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The raison d'être of diffusion intermediaries in solar and wind power in Sweden

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Abstract

Renewable energy technologies such as solar photovoltaics (PV) and wind power are now mature enough to be utilized as a means to build a sustainable energy system. Regardless, the diffusion of these technologies is not always a seamless process since it involves many actors and complex implementation procedures. Therefore, there is a need for actors that can facilitate the diffusion of these technologies. Diffusion intermediaries such as project developers can play a crucial role in this regard, by acting between input providers such as technology suppliers and adopters to facilitate the implementation of these technologies. This thesis scrutinizes the raison d'être (reason for being) of diffusion intermediaries by focusing on the activities of and value generation by solar and wind power diffusion intermediaries in Sweden.

The thesis is based on qualitative methods, including a qualitative survey with semi-structured interviews of diffusion intermediaries in Sweden, a one-month longitudinal embedded case study of one solar PV intermediary in Sweden, and a longitudinal multiple case study of six large-scale projects. The results of these studies are presented in a compiled synthesis and three appended papers.

The findings of these studies indicate that the raison d'être of diffusion intermediaries is to broker between at least two other parties in implementation projects. A literature review revealed that scholars do not always succeed in explicating the in-betweenness of intermediaries. By contrasting intermediation activities with other activities, it was possible to provide a more complete and nuanced understanding of the complex context that diffusion intermediaries are part of. The results reflect that diffusion intermediaries are, to some extent, involved in one-to-one activities that can be important in satisfying adopters' needs. The results also revealed that value creation in implementation projects unfolds during the collaboration and that a potentially fruitful approach aims at focusing on value co-creation with adopters. It is also seen that it is possible to view intermediation as an iterative process consisting of both intermediation and other activities in different phases of implementation, which oftentimes starts and ends with non-intermediation activities.

These results have several policy and managerial implications. Managers are recommended to focus on adapting their services to match the different needs of adopters. Policy makers should consider the multifaceted activities that diffusion intermediaries conduct in order to make seemingly complex implementation procedures appear simple and comprehensible to adopters. Future research can focus on additional deep longitudinal case studies of diffusion intermediaries to provide a more detailed understanding of the activities associated with brokering in different empirical contexts.

Keywords: diffusion intermediaries; innovation intermediaries; intermediation activities; non-intermediation activities; value creation; adopters; raison d'être; renewable energy technologies; solar PV; wind power

LIST OF PUBLICATIONS

This thesis is based on the work contained in the following papers:

I. Aspeteg, J., Bergek, A., 2019. The value creation of diffusion intermediaries: Brokering mechanisms and trade-offs in the case of solar and wind power in Sweden. Submitted to Journal of Cleaner Production.

II. Aspeteg, J., Mignon, I., 2019. Intermediation services and adopter expectations and demands during the implementation of renewable electricity innovation–Match or mismatch? Journal of Cleaner Production, 214, 837-847.

III. Aspeteg, J., Bergek, A., 2019. When is a diffusion intermediary an intermediary? The intermediation activities of solar and wind power project developers in Sweden. Manuscript.

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1 INTRODUCTION

The following discussion centers on the actors or organizations that contribute to the diffusion of innovations by supporting adopters that are willing to invest and use these innovations. They are conceptualized as "diffusion intermediaries" or simply as "brokers," that is, a subgroup of innovation intermediaries, in the sense that they broker between different input providers (e.g., technology suppliers) and adopters. In contrast with the overall group of innovation intermediaries, diffusion intermediaries are specifically involved in the process of dissemination of technologies that are available more or less "off-the-shelf." A central theme of the thesis is that it focuses on the raison d'être of diffusion intermediaries, that is, the reason or justification for their existence in innovation processes. While the concept of raison d'être may have somewhat philosophical connotations, in this thesis, it is used in a specific (and more concrete) manner to denote the contribution that diffusion intermediaries make through their intermediation activities to innovation diffusion processes.

1.1 BACKGROUND

In the last 200 years, as Deng et al. (2012) pointed out, we have experienced an enormous increase in energy use globally. Global warming has reached an alarming stage and ambitious actions are necessary to mitigate its impacts and to achieve sustainable development (IPCC, 2018). One approach toward climate change mitigation is a transition in the energy system, based on the diffusion of renewable energy technologies (RETs) that can meet the global energy demand "many times" (Reddy and Painuly, 2004). Two technologies for electricity generation that are key in this daunting complex transition process are wind power and solar photovoltaic (PV) power (Breyer et al., 2018; IPCC, 2014).

In 2017, wind power and solar PV covered 6.5% and 2.5% of the global electricity demand respectively, which can be compared by taking 140 million cars of the road or planting 164 million trees annually (EIA, 2018). Statistics Sweden (SCB) indicated that in Sweden, diffusion was limited to 11% wind and 0.14% solar PV of the total electricity demand (SCB, 2018). Given that several identified planetary boundaries have been exceeded (Rockström et al., 2009a; Rockström et al., 2009b) and that world energy consumption continues to increase, environmental mitigation activities are necessary. The complexity of the sociotechnical system, that is, a system incorporating technologies, infrastructures, regulations, and different actors (e.g., suppliers, policymakers, users, producers etc.) – in which these challenges occur – indicates that there is a need for specific actors that fulfill essential activities geared toward increased diffusion.

1.2 INNOVATION INTERMEDIARIES

Intermediary actors have been emphasized as key players in sustainability transitions (for recent reviews see: Gliedt et al., 2018; Kivimaa et al., 2019). They provide a variety of activities, such as linking demand- and supply-side actors, creating platforms for collaboration, creating legitimacy and awareness of innovations, stimulating the development of technologies, supporting eco-innovations, mobilizing resources (financial, human, and technical), contributing to green economic development, creating green jobs, helping

articulate client demands, facilitating knowledge flows, and facilitating technological adoption and commercialization (Geels and Deuten, 2006; Gliedt et al., 2018; Johnson, 2008; Kanda et al., 2018; Mignon and Kanda, 2018; Paraga and Jandab, 2014; van Lente et al., 2003).

In the literature on innovation and transitions, intermediaries have been defined according to their primary activities, such as technology brokering (Hargadon and Sutton, 1997), knowledge brokering (Hargadon, 1998; Kilelu et al., 2011; Wolpert, 2002) or, in a more general fashion, as bridge builders (Bessant and Rush, 1995), third-parties (Mantel and Rosegger, 1987), mediators (Håkansson et al., 2011), middle actors (Paraga and Jandab, 2014), and as intermediary firms (Stankiewicz, 1995).

The interest in innovation intermediaries gained momentum after Howells (2006) published a seminal paper in which he outlined the roles of intermediaries in innovation. One of the greatest contributions was that he put forward a definition specifying what intermediaries do in innovation:

> "An organization or body that acts an agent or broker in any aspect of the innovation process between two or more parties. Such intermediary activities include: helping to provide information about potential collaborators; brokering a transaction between two or more parties; acting as a mediator, or go-between, bodies or organizations that are already collaborating; and helping find advice, funding and support for the innovation outcomes of such collaborations." (Howells, 2006 p. 720).

The definition is multi-layered and covers several key aspects that can be utilized in order to delimit the thesis and provide some key terms that will be necessary in the following discussions. First, innovation intermediaries "can be active in any aspect of the innovation process," from research to commercialization. This is important since the thesis deals with actors involved in the latter part of the innovation process, that is, innovation implementation and diffusion. Second, in contrast to more recent transition studies focusing on intermediation at a system level, the focus of the thesis is on intermediation at a firm/project level, which is in line with Howells' (2006) definition.

1.3 INTRODUCING DIFFUSION INTERMEDIARIES

Studies on intermediation originated from the field of innovation diffusion (Howells, 2006), which focuses on factors that explain the rate and speed of innovation diffusion (Rogers, 2003). For an innovation to diffuse, a prerequisite is that the adopters must be willing to adopt the innovation and that there are actors to diffuse the technologies. It is important that there are actors who can be a bridge between a variety of input providers (suppliers etc.) to make the implementation process as smooth and seamless as possible for the adopters.

Rekers (2016 p. 1058) described innovation diffusion as "a highly social process, involving sets of intermediate organizations that contribute to a product's reputation" (Rekers, 2016 p.

1058). In this thesis, such intermediary actors are referred to as "diffusion intermediaries" to reflect their main activity. Diffusion intermediaries are located downstream in the supply chain. In short, they facilitate the adoption process through adapting and implementing technologies for adopters (Stankiewicz, 1995). They are involved in activities such as consulting, import or sales, and project development (see Bergek, 2019 who mapped diffusion intermediaries involved in the field of RETs in Sweden).

Literature on solar PV and wind power provide some empirical examples of project-level diffusion intermediaries. Studies on the diffusion of solar PV emphasize the role of solar service firms illustrating the complex ecosystem or value network that such actors are involved in while implementing PV systems for adopters (Karakaya et al., 2016; Strupeit and Palm, 2016; Överholm, 2015, 2017). According to these studies, solar service firms provide value by handling transaction costs related to installation, permits, and incentives in individual implementation projects (Strupeit and Palm, 2016). They also facilitate adoption by interacting with various actors on the adopter's behalf, such as banks, insurers, and installers, which is fruitful for the adopters for whom the intermediary is the main point of contact.

Studies on the diffusion of wind power technology are quite scarce although a few scholars have touched upon the activities of project developers (Breukers and Wolsink, 2007; Loring, 2007; Toke et al., 2008). Mignon (2016) focused on project developers and consultants involved in wind power implementation in Sweden and how intermediaries' services matched the adopters' demands during the innovation implementation process. Mignon noted that one of the activities of the intermediaries was to act between the users and the technology supplier and, if necessary, compare and choose suppliers for users. As with solar power, wind power intermediaries act on behalf of the adopters among infrastructure suppliers, local grid owners, and technology suppliers geared toward finalizing the implementation process.

It can be claimed that diffusion intermediaries typically broker between downstream actors (adopters or end users) and upstream actors (input providers) in the supply chain (Benouniche et al., 2016; Caiazza and Volpe, 2017; Kilelu et al., 2013; Mignon, 2016; Owen et al., 2014; Stewart and Hyysalo, 2008). Figure 1 draws on previous literature and illustrates the diffusion intermediaries as actors located between upstream and downstream actors. The left side displays the input providers such as suppliers and manufacturers. The right-side outlines the adopters or end users, that is, the recipients of the services provided by the diffusion intermediaries. Figure 1 is a simplification of the types of relationships that intermediaries can be involved in and demonstrates the central in-betweenness or brokering aspect in Howells (2006) definition. To this end, the primary focus of this thesis is the activities of diffusion intermediaries that are located somewhere downstream in the supply chain. These

intermediaries act as brokers between technology adopters and the input providers or the providers of resources needed to adopt and implement a technology.[1]

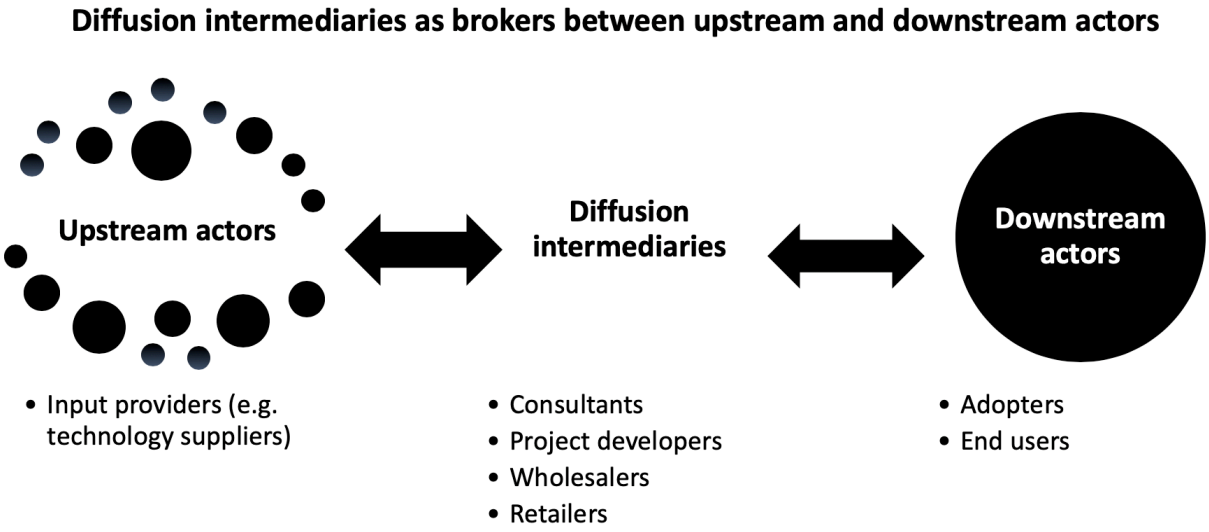

Figure 1: Diffusion intermediaries as brokers between upstream and downstream actors.

1.4 PROBLEM DISCUSSION AND PURPOSE

Previous studies on innovation intermediaries suffer from two main problems: (1) It remains unclear what distinguishes intermediary activities from others, and (2) there is a lack of a common understanding about intermediaries in the commercialization and diffusion phase, that is, diffusion intermediaries.

First, according to Howells' (2006) definition, innovation intermediaries are brokers that act between at least two different parties. Winch and Courtney (2007) explained that brokers are positioned between the sources and users of innovation in a development context, in order to enable others to innovate. In addition to acting as brokers, intermediaries tend to be involved in other activities. This was already emphasized by Howells (2006 p. 725) who asked, "When is an innovation intermediary not an innovation intermediary?" after noting that "[i]nnovation intermediaries were often not only involved in providing mediated innovation services linking their clients with other organizations, but also supplying services direct to their clients on a one-to-one basis, which involved no other interaction with other organizations." This was reflected in his typology of different functions of intermediation in the innovation process. In more recent literature, there are many lists of roles, activities, or functions of intermediaries that, similar to Howells (2006), do not distinguish between intermediation and other activities (cf. Gliedt et al., 2018 listing the roles of sustainability-oriented innovation intermediaries for a recent review). Other examples include Dutrénit et al. (2012) who studied innovation

[1]Bergek (2019) noted that a specific type of diffusion intermediary (dedicated ones) has intermediation activities as its main task and acts within a specific sector, such as the energy sector (which is also what the present thesis centers on).

intermediaries working with small farmers in a developing country; Inkinen and Suorsa (2010) who examined high-tech enterprises involved in project development activities in Finland; Tran et al. (2011) who studied the value creation process of intermediaries in new product development; and Stewart and Hyysalo (2008) who studied the roles and activities of intermediaries in the development and appropriation of new technologies.

