: a multi-case study approach would have required an excessive amount of work for just one researcher, especially for a Master's Thesis. Also, a revelatory case study provides a more detailed inquiry of (intermediation in[11]) joint procurements of solar power plants in HINKU, which have been previously studied by Lukkarinen et al. (2018), Matschoss and Heiskanen (2017), Heiskanen et al. (2017) and Saikku et al. (2017). This complementary aspect of this thesis is more a coincidence then a planned choice, since I found about these prior studies through the TRIPOD research consortium when they were still in press or being planned and/or written.

While conducting case studies, the researcher has to take into account the requirements of validity and reliability of the method (Yin 2014: 45-49). When considering the validity of the case study of this thesis, the findings are linked to the empirical context and therefore make possible only analytical generalization, not statistical generalization as described earlier in this section. The events of the case were described in the case study report that I wrote for the SET project (Seppälä 2017). The report was read and approved by the involved intermediaries and the representative of the contractor firm (see section 5.2) which can be seen to bring credibility for the validity of the analysis. As for the reliability, the data collection and analysis process has been described in detail in sections 5.2 – 5.4.

[11] All of the studies did not focus on intermediation, at least explicitly.

5.2 Research material and data collection

This section presents the research material used in this Master's Thesis and describes the process of data collection. The data of this thesis contains both primary material collected via semi-structured interviews with the different stakeholders and material from secondary sources. Therefore, this thesis uses triangulation, i.e. a multimethod approach, to data collection (Rothbauer 2008, Yin 2014: 17). By using multiple data sources in qualitative research, researchers are able to explore phenomena under study from different perspectives and in multiple contexts and therefore increase the credibility of the findings and their interpretations. However, some scholars have criticized triangulation for emphasizing positivist notions of reliability and validity to excess. (Rothbauer 2008)

In qualitative research, primary material can be described as research material collected by the author her- or himself (Silvast 2014: 36). The primary material of this thesis includes 9 semi-structured interviews with 11 people conducted during January and February 2017. The interviewed stakeholders were:

- 1 interview with intermediaries of Välke employed by the municipality of Asikkala, 2 persons interviewed at the same time (length 33 minutes). Interview identifiers A1-2
- 3 interviews with intermediaries of SYKE[12] working in HINKU network (length 22-45 minutes). Interview identifiers S1-3.
- 4 interviews with participating households, 1 interview included 2 persons of the same household (length 20-59 minutes). Interview identifiers HH1-5.
- 1 interview with a representative of the contractor firm (length 32 minutes). Interview identifier F.

All of the interviews were conducted in Finnish and face-to-face in person, with the exception of one household interview, which was done via a Skype call. The interviews were also all transcribed in Finnish, by including all but expletives and

[12] 2 of the interviews with intermediaries of SYKE focused on the joint procurement of the case study. One interview dealt with joint procurement of solar power plants in HINKU in general.

utterances. I translated the quotes presented in section 6 from Finnish to English. The supervisors of this thesis saw the quotes also in Finnish and gave their opinion about the correctness of the translations. All of the interviews dealt with the same five themes, but the exact questions were modified to match the role of the stakeholders. The themes were: (1) background questions, (2) knowledge gathering and learning during experimentation, (3) co-operation between stakeholders, (4) documentation and dissemination of the lessons learned and (5) broadening and scaling up joint procurements.

The data was gathered in order to be used as material both for this Master's Thesis and the case study of the SET project. Both studies had similar aims, but they still had their differences (see Seppälä 2017: 1-2 for SET). The SET project provided a ready set of questions that were for the most part also relevant for this thesis. However, the set of questions was modified to better fit the scope of the research questions of this thesis. The secondary material (see below in this section) was used to modify the questions to fit better the context of the studied case. Before the actual interviews, the question set was tested with a PhD student at the University of Helsinki who is working on energy issues from a social scientific viewpoint. The test revealed some problems in the question sets, which were modified with the help of the supervisor of this thesis Paula Kivimaa and also Eeva Primmer from SYKE. The set of questions for each stakeholder group is presented in Appendix 1.

The interviewed stakeholders were identified through project documents and snowball sampling. Snowball sampling means using initially a few informants that are requested to nominate other relevant informants to be interviewed about the phenomenon under study (Morgan 2008). The person in charge of Välke in SYKE was identified from the project information sheet and was asked to name relevant intermediaries from SYKE and the municipality of Asikkala for the interviews. Some of the named intermediaries had already been identified through news and websites. In addition, the energy expert of Välke in the municipality of Asikkala provided essential help in finding members of households and the contractor firm for interviews. Since the list of the participating households was not public, the energy expert of Välke relayed a request for interviews to a closed email-list of

participating households. This request led to 4 contacts and interviews. In addition, the energy expert of Välke provided the contact information of the contractor firm.

In addition to the primary material of the semi-structured interviews, the data used in this Master's Thesis includes secondary material. In qualitative research, secondary material is research material that is collected by someone else than the researcher her- or himself, such as documents of organization and news articles. (Silvast, 2014: 36) The secondary material of this thesis was gathered from the websites of HINKU and Välke and two other HINKU related sites, HINKUmappi and cleantech Hankintamappi, during December 2016 - August 2017. From these websites, news articles and case descriptions were collected that dealt with joint procurements of solar power plants. The secondary material dealt with the particular joint procurement of Välke, but also with other joint procurements related to HINKU. Also, the interviewed intermediary actors handed over material that they considered to be relevant for this thesis. All of the secondary material were in Finnish with the exception of one document provided by an intermediary actor. Therefore, I have translated most of the quotes from the secondary material presented in section 6. The secondary material includes:

- 14 news articles from the HINKU website, HINKU-foorumi. (HINKU-foorumi 2013, 2014a, 2014b, 2015, 2016a, 2016b, 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2017b, 2017a)
- 7 web-pages from the Monistamo-toolkit from HINKU-foorumi (Monistamo 2017a, 2017b, 2017c 2017d, 2017e, 2017f). The websites also included:
    - Information letter for potential participants written by the energy expert of Välke from the municipality of Asikkala. Available through Monistamo 2017c (Information letter 2016).
    - Video of the information event of a joint procurement. Available through Monistamo 2017d (Video 2016).
    - The program of the information event. Available through Monistamo 2017d (Program of the information event 2016).
    - Summary of the event for potential participants. Available through Monistamo 2017d (Summary letter 2016).

    - 4 Powerpoint presentations from the event. Available through Monistamo 2017d (Linjama 2016, Naps 2016, Rajala 2016, Viander 2016).
    - Order form and its filling instructions for participants by the energy expert of Välke from the municipality of Asikkala. Available through Monistamo 2017e (Order form 2016, Instructions 2016).
    - Invitation to tender for firms. Available through Monistamo 2017f (Invitation to tender 2016).
- 1 news article from the website of the municipality of Asikkala (Municipality of Asikkala 2016).
- 4 cases of HINKU-related joint procurements of PV systems from Cleantech Hankintamappi website (Hankintamappi 2013, 2015, 2016a, 2016b). The websites also included:
    - 1 document describing the process of one joint procurement. Available through Hankintamappi, 2015 (Process description 2015).
- 2 Covering letters sent to the households involved in the procurement (Covering letter 2016a, 2016b).
- Documentation of the progress of the joint procurement by the energy expert of Välke from the municipality of Asikkala (Documentation 2016).
- 9 feedback forms from participants of the joint procurements[13]. Indentifiers FB1-9.
- Project description of Välke (SYKE 2015)
- Project description of HINKU (SYKE 2013)
- Conference paper about Välke (Tenhunen et al. 2016)
- 3 articles from technical journals (Tainio 2014, 2016, Järvinen 2014)

[13] I acknowledge that the respondents of the feedback forms can potentially be partially the same households that were interviewed for this thesis.

5.3 Semi-structured interviews

This section deals with the primary data collection method used in this thesis, semi-structured interviews. As an interview method, semi-structured interviews are situated between structured and in-depth interviews. Structured interviews follow a relatively standardized set of interview questions, whereas in-depth interviews only define the topic which is discussed (Hirsijärvi & Hurme 2009: 43-47, Tuomi & Sarajärvi 2009: 74-77). Contrary to prior two, semi-structured interviews proceed according to previously determined themes and possible following specifying questions that can vary between different informants (Hirsijärvi & Hurme 2009: 47-48; Tuomi & Sarajärvi 2009: 75). According to Hirsijärvi and Hurme (2009: 60) there is no uniform way of conducting semi-structured interviews, but the focus of the interview is always pre-set to a degree. Ayer (2008) sees that semi-structured interviews are useful especially when concepts and relationships of the phenomenon are relatively well understood in relation to the research questions. The aim of semi-structured interviews is to acquire meaningful answers about the phenomenon under study (Tuomi & Sarajärvi 2009: 75).

I chose semi-structured interviews as a data-collection method for this thesis because of the flexibility of the method. Before the interviews, I had familiarized myself with the secondary material available and the theoretical concepts and prior studies. Also, I did not want to restrict the path of the interview if something unexpected and meaningful would surface during them. In addition, face-to-face semi-structured interviews enabled me to rectify misunderstandings and clear the wordings of the question, which indeed was in order during some of the interviews (Tuomi & Sarajärvi 2009: 73). Also as suggested by Tuomi & Sarajärvi (2009: 73), the themes of the interviews were told to the informants in advance. Two of the interviews can be defined as group interviews, as they included two persons. Group interviews differ from individual interviews, as they bring out the interaction and power structures between the informants (Hirsijärvi & Hurme 2009: 60). This was taken into consideration by explicitly giving each informant a turn to speak, if it was seen as necessary.

Interview data is usually seen to be sufficient when saturation happens, i.e. new informants do not provide any new essential information for the topic (Hirsijärvi & Hurme 2009: 60). I felt saturation was observable among interviewed intermediaries and there was only one firm to talk to. However, among participating households, I felt I could have conducted two or so more interviews, since somewhat different kinds of answers rose from the interviews. However, only four households offered to be interviewed. This lack of informants was complemented through secondary data, especially the feedback forms from participants. Still it is acknowledged as a weakness of the thesis

5.4 Qualitative content analysis

The research material of this thesis was analyzed using qualitative content analysis. As an analytical method, qualitative content analysis is used to handle a wide range of textual data (including documents, interview transcripts, photographs etc.) and deriving meaning from it. By using qualitative content analysis, researchers can reduce large bodies of text and make sense of it. (Julien 2008, Silvast 2014)

The aim of a qualitative content analysis is to identify and appoint new phenomenon and meanings or new viewpoints and ideas from an already familiar phenomenon. The profound idea is to understand deeply the phenomenon under study. (Silvast 2014: 37) In qualitative content analysis, textual data is categorized into homogeneous clusters, i.e. codes, or conceptual categories in order to observe consistent patterns and relationships between variables or themes. Coding, i.e. reducing the research material into similar entities of text that form wider themes. Coding is an iterative process which demands profound familiarization with the research material. Qualitative content analysis requires multiple rounds of analysis which was also done in the case of this thesis using the Atlas.ti program. As an analytical tool, content analysis is useful to identify both content that is explicitly expressed, but also that which is revealed in a more implicit manner, i.e. implied or related to the context of the text. (Julien 2008, Silvast 2014).

Qualitative content analysis can be carried out in an inductive, deductive or abductive manner. In inductive content analysis, the coding process is performed without prior links or presumption concerning a specific theoretical framework. Contrary in deductive content analysis, the data is coded based on a pre-existing set of codes that have been derived, i.e. operationalized, from a specific theoretical framework. However, in this Master's Thesis qualitative content analysis was done in an abductive manner. (Silvast, 2014) According to Silvast (2014: 43), abductive content analysis can be understood as the combination of deductive and inductive content analysis. In abductive content analysis, the coding process is based on codes operationalized from the previous literature, but the analysis is not as restricted as in deductive content analysis. In abductive content analysis, new codes and themes can be created during the process, if relevant new issues for the studied phenomenon emerge from the data. In this Master's Thesis, the themes were derived from the analytical framework presented in section 4. However, as the analysis was conducted in an abductive manner, there was still room left for the material to "speak" regardless of the derived codes. The coding tree of this thesis is presented in Appendix 2.

Qualitative content analysis is always an interpretive process that allows subjective interpretation and is context dependent (Julien 2008). The trustworthiness of qualitative content analysis can be increased by using multiple researchers in coding and seeking agreement between them (Julien 2008, Silvast 2014). However, this was not possible in this Master's Thesis and it is recognized as a lack in the reliability of the study. However, the robustness of the interpretations were increased by triangulation in data collection. In addition, the manuscript was commented on by the supervisors and refined based on the received comments.

5.5 Description of the study case

Before presenting the results in section 6, this section provides a general description of the case under study and also the larger scope of Välke and its link to HINKU.

The description is provided in order for the readers to better understand the context of the empirical findings. The case description is largely based on the case study report of the joint procurement that I wrote as a part of the SET project (Seppälä 2017).

Välke was implemented during April 2015- July 2017. The description of Välke states that it *"aims at creating an on-going process that will help guide Finland towards a carbon neutral society."* In practice, Välke pursued to implement climate-friendly and clean technological solutions in municipalities and private companies. The aim was to create new solutions, methods and approaches which were to be disseminated further. In addition, the project aimed to assess the challenges and barriers related to the developed solutions and practices. (SYKE 2015)

As stated before, Välke is a sub-project of HINKU and the link between the two projects was clearly articulated. The description of Välke states that *"the Välke project builds on the knowledge, experiences and networks of The Carbon Neutral Municipalities project (HINKU)"* and *"the results and outputs of the Välke project will be implemented and further developed in the HINKU project"*. However, Välke and HINKU were separate projects from an administrative perspective. Välke was funded by the European Regional Development Fund (ERDF), Helsinki-Uusimaa Regional Council, Regional Council of Päijät-Häme, Regional Council of Central Finland, the Finnish Environment Institute and the participating municipalities. Also, the partner organizations differ, as in Välke they were small and medium-sized enterprises (SMEs), the property owners of the region, Motiva and Novago Ltd (in Western Uusimaa). Also, Välke was not addressing civil society as much as HINKU. Still, both of the projects were coordinated by SYKE and employed partially the same people from the institute. (SYKE 2013, 2015)

Geographically, Välke was carried out in two separate locations: (1) in South-Western Päijänne, focusing on the municipalities of Asikkala, Padasjoki and Kuhmoinen and (2) in Western Uusimaa focusing the municipalities of Lohja, Raasepori, Hanko, Siuntio and Inkoo. In both of the locations, Välke had assigned employees who in South-Western Päijänne worked for the municipality of

Asikkala. Välke included three different work packages: 1) Low-carbon business models for enterprises, 2) Energy efficiency and cleantech solutions for properties in municipalities, and 3) Collective procurement (i.e. joint procurements) of clean technology by small and medium sized enterprises and municipalities. (SYKE 2015) All municipalities involved are also members of HINKU (HINKU-foorumi 2017a). Also, the focus municipalities of this thesis in South-Western Päijänne are small as their population ranged from Asikkala's 8328 to Kuhmoinen's 2286 habitats in the beginning of 2017 (Kuntaliitto 2017).

The joint procurement of solar power plants that I examine in this thesis is only one of many activities related to Välke. In the bigger picture of both HINKU and Välke, the joint procurement of solar power plants has been a part of a larger entity of experiments. For example, the activities of Välke included studying and analyzing approximately 120 small and medium sized enterprises and 150 properties in order to support the reduction of their GHG emissions (SYKE 2015).

During Välke, there were in total three different joint procurements of solar power plants (Table 4, joint procurements D, E, F). In addition, the nationwide joint procurement of HINKU (Table 4, joint procurement H) linked to Välke, as it was partially funded through the project. However, the case study of this thesis focuses only on the first joint procurement of Välke in South-Western Päijänne (Table 4, joint procurement D). The procurement was initiated by the employees of Välke in the municipality of Asikkala and coordinated by it, with the assistance of SYKE. However, neither of the organizations was a contracting party in any purchases and they only facilitated interaction between retailers and end-users. (Seppälä 2017) Hence, when taking in consideration the general aim of Välke, the municipality of Asikkala and Syke can be unambiguously conceptualized as strategic intermediary organizations in the experiment.

As a whole, the implementation of the joint procurement under study took approximately a year: the planning started in the autumn of 2015 and the last solar panels were installed in autumn of 2016. The joint procurement was aimed only at private households. The experiment received a lot of interest and there were at best 200 households interested in buying solar power plants through the joint

procurement. Eventually, the experiment brought 34 new solar power plants in the municipalities of Asikkala (20), Padasjoki (6), Kuhmoinen (6), Hollola (1) and Orimattila (1). Hollola and Orimattila were not among the focus municipalities of Välke in South-Western Päijänne, but the coordinators of the joint procurement allowed their residents to participate as well. (Seppälä 2017)

Initially, the intermediary actors gave the households an option to order 2,5 kW, 4,5 kW or a 9 kW system that would be provided as turnkey solutions through the joint procurement. However, during the bilateral negotiations between the contractor firm and the households many participants modified the size of their system. Eventually, the average size of solar power plants purchased through the joint procurement was 4 kW, with sizes varying between 2,5 – 9 kW. The combined power of the procurement was 130 kWp. (Seppälä 2017) The solar power plants purchased through the joint procurements produce approximately 108 000 kWh electricity per year, leading to 22 700 kg of avoided carbon dioxide emissions annually (Hankintamappi 2017c).

The joint procurement grew the relative amount of solar energy in South-Western Päijänne. According to a survey conducted by SYKE, prior to the joint procurement there were only 8 on-grid solar power plants in the municipalities of Asikkala, Padasjoki and Kuhmoinen combined. Based on the survey, five of these solar power plants were acquired through previous joint procurements. (Tenhunen et al. 2016) The biggest relative growth of solar panels was experienced in Kuhmoinen, where according to SYKE there were no on-grid solar plants before joint procurement. In all of the participating Välke municipalities, the relative growth of on-grid solar power was significant, as it quintupled the amount of on-grid solar power plants in the area. (HINKU-foorumi 2016g) The effect on the situation Hollola and Orimattila cannot be assessed here, because of lack of data.

6. Results

This section presents the results of this thesis. The findings are grouped under the intermediary roles presented in section 4. In addition to the four roles proposed by the framework, the findings suggest a fifth role that did not fit unambiguously under the other roles. I call this role "broadening experiments" and it is presented in section 6.5. The summary of the results is presented in section 6.6.

6.1. Aggregating lessons from individual experiments

The first role suggested for intermediary actors is the aggregation of lessons from local experiments. In this process, local lessons are scrutinized and modified to context-free knowledge that circulated between experiments (Deuten 2006, Hargreaves et al. 2013). According to Hargreaves et al., in the UK community energy sector the aggregation of the lessons was usually done by producing 2-3 page long case studies about projects (113 in total) that contained key facts and learned lessons. Later on, intermediaries had started to produce how-to guides about projects that emphasized detailed processes and challenges involved in the projects.

Even though as an experiment, joint procurement of solar power plants in HINKU differs largely from those of the UK community energy sector, there are clear similarities in the measures taken by intermediaries in the aggregation of the lessons learned. In this section, the case study of Välke is examined as a part of the whole scheme of joint procurements in HINKU. This is done because the aggregation of lessons in Välke is fundamentally linked to other joint procurements in HINKU, as will be shown later in the results section. Based on the research material, the aggregation of lessons of joint procurement experiments in HINKU can be examined through four separate processes: production of (1) case studies and (2) how-to guides, (3) archiving and circulating documents from previous joint procurements and (4) aggregation of tacit knowledge.

Like in the UK community energy sector, intermediaries in HINKU had produced (1) case studies of four joint procurements[14] (Hankintamappi 2013, 2015, 2016a, 2016b). The case studies are all approximately 2 pages long and they include key facts of the procurements and lessons learned. The information of the case studies are grouped under four topics: "general information of the procurement", "planning and preparation of the procurement", "implementation of the procurement and invitation to tender" and "evaluation of the procurement". In addition, each section has its own sub-sections, for example "description of cleantech procurement and the year of implementation" (in "general information of the procurement"); "definition of the purpose and goal of the procurement" (in "planning and preparation of the procurement"); "criteria for comparing and evaluating offers" (in "implementation of the procurement and invitation to tender") and lessons learned (in "evaluation of the procurement").

Even though the technology applied in the experiments was the same, the key facts and lessons learned vary to an extent. Case studies in Hankintamappi 2013 and 2015 were written by SYKE and they included municipalities as participants. As a result, the lessons learned deal more with procurement processes within the public organization. Also, Hankintamappi 2015 deals a lot with the funding mechanism as it included a novel (at the time) leasing-funding. For example, the section "most important factors for the success of the procurement" in Hankintamappi 2015 states:

"Sufficient time for preparation. Decision-making in municipalities takes time, even though the outcome is in principle clear. The meeting dates of the local government and council and technical board have been decided in advance, which must be taken into consideration in the project schedule"

Lessons learned in the case studies Hankintamappi 2016a and 2016b were in this sense different, as the procurements were aimed only at private households, and in the case of Hankintamappi 2016b also for private companies. In addition, the case studies were produced by municipal intermediaries. Also, neither of the procurements included a separate financing plan. Special to these case studies is the

[14] Table 4, joint procurements A (Hankintamappi 2013), C (Hankintamappi 2015), D (Hankintamappi 2016a) and F (Hankintamappi 2016b).

notion of lack of knowledge about the technology and the regulation of solar power among participants. For example:

"From the beginning, the biggest challenge was the tremendous need for knowledge among almost all households that showed interest. The lesson was that carefully prepared information material, information events and phone calls with the participants were not enough to make sure that everyone had the correct understanding of the procurement when dealing with a novel technology." (Hankintamappi 2016a)

However, in addition to the differences between the case studies, there are also similarities among the identified lessons. All case studies emphasize the benefits of economy of scale in reducing the prices and identify essential steps in the process of invitation to tender based on the characteristics of the individual procurement. In addition, the case studies identify separate lessons, e.g. using the employees of the municipalities in the installments to gain new know-how (Hankintamappi 2013), the importance of spreading the knowledge of the joint procurement through informational events and local press (Hankintamappi 2016b) and ways to commit participants to the procurements since the price reduction was dependent on the size of the pooled demand (Hankintamappi 2016a, 2016b).

The case studies were able to aggregate some lessons from the joint procurements, but they still suffer from the same kind of shortcomings as the case studies in the UK community energy sector. They might offer inspiration and encouragement for other experiments, but like in the UK community energy sector, these short reports *"offered little detail on the processes gone through, the challenges faced and the pitfalls experienced"* (Hargreaves et al. 2013: 872). In other words, the case studies provide a superficial glance into a complex process.

However, in addition to the case study report described above, Hankintamappi 2015 also includes an attachment file that can be described as a (2) how-to guide (Process description 2015). Hargreaves et al. (2013: 873) describe how-to guides differing from case studies as they *"provide more detail on the processes and challenges involved"*. These processes can be for example *"organizational structures; funding*

models; communications and consultation techniques etc." (Hargreaves et al. 2013: 873).

The document is 4 pages long and starts with a general introduction to the case and then deals with the joint procurement process as four separate parts: "planning and preparation of the procurement", "invitation to tender", "purchase decisions and contracts" and "follow-up of the agreed terms". Subsequently, each of these parts are divided into three sub-sections: "phase of the procurement" (this section included a short general description what was done), "what was done in practice?" and "what was learned?". (Process description 2015) Contrary to the case studies, the how-to guide deals with the processes of the procurement in more detail and is open about the struggles involved, for example:

"The consultation of the product suppliers and financiers at a general level would have helped to articulate the invitation to tender in such a way that we would have received more offers during the first round. Now, during the first round the leasing price (€/month) of the solar panels was fixed in euros. This way the bid document did not enable fixing the price to a specific index or interest. This essentially decreased the willingness of financiers to finance the project and we only received one offer. The procurement was interrupted and the possibility to fix the offer to, for example, the Euribor interest was added. The invitation to tender was put again to the HILMA-system[15] in August 2015. Following this change, we received multiple offers. During the second round one municipality dropped out, leaving four municipalities to the procurement". (Process description, 2015)

Outside of these case studies, an article that can to some extent be described as a how-to guide was published in a technical journal (Tainio 2014). This how-to guide deals with the first joint procurement of HINKU (Table 4, joint procurement A). The article highlights the process of the procurement, for example: how the idea of the joint procurements came to the HINKU network, how the information event for participants was organized and implemented, and how the systems were ordered

[15] https://www.hankintailmoitukset.fi/fi/

and installed. The article is also open about the initial lack of knowledge among the intermediaries and lists lessons learned during the process, for example:

"Joint procurements have many advantages. The most indisputable of these are lower price and peer-support. The firms naturally want bigger orders and the largest order in Finland[16] *always interest everyone. From the viewpoint of the participant, peer-support can be even irreplaceably valuable. It is easier to make the purchase decision when you know many other people are doing the same. The crowd also comes up with more questions than an individual. This means that there is a greater possibility for all essential matters to be considered".* (Tainio, 2014: 32)

However, despite delving more deeply into the steps and process than the case studies, the article cannot clearly be described as a how-to guide. It is more of an in-depth description than a *"toolkit"* (Hargreaves et al. 2013: 873). For joint procurements aimed at households and private companies, a clear how-to guide was created only recently by SYKE (Monistamo 2017a, 2017b, 2017c 2017d, 2017e, 2017f). In this how-to guide, the process of joint procurement is divided into five separate parts: general introduction of the joint procurements and its benefits, arousing participants' interest, organizing information events, committing the participants to the procurement, and invitation to tender. This how-to guide was produced using the joint procurement of this case study as an example. This is somewhat unsurprising, as Välke aimed at creating tools that enhance the shift towards a low-carbon society.