Second, contemporary descriptions of activities, functions, and roles are mainly focused on intermediaries involved in innovation development processes as opposed to intermediaries involved in innovation diffusion processes (Aspeteg and Bergek, 2019). Although it is possible to identify studies on diffusion intermediary-type actors (Dewald and Truffer, 2012; Fabrizio and Hawn, 2013; Hanna et al., 2018; Jami and Walsh, 2017; Singh, 2016; Överholm, 2015, 2017), most of these do not focus on their roles as brokers (for some exceptions, see Mignon (2016), Jami and Walsh (2017) and Överholm (2017)). Since much of the focus has been on development-oriented intermediaries and not on intermediaries involved in the innovation diffusion process, the notion and activities of diffusion intermediaries has been unexplored to a large extent. This suggests that to understand why they exist – their raison d'être – it is important to start with the basics, that is, by scrutinizing the activities that they perform as brokers in implementation projects and how these activities create value for adopters.

Against the background of both these problems, the purpose of this licentiate thesis is twofold: first, to study the activities of diffusion intermediaries in order to distinguish intermediation activities from other activities, and second, to examine how these activities create value for adopters.

1.5 OUTLINE OF THE THESIS

The rest of the thesis is structured as follows: Section 2 outlines the theoretical underpinnings of the thesis. Section 3 provides an overview of the overall study design and a methodological summary of the thesis covering data collection and analysis and a reflection on the methodological limitations. Section 4 summarizes the three appended papers. Section 5 synthesizes the findings of the studies and Section 6 concludes the thesis by providing answers to the research questions and outlining issues for further research, managerial implications, and policy recommendations.

2 THEORY

This section discusses some of the key issues introduced in the previous section. First, intermediaries in different phases in the innovation process are presented, followed by a more detailed discussion on previous research on diffusion intermediaries. Second, intermediation and brokering are introduced as key terms, followed by a review of previous studies focusing on activities performed by intermediaries. Third, two different views on value creation are outlined in order to examine how diffusion intermediaries create value for adopters. Finally, a new framework is introduced to help distinguish intermediation activities from other types of activities and to understand how diffusion intermediaries generate value for adopters.

2.1 POSITIONING DIFFUSION INTERMEDIARIES IN THE INNOVATION PROCESS

Before narrowing the discussion down to intermediaries in the commercialization and diffusion phase, it is important to paint a more inclusive picture of the variety of intermediary types that have been studied in prior phases, such as in the development of new technologies.

In the early phase of development, it can be challenging to find or come up with novel ideas or locate specific resources. Once an idea begins to take shape, there are issues associated with the development of the prototype and with identifying relevant partners. Before the innovation is commercialized, activities related to diagnostic work, validation, regulation, protecting intellectual property, and evaluation of the outcomes of innovation collaboration may be carried out (cf. Howells, 2006). Once developed, in order to be diffused at a larger scale, the innovation has to be commercialized and adopted by users. Such adoption processes involve activities such as knowledge transfer, investment design and technological implementation. These activities can sometimes be challenging and hence require the help of different types of innovation intermediaries.[2]

Figure 2 illustrates intermediaries involved in various stages of the innovation process. A similar model was developed by Katzy et al. (2013) to illustrate a process view on open innovation coordination by demonstrating various types of intermediaries that are involved in different development phases. In this adapted version, actors in the diffusion phase have been added to provide some examples of diffusion intermediaries. Figure 2 divides the intermediaries into two subgroups: development- and diffusion-oriented. Intermediaries that are active during the development of innovations, however, seem to differ from intermediaries that are active during the diffusion phase. Both types are scrutinized below the figure.

[2] The complete innovation-development process is described in greater detail in Rogers (2003).

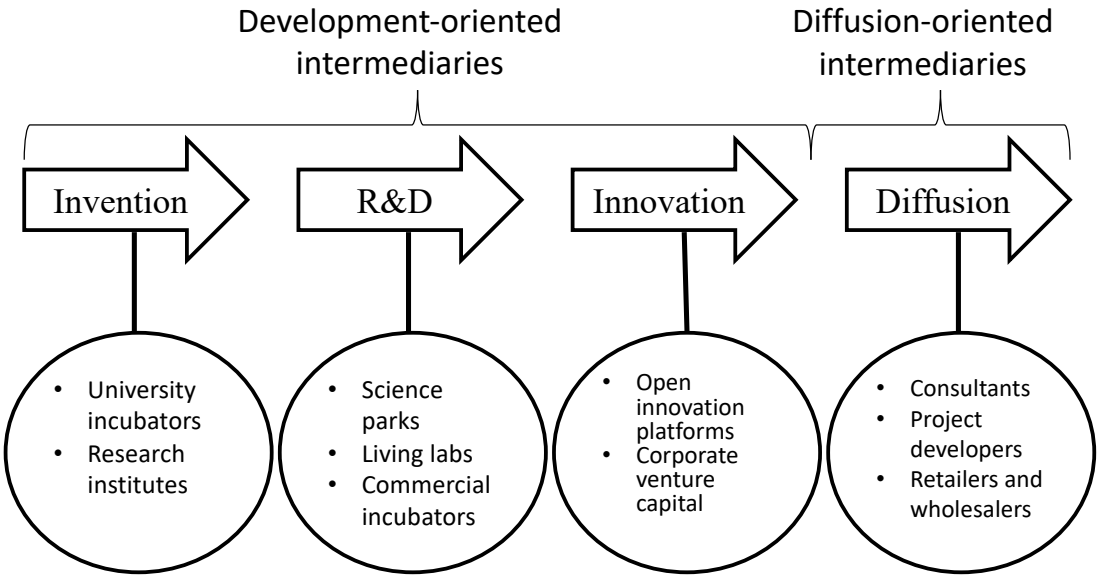

Figure 2: Intermediaries in different phases of the linear innovation process.[3]

Studies on development-oriented intermediaries have primarily focused on the development and transfer of new technologies. These intermediaries have been examined closely in the context of open innovation (OI) where "traditional" or "project-level" intermediaries have been in focus (cf. Bergek and Mignon, 2018). Dahlander and Gann (2010) explained that OI is a research field that is based on the idea that innovation does not happen in isolation. Chesbrough (2006) indicated that innovating firms should seek collaboration and knowledge outside firm boundaries to be competitive. The OI literature has emphasized the central activities that innovation intermediaries carry out while being involved in such processes such as to facilitating interactions between firms (Chesbrough, 2006). Firms in OI development processes aim to find collaboration partners, and in such contexts, innovation intermediaries can act as brokers between the so-called innovation seekers and innovation solvers in, for example, new product development projects (cf. Tran, 2010). OI principally focuses on processes geared toward selling or revealing innovations to other supply-side firms (Bergek and Mignon, 2018; Dahlander and Gann, 2010; Mignon and Bergek, 2016). Since this type of intermediary is quite frequently studied, there are some implicit suggestions as to why they exist. There are examples of studies focusing on this particular aspect, the most notable among them being Dalziel (2010) who noted that innovation intermediaries purposefully position themselves in the innovation gap:

[3] The picture depicts the innovation process as linear. While this is not an accurate representation of the actual innovation processes which tend to be far more complex than this, it illustrates the main idea of this section, namely that there are different types of intermediaries in different phases of the innovation process and that it can be useful in distinguishing the diffusion intermediaries from the development ones.

> **"**Why innovation intermediaries exist. Innovation intermediaries that conduct or support technology development activities are the only organizations that purposefully position themselves in the innovation gap. They do so to enhance the capacities of national, regional or sectoral systems of innovation by intermediating on the intercommunity level, between the business and research communities. Other organizations may have some innovation gap activities or may, of necessity, may operate in the innovation gap for a limited period of time." (Dalziel, 2010 p. 12).[4]

In contrast, diffusion-oriented intermediaries – diffusion intermediaries for short – are involved in transactions between adopters or end users and input providers (e.g., technology and component suppliers). In this position they are involved in change processes geared toward assisting adopters in implementing innovations. Caiazza and Volpe (2017 p. 4) offered a general description of diffusion intermediaries and their work within innovation: "They work with adopter to identify their needs and problems and then to adopt the appropriate innovation to meet those needs".

Palm (2018) noted that adopters face barriers of different sorts in adoption processes. For instance, in order for innovations to diffuse, it is important to overcome economic, management, policy, sociotechnical, and relational barriers such as trust and social relationships (Caiazza and Volpe, 2017; Karakaya and Sriwannawit, 2015). Seen from the adopters' perspective, decisions pertaining to technical, financial, and strategic perspectives must be considered while evaluating new ideas (Caiazza and Volpe, 2017). As actors working between input providers that can help adopters implement technologies, diffusion intermediaries conduct a diverse set of activities to facilitate and reduce complexity in the adoption process such as by designing their offer to match a variety of contexts/adopters' needs, taking part in choosing products, giving advice, creating legitimacy for products, communicating between the innovator and adopter, providing technical know-how by informing them about the technology, operations, and funding, and diffusing, installing, and fitting innovations (Aggarwal, 1997; Benouniche et al., 2016; Caiazza and Volpe, 2017; Dicecca et al., 2016; Karakaya, 2015; Leonard-Barton, 1984; Mignon and Bergek, 2016; Owen et al., 2014; Poncet et al., 2010; Singh, 2016; Stankiewicz, 1995). No scholars have tried to explain the raison d'être of diffusion intermediaries, which is not very surprising considering that the topic is new and emerging.

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[4] Moreover, Dalziel (2010, p. 10) explained the innovation gap, in which development-oriented intermediaries are said to be active, as follows: "a space between the business and research communities where goals are incongruent and performance is highly ambiguous. As a consequence, economic incentives are weak and legitimacy is hard to come by."

2.2 DIFFUSION INTERMEDIARIES SUPPORTING THE DIFFUSION OF RENEWABLE ENERGY TECHNOLOGIES

Early studies on innovation diffusion (cf. Rogers, 1983) have focused primarily on actors that facilitated adoption decisions such as specialized third-party actors and change agents. More recent studies (focusing on mapping diffusion intermediaries in renewable electricity production in Sweden) have been more specific in noting that actors such as project developers, retailers, distributors, and consultancies can be conceptualized as diffusion intermediaries (Bergek, 2019).

Scholars have empirically focused on a variety of diffusion-oriented intermediaries involved in transactions with adopters and end users. There is a growing stream of literature relating to such actors. Hanna et al. (2018) studied how microgeneration installers of solar PV and air sources heat pumps (ASHP) in the UK influenced adoption rates and installation standards, as well as the interplay between business practices and government policy. The study identified installers as brokers between manufacturers and adopters (homeowners) and provided information on their business models such as their payment models and the criteria they used to select solar panel manufacturers (reliability, warranty, and cost).

Karakaya et al. (2016) studied a German solar company and focused on the company's business model and the inherent challenges it faced in adapting to changed market conditions (e.g., reduced feed-in tariffs). They indicated that the solar company acted as a broker between wholesalers (for system components), local networks (for knowledge), and adopters. The adopters are mainly households, farmers, and small-size companies, for whom they created value by adapting their services to their unique needs. An important factor that contributes to the success of the company is that it provides local products, high quality service, and installations (ibid).

Strupeit and Palm (2016) studied barriers to RET diffusion while focusing on solar service firms in Japan, Germany, and the US, using the business model framework created by Osterwalder et al. (2005) as a tool. The study showed that firms act as brokers between partner networks of, for example, wholesalers of system components, banks, and adopters. The adopters include companies, public organizations, and private homeowners. According to the study, there are different business models in the three countries studied. In Germany and Japan, the value proposition aims at offering an easy adoption process by providing turnkey product solutions, resulting in low consumer transaction costs, electricity bill savings, low technical risk regarding installation and operation, and independence from utilities. In the US, where a third-party ownership model is utilized, the value proposition is: "immediate electricity cost savings, predictable cost of electricity over 15-25 years, monthly bill payments and no upfront cost of installation, a simple switch to solar & no technology risk, easily transferable upon moving" (ibid, p. 127). In this business model, the adopters' only contact is the intermediary who interacts with several other actors in order to deliver the value underlined above. The study also identifies the barriers that firms have to overcome to disseminate PV systems and the different strategies they use to overcome them. Like Karakaya et al. (2016), the challenge of adapting the business model to suit the needs of

changing market conditions is indicated. For instance, in Germany, firms mainly used a feed-in model initially, but installations decreased because of diminishing tariffs, and companies had to shift toward a self-consumption model.

Överholm (2017) studied solar service firms selling solar PV panels, solar heating systems, and electric vehicles in the US. The study focused on firms with product-service systems business models that aimed to sell product functionality rather than the product itself. Solar service firms are conceptualized as a link between an ecosystem of input providers and end-customers to install solar PV for customers. The input providers that they broker between (or form alliances with, to use Överholm's term) include: installation and service partners, regulators, utilities (for permits and incentives), financial partners, insurers, manufacturers of solar panels, racking (hardware sales), and end-customers. This type of business model enables implementation processes without: "owning intellectual property or manufacturing facilities related to the products used." Överholm argued that the value offering for customers was that they would simply get solar energy "with minimum hassle" and "on better terms than what they could buy grid electricity for" (ibid, p. 293). However, to create value (in terms of revenue), alliances have to be established between the intermediary and at least three other key actors: customers, product providers, and financial partners.