The first part, general introduction of the joint procurements and its benefit, describes the greatest benefits of the joint procurements, which were stated to be the lower price of individual power plants, easiness of the purchase and peer-support (Monistamo 2017a). Also, before dealing with individual parts of the process, the section also introduces shortly the rationale behind the how-to guide: "*Through this example, the purpose and wish is to provide support to all those interested in organizing a joint procurement."* (Monistamo 2017b)

[16] According to the article, this was the biggest solar energy joint procurement in Finland during the time.

The second part, arousing participant interest, provides advice about spreading knowledge and prepares the intermediaries to respond to the need for knowledge among customers. The section for example suggests using local press for advertising the joint procurement, sending an information letter about solar technology for interested participants and organizing an information event. Also, this section contains a six-page long information letter that was sent to potential participants in the joint procurement of Välke. The letter includes general information about the process and technical and economic issues involved (Information letter 2016). In addition, the second part includes a segment about the tacit information that was learned during the process, such as:

"The enrollment for the joint procurement might lead to multiple phone calls. To make this phase easier, it is smart to register the potential participants through internet by using a webpropol form or something similar." (Monistamo 2017c)

The third part, organizing information events, provides advice about the nature and practical issues involved in organizing an information event to the potential participants. The section recommends that coordinators (i.e intermediaries) reserve time for questions and general discussion, summarize the main point of the event to those who could not attend and inform the potential participants about the next steps. The section also includes a bit over a 2 minute video that was filmed during the info event of this case study. The video provided general footage about the event, a short interview with a potential participant and glimpses of a presentation held at the event (Video 2016). In a way, the video provides perspectives on what actually happens in such events. In addition, the section provides the program of the event (Program of the event 2016), all of the slides of the presentations held in the event (Linjama 2016, Naps 2016, Rajala 2016, Viander 2016) and the summary letter of the event, which also contains information about the next steps of the procurement (Summary letter 2016). Also, the section includes links to videos and guides about solar energy in apartment buildings, but these are not discussed in this thesis. (Monistamo 2017d)

The fourth part deals with essential aspects in committing participants to the procurement. The main tool suggested for this is a commitment form. The order

form, which commits participants to the procurement, and filling instructions used in Välke are provided in this section (Instructions 2016, Order form 2016). The instruction form includes practical advice on the filling of the form, but also rules-of-thumb how to determine the power plant size that is proportional to the electricity consumption of the real estate and how to place the panels to the roof in relation to the sun. The commitment is seen as highly important, since the price of the solar power plants depends on the size of the pooled demand. (Monistamo 2017e)

The last part of the how-to guide deals with the invitation to tender. This section recommends sending the offer to 5-10 firms and checking the financial status of the companies. Also, this section provides an example of the document sent to the companies (Invitation to tender 2016). (Monistamo 2017f)

All in all, both SYKE and the local intermediaries involved in HINKU were aggregating lessons from individual joint procurements into more general lessons through case studies and how-to guides. However, this process was somewhat patchy and inconsistent, as during the time of gathering the material only four of the six completed joint procurement had been dealt with in the case studies or how-to guides. This was also acknowledged by the intermediaries themselves:

"One scientific article has been written about joint procurements in general in Finland and also articles have appeared in technical journals and in local media… but I don't think we have had any systematic following up nor documentation besides the articles and they have as well dealt with the issue on a more general level" (S1)

This is interesting especially considering that one of the case study documents (Hankintamappi 2016a) and the how-to guide for households and private companies were written using the case study of this thesis. In addition, one of the case studies (Hankintamappi 2016b) was implemented after the first joint procurement of Välke. This means that many of the documents presented in this section were not available during the implementation of this case study. However, two other ways to aggregate lessons from the joint procurements were observed in the HINKU network.

Firstly, since the joint procurements dealt with the same technology and according to the case study documents they all had the same motivation: *"The interest and motivation of the procurement unit to promote cleantech procurements"* (Hankintamappi 2013, 2015, 2016a, 2016b). Hence, the intermediaries in the HINKU network could (3) circulate archived documents from previous joint procurements in order to help and provide examples in following procurements. For example, in the case study of this thesis, documents from another joint procurement (Table 4, Joint procurement C) were utilized:

"We gave the material [from the previous joint procurement] to the energy expert of Välke in Asikkala and he has applied it and created the way of action to the process in the location" (S2)

The material provided help in, for example, drawing up the documents for the invite to tender, even though the previous documents could not be used as such (A1, S2, S3). Aside from the variation between the participant groups in different joint procurements in HINKU, the development of solar markets in Finland – especially the fall in price – required the intermediaries to update their processes at each joint procurement (S2). This is similar to the UK community energy sector, where intermediaries had to (re)learn how to intermediate as the policy context around the niche evolved (Hargreaves et al. 2013: 874).

Considering the joint procurement discussed in this case study, the intermediary organizations – mainly the local intermediaries in Asikkala – had produced a variety of different kinds of documents. In addition to the ones presented before in this section, these documents included two covering letters sent to potential participants (Covering letter 2016a, 2016b), a two-page long documentation of the phases of the procurement (Document 2016) and a feedback questionnaire that were delivered to SYKE along with the other documents presented before in this section (A1).

Secondly, the lessons from joint procurements were aggregated as (4) tacit knowledge within the HINKU network. As the same people working at SYKE in HINKU had been involved with all or many of the joint procurements (S2, S3), they were gaining experience about the technology and joint procurements which they could apply later on, as the following quotation shows:

"Of course we have duplicated the model of the process and at the same time updated the invitations to tender. It is inevitable that you learn things and we have also studied the [solar power] industry afterwards. So of course the invitation to tender and the whole process develops all the time and in this sense it is always easier" (S1)

In addition, the same kind of aggregation of knowledge occurred with the intermediaries of the municipality of Asikkala working with Välke, after they became involved with the joint procurement process:

"Well, the municipality gained knowledge about how to organize the invitation to tender, especially considering solar panels. Subsequently, I have organized an invitation to tender on the behalf of the municipality[17]*"* (A1)

To summarize this section, both SYKE and municipal intermediaries in HINKU were aggregating lessons to documents, i.e. case studies and how-to guides and also more informal documents that were circulated between experiments. However, this section shows that the intermediary actors themselves were aggregating the lessons and most importantly the tacit knowledge that was difficult to include in the formal documents.

6.2. Establishing an institutional infrastructure for experiments

The second role suggested for intermediary actors is establishing an institutional infrastructure for the aggregated lessons. Through this infrastructure the lessons learned can be stored, exchanged and circulated. In the UK community energy sector, Hargreaves et al. found that intermediaries were building this infrastructure through web-based knowledge repositories and by creating networks between different (intermediary) actors involved in the niche. In HINKU, a similar kind of process of creating web-based repositories can be observed. The intermediary

[17] Table 7, joint procurement E

actors have created (mostly) three different kinds of websites that store and share the gained knowledge about the joint procurements of solar power plants. However, similar active creation of networks between (intermediary) actors cannot be observed in HINKU since the projects itself provided a pre-existing network.

First of the three web-based knowledge repositories is called Hankintamappi[18],which can be translated as "Procurement folder". This website contains the case studies described in section 6.1. However, the website is not solely for the joint procurement experiments, as it compromises 25 case studies in total[19]. The website is maintained by SYKE and its front page describes the site as follows: *"Hankintamappi is a database for public procurement. The examples are published in cooperation with the users. In the service, you can take a closer look at cleantech projects in different phases that advance sustainable environmental and energy solutions."*

The second website is Monistamo[20], which can be translated as "the duplication room". As the name implies, the websites aims to spread good practices. The front page describes the website as following: *"Monistamo brings together ways of action, models and products developed in HINKU in order to diffuse good practices. Use these examples and/or inform us about good practices that can be circulated".* Monistamo is a part of the HINKU homepage[21] and it contains the how-to guide of joint procurement presented in section 6.1. Also, the website includes other segments, but these parts are not analyzed in this thesis.

The third website is the news section of the HINKU website, which provides news about activities concerning HINKU. By August 2017, 14 news articles had been published on the website that dealt with joint procurements of solar power plants. In addition to the website, the articles had been included in a quarterly newsletter of HINKU that is sent to subscribers. The news articles present, for example, stories about the implementation of the procurements, comparisons between the number of solar panels in HINKU municipalities and the rest of Finland, and promote the

[18] www.ymparisto.fi/Hankintamappi
[19] number of case studies on 18th of July 2017.
[20] www.hinku-foorumi.fi/fi-FI/Monistamo
[21] www.hinku-foorumi.fi

same benefits of the scheme that were listed in the case studies and how-to guide, such as lowered price, peer support and easiness of purchase. In addition, the news highlight the wider benefits of joint procurements: access to help from experts and general information about the technology; economic viability of the investment; increasing economic activity in the municipalities; boosting the diffusion of a new sustainable technology and developing solar markets in Finland. For some joint procurements – for example the nationwide joint procurement (Table 4, joint procurement H) – the news articles also provide advertisement for potential participants. The news articles also include comments from intermediary actors, representatives of solar firms, officials of municipalities and potential participants. For example, in a news article that deals with the joint procurement discussed in this thesis, a potential participant comments the following:

"The joint procurement is not a prerequisite for me, but it persuades to take action. I'm not for building nuclear power plants, it is a future time bomb. We also must get rid of oil". (HINKU-foorumi 2016a)

In addition, the website of the municipality of Asikkala has a news article about the joint procurement discussed in this case study (Municipality of Asikkala 2016). The article dealt with the combined power of the procurement, expected payback time of the investments and the municipality's future plans with solar energy. Besides the web-based repositories, some technical journal articles had been written about the joint procurements (Järvinen 2014; Tainio 2014, 2016) but they are not actively promoted in the communication channels of HINKU.

Even though the intermediaries of HINKU had been creating web-based institutional infrastructure for the joint procurement, in the case study of this thesis these were not seen as the most important route for circulating knowledge. In section 6.1, I already showed that archived documents were used Välke. In addition to this, the tacit knowledge of employees of HINKU at SYKE were put to use in the procurement presented in this case study, as they shared their know-how with the intermediaries of the municipality of Asikkala:

"There were the same people [from SYKE] involved with Välke, who had been doing joint procurements in HINKU municipalities earlier. We used their

knowledge. In early spring 2016, we held a meeting with the people from SYKE. I presented our work and the phase we were in. They were amazed how good we were doing, even though it was more that we went there to ask advise on what we should do" (A1)

"Yes, we used them [the previous experiences] a lot. The concept, the experiences that we have had made it what it was. We have also made mistakes and we have learned from them." (S3)

This cooperation between the intermediaries continued through the whole joint procurement process (S3). As already section 6.1 showed, during the process the intermediaries of Asikkala – mainly the energy expert of Välke – gained new knowledge and know-how about the joint procurements of solar power plants that they used in a following joint procurement. In addition to this, the gained tacit knowledge and related documents were shared with intermediaries of Välke in West-Uusimaa and PK-HINKU in order to help organize local joint procurements[22] (A1, A2). Also, the experiences from the joint procurement were shared through a presentation in an info event of a HINKU-related joint procurement in Mynämäki[23] (HINKU-foorumi 2017b). The energy expert of Välke in Asikkala explained how he had helped other intermediary actors in the following way:

"Well basically, [helped] how a joint procurement is organized. About a year ago we were wondering if we should do it like this or that and asked for help from SYKE. I gave the same kind of help. I've also received questions about the technology from West-Uusimaa and Joensuu." (A1)

This was also mentioned in the case study in Hankintamappi that dealt with the joint procurement analyzed in this thesis:

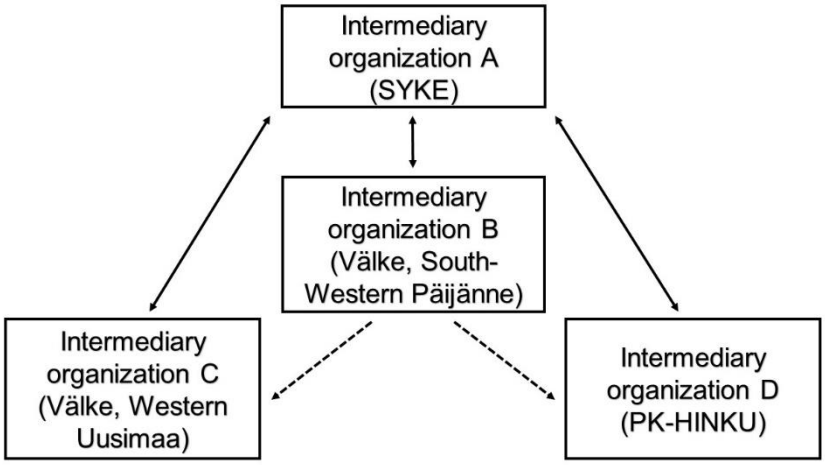
"On this basis, similar procurements were organized in West-Uusimaa and North-Karelia." (Hankintamappi 2016a)

The interaction between the intermediary actors is particularly interesting since at the end of 2016, SYKE estimated that there had been in total approximately 20

[22] Table 7, joint procurements F and G.
[23] Table 7, joint procurement J.

different joint procurements of solar power plants in Finland (SYKE 2016g, see also Saikku et al. 2017). However, the material in this thesis did not show any interaction with experiments nor intermediaries that had no link to HINKU. In addition, the network of intermediaries in HINKU and its sub-projects had hierarchical features, as the coordinating intermediary actor SYKE seemed to provide a link between the local intermediaries involved in the separate experiments. Also, SYKE is the intermediary actor who created and maintained the web-based knowledge repositories of the experiments. Figure 2 below depicts the circulation of knowledge between intermediary organizations in the experiments.

Figure 2. Circulation of knowledge between intermediary organizations in joint procurement experiment of solar power plants



In the UK community energy field, intermediaries were working towards creating a network between (intermediary) actors involved in the niche (Hargreaves et al, 2013). In HINKU, similar kind of activities could not be observed. I argue that this is because the project itself provided a sufficient network of intermediaries to exchange knowledge and support experiments. This is why there were no cooperation with intermediary actors outside HINKU. Also, contrary to the UK community energy niche, intermediary actors in the joint procurement experiments of HINKU did not struggle to come up with "a shared trajectory" for the solar niche. This was partly because the experiments examined here shared the same technology-bias and partially also the same social setting, unlike the UK community energy niche that was heterogeneous in its technologies and political aims. (Hargreaves et al. 2013) In addition, I argue that the clearly articulated aim to

reduce GHG emissions and diffuse environmentally sound technologies in HINKU and its sub-projects Välke and PK-HINKU paved a way for the cooperation of intermediaries (SYKE 2013, 2015, 2016). The articulated aims formed a common guideline for the experiments. In addition, in the UK community energy niche Hargreaves et al. observed competition of scarce funding resources that made it harder for intermediaries to cooperate. Similar competition was not visible in HINKU and therefore the cooperation was easier.

To summarize this section, the intermediary organizations in HINKU were producing knowledge repositories that are mostly web-based and formal. However, the intermediary network itself formed the most important channel were formal lessons and tacit knowledge were shared. The network also showed hierarchical features, as SYKE maintained the knowledge repositories and provided the link between other intermediaries.

6.3 Framing and coordinating experiments on the ground

The third suggested role of intermediaries is framing and coordinating local experiments. In a sense, this is a reversal role of the first two, since the aggregated and stored lessons are put into use in new projects (Hargreaves et al. 2013). In the UK community energy niche, Hargreaves et al. found that intermediaries had a hard time replicating successful projects in "a cookie cutter approach" because of the differences in local contexts and lack of shared trajectories between heterogeneous projects. Still, according to Hargreaves et al. transfer of knowledge was the "easiest" part of the work of intermediaries, as the harder and critical part was the building of confidence and capabilities of local projects. Without them, the projects could not survive the challenges and hardships during the implementation. As for framing, Hargreaves et al. pointed out that projects were mainly framed through the narrow lens of GHG emissions reductions, even though the projects had multiple motivating factors. The implementation and framing of the experiment in this case study had some similarities to Hargreaves et al., but mostly it was quite different.

As section 6.1 and section 6.2 showed, SYKE shared their formal and tacit knowledge with the municipal intermediaries in Asikkala. In addition, the joint procurement experiments in HINKU concentrated on the same niche-innovation and shared the same goal behind the experiments. Despite all this, the municipal intermediaries in Asikkala could not simply replicate the previous experiments:

"We got help from SYKE as they had experience from organizing a joint procurement and they knew what different phases require. But for the most part, we proceeded step by step, thought what we should do now and which direction we should take the process by doing it ourselves. I had dealt with solar panels in my studies, but I had to get more acquitted with them concerning private instalments. I also put together the info material." (A1)

As this quotation shows, the municipal intermediaries in Asikkala had to put in efforts to organize the joint procurement despite the experiences and knowledge of the HINKU network. Municipal intermediaries in Asikkala also modified the scheme of the previous experiments by adding domestic content as a criterion for the procurement (see section 6.4 for more detail). In addition, they initially tried using a financing model of leasing but it turned out to be unsuitable for household instalments because of higher costs (A1, Information letter 2016). Still, SYKE had an important part in the experiment as their legal department helped to draw the documents of the invitation to tender, which was seen as a critical part of the process (S2, S3). In addition, SYKE, as a more experienced intermediary, provided confidence for the municipal intermediaries in Asikkala, who were dealing with a new kind of process, as the following quotation shows:

"Well, we always received confirmation [from SYKE] that we are apparently doing the right things" (A2)

As section 6.2 showed, following the joint procurement studies in this case study, the intermediaries in Asikkala used the knowledge they gained to help less experienced intermediaries in the HINKU network to organize joint procurements in the same manner as SYKE had helped them. This help can be understood both as transferring knowledge and building up the confidence of the other intermediaries. Therefore, not only the circulation of knowledge, but also the

coordination of experiments had hierarchical features in the HINKU network. In the experiments, a more experienced higher profile intermediary organization provided assistance – by sharing lessons and tacit knowledge and giving reassurance – for a more inexperienced lower profile local intermediary organization. However, these roles of higher and lower profile intermediaries were not permanent, but evolving and changing as intermediaries gained experience of the experiments. For example, the intermediaries of the municipality of Asikkala seemed to embrace some characteristics of a higher profile intermediary after their first experiment. Hargreaves et al. also made similar observations in their study, as higher profile projects started to directly assist other groups and in this way adopted the role of an intermediary themselves.

In addition to intermediaries providing knowledge and support to other intermediaries, this dynamic was observable between intermediaries and the participants of the experiment. As the previous sections have already partially shown, the intermediaries of Asikkala went to great lengths in order to organize and coordinate the experiment: they advertised the joint procurement, organized information events, produced information material, answered questions from participants, pooled the demand, drew the terms of the purchase (dealt with in more detail in section 6.4), invited the firms to tender, and chose a firm based on the best offer (A1-2, S1-3). Everything was free for the potential customers and it was done in order to make the purchase of a novel technology as easy as possible. An intermediary actor at SYKE explained to rationale behind the actions:

"A private household – but also an individual municipality or an organization – may not have the time or courage to start acquiring a completely novel technology just by themselves. But if a households sees that 30 other households are getting some, it is much easier to participate. As if you get the feeling that this cannot go completely wrong since there are so many participants. We have got good experiences, we have had lower prices and people and municipalities have been satisfied" (S3)

According to the interviews with the households and the feedback questionnaire, the participants who invested in solar power plants mostly shared the idea that joint

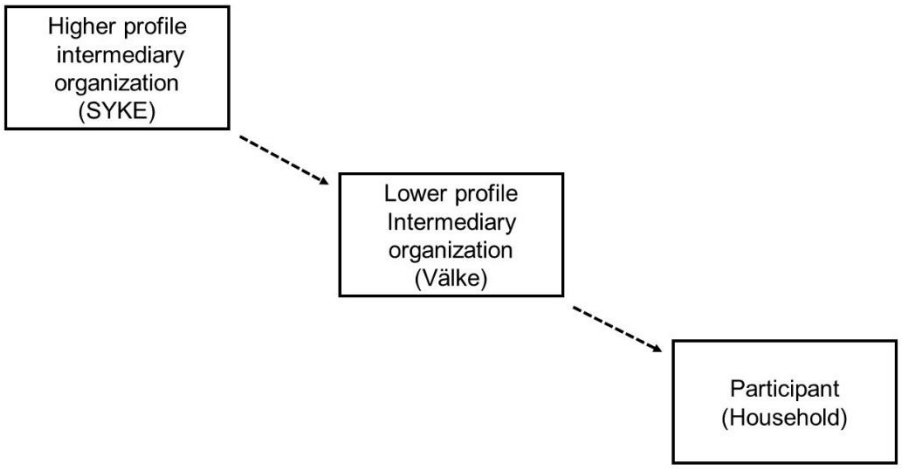
procurement was an easy and convenient way to purchase a solar power plant without prior expertise, even though some would have wanted more information (e.g. FB6). For example, one household commented the following:

"This did not require any other skills from the participant than a sufficient understanding of what you are doing. The project did the invite to tender and drew the terms for the purchase, so there was little left for the participant to know. Of course you have to know the proper scale of your own investment and understand what you are doing, but other than that not much more". (HH1)

However, the experiment faced problems that were clearly out of the influence of the intermediaries, mostly because solar power was quite new in the region. For example in Kuhmoinen, there were previously no on-grid solar power plants in the municipality and as a result there were no clear rules for the permit processes. One interviewed household said he had received *"three to four"* (HH2) different answers about the permits required for the panels from the officials of the municipality. However, through this process the experiment paved the way for future solar power installments in the municipality.

All in all, the coordination of the joint procurement had the somewhat similar kind of features as the circulation of knowledge presented in section 6.2. The HINKU network created flows of knowledge and confidence, where a higher profile intermediary provided these to a lower profile intermediary. Following, the lower profile intermediary helped the participants gain these in order to feel secure to investment in a solar power plant. This process is depicted in Figure 3 below.

Figure 3. Flow of knowledge and support in joint procurement experiment of solar power plants in Välke



The motivation of the intermediaries to organize the joint procurement followed the mandate of Välke (SYKE 2015). All interviewed intermediaries stated that from the viewpoint of Välke, the aim was to increase the use of renewable energy and lower GHG emissions (A1-2, S1-3). However, at the same time they acknowledged that the situation for a private household is not that simple, if many ought to invest in a solar power plant. As one employee of SYKE put it:

"For us, the reduction of GHG emissions is the number one thing. But then, in order for somebody to participate in the procurement, she or he must receive some benefits. As far as I understand there are two main benefits: you get an easy turnkey solution and the best price that you can get at the time. Also, there is a reliable actor behind it. It is easy to participate since your neighbors are doing it and you will regret if you do not join in as well" (S2)

In other words, the intermediaries saw that they had to frame the joint procurement to provide wider benefits for the potential participants than just mere GHG emissions. Hence, the information material sent to the potential participants presented the experiment as having multiple benefits. Firstly, pooling the demand through the procurement would lead to lower unit prices of the solar power plants than buying the equipment individually. Secondly, the material stated that the solar power plants would be an economically viable investment if the power plant size matches the electricity consumption of the real estate and one could use most of the

produced electricity oneself. The economic benefits were stated to result from a reduced electricity bill and increasing value of the real estate. Thirdly, the technology itself was stated to be environmentally friendly. Lastly, the joint procurement was stated to provide the solar power plants easily as a turnkey solution and through the scheme the participants would be able to get help and instructions. However, the material also pursued to paint a realistic picture about the technology: it stated that electricity production through solar panels should not be seen as a lucrative business opportunity for the households and the power plant would not provide electricity self-sufficiency. In addition, the material was open about Välke's motivation to decrease GHG emissions. (Information letter 2016)

To add to the benefits stated in the info material, the slides of the presentations of the information event promoted wider benefits of the joint procurements such as positive effect on the balance of trade through increased energy self-sufficiency, new domestic jobs and economic activity (Linjama 2016). All in all, the framing of the joint procurements in Välke were in line with the benefits promoted in the institutional infrastructure presented in section 6.2.