Scholars have mainly focused on project developers in the context of wind power diffusion intermediaries. For example, Jami (2017) examined project developers and knowledge brokers in Ontario Canada. The study focused on community engagement in five wind energy projects. The wind project developers were involved in establishing community liaison committees (CLC), that is, they interacted with local communities to share information on issues related to "siting, construction, installation, use, operation, maintenance, and retirement of wind turbines" (ibid, p. 20). Mignon (2016) studied collaborations during technology implementation among three intermediaries specialized in the development of wind power projects and six adopters in Sweden. The intermediaries handled a variety of activities such as the administration of building permit applications, coordinating contracts with local inhabitants and the local authorities, comparing and selecting technology, and negotiating contracts with suppliers. The collaboration process was rather direct and indicates that the intermediaries focused on delivering value to the customers by adapting their services based on customer needs. In Mignon's (2006) words, "users chose from a portfolio of services what was best adapted to their strategies and needs, and intermediaries facilitated implementation" (p. 744).

The reviewed literature indicates that a central approach for diffusion intermediaries to support the diffusion of RETs is by acting as a bridge between an entire ecosystem of input providers (e.g., installation and service partners, regulators, utilities, financial institutions wholesalers, and manufacturers of technologies) and adopters or end users. They make a complex procedure (implementation of solar or wind power) simple by providing a variety of activities to match the adopters' needs in implementation processes. This would not have been possible without the different input providers that they collaborate with, such as for example, if a diffusion intermediary would not act between technology providers, the adopters would

have to interact with several solution providers (of which the intermediary is one and the technology provider is another) to adopt the technology.

The reviewed studies have reported that diffusion intermediaries collaborate with a variety of input providers to deliver technologies and tailored solutions to end users or adopters (cf. Karakaya; 2016; Mignon, 2016; Strupeit and Palm, 2016; Överholm, 2017). The types of relationships that diffusion intermediaries are involved in differ based on the size of the projects. In smaller projects, they may broker between a single technology supplier and a single adopter or end user. This association is referred to as a simple triadic one(supplier)-to-one(intermediary)-to-one(adopter) type of relationship. In larger and more complex projects, diffusion intermediaries may broker between several input providers such as manufacturers, financial institutions etc., and one or more adopters or end users (cf. Strupeit and Palm, 2016; Mignon, 2016; Överholm 2015, 2017). This association is referred to as a many(several input providers)-to-one(intermediary)-to-one(adopter) type of relationship.

Given that most previous studies have focused on innovation (and other types of) intermediaries, it can be worthwhile to examine what scholars have discovered with respect to other intermediaries' activities, roles, and functions in innovation (e.g., innovation intermediaries, development-oriented intermediaries etc.). Since diffusion intermediaries constitute a subgroup of innovation intermediaries, chances are that there are some similarities, differences, and lessons to be drawn upon by zooming in on previous activities outlined in the scattered literature on intermediation.

2.3 ACTIVITIES, FUNCTIONS, AND ROLES

As mentioned in the introduction, the literature focusing on intermediaries contain many different descriptions of the activities of innovation intermediaries. Previous studies have also provided numerous typologies, taxonomies, and systematic reviews of innovation intermediaries' activities functions and/or roles. This section provides a few examples.

Based on a broad literature review, Howells (2006) offered a typology of intermediation in the innovation process. This review covered ten basic functions of intermediaries in innovation: (1) Foresight and diagnostic. (2) Scanning and information processing. (3) Knowledge processing, generation, and combination. (4) Gatekeeping and brokering. (5) Testing, validation, and training. (6) Accreditation; (7) Validation and regulation. (8) Intellectual property and protection of the results. (9) Commercialization of the outcomes. (10) Assessment and evaluation (Howells, 2006, p. 721-2). These functions are referred to in the literature on innovation intermediaries quite frequently (cf. Abbate et al., 2013; Agogué et al., 2013; Dutrénit et al., 2012; Tran et al., 2011; Yang et al., 2014). Abbate et al. (2013) even referred to them as "main functions."

Another typology of innovation intermediaries (in Dutch agriculture) is derived from Klerkx and Leeuwis (2008 p. 265-266) who outlined five intermediary types with four associated functions, namely (1) Innovation consultants aimed at individual entrepreneurs (functions: demand articulation, network brokerage, and innovation process management); (2) Innovation

consultants aimed at collectives of entrepreneurs (functions: same as above); (3) Brokerage organizations that forge peer (inter-firm) networks (functions: demand articulation and network brokerage); (4) Systemic instruments for the support of innovation at a higher system level (functions: demand articulation, network brokerage, and foresight); and (5) Internet-based portals and databases that display knowledge and information relevant to farmers and related parties (functions: network brokerage).

Abbate et al. (2013) examined development-oriented innovation intermediaries' activities in knowledge transfer processes through a systematic review and outlined three main activities, each with a number of sub-activities, namely (1) Inter-organizational networking (scanning and processing of information, transfer of specialized knowledge, dissemination of best practices and techniques, cluster and industry promotion, helping firms describe their innovation needs, helping combine knowledge for partners, and brokering and developing standards); (2) Technology development (facilitating access to expertise and equipment, development of standards and support of systems development, testing and validation of new technologies and equipment, adaptation of technologies for alternate applications, and IP management and activities associated with the commercial exploitation of the inventions of university and other public researchers); and (3) Other activities (training and sales and marketing).

Johnson (2008) studied an intermediary organization facilitating triple helix projects in the commercialization of new technologies and identified five roles with associated activities (referred to as "benefits" in the paper). Two of these are addressed here. The following activities are recognized as being associated with the role of a technology broker: (1) providing technology and knowledge transfer mechanisms by centrally managing connections in the distributed innovation network, (2) facilitating the technology network, and (3) ensuring a repository of technological knowledge sources and expertise within the regional S&T infrastructure. The following activities are conducted in the role of a mediator: (1) ensuring mechanisms to ameliorate conflict arising within the distributed innovation network to facilitate effective collaboration, (2) allowing for fairness and equity in disputes within the regional S&T infrastructure, and (3) allowing for less friction within collaboration and thus possibly lowering potential transaction costs within the network.

Yang et al. (2014) studied three cases to demonstrate the roles of an innovation intermediary in the form of farmer cooperatives in China and identified seven roles divided into two categories: knowledge and innovation intermediation. Knowledge intermediation includes: (1) articulating and voicing the demands of farmers' needs, (2) supplying information for problem solving and responding to farmers' needs, (3) generating knowledge applicable in production, (4) building a vision on new technology, (5) building and managing networks with actors from different domains, (6) facilitating and participating in the learning process, and (7) providing necessary resources and services. In addition to these overarching roles, each case is broken down to more specific activities. For instance, the first role includes communicating with the county's agricultural bureau on particular issues and it is also noted that the intermediary and the bureau had developed regulations together.

Stewart and Hyysalo (2008) focused on the role of intermediaries in the development and appropriation of new technologies and provided three distinct roles of cybercafés as intermediaries: (1) facilitation (educating others, gathering and distributing resources, influencing regulations and setting local rules, and creating spaces of various kinds), (2) configuring (creating spaces for others, configuring technology, creating and configuring content, setting rules and regulations on use and usage, prioritizing uses, the goals and form of projects, and the goals and expectations of other members of a network), and (3) brokering (raising support from sponsors and suppliers, representing individuals and institutions for which they negotiate, brokering the entry of new sponsors or suppliers and defending the space they created, and articulating user needs regarding the technology to suppliers).

To complement the abovementioned studies and to provide an overarching picture of the variety of activities, roles, and functions applied in the field, a broad literature review was conducted in Paper 3. This review covers a variety of studies to provide an overview of the assortment of activities that intermediaries conduct. This review illustrated four overarching types of activities, namely knowledge-related, technology-related, resource-related, and actor-related. The resulting activities (with references) are summarized in Table 1. A complete version can be found in Paper 3 and is discussed further in the chapter where the papers are synthesized.

Table 1 Groups of activities served by innovation intermediaries as described in previous literature. [a]

	Groups of related activities	References
Knowledge-related	Develop new knowledge and solutions, combine and configure knowledge to fit new context	Abbate et al. (2013), Castrogiovanni et al. (2012), Howells (2006), Intarakumnerd and Chaoroenporn (2013), Yang et al. (2014)
	Disseminate information, distribute newsletters, guidebooks, manuals etc.	Hargreaves et al. (2013), Kilelu et al. (2011), Kingiri and Hall (2012), Kivimaa (2014), Kanda et al. (2018), Tremblay and Dossou-Yovo (2015)
	Gather, scan, compile, and process and analyse information	Dicecca et al. (2016), Howells (2006), Intarakumnerd and Chaoroenporn (2013), Kanda et al. (2018), Popp (2000)
	Provide specialist/expert knowledge, expertise and skills[b]	Dicecca et al. (2016), Edler and Yeow (2016), Kanda et al. (2018)
	Transfer knowledge between seekers and solvers, users and suppliers, different user groups etc.	Agogué et al. (2013), Abbate et al. (2013), Bessant and Rush (1995), Dicecca et al. (2016), (Hargadon and Sutton, 1997), Hargreaves et al. (2013), Smedlund (2006), Yang et al. (2014)
Technology-related	Adapt, fit or configure technology to (new) adopters, market segments, applications etc.	Abbate et al. (2013), Benouniche et al. (2016), Stewart and Hyysalo (2008)
	Communicate the features and functionalities of new technologies	Stewart and Hyysalo (2008)
	Develop new technologies and products	Clark (2014), Dalziel (2010), Hargadon and Sutton (1997), Howells (2006), Stewart and Hyysalo (2008), Yang et al. (2014)
	Diffuse, disseminate, or install technology	Benouniche et al. (2016), Karakaya et al. (2016), Kilelu et al. (2011)

	Groups of related activities	References
	Test, assess, evaluate, and validate technology	Abbate et al. (2013), Howells (2006), Intarakumnerd and Chaoroenporn (2013), Kanda et al. (2018), Tran et al. (2011)
	Transfer technology, products, processes, or solutions between two or more parties	Agogué et al. (2013), Bessant and Rush (1995), Hargadon and Sutton (1997), Howells (2006), Lichtenthaler (2013)
Resource-related	Distribute or facilitate access to funding from external sources	Bessant and Rush (1995), Chen et al. (2015), Dicecca et al. (2016), Inkinen and Suorsa (2010), Kanda et al. (2018), Kilelu et al. (2011), Kivimaa (2014), Polzin et al. (2016), Stewart and Hyysalo (2008)
	Provide direct funding	Inkinen and Suorsa (2010), Kanda et al. (2018)
	Provide physical infrastructure and space for testing, evaluation, legitimation etc.	Chen et al. (2015), Clark (2014), Intarakumnerd and Chaoroenporn (2013), Kanda et al. (2018), Winch and Courtney (2007)
	Provide training and education (develop human resources)	Chen et al. (2015), Edler and Yeow (2016), Gajzágó (2017), Howells (2006), Intarakumnerd and Chaoroenporn (2013), Kilelu et al. (2011), Kingiri and Hall (2012), Kivimaa (2014), Yang et al. (2014)
Actor-related	Evaluate and accredit suppliers	Balkow (2012), Howells (2006)
	Identify and analyse problems and bottlenecks for the implementation and application of technology	Edler and Yeow (2016), Kilelu et al. (2011), Yang et al. (2014)
	Help users/adopters and other stakeholders identify, define, and articulate their needs and requirements, expectations, and visions	Bessant and Rush (1995), Boon and Edler (2018), Dutrénit et al. (2012), Edler and Yeow (2016), Howells (2006), Kilelu et al. (2011), Kingiri and Hall (2012), Kivimaa (2014), Stewart and Hyysalo (2008), Tran et al. (2011), Westbrooke et al. (2018), Yang et al. (2014)
	Identify, select, and connect different parties (e.g., problem seekers and solves, suppliers and adopters)	Agogué et al. (2013), Bailey and Bakos (1997); Balkow (2012); Bessant and Rush (1995); Caloffi et al. (2015); Dutrénit et al. (2012), Howells (2006), Håkansson et al. (2011); Kilelu et al. (2011), Kingiri and Hall (2012), Stewart and Hyysalo (2008), Westbrooke et al. (2018)
	Provide users with a single point of contact through which to access a wide range of specialist services	Bessant and Rush (1995)
	Facilitate and negotiate deals and contracts between partners	Howells (2006)
	Provide spaces and arenas for meetings and social interaction	Kanda et al. (2018), Stewart and Hyysalo (2008)
	Facilitate interaction, communication, and networking between (potential) partners	Dutrénit et al. (2012), Håkansson et al. (2011), Kanda et al. (2018), Roxas et al. (2011), Stewart and Hyysalo (2008), Winch and Courtney (2007), Wolpert (2002)
	Facilitate within-group collaboration between sets of adopters, suppliers, etc.	Chen et al. (2015), Dicecca et al. (2016), Hargreaves et al. (2013), Kilelu et al. (2013)
	Manage conflicts of interest and crises	Boon et al. (2008), Intarakumnerd and Chaoroenporn (2013), Tran et al. (2011)

[a] A complete list of activities is available upon request.

[b] Note that some sources speak specifically about *technological* knowledge, expertise, and skills.

No distinction is made between intermediation activities (i.e., activities that constitute brokering) and other activities in Table 1 and the literature it is based on. It can be assumed that it includes a combination of both kinds of activities. Some activities seem to involve a one-to-one type of relationship, for example training, education, and provision of funding and infrastructure. Others seem more clearly related to intermediation, for example, the alignment of interests indicates that at least two other parties with different interests are involved. Winch and Courtney (2007) noted that intermediaries can sometimes conduct intermediation activities as by-products of their principal activities. Even when intermediation is the core task, intermediaries tend to engage in additional bilateral activities such as analyzing client needs and giving advice on external research links, for example to form lasting relationships with clients (Dalziel, 2010; Howells, 2006). As a consequence, "the role of innovation intermediation may … be only one among a number of other roles an organization may undertake in terms of its strategic remit" (Howells, 2006 p. 725).[5]

In the reviewed literature, it was uncommon to adhere to any specific definition or framework that distinguishes intermediation activities from others (except e.g., Howells, 2006). This is problematic for two main reasons. First, given that many scholars do not adhere to any specific definition, it can be hard to comprehend how the concept is utilized, and one can only assume that the implicit understanding is brokering between at least two other parties (it is important to note that the ones who do adhere to a definition typically utilize Howells (2006)). Second, inherent in a definition is usually some type of limitation. Howells (2006) clarified that intermediaries act between at least two parties, and in doing so, he solely included brokering activities. Following this line of thought, it can be assumed that brokering and intermediation can be key terms in understanding the raison d'être of diffusion intermediaries better.

2.4 INTERMEDIATION AND BROKERING AS KEY TERMS

Before starting the discussion on the key terms, it is important to emphasize that according to the definition used in this thesis, an intermediary is an actor that acts as a broker in the innovation process (see section 1.2). This is in line with common usage of the words. For example, Merriam-Webster's online dictionary defines a broker as: "one who acts as an intermediary" and describes the two terms as synonyms. It follows from this that the words "brokering" and "intermediation" are also different ways to describe the same thing, that is, the specific role or function performed by innovation intermediaries.[6]

Marsden (1982 p. 202) noted that brokering is a process "by which intermediary actors facilitate transactions between other actors lacking access to or trust in one another." Stovel (2011, p. 1) defined brokering as "intermediary links in systems of social, economic, or

[5] It has even been stated that intermediaries might take on a brokering role unconsciously (Smedlund 2006; Winch & Courtney 2007).

[6] Some view brokering as a sub-set of intermediation (cf. Stewart & Hyysalo, 2008).

political relations who facilitate trade or transmission of valued resources that would otherwise be substantially more difficult.". In short, brokering is when a third-party form a bridge between two actors (cf. Spiro et al. 2013). Brokers can be involved in can general activities such as the transfer of knowledge, information, and goods across gaps in innovation and social structures that they position themselves in (Dalziel, 2010; Stovel and Golub, 2011). The primary focus of this thesis is the brokering activities that are geared toward value creation for clients as opposed to how brokers create value for themselves in order to gain competitive advantage (cf. Ryall and Sorenson, 2007).[7]

As mentioned in section 2.3 there is a need to distinguish between intermediation activities, that is, brokering between at least two other parties, and other activities such as providing services on a one-to-one basis. Ideas on different types of brokering can provide important insights to refine our understanding of how such types can be distinguished more clearly.

2.4.1 THREE TYPES OF BROKERING

Spiro et al. (2013) provided a framework of three distinct brokering mechanisms: coordination, transfer, and matchmaking. The mechanisms are illustrated in Figure 3 below and the following sections describe each mechanism through some of the associated activities derived from the literature on intermediation.

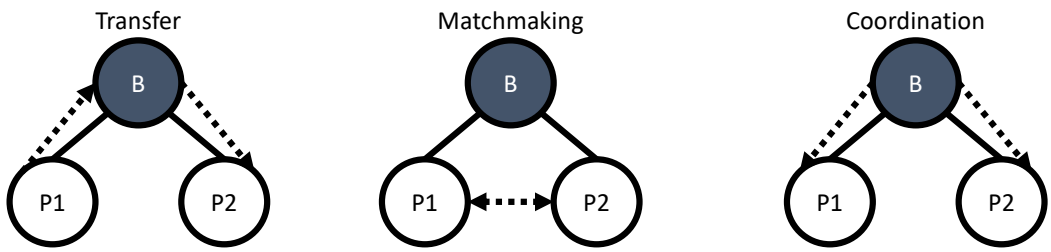

Figure 3: Brokering mechanisms. Illustrations adapted from Spiro et al. (2013).

Transfer occurs when the broker transfers resources from one party to another, for example from a seller to a buyer, without creating a direct tie between them. Previous literature has described two main types of transfer. First, brokers transfer technologies between two parties, for example between sources of technology and users (Bessant and Rush, 1995), between adopters of solar PV and wholesalers (Karakaya et al., 2016), between adopters and retailers and manufacturers (Benouniche et al., 2016), and between firms (Caiazza and Volpe, 2017). Second, brokers transfer knowledge, for example between suppliers and users (Bessant and Rush, 1995), between "two or more parties" (Agogué et al., 2013), between seekers and solvers (Abbate et al., 2013), and between farmers (Dicecca et al., 2016). From a diffusion perspective, knowledge transfer also includes the diffusion of best practices (cf. Dicecca et al., 2016; Edler and Yeow, 2016). Intermediaries can also be involved in a variety of other

[7] Paper 1 focuses on both value creation and value capture.

transfer activities such as the articulation of client needs and demands to potential collaboration partners and the redistribution of money from financial institutions to clients.

Matchmaking occurs when the broker facilitates the formation of a direct tie between the parties, for example to bring them together to cooperate. This implies that the broker forms a relationship between parties that can meet and trade with each other (with or without the involvement of the broker). Examples from the literature cover three matchmaking types. First, intermediaries provide platforms for cooperation such as arenas in which key stakeholders can connect (Kanda et al., 2018), and "spaces" in the form of communities and networks where users and suppliers connect (Stewart and Hyysalo, 2008). Second, intermediaries connect collaboration partners to each other. Examples include mobilizing farmers into groups (Kilelu et al., 2013), identifying and linking actors in networks (Kilelu et al., 2011), and connecting parties that were not previously aware of each other's existence (Håkansson et al., 2011 p. 265). Finally, intermediaries align interests, for example by acting as matchmakers to mediate conflicts (Boon et al., 2008; Intarakumnerd and Chaoroenporn, 2013; Tran et al., 2011). It may be concluded that as "matchmakers," intermediaries connect different collaboration partners and enable them to collaborate.

Coordination occurs when the broker facilitates parties to interact without forming a direct tie between them. This implies that the broker communicates between at least two other actors and is the main point of contact for the parties it acts between (this argument also applies for transfer). Explicit examples of coordination are quite sparse in the literature, but it is nevertheless possible to recognize the underlying mechanism of coordination in some studies. For example, Strupeit and Palm (2016) studied different business models and revealed that the partner networks were important in order to provide turnkey installation of the PV system in Germany. Given that the intermediary provided turnkey installations which normally includes handling most aspects of the implementation process for adopters such as interacting with different input providers which the adopter does not have to interact with, it is indicated that the intermediary is involved in coordination (see also section 2.2 reflecting this study). Another example is Karakaya et al. (2016) who demonstrated the relationships between a local solar company brokering between wholesalers for system components, local networks for knowledge, and solar PV adopters which implies that the solar company handled these contacts on the adopter's behalf without the parties having to interact with each other. It is not certain whether the intermediary is coordinating, although it is likely in light of the authors illustration on page 1031 indicating that the intermediary is acting between the parties without forming a direct tie between them. A significant aspect of coordination is thus to coordinate a series of input providers, and seen from the adopter's point of view, the only point of contact is with the intermediary.

The sole focus of the brokering mechanisms framework created by Spiros et al. (2013) is brokering between groups. However, according to previous literature on brokering (cf. Gould and Fernandez, 1989), it can occur both between and within groups (see Figure 4).

- *Between-group brokering.* The broker connects two distinct parties (without allegiance to either), thus, allowing them to cooperate. Both parties and the broker all belong to different subgroups (white, gray, and black in Figure 4). For example, the broker can be a project developer in a project, brokering between a client/adopter and a technology supplier.

- *Within-group brokering.* This type of brokering implies that both parties belong to the same subgroup (white in Figure 4), for example adopters or suppliers providing similar products, while the broker is an outsider (black in Figure 4).

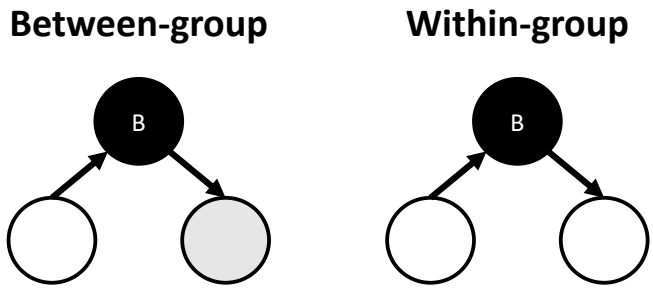

Figure 4: Between and within-group brokerage roles.

In the literature on brokering (cf. Stovel and Shaw, 2012), one central theme is that brokers create value for themselves through their position in-between parties with the advantages that are inherent in this position. However, this assumption has been questioned. Ryall and Sorenson (2007, p. 578) suggested that "Critics question whether positions of intermediation themselves can convey a competitive advantage or whether they merely reflect the valuable capabilities and/or resources that these actors' control.". Zooming out, it is clear that value creation can be interpreted in different ways. In a diffusion context where diffusion intermediaries are working toward facilitating for clients in implementation processes, it is not certain through which types of activities (i.e., intermediation or other activities, or a combination) that create value for adopters. However, brokering mechanisms can be a useful framework in distinguishing whether value creation stems from other activities or from intermediation activities (Aspeteg and Bergek, 2019).

2.5 TWO VIEWS ON VALUE CREATION

With regard to the raison d'être of diffusion intermediaries, recognizing the value they create for adopters and end users can be a crucial step toward understanding why they exist. More specifically, understanding the specific value that diffusion intermediaries create as brokers can illustrate what make them unique as opposed to other companies. Focusing on two views on value creation, namely value proposition and adopter satisfaction can provide a more complete picture of the activities that are associated with value creation that diffusion intermediaries provide to adopters and the problems they could solve in implementation projects. The first of these refers to a company's bundle of products and services through which they intend to create value for their customers (in this case, innovation adopters)

(Osterwalder et al., 2005 p. 18) and the second refers to how satisfied the adopters are with what the company has to offer and how it is delivered.

2.5.1 VALUE PROPOSITION

The business model concept is especially useful in understanding the overarching business logic of firms and the value that firms create for their customers (Osterwalder and Pigneur, 2010; Osterwalder et al., 2005; Zott et al., 2011). A major component of firms' business models is the value proposition which can be understood by asking questions such as: "What value do we deliver to the customers? Which one of our customers problems are we helping to solve? Which customers' needs are we satisfying? What bundles of products and services are we offering to each Customer Segment?" (Osterwalder et al., 2005 p. 23). It can be applied to investigate the overarching value that diffusion intermediaries offer to adopters in implementation projects.

From a theoretical perspective, it is relatively clear that intermediaries' value propositions based on brokering are geared toward solving adopters' key problems. This can be traced back to Spiro et al. (2013) who actually discussed value through the lens of the brokering mechanisms (coordination, transfer, and matchmaking). This was illustrated in Paper 1, where value creation was conceptualized as an outcome of activities related to the three brokering mechanisms. In their role as brokers in implementation projects, it is necessary for diffusion intermediaries to combine products and services that Velamuri (2013) referred to as hybrid value creation, but previous studies have not identified how diffusion intermediaries create value for adopters with precision.

The idea that the sole value creation feature of intermediaries lies in the fact that they are brokers can be fruitful from a theoretical perspective (since it most likely simplifies matters), but it focuses on a type of value creation that is common to all intermediaries rather than many types of value creation that create a competitive advantage for individual intermediaries. To understand the latter better, it might be useful to study value creation from the perspective of the adopters and consider the determinants of adopter satisfaction.

2.5.2 ADOPTER SATISFACTION

Herrmann et al. (2000) developed the means-ends model that can be utilized to analyze different elements of adopter satisfaction. Four elements of the model are summarized below to reflect the context in which diffusion intermediaries act within, that is, in implementation projects:

- Tangible or concrete attributes reflect aspects that are easy to explain and are thus used to compare intermediaries, for example the contents of the service package;

- Abstract or intangible attributes reflect the adopter's subjective opinions regarding the services it expects from the intermediary (e.g., the intermediary's willingness to help the adopter);

- Psychological utility components reflect the needs that adopters have to make things happen (e.g., to carry through with the investment); and

- Functional utility components reflect the types of support that adopters need in association with the intermediary's turnkey offer (e.g., help choose technology).[8]

In contrast to the value proposition, which reveals the overarching value related to intermediation activities, the adopter satisfaction view on value provides a more detailed insight into the uniqueness of each diffusion intermediary's value proposition. Value proposition and adopter satisfaction may converge or diverge, but an important part is presumably for intermediaries to tailor their solutions to match the adopters' individual motives and driving forces. To this end, focusing on the activities of diffusion intermediaries in combination with the two outlined views on value creation can provide a better understanding of the specific problems that diffusion intermediaries solve for adopters in implementation projects.

2.6 RESEARCH QUESTIONS AND THE NEW PROPOSED FRAMEWORK

Scholars such as Klerkx and Leeuwis (2009) and van Lente et al. (2003) have noted that there is confusion and terminological redundancy in the intermediation literature. Perhaps, as Kivimaa et al. (2019) suggested, one reason for this is the fact that there is neither any universal definition nor any distinction of when in an interaction the intermediation process begins and ends. Håkansson et al. (2011 p. 262) goes even further and asserts that: "There is no consensus as to the nomenclature and semantic conventions best suited for the description and analysis of innovation intermediation as a process, nor of innovation intermediaries as organizational entities."

The topic in this thesis, which has been introduced in the previous sections of this chapter, is the lack of attention toward intermediation activities vis-à-vis other activities. This means one might assume that all the activities described in the literature as being performed by innovation intermediaries are to be defined as intermediation activities. However, this is not certain, since intermediaries are also known to do other things (cf. Howells, 2006; Winch and Courtney, 2007). As the previous section on activities indicates, this seems to be a valid assumption. These topics have not been scrutinized thus far in the previous literature. Thus, the challenging task of distinguishing the activities and the resulting value(s) are left to subsequent scholars.

A central argument is that to be able to shed light on more activities, functions, and roles, the first step is to come to terms with how to distinguish between the already existing ones. Since this would allow those that are only interested in intermediation activities (or perhaps other activities or a combination) to focus on these. Refining brokering activities is also a way to

[8] For a summary of all 6 elements, see paper 2 in which the model was utilized.

get a better understanding of the activities that can be linked to the raison d'être of diffusion intermediaries and the associated views on value creation in diffusion processes. Against this background, two research questions can be formulated:

1) Which activities can be classified as brokering?

2) What value do diffusion intermediaries contribute to in the implementation processes?