In general, the comments of the participants were quite in line with the framing of the intermediaries. Many participants saw that solar power plants were an economically viable investment (HH1, HH3, FB1, FB2, FB3, FB5 FB6), that joint procurement lowered prices (HH1, HH2, HH4), expressed environmental motives (HH2, FB1, FB2, FB3) and that the project made the investment decision easier (HH1, HH4, HH3, FB1, FB4, FB5, FB7). Also, many expressed general interest in technology (HH1, HH4, FB2, FB3, FB6). However, the benefits promoted by the intermediaries were also questioned by some. For example, the contractor firm was not convinced that the joint procurement was able to provide a lowered price for all, because the price was set based on the system size of the solar power plant:

"I know that some could have got it [the solar power plant] a thousand euros cheaper, whereas you could have asked for two thousand euros more from some. The instalment work ranged from three hours to two days. In practice, the price was the same whether it [the instalment] lasted three or 16 hours. You can come to

a conclusion, that the easy site could have had it probably cheaper as an individual investment" (F)

This notion was evident in one household interview, where the resident had talked about the investment with the representatives of the firm:

"It might have been that I could have had it [the solar power plant] a bit cheaper, if I had bought it as an individual purchase. But this was easy and it had a ten year guarantee". (HH3)

In addition, in the feedback questionnaire one household who eventually withdrew from the experiment said he or she had had *"10-15 percent"* cheaper offers from firms as an individual participant (FB9). However, one household went even further and denied that the solar power plant would be an economically viable investment. Nevertheless, the household had participated in the joint procurement as they were mainly driven by political motives. The household thought that politicians were not doing enough to promote renewable energy and citizens must then act themselves:

"We have to end the era of coal and oil… the only way we are really going to achieve economic growth is by building our old systems again from ground up as sustainable. That would bring jobs and wellbeing to our society". (HH2)

All in all, the comments by the representatives of the firm and the some of the households show the limited influence of the intermediaries on other actors involved in the experiments. The other actors were clearly influenced by the framing efforts of the intermediaries, but the intermediaries could not dictate how the providers of the technology and end-users created their view and understanding around the experiment and solar energy.

To summarize this section, the quite similar joint procurement experiments of HINKU could not simply be replicated in "a cookie cutter approach", because of lack of experience among the municipal intermediaries and development of the Finnish solar niche. To address this problem, SYKE, as a "higher profile" intermediary organization in the network, provided valuable knowledge and confidence for municipal "lower profile" intermediaries in order to implement the experiments. Following, the municipal intermediaries provided similar knowledge

and support for the participants of the experiments. However, during experiments intermediary roles evolved, as the intermediaries of the municipality of Asikkala adopted some higher profile intermediary roles. Also, the section showed that intermediaries could affect other actors by framing efforts, but they could not dictate how other actors understand the niche innovation and the experiment

6.4. Brokering and managing partnerships

In the fourth suggested role, brokering and managing partnership, intermediaries are negotiating partnership between actors inside and outside the niche. In Hargreaves et al. (2013) actors outside of the niche outside consisted mostly of large energy companies. In the UK community energy niche, the intermediaries linked actors to one another, made efforts to overcome distrust between the projects and the energy companies, drew up terms of the contracts and made sure the cooperation benefitted the community energy projects. In addition, the intermediaries were found to be lobbying policy makers to promote policies that would benefit the development of the niche. In the case of Välke and HINKU, intermediaries showed similar kind of activities, but of a different scale and in different ways.

In the case study of this thesis, the intermediaries interacted with the local utility company, but there were no conflicts involved (Rajala 2016). The intermediaries were mainly in contact with smaller companies who provided turnkey solutions of the solar power plants. As earlier sections have shown, the intermediaries of the municipality of Asikkala and SYKE went to great lengths in order to implement the joint procurement and many of these efforts can be conceptualized as a brokering and managing partnership. Section 6.3 showed that this had an influence on the purchase decision of the households.

The interaction between the companies and intermediaries started early on during the planning of the experiment. The intermediaries of SYKE and the municipality of Asikkala did *"unofficial consultation"* with some solar energy companies about

the terms of the procurement and the invitation to tender (A1, S3). Based on this, and previous experiences, the terms of the invite to tender were drawn. These terms included, for example, providing solar power plants as turnkey solutions; guaranteeing for the work and equipment (5 years for the instalment work, 10 years for equipment and the panels should function at least with 80% power after 25 years); a maximum time schedule for the instalment (five months after the providing firms has been confirmed); requiring references of the company (at least 5 similar instalments of solar power plants during 2014-2016); a maximum price for different power plant sizes available for participants in the procurement (5500 € for 2,5 kW, 7500 € for 4,5 kW and 10 000 € for 7 kW) and requiring firms to prove their financial stability. The invite to tender had a valuation system for the offers that included both the ratio of domestic content and the price of the offer, but emphasis was on the latter. (Invitation to tender 2016) This valuation criteria was criticized by the firm who provided the solar power plant for the joint procurement, as they saw it ignoring the quality differences in the equipment (F).

The invite to tender was sent to 21 companies, which some had inquired about the experiment beforehand (A1, Documentation 2016). Seven companies sent an offer, from which the intermediaries of the municipality of Asikkala chose the providing company. After this, the joint procurement officially turned into bilateral deals between the individual household and the company. After talking to the company directly, many households chose a bigger system than they originally planned (F). In this phase, the intermediaries were not any more officially connected to the bilateral business between the company and the households, but in practice they still had to manage the business relationship. Particularly, the intermediaries had to mediate the interaction when the promised time schedules of the instalment were delayed, which caused annoyance among the participants (A1). Hence, the intermediaries had to stretch the duties that were officially defined to them.

As this and previous sections have shown, the intermediaries had an important role in pooling the demand for solar panels. However, the household interviews showed some limitations about what kind of participants the intermediaries could attract. All of the interviewed participants had had previous experiences with solar technologies whether through off-grid locations (HH2, HH3 & HH4), solar heaters

(HH1) or boats that included solar panels (HH4). Two of the interviewed households explicitly expressed that they had already considered buying solar power plants before the experiment (HH2 & HH3). Also, in the feedback form some participants expressed that they had previous experiences with solar technologies (FB2, FB5 & FB8) and one participant had already considered purchasing a solar power plant (FB7). Hence, the experiment did not introduce a completely novel technology for the participants. Quite the contrary, the experiment rather linked the available supply to a demand that was already bubbling under the surface.

Besides managing partnership between the projects and the energy companies, the intermediaries in the UK community energy niche were involved in lobbying policy makers to promote suitable policy development for the niche. Somewhat similar activities could be observed in HINKU, but it was implemented in a much more implicit manner. The partner ministries were informed about the activities of HINKU (S2), but the interviewed intermediaries showed no signs of actively lobbying policies for the suitable development of solar technologies nor joint procurement to key stakeholders in the energy regime in Finland. However, the research material showed clear biases of SYKE towards solar energy solutions. The following was stated in a HINKU-foorumi news article:

"The joint procurements of solar power plants can kickstart a new line of business that can in the long run even challenge the existing energy markets. The joint procurements have already increased the amount of solar power plants and have shown that low-carbon experiments can mitigate climate change." (HINKU-foorumi 2016g)

This showed that SYKE had clear advocacy towards solar energy and some intentions to disrupt the existing Finnish energy regime through the experiments. However, the views stated in the quotation above were not actively or explicitly promoted elsewhere in the research material. Two things can be considered here. Firstly, some SYKEs employees in HINKU can have their own agenda considering solar. Secondly, as a governmental research institute, SYKE would probably experience hardships if it were to engage in traditional policy lobbying or radical political activism. Instead, the joint procurement experiments function as a way to

show in practice the possibilities of novel solutions and in this way disrupt the regime without exceeding any institutional mandates.

To summarize this section, the intermediaries were actively brokering and managing the relationships of other actors involved in the experiment. Also, the intermediaries were showing active support for the solar niche, but were not engaged in traditional political lobbying, but rather highlighting the potential of the innovation through the experiment. Such activities were linked to the institutional settings of the intermediaries.

6.5 Broadening experiments

In this case study, most of the activities of the intermediaries fitted under the four roles suggested by Hargreaves et al. (2013). However, the research material also pointed to an additional fifth role that I call "broadening experiments". As defined in section 2.2, "broadening" means the repetition of an experiment in an adjusted form in another location and context. (Grin et al. 2010: 146, Van den Bosch 2010: 187, Sengers et al. 2016). This section will elaborate on this role of the intermediaries in the case study. In addition, the effects of broadening on the Finnish energy regime and the intermediaries themselves will be discussed.

In the UK community energy niche, intermediaries were initiating local projects (Hargreaves et al. 2013). However, the intermediary role of broadening experiments was much more essential and active in the joint procurement experiments in Välke and HINKU in general. I see this as linking to the strategic role of the intermediaries to reduce GHG emissions, which the broadening of the experiment supported. An employee of SYKE described their role in broadening the experiments in HINKU with the following:

"We have been the actor who originally brought up the idea. If we talk about all of them [the joint procurements of solar power plants in HINKU], I guess we have been the initiator in general" (S1)

In the case study of this thesis, the most active role in initiating the experiment was of the intermediaries of Asikkala. However, one must be reminded that the implementation of joint procurements was also listed in the project plan of Välke and in this way SYKE can be seen as the ultimate enabler of the experiment (S1, SYKE 2015). Still, as the project was mostly aimed at SMEs, the original intention was not to organize a joint procurement for private households, but the plan was modified because only the members of this participant group showed a sufficient amount of interest for a joint procurement (S1, A1). The energy expert of Välke in the municipality of Asikkala explained how the idea of the joint procurement for private households came up:

"Well the idea was sparked by the joint procurement of solar panels that SYKE organized for four municipalities[24]*. We got 20 kW here and 10 kW to Padasjoki, where I work as well. After that [Intermediary actor X in the municipality of Asikkala] got excited that we should organize one here locally." (A1)*

Through this active broadening of joint procurements of solar power plants, the intermediaries went beyond mere verbal advocacy of the solar niche in Finland. During the time of gathering the research material, the intermediaries involved with HINKU had initiated 9 joint procurements and especially the second latest one (Table 4, joint procurement H) showed a rising level of ambition as it is open for all Finnish municipalities until 2020. However, the representative of the firm criticized the nationwide procurement benefiting only large solar companies, even though in general he saw that the joint procurements had worked in favor of solar business development in Finland (F).

In addition to the effects on solar business development (Lovio 2017, Matschoss & Heiskanen 2017), according to SYKE, the joint procurements have had a significant effect regionally on the relative growth of solar power in HINKU municipalities. As section 5.5 showed, this was also evident of the municipalities in this case study. In general, according to SYKE, the joint procurements have made HINKU municipalities forerunners of solar energy development in Finland. According to SYKE, since 2014 there have been at least two and half times more on-grid solar

[24] Table 4, joint procurement C.

power plants per capita in HINKU municipalities than on average in Finland (Hinku-foorumi 2014b, 2016b). Still, the intermediaries of HINKU acknowledged that the added energy capacity was little in the scale of total energy demand in Finland. However, as was already shown in section 6.4, the intermediaries hoped that the joint procurement would accelerate solar energy development in Finland. An employee of SYKE explained their vision in the following way:

"These joint procurements have added about one MW [of solar energy]. When you think about it, one wind turbine produces 3-5 MW and one nuclear power plant 1600 MW, so we are talking about quite small numbers. But these have received a lot of publicity and through that we will very surely create a snowball effect and the wheel will start turning. When we install a solar panel on the roof of one house in a village, his or her neighbor might get one and his or her neighbor might get one or two and so on. I think this will start and accelerate it." (S1)

The idea of the snowball effect was realized to a degree in South-Western Päijänne. Following the joint procurement analyzed in this case study, the contracting firm had received some new orders from households. The firm had previously promised to deliver them at the same price as the ones included in the previous joint procurement (F). In addition to these concrete investments, the intermediaries had also hoped that the joint procurement would provide and disseminate user experiments of the novel technology in the area (A1). This was happening at least on some scale as all of the interviewed households said they had talked to numerous people about their experiences, which were mostly positive (HH1-4).

Also, the joint procurement had sparked the households' interest in other environmentally sound technologies. All of them were considering a car that run at least to some degree on electricity, enabling them to utilize their own production. The speculated options ranged from electric (HH1-3) to hybrid cars (HH3) and campers that included solar panels (HH4). Also, one household mentioned a hydrogen car as a possible future option (HH3). One household was already using his own electricity production to charge his e-bike and he was also thinking about utilizing solar electricity to heat his water (HH2). Another household was thinking about switching to geothermal heating (HH3). All of the households were thinking

about purchasing more panels in the future and two of them were also open to the possibility of battery systems (HH1 & HH2). However, the examination of the realization of these plans is beyond this thesis and they might not happen. Still, the installed solar power had initiated some already observable changes as one household reported they had started to use the dishwasher and washing machine during the daytime when the solar power plant was producing energy (FB7).