In order to answer these questions and better grasp why diffusion intermediaries exist, the brokering mechanisms framework described in Section 2.4.1 is utilized. If the framework in its current state is accurate, it should work to categorize intermediation activities into coordination, transfer, or matchmaking, and thus distinguish brokering from other activities.

To this end, an analytical framework based on the brokering mechanisms is proposed (see Figure 5). The first step in the analysis is to identify unsorted "raw activities." In the second step, these are analyzed through the lens of the brokering mechanisms in order to distinguish the intermediation activities (i.e., activities that match either coordination, transfer, or matchmaking) and other activities. Third, after distinguishing intermediation from other activities, the value creation in terms of both value proposition and adopter satisfaction of different types of activities is identified. While the core of the thesis is value generated through intermediation activities (illustrated with solid lines in Figure 5), the framework acknowledges that value is not necessarily created exclusively through intermediation activities but can also be generated through other activities (illustrated with dotted lines in Figure 5).

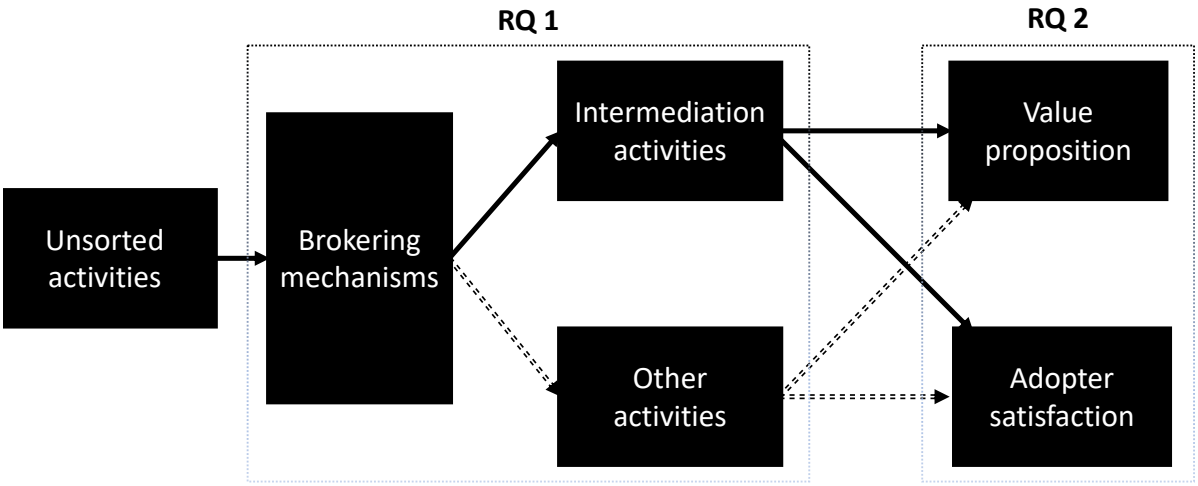

Figure 5: Modified brokering mechanisms framework

3. METHOD

The purpose of this thesis is not only to answer the research questions but also to synthesize and show how the appended papers, with somewhat different but converging contents, are connected and can be utilized to answer the research questions in this thesis. Writing a licentiate thesis can be challenging. However, it is also rewarding in the sense that it is possible to "connect the dots" and to elaborate a little more than what is possible in a research article. This section provides an overview of the methodological approaches used in the appended papers. It is based on material from the appended papers, emphasizing the process of collecting and analyzing the data. The chapter starts with a presentation of the research project and outlines the three main studies in the thesis and ends with a reflection on methodological choices and research quality.

3.1 INTRODUCTION TO THE RESEARCH PROJECT

The thesis is written as part of the project *The roles of intermediaries in the transition to a sustainable energy system,* which is financed by the Swedish Energy Agency. The overarching aim is to understand how intermediaries can facilitate and improve investments in renewable energy production. The research project included four pre-defined questions:

I. What types of intermediate actors are there in renewable electricity production in Sweden, that is, which are the different categories of intermediaries that can be identified? Are there differences in this regard between different types of RETs?

II. What roles do different types of intermediaries play for individual investments and for the transition to a sustainable energy system?

III. What risks are associated with intermediaries – for individual investments and for the energy system as a whole? Are some investors or technologies more exposed to these risks than are other investors or technologies? Are there any specific investors or energy types that are more exposed to such risks?

IV. How could intermediaries be used to increase the number and quality of investments in renewable electricity production?

My primary focus was question II, which is reflected in the purpose of and in the research questions in this thesis. In order to study the "roles" of the intermediaries, it was necessary to first discern the activities that were carried out by the diffusion intermediaries. Question II focused on the roles of intermediaries, and the term used in this thesis is "activities," that is, something concrete, such as serving to link parties, transferring technologies or knowledge from one source to another. This implies that if one understands the central activities, it is possible to also understand the role(s) played by the intermediaries in the innovation process.

Although research questions III and IV were not the primary focus of the thesis, they are touched upon. For instance, in Paper 1, we focused on the risks in the form of trade-offs, and

the results of all papers could be used by decision-makers to understand the central activities of diffusion intermediaries. This understanding can lead to refined decisions at a policy level, resulting in the increased quantity and quality of investments (question IV).

At the outset of my PhD studies, two (wind) projects had already been identified by my colleagues. This implies that it was a good and early opportunity for me to gain a deeper understanding of the study context, that is, what the diffusion intermediary concept entailed. Besides the overarching research questions and ongoing projects, the research process was open to a large extent and I could choose how to progress. For instance, I identified diffusion intermediaries who were willing to participate in interviews that were conducted initially to get a broad overview of their business models and value creation and capture dimensions.

It is vital to note that even though the research project worked as a guiding thread, many aspects were not pre-decided. For instance, the majority of methodological approaches for collecting and analyzing data, whom to interview, and which questions to include in the interview guides were not pre-decided. Since the wind projects were ongoing, I was not free to choose the methods for this project. However, I was free to identify an additional longitudinal solar PV project.

3.2 OVERALL STUDY DESIGN

In order to study the diffusion intermediary phenomenon, three main qualitative empirical studies were conducted: (1) an interview-based qualitative survey, (2) a longitudinal embedded case study based on observations and interviews, and (3) a multiple case study of six larger-scale projects based on observations and interviews. The results of these studies have been reported in three papers, which are included in this thesis (see Table 2) and are described in detail in the following sections. The rationale behind using a qualitative approach is that the study object, that is, diffusion intermediaries, remains unexplored to a large extent. This is also why the studies are exploratory with the broad point of departure being associated with question II regarding the roles of diffusion intermediaries.

Table 2 Overview of the papers.

Paper	Title	Purpose and Research questions	Study design and data
I	The value creation of diffusion intermediaries: brokering mechanisms and trade-offs in solar and wind power in Sweden	Purpose: To investigate through which brokering mechanisms diffusion intermediaries create value for adopters of new technologies and what conflicts of interests and trade-offs they face in relation to value capture. RQ 1: On what types of brokering mechanisms is value creation by diffusion intermediaries based and what intermediation activities are carried out as part of those mechanisms? RQ 2: What types of trade-offs do diffusion intermediaries make with regard to value creation and capture?	Qualitative survey (interviews)
II	Intermediation services and adopter expectations and demands during the implementation of renewable electricity innovation – match or mismatch?	Purpose: To identify adopters' expectations for services provided by intermediaries when adopting PV and how well the services provided by intermediaries actually match these expectations? RQ 1: What attributes do RE adopters consider when hiring the services of an intermediary? RQ 2: How well do attributes valued by RE adopters match the services offered by intermediaries?	Embedded case study (observations and interviews)
III	When is a diffusion intermediary an intermediary? The intermediation activities of solar and wind power project developers in Sweden	Purpose: To map the activities of a number of intermediaries and, based on a theoretical understanding of brokering, determine which of these can be considered intermediation activities.	Multiple case studies and qualitative survey (observations and interviews)

3.2.1 Study context: Why focus on solar and wind power in Sweden?

In the project application, it was pre-decided that the focus of the research was intermediaries in the transition to a sustainable energy system, that is, actors working with RETs. This decision was based on insights from previous studies, which had shown that such intermediaries exist and, more importantly, that they are important actors in the innovation diffusion process, conducting an assortment of activities to facilitate the adoption of RETs (Mignon, 2016; Mignon and Bergek, 2016) (see also Section 2.4).

In order to limit the study further, the first step was to understand the different trajectories of the three predominant RETs in Sweden, namely solar, wind, and hydroelectric power. To this end, interviews with three Swedish trade associations were carried out. The representative from the trade association of hydroelectric power noted that the development of small-scale hydropower in Sweden had been questioned and that the market for hydro power appeared to be in a downward spiral phase because of the regulations that had a negative impact on the progress of the industry. In contrast, the wind power representative noted that the market for wind power had also experienced similar issues but was now about to "wake up" again. Thus, it was decided to focus on wind power. As mentioned above, contact with some wind projects had already been established and data collection had already been initiated, and the interview essentially confirmed that the projects were in line with the aim of the project. The solar PV industry was described as growing and most new companies were smaller installer companies, consultants, and other actors. This also seemed like a good match. Thus, it was chosen as the second technology for the project in general and for this thesis in particular.

3.3 The three studies: case selection, data collection, and analysis

The following sections discuss the three studies and end with a summary of the three studies in Table 3.

3.3.1 Study I: Qualitative survey

The first study was an interview-based *qualitative* survey (not to be confused with a *quantitative* survey). According to Jansen (2010 p. 6) the goal of a qualitative survey is not to establish "frequencies, means or other parameters but [..] at determining the diversity of some topic of interest within a given population." More specifically, a qualitative survey can be utilized to examine and compare differences and similarities between several factors as opposed to other methods that are geared toward depth instead of breadth as the qualitative survey. Perhaps the most evident difference between case study research and an interview-based qualitative survey is that the latter is applicable to covering a larger set of companies and a more limited amount of data per company. Given that the overarching goal of the study was to get a broad overview of the field, this approach was considered a relevant starting point to cover a variety of solar PV and wind power diffusion intermediaries.

The study is based on a previous mapping of the Swedish firm registry covering over 600 RET diffusion intermediaries (Bergek, 2019). Theoretical sampling was used to identify 14 private diffusion intermediaries. The study included specialized and non-specialized intermediaries. The former were companies whose business models were built up around

intermediation, whereas the latter were also involved in other types of businesses. In all, the study covered 7 + 5 solar PV firms, whose main businesses varied, such as solar PV consulting (specialized), solar PV development (specialized), solar PV wholesale (specialized), electric installation (unspecialized) etc., and 7 wind power intermediaries whose main businesses also varied, such as wind power development (specialized) and electricity production (unspecialized). As it turned out to be rather difficult to identify unspecialized intermediaries, the final selection included more specialized intermediaries (although the initial goal was to achieve a balance between the two).

Following a qualitative survey approach, a single interview per company was carried out. These diffusion intermediaries were interviewed face-to-face using a semi-structured interview approach. More specifically, the interview guidelines covered four key topics (the first two were more general ones whereas the last two focused on the research questions): (1) general information on the company, (2) information on the industry as a whole, (3) the company's business model with regard to renewable energy technology, and (4) challenges and risks. Interviews lasted approximately between 40 minutes and 1 hour and 40 minutes. The third question covered the main components of the company's business model (value propositions, customer segments, channels, customer relationships, key resources, key activities, and key partners, as well as the resulting cost structure and revenue streams of each company) (Osterwalder and Pigneur, 2010). One question asked about describing a "general" project from start to finish, in order to understand the activities that companies conduct in implementation projects. The descriptions were often rather general, so follow-up questions were often necessary to focus the interview on core topics and gain a deeper understanding of activities in the implementation projects. The fourth question focused on the respondent's understandings of success criteria, trade-offs, conflicts of interest, and challenges.

Most interviews were conducted in 2017 (complementary interviews with the largest solar PV companies in Sweden were conducted in late 2018). The respondents were managing directors, chairmen of the board, sales persons, or sales/business managers. Most interviews were done in person, but some were conducted on the phone. The interviews were audiotaped and transcribed word-for-word (four interviews were reused from a previous study conducted by a colleague and member of the research project and was thus already transcribed). Some of the companies' websites were studied as a complement to questions that were not covered in the main interview, and some companies were contacted on the phone for complementary information. The study was also complemented by five additional intermediaries to cover the largest solar PV diffusion intermediaries in Sweden. Three of these intermediaries were interviewed on the phone due to geographical constraints and in response to the intermediary's requests. Two were interviewed face-to-face following the same logic as for the other diffusion intermediaries.

A framework was developed and used as a guide to analyze the transcribed data. The framework combined the components of the business model canvas and Spiro et al.'s (2013) brokering mechanisms (we conceptualized the brokering mechanisms as the core of the diffusion intermediaries' value proposition). In the analysis, the first step aimed to identify the

business model components for each intermediary to distinguish the main trade-offs between the intermediary and its key stakeholders (clients, suppliers etc.). Then, the result from each technology was compared and synthesized separately. Finally, similarities and differences between solar and wind intermediaries were identified and discussed.

3.3.2 STUDY II: EMBEDDED CASE STUDY

The second study is an embedded case study (cf. Yin, 2013) that includes one of the largest Swedish solar PV diffusion intermediaries as the main case. The so-called sub-units consist of six adoption projects with adopters using the services of the intermediary. This type of study opens up the possibility of many different types of interpretations of the data: "The ability to look at sub-units that are situated within a larger case is powerful when you consider that data can be analyzed within the sub-units separately (within case analysis), between the different sub-units (between case analysis), or across all of the sub-units (cross-case analysis)" (Baxter and Jack, 2008).

The overarching goal of the embedded case study was to conduct a study at the one and same diffusion intermediary for an entire month to identify adoption projects to study from initiation to closure, and to observe the daily work of the intermediary to explore which activities it conducted in adoption projects. It can thus be argued that this study was a so-called longitudinal study. A longitudinal approach is adequate if one is interested in the depth and breadth of a phenomenon (Saldaña, 2003), which was considered fruitful in order to better understand the roles and activities of diffusion intermediaries. Being immersed in longitudinal qualitative research means that studies are continuing for at least a couple of months, although it seems as if there is no actual consensus on the precise length of longitudinal studies (Saldaña, 2003). Additionally, one does not necessarily have to participate in the daily work of a company but the researcher can also focus on episodic observations and interviews (Saldaña, 2003). The present research is based on a combination of the techniques.

The main case, that is, the diffusion intermediary in focus, is one of the largest (and growing) solar PV intermediaries in Sweden. The firm serves all customer segments including homeowners, housing associations, farmers etc. Besides providing turnkey solutions the intermediary is involved in research and development and is expanding internationally. The intermediary performs activities in-house. For example, the company has its own installers and electricians. During the study, most employees were observed and interviewed (e.g. the CEO, chief technology officer, sales team, and project managers) in no specific order. Following everyday work meant participating in undertakings such as meetings both with adopters and internal meetings (e.g. sales and management meetings). This implies that the study object was not a particular actor in the firm. The implication of conducting a longer observational study is that the researcher can collect data from several different sources.

Data were collected through day-to-day observations of activities and interactions with a diverse set of stakeholders which were documented in observation notes. Data were also collected by participating in fairs (three observations from two different fairs). During the

fairs, the interactions between the representatives from the intermediary and potential adopters was central. On these occasions, potential adopters (i.e., adopters who talked about investing with the intermediary) were interviewed regarding the decision process, for instance, if other intermediaries had been evaluated, what criteria they used to evaluate them, expectations of the process from that day's contact until they began producing their own electricity, and whether it was possible to study their potential implementation project. All interviewed adopters at the fair were informed that I was an independent researcher who would not share any information with the intermediary, that they would be anonymous, and what the data would be used for, in addition to being given a short description of the research project. The length of the interviews varied from approximately 5 to 15 minutes and they were conducted in the exhibition area in a location where the intermediary could not overhear the interview. The employees of the company were also interviewed and interview questions related to matters such as their roles in the company, when the employee was in contact with the adopter (why and in what context), what the employee helped the adopter with (if it matched the adopters' expectations), and what happened if it was not possible to achieve the adopters' expectations (and how this was communicated to them). A total of 12 employees were interviewed: CEO, CTO, sales manager, five sales people, two project leaders, one that was responsible for public procurement, and one technician. In addition, interviews with 8 adopters who had previously invested were carried (the interviews were conducted over the phone). Interview questions related to their needs, expectations and selection criteria.

The adoption cases/implementation projects were identified by talking to sales people at the intermediary and asking them if they had any potential adopters that were about to invest in the projects. This resulted in observations from meetings with potential adopters who later decided to adopt and whose implementation projects were later included in the study. This also opened up room for the opportunity to ask adopters face-to-face if their implementation projects could be included in the study and if they were willing to participate in interviews before and after implementation. The rationale behind interviewing the adopters was that it would provide a broader picture of the implementation projects.

Data were collected during different stages of the adoption projects. In the project initiation phase, adopters were interviewed to understand the criteria leading to the selection of the intermediary, as well as their needs and expectations regarding implementation. During this phase, data were collected through interviews with sales people at the intermediary firm, since they were responsible for the initial contacts with the adopters. When the initiation phase ended and the implementation process was about to be initiated, the focus shifted onto the activities of the project manager who managed contact with the adopters, set up a chat group where the intermediary could internally discuss the project, and handled various kinds of applications. The interview questions after implementation related to the following topics: project process (i.e., what services were provided to the adopters and how), adopters' satisfaction with the project, and the reasons behind their appreciation level. The salespersons and project leaders received questions covering the following topics: Why did the adopter choose to invest in PV? What criteria were considered by the adopter while selecting from among PV installers? Why did the adopter choose the intermediation firm for support? What

support did the adopter need? Did the support from the firm match the adopter's expectations? Interviews with previous adopters (whose projects were not studied) were also conducted following the same interview guide as outlined above.

The majority of data collection occurred between fall 2017 and spring 2018. In total, seven interviews were conducted with adopters over the phone that were spread-out all over Sweden, face-to-face interviews were conducted with three adopters, one with an adopter who visited the intermediary to discuss the PV plant with the sales manager and two with local adopters. The interview durations ranged from ten minutes to over one hour (with the employees, especially the interviews with the CEO and CTO). Besides the primary data mentioned, other secondary data sources were gathered from participating in chat groups where the employees at the company updated each other on topics related to the implementation projects with text and photos. In the chat group, the daily undertakings were reported, and this was an important secondary data source to grasp the progression of the projects. Another secondary data source was documents related to the projects (see Table 3 for a full overview).

A qualitative software called NVivo was utilized to analyze the collected data. The benefit of NVivo is that data can be coded in different hierarchies of nodes to structure and make sense of a large set of data by categorizing them in different hierarchies of nodes. That is, parental node (e.g., motives for investing) and child node (i.e., a sub-node with associated data).

3.3.3 Study III: Multiple case study

The third building block is a multiple case study covering six larger-scale projects developed by three different intermediaries. The rationale behind utilizing a multiple case study methodology as articulated by Yin (2013) is that the evidence based on multiple cases is often considered more compelling. The approach was especially fruitful in exploring the activities of diffusion intermediaries, since it made it possible to get a more inclusive picture of the activities that the diffusion intermediaries conducted and to identify activities in various phases of the implementation process. It was also possible to observe the actors of the diffusion intermediary firm in their real-life context, for example when they were interacting with adopters. It was also fruitful to combine the observations with interviews and secondary data (documents and chat groups) to triangulate the data. The downside of a multiple case study as pointed out by Yin (2013) is that it can be quite time consuming. One of the longest projects in the study was initiated in 2015 and another was initiated in 2016. Although one does not study the projects on a daily basis since it can be time consuming, it also provides very rich data that can capture change over time (Saldaña, 2003).

This study focuses on two longitudinal wind projects and four solar PV projects. The two longitudinal wind power projects were handled by the same intermediary and the two adopter consortia also overlapped to a large extent. The intermediary was specialized in developing so-called public-private partnership. In these projects, the private company was the intermediary which collaborated with public companies in a consortium to establish wind power in a Swedish region. The intermediary handled some activities in-house, for example,

one of the owners of the company were involved in writing the environmental impact assessment (EIA) which is a major activity in wind power implementation. The adopters in both projects were public companies, with one exception, that is, an association with the purpose of establishing wind power in the local municipality. The two wind projects have been observed since 2015. One of the projects was denied an environmental permit by the Land and Environment Court in 2016 and was closed down after that. The other project also got a negative decision from the county administration and is now in an appeal process.

Three of the longitudinal solar PV projects were developed by the same intermediary as in paper II. The adopters were two private housing companies and one multinational construction and development company. The projects were observed between October 2017 and their completion in 2018. The fourth solar PV project started in late 2017. It was observed from the beginning, which implies that both the process of choosing a solar PV installer (managed by one intermediary) and the subsequent implementation process (managed by the chosen installer, i.e., another intermediary) were studied. The first intermediary was a specialized consultant whose activities were mainly geared toward detailed design and the preparation of joint tender documentation, that is a document used to describe the prerequisites for the procurement in terms of what is purchased and what requirements are imposed on what is purchased etc. The joint tender document was formulated to find a solar PV installer that matched the requirements and demands that the two adopters, which were real estate companies, had decided upon together with the consultant. The second intermediary (the installer) is one of the largest solar PV installers in Sweden. It has been active for quite some time in the Swedish market and is currently in a rapid growth phase. It is involved in implementation projects all over Sweden, focusing on two primary customer segments, namely companies and property owners. The main activities are consultations, project planning, and the establishment of larger solar plants with their own installers and electricians. The two implementation projects with this intermediary were chosen based on the fact that we wanted to study them from start to finish and also, that the projects were situated in appropriate locations that made it easy to attend both board and building meetings. It was fruitful to follow the activities during the entire process from planning to procurement with one intermediary and then from planning to implementation with a second intermediary.

The data collection process for the cases was based on two approaches: semi-structured interviews and observations. In the two wind projects, the semi-structured interviews covered both the intermediary and the adopters. In all, seven interviews were conducted: two with representatives of the intermediary and five with the adopters. The length of the interviews varied between 40 minutes and approximately 90 minutes. Questions to the adopters covered the following topics: (1) the respondent, its role in the organization, and its role in the wind implementation project, (2) the motive behind participating in the project, as well as the goals for and expectations from the project and the investment, (3) what role the adopters expected the intermediary to play during the project development stages and how they chose the intermediary, (4) the intermediary's role so far and the intermediary's activities in relation to the adopters' expectations, and (5) more detailed questions on how the intermediary contributed to the project. Questions to the intermediary representatives were quite similar to

some of the modifications that sought to reflect the adopters' roles in the project as well as their own. Some questions were also excluded, such as why the intermediary was hired. Instead, questions regarding how the intermediary assisted the adopters were asked.

In the three longitudinal solar PV projects, nine interviews were conducted before and after implementation with adopters, sales people, and project leaders (for more information on interview questions, see section 3.3.2). In the other longitudinal solar PV project, three semi-structured interviews were conducted, two with the different types of intermediaries, that is, the installer and the specialized consultant, and one interview with one of the adopters directly after they had chosen the intermediary, to ask questions regarding the choice (and if it we could continue to follow the project with the new intermediary).

The wind projects were observed on 21 occasions during board meetings and on one occasion when the intermediary had a meeting with the County Administrative Board. The 4 solar PV projects were observed on 19 occasions. The goal with the observations was to get additional information on the activities of the diffusion intermediaries. The observational notes provided rich data since they included real-life interactions between the adopter and intermediaries. The observational notes varied in duration from 30 minutes to roughly 2 hours on some occasions (for example the wind project meetings could differ a lot in time if they had a lot to discuss). The solar PV meetings also varied in duration, some construction meetings lasted for roughly 40 minutes and other meetings when there were a lot to discuss such as training sessions with board members and adopters, the meetings lasted for nearly 2 hours. During the observations, the majority of the interactions were transcribed, besides the more informal interactions where the discussion related to topics other than the implementation projects. The study also comprises secondary data sources such as meeting protocols and other documents. The secondary data sources were partly derived from participating in the email correspondence pertaining to the project. The dates for the next meetings were disseminated, the protocols summarizing the meetings were distributed, and updates that did not require a formal meeting were announced via email. The communication channels differed between the projects, wherein some did not use email at all but instead implemented all internal communication through a chat group (in the three longitudinal solar PV projects). The secondary data were a good complement since they provided a better understanding of the different projects.

The activities were scrutinized and categorized in nodes using the same the qualitative software package as utilized in study II, that is, NVivo. The process was inductive (bottom-up) and the data were analyzed several times to map all the activities of diffusion intermediaries (intermediation and other activities). The activities were then categorized in different nodes based on the project and whether it was solar- or wind-related.

Table 3 Summary of the three studies.

	Study I	Study II	Study III
Study design	Qualitative survey	Longitudinal embedded case study	Multiple case study
Study objects	10 + 4 + 5 intermediaries	1 intermediary and 6 adoption projects	6 larger-scale projects developed by 4 intermediaries
Type of adopter (the adopters in studies two and three were interviewed – those noted in study one refers to the adopters that the intermediary has mentioned)	Solar: Households, farmers, private housing companies, installers (electricians, builders, specialized solar companies), municipalities, and public companies Wind: pension funds, energy companies, foreign asset managers, large companies, energy companies, farmers, forest owners, electricity companies, land owners, municipalities, and housing associations	6 homeowners	1 multinational construction and development company 2 housing companies 2 real estate companies 3 adopters from the municipality 1 association
Primary data	10 + 5 semi-structured interviews	6 semi-structured interviews with sales people 6 semi-structured interviews with project leaders 12 semi-structured interviews with adopters (6 before and 6 after implementation) 8 semi-structured interviews with previous adopters 12 semi-structured interviews with employees	21 wind meeting observations 19 solar PV observations 7 semi-structured wind interviews (2 intermediaries and 5 adopters) 12 semi-structured solar PV interviews

	Study I	Study II	Study III
Secondary data	Transcripts from 4 previous interviews Company web pages	Chat group conversations Notes from observational studies	Chat group conversations Checklists Protocols from meetings Email correspondence
Data analysis	Categorization and comparison based on business model canvas framework	Coding using NVivo software	Emergent coding using NVivo software

3.4 REFLECTIONS ON METHODOLOGICAL CHOICES

The last sections discuss credibility, validity, generalizability, as well as the benefits and challenges of observational studies.

3.4.1 CREDIBILITY, VALIDITY, AND GENERALIZABILITY

A central aspect of qualitative research is credibility, that is the fact that it studies what it is supposed to study in the first place. To this end, peer debriefing has been important, especially while conducting observational studies. When one is immersed in the daily work of an organization, it is necessary to take a step back to discuss the original purpose of the study or to review the findings in order to refine the interview guides and to find new sub-paths that can be explored. These studies have been presented at internal seminars and discussed with supervisors, the preliminary results have been presented to intermediaries, and the research findings have been presented at conferences. Two of the appended papers (1 and 2) have gone through review processes in an academic journal which is a central means to achieve credibility. A session was also arranged before the licentiate seminar to receive feedback on the writings of this covering paper (i.e., not from the supervisors). Thus, feedback has been obtained from several sources.

Triangulation is another aspect that is important for validity, where two or more sources should have been used to understand a problem or cross-check the results and to increase the validity of the evaluation and the results (Mathison, 1988) or as a means to increase validity and reliability (O'Donoghue and Punch, 2003). There are several different types of triangulation (Denzin, 2006) that have been utilized in this thesis. First, investor triangulation aims to include several researchers in a study. We were two researchers involved in discussing the coded data and on some occasions in collecting data as well. Throughout the process, starting from collecting the data to sending them to a journal, we had an open dialogue on how best to proceed and divide responsibilities. Second, methodological triangulation includes using several methods to gather data. This thesis builds on several different study designs and data collection methods. Data were also collected at different time

periods, since the implementation projects sometimes continued for several months and had building and board meetings at different points in time.