Overall, the joint procurement experiments have been a vital source for diffusing solar energy in the focus municipalities of Välke in South-Western Päijänne and in other HINKU municipalities. The experiments were largely the result of strategic efforts of intermediary actors and the intermediaries showed clear advocacy and bias in favor of solar energy. Still, an intermediary actor at SYKE expressed that they needed to be careful that their *"neutrality does not suffer"* and they have to be viewed *"as a trustworthy expert organization"* by companies (S1). This clear contradiction between advocacy and neutrality had inflicted critical discussion about the limits of the actions of SYKE inside the institution, as one employee of HINKU at SYKE commented:

"SYKE gave a group price for the 2016 joint procurement for municipalities, so SYKE evidently is in favor of this kind of activity. Then again, the lawyers of SYKE have stated that this does not belong to the agenda of SYKE and we should not participate in this kind of business, so we will see. If the lawyer will let us, then we will participate in these in the future… It is totally understandable that if a governmental organization starts doing this kind of business that some will think this is in the gray zone. But I think it is a good thing. Everybody benefits: the municipality will save money, the residents will save money, we will diffuse renewable energy and increase employment. Overall, it is really hard to see what harm this will cause" (S3)

In other interviews, the intermediary actors at SYKE said it is likely that SYKE will no longer organize joint procurement of solar power plants for private households and companies in the future. However, this was not seen to be a consequence of "stretching of the gray zone", but rather due to the lack of funding for the experiments and the interest of the intermediaries themselves (S1, S2). Then again,

the intermediary actors of SYKE questioned the need to organize these experiments, since they already had pushed the solar development in Finland forward. (S1, S2) For example, one employee of SYKE commented the following:

"This has been the first step to make this thing mainstream. After these, you will not need joint procurements because they have done their part. These have been done in so many parts of the country" (S2)

Hence, SYKE was detaching itself from future joint procurements of solar power plants aimed at private participants. However, as section 6.2 showed, they had shared their experiences and best practices via how-to guides and this way aimed at helping other actors implement similar experiments in the future. The intermediaries saw that almost anyone could organize a joint procurement (S2). However, in their opinion, the joint procurements did not have business potential since without the benefits of external funding, the salary of the coordinator would diminish the lowered price created by the pooled demand (S1, A1). This notion highlighted the importance of the intermediary organization's role as an essential public actor. Also, I argue that for private actors without external funding, the creation of the institutional infrastructure presented in section 6.2 would have been more difficult.

Even though the joint procurements of solar power plants for private actors seemed to be moving in to the past in HINKU, SYKE still had plans for further experiments using the joint procurement scheme (S1-3). In these plans, the focus was on other environmentally sound technologies, such as other forms of renewable energy and energy efficiency. Working with a partner organization, SYKE's plan was to use joint procurements coupled with a financing plan to help diffuse these technologies (S2). The experiment, called Energy Add-ons, aims to create investments worth at least 30 million euros (HINKU-foorumi 2016e). The hoped-for success of the experiment was justified by the experiences of the joint procurements of solar power plants, as the following quote from a HINKU-foorumi news article shows:

The "Energy Add ons' principle of action has already been tried out with solar energy. The latest joint procurement has already in its early stage gathered more than one million euros of commitments and more is coming all the time. The

participants will receive solar power plants and an ESCO-financing meaning that the investment will be paid off based on the saved energy and money provided by the new equipment." (HINKU-foorumi 2016e)

Hence, the intermediaries of HINKU in SYKE were aiming to use the gained knowledge from joint procurements of solar power plants to spread other sustainable technologies. This shows how intermediaries can evolve and use governance innovations to support multiple sustainable niche-innovations. Whether this project was actually realized or not, and if so, how successful it was, goes beyond this thesis. My point is to show that the intermediaries were at least aiming to spread the positive experiences of joint procurements from solar energy by applying the experiment scheme to other environmentally sound technologies.

To sum up this section, the intermediaries were actively supporting the solar niche through broadening of the joint procurement experiments. This was linked to the strategic role and mandate of the intermediaries, since the experiments supported GHG mitigation. However, this active support was contradicting the "neutral" role of the intermediaries, especially SYKE. Partially as a result, SYKE was planning to gradually withdraw from joint procurement experiments with solar energy, but planning to use it with other environmentally sound technologies.

6.6 Summary of the results

This section briefly summarizes the results of sections 6.1-6.5. Results are grouped under each intermediary role.

1. *Aggregating lessons from individual experiments*

Both SYKE and the municipal intermediaries of HINKU were aggregating lessons to formal and also to some informal documents. These were mostly web-based case studies and how-to guides. However, as a small and tightly knit network of intermediaries, it seemed that the HINKU network itself was an essential place for

aggregating lessons. This was done by archiving documents from previous joint procurements that were used to provide help and examples in following experiments. Also, a relatively small number of people, especially at SYKE, were important to the network, since they had been involved in many or all joint procurement experiments and carried with them the gained know-how and tacit knowledge.

2. *Establishing an institutional infrastructure for experiments*

The intermediary organizations of HINKU were producing web-based knowledge repositories where knowledge of the joint procurements was stored, exchanged and circulated. However, in Välke and HINKU in general the most important way of circulating lessons between experiments was personal contact between intermediaries. The HINKU network itself provides a channel for the intermediaries to cooperate and exchange experiences. Through these channels both tacit and formal knowledge was exchange. The network showed hierarchical features as SYKE acted as an organizational link between the municipal intermediaries and also maintained the web-based knowledge repositories. Cooperation was easy during the experiments since the intermediary organizations shared the same aims and technology-bias and there was no competition for funding resources.

3. *Framing and coordinating experiments on ground*

The joint procurement of this case study followed largely the pattern of previous experiments in HINKU. Still, the municipal intermediaries of Asikkala could not simply replicate the past experiments due to the development of the solar niche and a lack of experience. In order for the municipal "lower profile" intermediaries to coordinate the experiment, a more experienced "higher profile" intermediary, SYKE, provided its support. This support was not just formal and tacit knowledge, but also the building of confidence. In the HINKU network, SYKE was clearly a higher profile intermediary, but this case study showed that also lower profile intermediaries could evolve and adopt the roles of higher profile intermediary actors through gained lessons and experiences. Following the help of higher profile intermediaries, the lower profile intermediary provided knowledge and confidence for the participants of the experiments. This process can be seen as a hierarchical

flow of knowledge and support in the experiments. As for framing, even though the coordinating intermediaries were aiming to reduce GHG emissions, they acknowledged that the experiment must offer wider benefits for individuals investing in solar power plants. As a result, the intermediaries promoted many potential benefits of the scheme. The intermediaries were able to influence other actors but only to a limited extent, as providers and end-users formed their own understanding of the technology and the experiments.

4. *Brokering and managing partnerships*

Intermediary organizations were actively involved in managing and brokering partnerships between the participants and companies, for example, by drawing up the terms of the contract, selecting the contractor firm and pooling the demand. In this case study, the interaction was mostly facilitating the business between smaller solar energy companies and participants and the intermediaries went beyond their official duties. It was also evident that the experiment did not introduce a completely novel technology to the participants, but acted more as a push factor for an investment that many of the interviewed participants were already considering. In addition, SYKE showed clear biases to solar energy solutions and some efforts to disrupt the wider energy regime. However, instead of engaging in more traditional policy lobbying, this was done through joint procurement experiments that showed the potential of solar energy in practice. This was partially a result of SYKE's status as a governmental research institute, which set limitations to its level and ways of advocacy.

5. *Broadening experiments*

Intermediary organizations went beyond mere verbal advocacy of solar energy by actively broadening joint procurement experiments. This is linked to the strategic nature of the intermediaries of Välke and HINKU in general. The individual joint procurements of Välke and other HINKU-related experiments were driven by intermediaries and aimed at mitigating GHG emissions and diffusing environmentally sound technologies. The active broadening of the joint procurement experiments worked in favor of the clearly articulated project goals. Yet, this sort of technology-bias was clearly stretching the "gray zone" of

intermediation, especially for SYKE. Intermediation is always a temporal activity and it seemed to be gradually coming to an end with these experiments for private participants in HINKU. However, the governance innovation of joint procurement experiments were possibly being tried out with other technologies in the future.

7. Discussion

In this section, I scrutinize the findings of this thesis and discuss how they relate to prior research on intermediaries in sustainability transition studies. The findings contribute to the literature by strengthening earlier findings through empirical evidence and also by refining and extending prior theoretical views on the roles of intermediaries in sustainability experiments and wider sustainability transitions. Also, this thesis provides new findings about HINKU, which is an influential experiment in the Finland.

This thesis contributes to the literature of sustainability transitions especially by providing empirical evidence on strategically-oriented technology-bias public intermediary organizations. These kind of case studies are still rare in the literature and therefore the findings improve the understanding of different kinds of intermediaries, which has been considered essential by scholars (e.g. Hargreaves et al. 2013, Kivimaa et al. 2017a). The intermediaries involved in the case study are strategic in the sense that they were established with the intention to catalyze societal change towards a low-carbon future (Hodson & Marvin 2009). Even though HINKU and Välke are in general focused on mitigating GHG emissions inmultiple ways, the intermediary actors were strongly advocating for a specific socio-technical niche in the joint procurement experiments. In addition, the prior literature has emphasized the role of public actors in promoting sustainability transition in comparison to private ones (Turnheim & Geels 2012, Kivimaa, 2014). As discussed further in this section, this institutional position was seen as essential.

Under the categorization of Kivimaa et al. (2017a), the intermediary actors involved in the case study can be defined as niche intermediaries, even though the HINKU organization as a whole can be seen as a regime intermediary. Hence, the findings strengthen the argument of Kivimaa (2014) that niche intermediaries can indeed have an effect on niche building and even regime destabilization. In this case study, the intermediaries were vital to the implementation and broadening of the joint procurement experiments. They were the main actors initiating experimentation, coordinating experiments and mediating the relationships between the other actors involved. The findings support prior research, which states that joint procurement experiments support niche innovations by creating markets, empowering citizens to act and by highlighting the essential role of coordinators (i.e intermediaries) in the process (Matschoss & Heiskanen 2017, Saikku et al. 2017, Lukkarinen et al. 2018). The experiments have been able to introduce and diffuse a novel sustainable niche-innovation in the focus municipalities of Välke and other HINKU municipalities (HINKU-foorumi 2016g). Even though the added electricity capacity is quite modest, the relative change is big – both in infrastructure and in knowledge – and it can affect the regional energy transition in the future as well as change behavior in the focus areas. However, the behavioral aspect is somewhat speculative, since the empirical examination of this argument would require a follow-up study.

The findings also support the arguments of Hodson and Marvin (2010) and Kivimaa et al. (2017a), who see that intermediary organizations should be included in governance frameworks to support sustainability transitions and innovation. Based on the results, strategically oriented public intermediaries can be used to create space and opportunities for actors such as citizens and private companies to participate in sustainable societal transition processes. This would extend the variety of actors involved in sustainability efforts, reduce the requirements for governments to turn to authoritative policies and create (sustainable) economic activity. The public role of intermediaries can be essential in experiments, as the vital role of the coordinator does not always entail a business opportunity. Also, the findings of this thesis, like those of Matschoss and Heiskanen (2017), imply that intermediary actors can support and accelerate transition processes in more rural areas and not just solely urban areas (e.g. Hodson and Marvin 2010).

The positive effects of the experiments were highly influenced by the intermediaries' strong technology-bias towards solar energy. The intermediaries used experiments to show the potential of solar energy technologies in Finland and also linked the niche-innovation to wider empowerrment narratives, such as employment and increased economic activities (Smith and Raven 2012, Raven et al., 2016). However, the findings support the anticipation of Kivimaa (2014) that having a technology-bias can make it difficult for intermediaries to present themselves as neutral actors. The clear advocacy for solar energy certainly made it easier for the intermediaries to support the particular niche, but as a result it partially contradicted the wish of intermediaries to be seen as impartial actors (e.g. Laschewski et al. 2002, Kivimaa 2014). The findings show that strong technology-biases stretch the "gray area" where intermediaries have to operate between the interests of other actors while pursuing a neutral and credible image. However, in the case of SYKE, I argue that this conflict can be linked to its status as a governmental research institute. For such an organization, it may not be so easy to adopt new roles and engage in intermediary activities that demand a clearer advocacy for a particular niche. In other words, SYKE was constrained by its institutional mandate as it could not contest the existing source of authority (Bulkeley & Castán Broto 2013, Kivimaa 2014). Still, the institutional position of SYKE might be a double-edged sword as Antikainen et al. (2017) have noted that vertical relationships with public actors is important for the success of experiments in Finland.