There are a few aspects that should be generic for most implementation projects, such as the process that intermediaries have to go through to implement projects for adopters (most notably the EIA process in wind projects and grant applications in solar projects). However, it may not be possible to generalize the results for all RETs, not least since the results show that there are some differences (but also many similarities) between solar and wind power. Nevertheless, the thesis includes interviews with the majority of the largest solar PV diffusion intermediaries in Sweden and some longitudinal projects reflecting the real-life interaction with adopters. To this end, it is possible to generalize the results within the particular setting of solar PV in Sweden. Wind implementation is a generic process, including a standardized permit process with associated activities (e.g., the EIA). Based on the data, that is, interviews with five companies and observations of two longitudinal wind projects including interviews with adopters, it should be possible to generalize the results within the context of wind power implementation in Sweden.

It is important to note that even though the studies are limited to actors within solar PV and wind power in Sweden, the literature provides some important insights on issues such as the impacts of wind energy on the environment in the USA and on the various impact assessments that must be carried out (cf. Saidur et al., 2011; Wang and Wang, 2015). Given that the EIA process is important in wind power implementation, and that studies indicate that there are various assessments that have to be conducted in other countries as well (Leung and Yang, 2012), and that wind power developers are involved in interactions with a variety of stakeholders in the project (Jami and Walsh, 2017), the findings of the thesis can perhaps be generalized to other contexts as well. This same line of thought can be applied to the findings on solar PV power as well. Since previous studies such as Karakaya et al. (2016) and Strupeit and Palm (2016) have shown that solar intermediaries in other countries also apply similar business models as those in the Swedish market, it is likely (but not certain) that the results are generalizable to other contexts.

3.4.2 Benefits and challenges of observational studies

This procedure can be challenging because of the one-month observational study and the issue of identifying implementation projects in a pre-decision phase. The studied intermediary had many projects that were about to be initiated, but the observational study took place at a time when not so many installations were carried out. If the study had been repeated, additional research before the actual initiation of the study would have been appropriate. For example, pre-study interviews would have been carried out with the sales manager and sales staff in order to get an impression of the “investing climate” (to conduct the study at a time when many implementation projects take place). While I did meet with the sales manager before the study to discuss the implementation process, this issue did not come up.

However, there were some advantages of observing the company in a less hectic period since the actors had more time to discuss issues and participate in interviews. They also took time

to elaborate on their roles and on the uniqueness of solar PV implementation projects, which might not have been prioritized during a hectic period. I observed the CEO for the first couple of days and gained access to two implementation projects. The insights from "shadowing" the CEO in the process of interacting with adopters to sign the contract was really interesting since it shed light on the complex reality that solar PV installers face. It was also valuable to understand how implementation projects begin. The reason for focusing on specific projects in the first place was to understand the implementation process that provided very rich data and a good insight on the entire solar PV implementation procedure. However, it has been pointed out by Andersen et al. (2018) that the richness of a study can be a problem, that it is a risk to include too much detail, and that it is sometimes complex to prioritize, since "streamlining" the case is also problematic as it entails a risk of oversimplifying the case. This was a challenging aspect and my colleagues and I discussed the matter back and forth to identify how best to utilize the large amount of data to achieve a balance with regard to details (besides discussing this aspect, another approach was to use tables to summarize the key aspects as we did in Papers 2 and 3).

In all the longitudinal projects where meetings between intermediaries and adopters were observed, a "fly-on-the-wall" technique (i.e., non-participant observation) was utilized. This implied that I participated in meetings but did not interact with anyone. This approach was sometimes challenging, since it happened that the intermediary or adopters directed some questions at me (which I tried to avoid as far as possible, given the methodology of choice). During the one-month observational study, I was either introduced by the intermediary or introduced myself as a researcher from Chalmers. The fact that a PhD student from a well-known Swedish university was conducting a study at this particular firm may have provided the intermediary some legitimacy. All the adopters and other actors were informed that I did not work for the intermediary. They were told about the research project. They were informed that the data would not be shared directly with the intermediary but would rather be published in academic journals. It was also vital to ask all the adopters for permission to observe the meetings and explain that they would remain anonymous.

It can be challenging to note everything that is uttered in observational studies if one does not record the meeting. There are also other aspects that can be hard to capture when not recording, such as who talks to whom, gestures, tone of voice etc., that can complement the more explicit and spoken parts of the meeting. Even though I tried to write down the most essential parts, which initially was most of the conversations, it soon became evident that it was not possible to write everything down, since people sometimes talked simultaneously and some people talked faster than others which made it difficult to keep up. Apart from taking notes of the actual conversations between diffusion intermediaries and adopters, some reflections based on the observations were noted (regarding the aspects mentioned above, such as who talks to whom, etc.). I usually divided a table into two columns and noted what was uttered on the left and wrote down my own reflections on the right. Although I did not record the meetings, the interviews with the intermediaries were recorded using an audio recording device. However, while conducting phone interviews with adopters it was easier to

write while we talked because recorded telephone interviews were often not of a high quality, which made it difficult to hear what was said.

3.4.3 SUMMARY

One of the possible strengths of the thesis is that it includes a lot of data that have been collected using different methods. Hopefully, this can provide an in-depth understanding of the implementation process given that the data reflect not only the diffusion intermediaries' points of view but also, to some extent, the adopters' opinions. Another potential strength is that it provides both empirical and theoretical insights that can be valuable in developing our understanding of intermediaries in general and diffusion intermediaries in particular. However, the complexity lies in describing such rich material without offering too many or too few details, which could potentially undermine the validity of the research itself. This has been a challenge since the goal was to be transparent to make as much data visible as possible in the appended papers as well as in this thesis. However, there is still a lot of data that could be used to reinforce certain statements and to explore aspects other than those that this thesis and the appended papers have focused on.

4 THE PAPERS

This chapter provides a summary of the three appended papers. For each paper, the purpose, status, results, and my contribution are outlined.

4.1 PAPER 1

The purpose of *The value creation of diffusion intermediaries: Brokering mechanisms and trade-offs in the case of solar and wind power in Sweden* was to investigate through which brokering mechanisms diffusion intermediaries create value for adopters of new technologies and what conflicts of interests and trade-offs they face in relation to value capture. The empirical focus of the paper comprised 14 diffusion intermediaries working with solar PV and wind power technologies in Sweden and included specialized consultants and project developers among others. The paper was co-written by Anna Bergek.

4.1.1 THEORETICAL FRAMING

The theoretical framework is based on the business model concept in combination with the brokering mechanisms, that is, coordination, transfer, and matchmaking (Spiro et al., 2013). The business model specifies a firm's value proposition, customer relationships, key activities, key partners, and revenue streams etc. The framework utilizes the brokering mechanisms that should reflect the intermediaries' value proposition. The framework underlines value creation and capture as related aspects of a business model and specifies that trade-offs and conflicts of interests can be an outcome of the intermediary's value capture ambitions.

4.1.2 RESULTS

The value proposition from solar PV and wind power intermediaries are similar. They provide total solutions or turnkey projects. The main difference is that wind power intermediaries sell an estimated return on investment (a function rather than a product) whereas solar PV intermediaries get their revenues from selling solar panels with associated services. To deliver the value proposition, the intermediaries provide relatively standardized activities that are mainly geared toward providing turnkey solutions to their clients. Although wind power intermediaries handle a larger number of partners and stakeholders during the long and complex permit process, they are involved in activities that mainly concern the environmental impact assessment (EIA) process. Coordination of key stakeholders plays a major role in the EIA. It was also noticed that most of the intermediaries handled some input services internally (e.g., installations), which indicates that they are also content providers.

Results pertaining to the brokering mechanisms show that value creation mainly stems from the coordination of input providers with technology transfer included in the offer. Such activities included managing projects, securing inputs (technology and permits) from input providers at different stages of the projects. The results also show that wind projects are characterized by greater complexity than solar projects, and this is reflected in the coordination mechanism illustrating that wind projects coordinate a broader set of stakeholders such as: various supply chain actors, experts, service providers, authorities, and

even the general public. In contrast, solar PV intermediaries usually coordinate actors within the supply chain such as: technology suppliers and installers.

The second brokering mechanism, that is, technology transfer, was mainly reflected in technology procurement. This implies that diffusion intermediaries transfer technologies from suppliers or distributors to adopters – oftentimes as part of a turnkey solution – while incorporating the assessment and selection of suppliers and technological options. One difference between the technologies is that intermediaries are mainly procured through open tenders in wind power projects as opposed to intermediaries in solar PV projects which had longer-term relationships with manufacturers, distributors, or wholesalers of solar panels. The results also show that intermediaries in solar power projects usually buy to stock technology, which implies that they also choose technologies and determine the appropriate supplier for the adopter. Finally, the results indicate that the third brokering mechanism, that is, matchmaking, was a rare phenomenon, as only one intermediary was involved in it.

The second research question reflected on the types of trade-offs that diffusion intermediaries make with regard to value creation and capture. The results indicate that adopters are generally not willing to pay for higher quality, which implies that trade-offs related to clients are more eminent in solar PV projects. In response, intermediaries have strategies to withhold quality (for example, they offer simpler and cheaper models, automatize and systematize the process as far as possible, offer a low initial price only to add additional fees for correctional and additional work to increase the margin, and to reject projects with too low margins). This suggests that diffusion intermediaries must choose between compromising project quality or accepting lower margins.

In both fields, there are trade-offs between dealing with activities in-house versus outsourcing them to input and service providers. From the intermediaries' point of view, it is ideal to keep activities in-house since there are no parties to share it with and there is no need for quality control of others' work. It can, however, become expensive to, for example, keep an in-house stock of solar panels. It is not easy to explicitly pinpoint a singular strategy that creates the highest margin that can thus explain why different strategies were identified.

Various types of trade-offs between different kinds of customer value were identified in solar PV, namely between quality and price (or rather margin); between quality and freedom of choice of technology and suppliers (to uphold high quality, intermediaries have few supplier relationships and offer few brands and may reject a customer if it wants a product that the intermediary cannot offer), between timely delivery and freedom of choice (regarding those who stock panels to make sure they can deliver in a timely fashion), and between timely delivery and access to the latest technology (regarding those intermediaries who buy from distributors or wholesalers to make sure that customers can benefit from recent technology improvements and cost reductions).

The fact that wind power intermediaries sell an estimated return on investment and that they consider their clients as partners is perhaps an explanation for why there are fewer trade-offs

between different kinds of value in wind power. Efforts to increase margins can also be considered a win-win situation for the intermediary and its partners. One advantage of insourcing is having increased control over project quality. The advantages of outsourcing are legitimacy, trust, and credibility which comes from partnering with independent and local external partners.

4.1.3 My contribution to the paper and its current status

I presented an earlier version of this paper at the 8th International Sustainability Transitions (IST) Conference in Gothenburg 2017. I was responsible for the data collection process. Anna Bergek (co-author) and I conducted two interviews together and took the lead in the first round of analysis. I wrote the first edition of the empirical chapter. We wrote the analysis and conclusions together. Anna took the lead in writing the introduction and the theoretical framework. We worked together on most parts of the paper in an iterative process and the paper was revised after receiving inputs from the IST conference. The paper is submitted to Journal of Cleaner Production.

4.2 Paper 2

The purpose of the paper *Intermediation services and adopter expectations and demands during the implementation of renewable electricity innovation - Match or mismatch?* was to identify the adopters' expectations while adopting PV technology, and to find out whether the services provided by intermediaries matched these expectations. A comparative case study of nine projects was performed involving different types of adopters who hired the services of the same intermediary. The paper was co-written by Ingrid Mignon.

4.2.1 Theoretical framing

The theoretical framework is based on customer satisfaction literature, which emphasizes factors influencing customer satisfaction such as tangible and intangible attributes. Tangible attributes are concrete characteristics that are easy to compare. In the empirical context of the paper, this may refer to the price of a PV system. In contrast, intangible attributes are based on the adopter's subjective opinions, such as service-mindedness.

In that literature, the means-end model was also developed to understand customers (or adopters) needs and demands better. More specifically, the model stresses that the following aspects should be considered:

- Functional utility components refer to the effect of using the product or service, for example, help with design and installation of the system, help with investment support, and to discuss technical options regarding the products etc.

- Psychological utility components relate to customers' feelings relating to using the product or service, for example, that the intermediaries help the adopters feel that they are in control of the process, thus motivating adopters to pursue the investment further.

- Instrumental value refers to the adopter's goal or motive for purchasing the product or service, for example economic value (save money), optimizing resources (using one's roof for PV), and for legitimacy reasons.

- Terminal value is similar to instrumental value, but reflects even more overarching goals or motives, for example to reduce one's environmental impact or to fulfill a technical interest.

4.2.2 RESULTS

The majority of adopters considered intangible attributes such as service-mindedness, expertise and experience, and legitimacy and commitment, as core factors while choosing between diffusion intermediaries. Adopters also underlined price competitiveness, process rapidity, geographic location, and content of the service package. Adopters expressed that the implementation process should be simple and include everything. In short, they requested turnkey solutions. The findings indicate that adopters had heterogenous needs that are essential factors for intermediaries to consider. On the one hand, all adopters needed support with the installation and design of the system, but their needs differed with respect to the functional and psychological utility components. The results also showed that psychological utility components were essential. One factor that was underlined by the adopters is that they did not feel that they had control over the implementation process. Although the intermediary updated them regularly with information during the implementation process, the adopters argued that they would have liked to receive more updates and information. Not all adopters mentioned that they needed help in the form of technological, investment, or administrative support. Some adopters were involved in comparing and choosing technologies, while others conducted an economic forecast without the help of the diffusion intermediary.

The study also shed light on the significance of reflecting adopters' perceived value. For example, the price became central for adopters who perceived an economic value in investing, which implies that the intermediary ought to have designed a system by taking this factor into consideration. If adopters perceived value in lowering their environmental impact, it is crucial to maximize the number of panels and the intermediary should, thus, focus on the design of the system accordingly. Adopters who perceive the investment as a means to fulfill a technical interest probably have some knowledge of the technology already and will choose an intermediary with up-to-date knowledge regarding technological aspects.