The findings of this thesis also highlight the limited timespan of intermediaries (Kivimaa et al. 2017a). SYKE and municipal intermediary organizations got involved in joint procurement experiments once they had been initiated by a civil society based group. Hence, like many intermediaries, the HINKU organization got involved only after the joint procurement experiments were established (Geels & Deuten 2006, Kivimaa et al. 2017a). SYKE consciously decided to limit their supporting role only to the beginning of the technological trajectory of solar energy in Finland, like some long-term intermediaries have been seen to choose to do (Kivimaa et al. 2017a). This was stated to be due to the interest and resources of the organization, but I argue that it can also be seen to relate to the narrow moving

space that came along with the advocacy of one particular socio-technical niche and the demands of neutrality. Still, by creating institutional infrastructure for learned lessons, the intermediary actors made efforts to disseminate best practices of joint procurement experiments of solar power plants for other possible intermediaries.

Considering experimentation, Matschoss and Heiskanen (2017) have defined HINKU as a whole as a societal problem-solving and change-process experiment, under the categorization of Kivimaa et al. (2017b). I also see the experiment of the case study fitting under the categorization of Kivimaa et al. (2017b) rather than Sengers et al. (2016). The joint procurement experiments can be defined as market creation experiments, since they have stimulated new markets and changed market conditions in favor of solar energy (Kivimaa et al. 2017b). Also, they emphasize the decision-making process and institutional reconfigurations (Bos & Brown, 2012, Bos et al. 2013, Sengers et al. 2016, Kivimaa et al. 2017b). The novelty of the experiment lies in creating market power through the pooling of demand and serving as a platform to provide valuable peer-support (Matschoss & Heiskanen 2017, Saikku et al. 2017). Therefore, the findings of this thesis show that intermediaries can have a role in transition processes also by creating and promoting governance innovations that can nurture, shield and at least regionally empower niche-innovations (Smith & Raven 2012, Kivimaa 2014). Also, the findings show that governance innovations can be used to support multiple niches since it is not tied strongly to the technological aspects of the innovation. However, I see this notion mostly applying to regime intermediaries that are not strongly concentrated on a specific niche.

The experimentation that the intermediaries engaged in had many links to prior studies about HINKU. Even though solar energy is still a niche, rather than a well-established socio-technical solution in Finland, the intermediaries pursued to frame the joint procurement of solar power plants as a win-win solution for all involved stakeholders (Heiskanen et al. 2015b). Also, the experiments can be seen as "an iconic example" that HINKU uses to promote its aims and to grow its activities (Kivimaa et al. 2017b). In addition, they provide legitimation and market formation for sustainable niche-innovations (Lukkarinen et al. 2018). Similar to the prior findings of Heiskanen et al. (2015b), most of the households involved in the

experiment of this case study took a "reasonable", i.e. economically viable, stand on the experimentation. Yet, the participants also included a household with more political motives to disrupt the Finnish energy regime. However, I acknowledge that due to the small amount of interviewed households, this view might be overrepresented in this thesis. Still, this notion was a prime example showing that intermediaries cannot control the way other actors understand socio-technical innovations, despite their efforts to frame experiments and technologies (Steward & Hyysalo 2008, Hargreaves et al. 2013).

Previous studies have also delved into the circulation of knowledge in HINKU and acknowledged "intensive informal lessons-sharing" within the network (Antikainen et al. 2017, Heiskanen et al. 2017). This thesis contributes to those studies by providing an in-depth and detailed case study on how the knowledge is actually circulated, and it explicitly addresses the hierarchical structure of the intermediary network of HINKU. In addition, the results showed that the network does not only circulate knowledge, but also confidence, which is required for the success of the experiments (Hargreaves et al. 2013). The findings also strengthen the arguments of Heiskanen et al. (2017) that formal evaluation and dissemination are not sufficient to diffuse lessons between experiments in HINKU and other experiments. Heiskanen et al. call for personal contact and cooperation with other ongoing projects. Based on the results, this is especially vital for circulating the vital tacit knowledge. However, even this was not enough for novel intermediaries to replicate the prior experiments without effort due to the lack of practical skills and the on-going evolution of the niche.

In addition, Heiskanen et al. (2017) have pointed out that part of the success of the joint procurements of solar power plants stems from the limited required infrastructure. This can partly explain why other experiments of HINKU, like joint village heating systems, have not been as successful (Heiskanen et al. 2015b). Still, it must be acknowledged that the experiment of Välke also relied on the development of the global level solar-niche during the last decade or so (Geels & Raven 2006, IRENA 2017: 21). In this way, the case study of this local experiment links to the emerging global technological trajectory. However, the experiments initiated by the intermediaries have been vital not only by showing that solar

technology works in the natural conditions of Finland, but also in serving the interests of municipalities, local residents and companies (Raven et al. 2008).

In many ways, the broadening of the joint procurement experiments in HINKU have followed the path described by Geels and Raven (2006). As the experiments have produced positive outcomes (i.e. "iconic examples"), it has been easier to attract new participants and to find resources for future experiments. However, the intermediary network of HINKU clearly had a significant effect on the broadening. The network formed a pre-existing and easy channel through which the experiment could be repeated in an adjusted form in different geographical locations since each experiment served the clearly articulated goals of HINKU (and Välke). The findings show that intermediaries are not only important for strengthening a niche through experimentation, but also through the supporting and complementing dimension of the ecology of intermediaries that they form (Steward & Hyysalo 2008, Kivimaa et al. 2017a, Matschoss & Heiskanen 2017). The notion of hierarchical structures of intermediaries and the dynamics they formed can be relevant for the wider literature of intermediaries in sustainability transitions, but it must be stated that the ecology of intermediaries was extremely small in the case study. Therefore, the dynamics can be different in larger ecologies.

Lastly, I acknowledge that my thesis has its limitations, which affect the analytical generalizations (Yin 2014: 21) suggested here. My empirical results are limited mostly to one geographical location in a country where experimentation is promoted in the current government programme (Prime Minister's Office 2015: 28.). Also, joint procurement of solar power plants is a particular kind of experiments and so is HINKU and Välke. Furthermore, I do not take a critical stance on the degree of sustainability of the applied solutions in the case study.

8. Conclusions

This section presents the conclusions of this Master's Thesis. Empirically this thesis focused on a case study of a joint procurement experiment of solar power plants that was conducted as a part of Välke, a sub-project of HINKU. Hence, because of institutional convergence, the experiment forms a link to other joint procurements in HINKU. Through this case study, this Master's Thesis set out to answer the following questions: (1) How do intermediary organizations aggregate, circulate and apply lessons within and across sustainability experiments? (2) What kind of other relevant roles or characteristics of intermediary organizations emerge in the context of sustainability transition studies?

In the case study, intermediary organizations – both SYKE and the municipal organizations – were aggregating lessons from individual joint procurements experiments in formal (and some informal) written documents, even though this documentation process was not completely consistent during each experiment. The written documents included many lessons learned, but they could not completely address the struggles involved in the experiments and include valuable gained tacit knowledge. As a result, the most important way of aggregating the whole spectrum of lessons was through the experiences of individual intermediary actors. Importantly, relatively few employees at SYKE possessed the important institutional memory since they had been involved in many or all of the joint procurement experiments.

The circulation of the lessons learned had similar characteristics to the aggregation process. While documents from prior experiments were disseminated among the intermediaries, personal contact was more effective in passing on lessons, particularly tacit knowledge. The circulation process had hierarchical elements as SYKE, the coordinator of HINKU, provided and maintained the web-repositories and archived other circulated written documents. Also, SYKE provided the link for personal contacts between municipal intermediaries who were only involved in one or few joint procurement experiments.

The individual experiments had many similarities with other joint procurements of HINKU. Still, the case study showed that municipal intermediaries could not simply replicate past experiments by applying previous lessons. Partially this was linked to the development of the solar niche in Finland that required the intermediaries to update the processes of the experiment, but it was also due to the lack of experience among the municipal intermediaries. This shortcoming was fixed by hierarchical structures in the intermediary network of HINKU, where SYKE as a higher profile intermediary providing knowledge and confidence for municipal lower profile intermediaries. Following, the municipal intermediaries provided similar knowledge and support for the participants of the experiments. However, during experimentation, the intermediary roles in the HINKU network evolved as the intermediaries of the municipality of Asikkala adopted some roles of a higher profile intermediary and subsequently supported other municipal intermediaries in the HINKU network in following experiments.

In addition to mere aggregating, circulating and applying lessons learned between and within experiments, the intermediaries went further to support the solar niche in Finland. They were actively initiating new experiments in new geographical locations and developing the process of joint procurements, i.e broadening experiments. This active role was strongly dependent on the strategic nature of the intermediaries, as both the HINKU and Välke were established with the intention to mitigate GHG emissions. As the results showed, the joint procurements were effective in growing the relative amount solar energy in the focus municipalities of Välke and in HINKU municipalities in general.

However, the strong advocacy towards solar energy solutions contradicted especially SYKE's aim to be viewed as a credible and neutral actor by others. The active role in niche support led to critical discussions in SYKE about the boundaries of its institutional mandate. The technology-bias approach of the experiments were seen to stretch the "gray zone" where intermediaries act between the interests of other actors. I argue that in the case of SYKE this was particularly related to their institutional position as a governmental research institute. For such an institution, the adoption of new (intermediary) roles and contesting existing sources of authority can be difficult. Due to the narrow moving space, but also because of

interest and resources, SYKE did not intend to initiate similar experiments for private actors in the future and therefore consciously limited their role in the development of the Finnish solar energy niche. However, SYKE was planning to use the joint procurement scheme with novel environmentally sound technologies in the future.

The findings of this Master's Thesis contribute theoretically to the literature of sustainability transitions by providing empirical findings about the roles and activities of strategic, public and technology-bias intermediary organizations, especially in the field of energy. The findings advance a more nuanced and sophisticated understanding of intermediaries. Most essentially, they support prior research that intermediaries have a role in niche support and to a degree in regime destabilization. In addition, the findings highlight that intermediaries can affect and accelerate at least regional energy transitions. The findings also emphasize the essential role of personal communication between intermediaries in order to transmit both formal and tacit knowledge and confidence across experiments. This notion also links to the importance of intermediary networks that complement the lack of skills of individual intermediaries. Also, the findings show that intermediaries can use governance innovations, such as joint procurements, to support a variety of sustainable niche-innovations. Overall, the results strongly support the argument that intermediaries should be included in sustainability and innovation governance networks, especially those concerning climate change mitigation. However, based on the results, particularly technology-bias public intermediaries might have to perform under unclear mandates due to demands for neutrality. Outside of pure academic interest, this knowledge can also be used to develop more sophisticated governance frameworks.

In the national context of Finland, the thesis offers additional knowledge of the abilities of intermediaries and their experiences of influencing energy transitions and wider sustainability goals. It contributes to a deeper understanding of HINKU, which is as an influential experiment in Finland. The results show that intermediaries can be utilized to diffuse novel sustainable niche-innovations and support at least regional energy transitions. However, influential public intermediaries like HINKU, currently have to act under unclear mandates. If the

Finnish society wants to utilize the abilities of intermediaries in sustainability transitions, these mandates should be made clearer and possibly stronger. This could be done by extending the mandates of already established intermediaries like HINKU or by creating new intermediary organizations who are not burdened with prior institutional path dependencies.

The findings of this thesis leave room for further research. Firstly, the success of the joint procurement experiments was clearly linked to the phase of solar niche development in Finland, as this provided a push-factor for the investments. Hence, more studies could address intermediary roles in different phases of transitions to understand how intermediation can increase and accelerate the diffusion of sustainable niche-innovation more effectively. Secondly, the dynamics of hierarchical intermediary network structures should be studied in larger ecologies of intermediaries. Lastly, more research needs to address the demand of neutrality among technology-bias intermediaries with different kinds of institutional backgrounds. This knowledge could be used in the future to design more effective governance frameworks and institutional configurations for intermediaries.

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Appendix 1: Question sets of the semi-structured interviews

The interviews were implemented in Finnish. Therefore, the question sets below are translations by the author. The question sets are presented in the following way in bullet points:

- Theme of the questions
    - The primary question
        - Possible additional question if the initial answer was not adequet or sufficiently spesific

1. Question set for intermediaries about Välke

- *Theme one: Background information*
    - 1. What has been your personal or your organization's role in the joint procurement of PV system (for private households) in Välke in the region of Päijät-Häme during 2015?
        - 1.1 In what part of the process where you involved with the joint procurement?
    - 2. Do you know where the idea for the joint procurement came from?
    - 3. What was the goal of the joint procurement and how was it accomplished?
        - 3.1 Was there a specific problem what the joint procurement tried to solve?
    - 4. What other actors were involved with the joint procurement?
        - 4.1 What was their role in the procurement?
- *Theme two: Knowledge gathering and learning*
    - 5. What skills or knowledge were required in the joint procurement and where these were attained from?
        - 5.1 Was all the required skills or knowledge found among the actors affiliated with Välke?
        - 5.2 Were lessons from previous joint procurements of PV systems utilized?
        - 5.3 Were there individuals involved with the planning and implementation that had been prior involved with joint procurements in HINKU?
    - 6. How was invitation to tender done?
        - 6.1 Was something particularly difficult?
        - 6.2 Was something particularly easy?
        - 6.3 Was something surprising?
    - 7. How did the implementation of the procurement go from a technical perspective?
        - 7.1 Was something particularly difficult?
        - 7.2 Was something particularly easy?
        - 7.3 Was something surprising?

- 8. How did the implementation of the procurement go from a fiscal perspective?
  - 8.1 Was something particularly difficult?
  - 8.2 Was something particularly easy?
  - 8.3 Was something surprising?
- 9. Were the plans modified during the implementation?
  - 9.1 How and why?
- 10. Did the joint procurement introduce new lines of action that prior did not exist in your organization?
  - 10.1 Did you have to learn new skills or knowledge because of the joint procurement?

- *Theme three: cooperation between stakeholders*
  - 11. How did you interact with other actors involved with the procurement?
    - 11.1 Were there regular meeting and if so, what was done in the meetings?
    - 11.2 Who organized the meetings?
  - 12. How did you gather knowledge of the expectations and experiences of other actors?
  - 13. How did the cooperation with other actors go?
    - 13.1 Was something particularly difficult?
    - 13.2 Was something particularly easy?
    - 13.3 Was something surprising?
- *Theme four: Documentation and dissemination of learned lesson*
  - 14. How has the joint procurement been documented?
    - 14.1 Who has access to the documents?
    - 14.2 How did the documentation process go?
  - 15. Has there been an evaluation of the joint procurement?
    - 15.1 What was the criteria used in the evaluation?
  - 16. Where and how have the achievements of the joint procurement been disseminated?
    - 16.1 Has there been any presentation?

        - 16.2 Has there been any media exposure?
        - 16.3 Has there been any information on websites?

- *Theme five: broadening and scaling up joint procurements*
    - 17. Have you received any questions or requests for help concerning joint procurements?
        - 17.1 Have the lessons learned in the joint procurement in Välke been used in some other project?
    - 18. In your opinion, what is needed for joint procurements to become more popular?
        - 18.1 What factors prevent joint procurements from becoming more popular?
    - 19. Are you or your organization planning to be involved with joint procurements in the future?
        - 19.1 Is something going to be done differently in the future? If so, why?

2. Question set for intermediaries about HINKU in general

- *Theme one: Background information*
    - 1. What has been your personal or your organization's role in the joint procurements in HINKU?
        - 1.1 In what part of the processes have you been involved with?
    - 2. Where did the idea for the joint procurements come from?
    - 3. What has been the goal of the joint procurements and how have they been accomplished?
        - 3.1 Was there a specific problem that the joint procurement are trying to solve?
    - 4. What other actors have there been involved with the joint procurements?
        - 4.1 What has been their role in the procurements?
- *Theme two: Knowledge gathering and learning*

- 5. What skills or knowledge has been required in the joint procurements and where these were attained from?
    - 5.1 Were all the required skills or knowledge found among the actors affiliated with HINKU?
    - 5.2 Have lessons from prior joint procurements been utilized in the individual procurements in HINKU?
    - 5.3 Have the same individuals been involved with the planning and implementation of the joint procurements in HINKU?
- 6. How was invitation to tender done??
    - 6.1 Has something been particularly difficult?
    - 6.2 Has something been particularly easy?
    - 6.3 Has something been surprising?
- 7. How has the implementation of the procurements gone from a technical perspective?
    - 7.1 Has something been particularly difficult?
    - 7.2 Has something been particularly easy?
    - 7.3 Has something been surprising?
- 8. How has the implementation of the procurements gone from a fiscal perspective?
    - 8.1 Has something been particularly difficult?
    - 8.2 Has something been particularly easy?
    - 8.3 Has something been surprising?
- 9. Have the implementation plans been modified during or between the joint procurements?
    - 9.1 How and why?
- 10. Have the joint procurements introduced new lines of action that prior did not exist in your organization?
    - 10.1 Did you have to learn new skills or knowledge because of the joint procurements?

- *Theme three: cooperation between stakeholders*
    - 11. How have you interacted with other actors involved with the procurements?

        - 11.1 Have there been regular meeting and if so, what has been done in the meetings?
        - 11.2 Who has organized the meetings?
    - 12. How have you gather knowledge from the expectations and experiences of other actors?
    - 13. How has the cooperation with other actors gone?
        - 13.1 Has something been particularly difficult?
        - 13.2 Has something been particularly easy?
        - 13.3 Has something been surprising?
- *Theme four: Documentation and dissemination of learned lesson*
    - 14. How have the joint procurements been documented?
        - 14.1 Who has access to the documents?
        - 14.2 How have the documentation processes gone?
    - 15. Has there been an evaluation of the joint procurements?
        - 15.1 What has been the criteria used in the evaluation?
    - 16. Where and how have the achievements of the joint procurement been disseminated?
        - 16.1 Has there been any presentation?
        - 16.2 Has there been any media exposure?
        - 16.3 Has there been any information on websites?
- *Theme five: broadening and scaling up joint procurements*
    - 17. Have you received any questions or requests for help concerning joint procurements?
        - 17.1 Have the lessons learned in the joint procurements in HINKU been used in some other project?
    - 18. In your opinion, what is needed for joint procurements to become more popular?
        - 18.1 What factors prevent joint procurements from becoming more popular?
    - 19. Are you or your organization planning to be involved with joint procurements in the future?

        - 19.1 Is something going to be done differently in the future? If so, why?

3. Question set for participating households

- *Theme one: Background information*
    - 1. Were you interested about solar energy before the joint procurement?
        - 1.1 Why?
    - 2. Where did you get the idea to participate to the joint procurement?
    - 3. What was the goal of the joint procurement for you and how it was accomplished?
        - Was there a problem you were trying to solve by participating to the joint procurement?
    - 4. To who were you in contact during the joint procurement?
        - What was their role in the procurement?
- *Theme two: Knowledge gathering and learning*
    - 5. What skills or knowledge was required in the joint procurements and where these were attained from?
        - 5.1 Was all the required skills or knowledge found among the actors affiliated with Välke?
        - 5.2 Were lessons from previous joint procurements utilized?
        - 5.3 Were there individuals involved with the planning and implementation that had been prior involved with joint procurements?
    - 6. How did the implementation of the procurement go from a technical perspective?
        - 6.1 Was something particularly difficult?
        - 6.2 Was something particularly easy?
        - 6.3 Was something surprising?
    - 7. How did the implementation of the procurement go from a fiscal perspective?
        - 7.1 Was something particularly difficult?

        - 7.2 Was something particularly easy?
        - 7.3 Was something surprising?
    - 8. Were the plans modified during the implementation?
        - 8.1 How and why?
- *Theme three: cooperation between stakeholders*
    - 9. How have you interacted with other actors involved with the procurements?
        - 9.1 Have there been regular meeting and if so, what has been done in the meetings?
        - 9.2 Who has organized the meetings?
    - 10. How has the cooperation with other actors gone?
        - 10.1 Has something been particularly difficult?
        - 10.2 Has something been particularly easy?
        - 10.3 Has something been surprising?
- *Theme four: Documentation and dissemination of learned lesson*
    - 11. Has someone asked about your expectations and experiences concerning the joint procurements?
        - 11.1 Who gathered the information?
        - 11.2 How did the documentation go?
        - 11.3 Who has access to the documentation?
    - 12. Have you told anyone about your experiences about the joint procurements and/or solar energy?
        - 12.1 What have you told?
        - 12.2 Who have you told? (e.g. friend, neighbor, reporter)
        - 12.3 How have you shared the information? (e.g. face-to-face, internet forum)
- *Theme five: broadening and scaling up joint procurements*
    - 13. Have you received any questions or requests for help concerning joint procurements or solar energy?
        - 13.1 If yes, from whom?
        - 13.2 What have you told?

- 14. In your opinion, what is needed for joint procurements to become more popular?
    - 14.1 What factors prevent joint procurements from becoming more popular?
- 15. Do you have any future plans concerning joint procurement or solar energy in general?
    - 15.1 Is something going to be done differently in the future?
    - 15.2 Are you planning to combine your solar power plant to another investment in the future?

4. Question set for the representative of the contracting firm

- *Theme one: Background information*
    - 1. How did you participate to the invite to tender in Välke?
        - 1.1 How did the process proceed after the offer from your perspective?
    - 2. What other actors were involved with the joint procurement?
        - 2.1 What was their role in the procurement?
- *Theme two: Knowledge gathering and learning*
    - 3. What skills or knowledge was required in the joint procurements and where these were attained from?
        - 3.1 Has your company done joint procurements before or participated in invites to tender?
        - 3.2 Has your company participated before in joint procurements in HINKU? If so, were these lessons utilized?
    - 4. How did the implementation of the procurement go from a technical perspective?
        - 4.1 Was something particularly difficult?
        - 4.2 Was something particularly easy?
        - 4.3 Was something surprising?
    - 5. How did the implementation of the procurement go from a fiscal perspective?
        - 5.1 Was something particularly difficult?

        - 5.2 Was something particularly easy?
        - 5.3 Was something surprising?
    - 6. Were the plans modified during the implementation?
        - 6.1 How and why?
    - 7. Did the joint procurement introduce new lines of action that prior did not exist in your organization?
        - 7.1 Did you have to learn new skills or knowledge because of the joint procurement?
- *Theme three: cooperation between stakeholders*
    - 8. How have you interacted with other actors involved with the procurements?
        - 8.1 Have there been regular meeting and if so, what has been done in the meetings?
        - 8.2 Who has organized the meetings?
    - 9. How has the cooperation with other actors gone?
        - 9.1 Has something been particularly difficult?
        - 9.2 Has something been particularly easy?
        - 9.3 Has something been surprising?
- *Theme four: Documentation and dissemination of learned lesson*
    - 10. Has someone asked about your expectations and experiences concerning the joint procurements?
        - 10.1 Who gathered the information?
        - 10.2 How did the documentation go?
    - 11. Have you told anyone about your experiences about the joint procurements and/or solar energy?
        - 11.1 What have you told?
        - 11.2 Who have you told?
- *Theme five: broadening and scaling up joint procurements*
    - 12. In your opinion, what is needed for joint procurements to become more popular?
        - 12.1 What factors prevent joint procurements from becoming more popular?

- 13. In your opinion, what has been the role of joint procurements of HINKU considering the development of solar business in Finland?
- 14. Are you or your organization planning to be involved with joint procurements in the future?
    - 14.1 Is something going to be done differently in the future? If so why?
- 15. In your opinion, what in general is needed for the development of solar business in Finland?

Appendix 2: Coding tree

Theme	Codes
1. Aggregating lessons from individual experiments	1.1. Case studies
	1.2. How-to-guides
	1.3. Other documents
	1.4. Tacit knowledge
2. Establishing an institutional infrastructure for experiments	2.1 Hankintamappi
	2.2 Monistamo
	2.3 HINKU-foorumi
	2.4 HINKU-mappi
	2.5 HINKU network
3. Framing and coordinating experiences on ground	3.1 Intermediaries coordinating action
	3.2 Framing of the joint procurement by intermediaries
	3.3 Framing of the joint procurement by households and the firm
4. Brokering and managing partnership on ground	4.1 Facilitating businness between households and firms
	4.2 Lobbying policy makers
5. Broadening experiments	5.1 Initiating and developing joint procurements of solar power plants
	5.2 Accelerating regional energy transition
	5.3 Expanding joint procurements to other technologies