From a management perspective, offering a competitive price and service package seems a relevant strategy. The fact that the intermediary provided the services quickly and adapted the level of service-mindedness and support were also noted as positive aspects. Similarly, the legitimacy of the intermediary was an important attribute, as many adopters were recommended to use a particular intermediary based on the fact that it had completed many successful projects. The results also reveal that adopters were missing recommendations on electricity retailers. Factors related to the adopters' sense of control were reported as unsatisfying, leading to the feeling of not having control over the process. Thus, intermediaries can be encouraged to consider this by providing adopters with information on

the positive and negative points of different electricity retailers and by adapting the amount of information based on adopters' needs. Intermediaries can also be encouraged to be explicit on what they include in their turnkey offers so that adopters are initially aware that some aspects are not included. However, satisfying adopters who feel that they need complete control over the process can be a challenging task and it can be questioned whether it is even possible to attain full satisfaction – although it should be the aim.

4.2.3 My contribution to the paper and current status

I was responsible for conducting the observational study and collecting data therein. I also took the lead on analyzing the material, although some processes were conducted simultaneously by Ingrid and me. I wrote the first draft of the empirical section, received comments, and rewrote parts of it. The same procedure was used in writing the methodological section, where I produced the first draft, and Ingrid made some minor changes. Ingrid took the lead in writing the theoretical framework and analysis.

The paper was sent to *Journal of Cleaner Production* on September 18, 2018. After a round of reviews, a revised version of the paper was completed on December 6, 2018. It was accepted for publication on January 5, 2019.

4.3 Paper 3

The purpose of *When is a diffusion intermediary an intermediary? The intermediation activities of solar and wind power project developers in Sweden* was to map the activities of a number of intermediaries and, based on a theoretical understanding of brokering, determine which of these can be considered intermediation activities to answer the question:"When is a (diffusion) intermediary an intermediary?" The paper was co-written with Anna Bergek.

4.3.1 Theoretical framing

This paper is based on a literature review of the activities, functions, and roles of innovation intermediaries. It outlines four distinct groups of related activities: knowledge-related, technology-related, resource-related, and actor-related. Each group of related activities includes a mix of brokering and non-brokering activities derived from the literature. In order to distinguish between these two types of activities, a framework originally developed by Spiro et al. (2013), that is, the brokering mechanisms framework (transfer, coordination, and matchmaking), was applied as a filtering device. This resulted in a more concrete division of brokering and non-brokering activities. Here, it is important to point out that, as suggested, non-brokering does not include any third-party interaction, whereas the activities identified as brokering include at least two other parties. The analysis also identified different sub-categories of brokering activities (see Table 4):

- Knowledge brokering refers to conveying knowledge from one party to another (transfer), enabling knowledge flow by connecting two or more parties in order for one of them to share knowledge with the other (matchmaking), or managing knowledge flows from several sources of knowledge and/or to several recipients without any interaction between them and without taking possession or control over the information (coordination).

- Technology brokering refers to conveying codified technical knowledge (including products) from one party to another (transfer), enabling flows of technology by connecting a technology supplier with an adopter or user between which technology is shared (matchmaking), or managing flows of technology from different parties without any interaction between them and without taking possession or control over the technology (coordination).

- Resource mobilization refers to conveying financial, physical, or human resources from one party to another (transfer), enabling resource flows by connecting two or more parties in order for one of them to convey funding or other resources to the other (matchmaking), or managing resource flows from different parties without any interaction between them and without taking possession or control of the resources (coordination).

- Mediation refers to conveying information about one party to the other such as, articulating the demands of users/adopters to a potential supplier or to explicate supplier offers to potential customers (transfer), bringing two or more parties together to collaborate or facilitate their collaboration (e.g., negotiates agreements or manages conflicts) (matchmaking), or aligning the interests of two or more parties without them having to interact (e.g., through standard setting) (coordination).

4.3.2 Results

From a theoretical perspective a diffusion intermediary functions as an intermediary when it is involved in activities that contribute to knowledge brokering, technology brokering, resource mobilization or mediation. Results also show that technology brokering and mediation are more common than knowledge brokering and resource mobilization. The analysis also made it possible to identify whether each intermediation activity reflected transfer, coordination, or matchmaking. The findings indicate that diffusion intermediaries are involved in all types of brokering and that matchmaking is more common than Paper 1 suggested. Nevertheless, transfer and coordination were utilized more than matchmaking. It was also shown that several non-intermediation activities were important for the implementation projects and sometimes necessary as a first step towards intermediation activities. Further research is needed to scrutinize the roles of diffusion intermediaries, and scholars are advised to broaden the scope and also include other types of diffusion intermediaries to increase our understanding of different types of intermediaries (and technologies).

4.3.3 My contribution to the paper and current status

I was responsible for the data collection process and I wrote the first draft of the empirical and methodological sections. I also took the lead in reviewing papers for the literature review. Anna took the lead in writing the first two sections: the introduction and the literature review and analytical framework. The process was iterative, and we worked together on all sections of the paper. The paper will be submitted to a scientific journal.

5 SYNTHESIS

To understand the raison d'être of diffusion intermediaries, the purpose of this licentiate thesis is twofold: first, to study the activities of diffusion intermediaries in order to distinguish intermediation activities from other activities, and second, to examine how these activities create value for adopters. This section develops the answers to the research questions by synthesizing the results of the appended papers and the additional content discussed in this thesis to shed light on diffusion intermediaries' activities in implementation processes. It is also important to point out that when study 1, 2, or 3 are referred to, it implies that the empirical data that are used are not included in the papers but can provide some clarity for certain aspects that are discussed in the thesis.

5.1 INTERMEDIATION AND OTHER ACTIVITIES[9]

The first research question in the thesis is centered on activities that can be classified as brokering. The results show that diffusion intermediaries, like other types of innovation intermediaries, conduct an array of activities in implementation processes. In Papers 1 and 3, the brokering mechanisms framework was utilized to categorize unsorted activities into intermediation activities and the results from these studies indicate that this framework is adequate for this purpose. The core function of the framework is to identify intermediation activities, although as a by-product, it also outlines non-intermediation ones (i.e., the resulting activities after the ones associated with brokering have been recognized). However, neither the appended papers nor previous literature have indicated whether there are any useful ways to utilize both types of activities. The studies that have combined them have most likely done so unconsciously since no attention has been paid to the differences. To focus on intermediation activities alone is perhaps an adequate approach to handle the complexity inherent in dealing with numerous activities. However, one can ask whether the discrepancies between intermediation and other activities can provide a more nuanced picture of the diffusion intermediary concept. It is reasonable to suggest that diffusion intermediaries perform activities *as intermediaries,* that is, brokering activities, and that they, by necessity, also carry out other activities that do not necessarily have to be linked to brokering but can still provide value to adopters. So far, this has not attracted attention in the literature and can be a reason why intermediation activities should be contrasted with other activities. Discussing both intermediation and other activities can potentially provide a more nuanced understanding of what brokering implies.

The next sections are based on the activities, roles, and functions identified in the literature review. In Table 1, an assortment of activities was presented without any further distinction to acknowledge what previous literature has contributed. In the following sections, the theoretically defined groups of activities (i.e., knowledge-related, technology-related. resource-related, and actor-related) are divided into pairs of intermediation and other

[9] The section is to a large extent based on ideas and data originally developed in paper 3.

activities. These activities are also compared with the findings in the appended papers and the findings are linked to the three brokering mechanisms to answer the first research question on the activities that can be classified as brokering. The first activity in each section is an intermediation activity followed by a linked non-intermediation activity.

The results also show, as noted by Kivimaa et al. (2019), that it can be difficult to determine when in an interaction the intermediation process begins and ends, that is, when the intermediation versus other activities occur in implementation processes. It is, however, possible to examine this, provided that the intermediation is seen as a process instead of as a series of isolated activities. Examining this line of thought makes it possible to scrutinize whether there are any significant linkages between intermediation and other activities that can be utilized to understand the diffusion intermediary concept better. The section ends with this discussion.

5.1.1 KNOWLEDGE-RELATED: KNOWLEDGE BROKERING VERSUS INFORMATION COMPILATION AND DISSEMINATION

The first intermediation activity is knowledge brokering, that is, to convey or facilitate/manage knowledge from one party to another, for example between seekers and solvers, users and suppliers, and different user groups etc. The findings show that diffusion intermediaries broker knowledge and information between two or more parties using all three brokering mechanisms (Papers 1, 2, and 3).

In a diffusion context, knowledge brokering through *transfer* implies that the diffusion intermediary conveys knowledge from, for example, suppliers/input providers to adopters (Papers 1 and 3). For example, if the adopter has an issue or a question, the intermediary can broker knowledge between a solution provider and adopter. In study 3, both intermediaries and adopters noted that one of the principal undertakings of the broker was to handle the contacts with, for example, the lawyer, the general public, suppliers etc. To this end, when the adopters and diffusion intermediary met, the main activity of the intermediary was to inform the adopters about issues and progressions in the wind project. Knowledge brokering through *transfer* was especially evident and critical in longer implementation projects, where information had to be compiled, and then discussed with adopters in order for the projects to progress (Paper 3). In longitudinal wind projects, it was shown that diffusion intermediaries are involved in knowledge brokering through *coordination*. For instance, the wind intermediary manages knowledge flows from variety of input providers (e.g., authorities, people living close to the site, land owners, and the general public) that can be seen as sources of information that the intermediary handle on adopters behalf and that can be discussed with adopters at board meetings (Study 3). Diffusion intermediaries are also involved in knowledge brokering through *matchmaking*. For example, in one of the longitudinal solar projects, the intermediary linked a previous adopter who had invested in a solar PV plant with battery storage to several prospective adopters who were interested in investing in solar PV and wanted more information on how it could be complemented with battery storage (Paper 3).

In Paper 3, within-group knowledge brokering was identified, that is, the intermediary brokered information/knowledge between adopters. This occurred when there were urgent issues to discuss, for example regarding the progression of the project when one of the adopters in a wind project decided to leave in the middle of the permit process. Previous studies emphasized that knowledge brokering is mainly about knowledge flow between parties and have not particularly underlined the idea of within-group brokering (cf. Agogué et al., 2013; Bessant and Rush, 1995; Hargadon, 1998). As noted by Hargadon (1998 p. 214) knowledge brokers: "are those individuals or organizations that profit from transferring *ideas* from where they are known to where they represent innovative new possibilities."

A first corresponding non-intermediation activity is information compilation. The activity can be distinguished from more passive endeavors, such as receiving information from stakeholders since information compilation is an active undertaking. For instance, diffusion intermediaries compile information from technology providers on how to install the technology. Another example is derived from the longitudinal wind projects where intermediaries are involved in technology procurement per project, which implies that various details must fall into place. It is not only the intermediary that needs information from the suppliers, but also the suppliers need information about the project, wind data, financial plan etc., before they can even send an offer to the intermediary (Study 3). In solar PV, it is important that the intermediary has knowledge about the panels and manufacturers, especially for those who buy directly from manufacturers. The empirical data are somewhat supported by previous literature (Dicecca et al., 2016; Intarakumnerd and Chaoroenporn, 2013; Popp, 2000), which on the one hand, acknowledges that intermediaries compile and analyze information to for example, support future decisions or give recommendations. On the other hand, it is oftentimes hard to know where the information is collected from or how it will be used and to whom it will be diffused (except for Interakumnerd and Chaoroenporn, 2013, stating that it is disseminated to the private sector).

A second corresponding non-intermediation activity is information dissemination. The public consultations that wind intermediaries are involved in include dissemination of information to relevant stakeholders, such as property owners, land owners, and neighbors (Paper 3). It was also shown that the intermediary conveys information regarding the installation procedure, the current legislation, or other questions directly to adopters (Study 3). Another example is from paper 3, which shows that the intermediary was involved in a debate in a local newspaper and through taking part in the debate the intermediary disseminated information regarding the project to local citizens. Activities related to information dissemination can perhaps be important for organizations, but they should not be distinguished as intermediation activities unless it is explicitly clear as to what entities the intermediaries' broker between. The literature provides a few examples of brokers involved in the diffusion of generic information to the wide masses (e.g., the private sector) in the form of newsletters, magazines, guidebooks, manuals, or documents (cf. Hargreaves et al., 2013; Kanda et al., 2018; Kivimaa, 2014; Tremblay and Dossou-Yovo, 2015). The data support this to some extent. For example, at a wind board meeting it was noted that the intermediary and adopters work together to produce information material regarding wind power.

5.1.2 TECHNOLOGY-RELATED: TECHNOLOGY BROKERING VERSUS TECHNOLOGY DEVELOPMENT

The second intermediation activity is technology brokering, that is, to convey technology or facilitate/manage flows of technology between two or more parties. The results show that diffusion intermediaries broker technologies between two or more parties using all three brokering mechanisms (Papers 1, 2, and 3).

With regard to technology brokering through *transfer,* a central technology brokering activity is technology procurement, in which diffusion intermediaries manage supplier relationships and transfer technologies from distributors or technology suppliers to adopters (Papers 1 and 3). In solar PV, it is common that diffusion intermediaries work with a few technology suppliers that they are loyal to. This implies that they oftentimes choose the technologies they want to transfer on behalf of the adopter, based on what that particular supplier can deliver (Papers 1 and 3). Paper 1 shows that most of the interviewed solar PV intermediaries buy directly from the manufacturers and in larger volumes, and that intermediaries also convey technologies from distributors or wholesalers. In contrast, wind diffusion intermediaries generally use open tenders to about five turbine suppliers that compete for the contract (Paper 1), which is a more competitive procurement process than in solar. The brokering activity is largely supported by previous literature which describes that technologies can be transferred from wholesalers or from developers of technologies to adopters (Karakaya et al., 2016; Stewart and Hyysalo, 2008). Results also show that intermediaries are involved in technology brokering through *coordination* (Papers 1 and 3). For example, in wind power projects, the diffusion intermediary manages several input providers simultaneously to synchronize their appearance at the construction site. In solar PV implementation projects the intermediary acts between several technology suppliers to convey components from different sources (e.g. panels, inverters, green certificate meter and battery storage unit). Intermediaries are also involved in *matchmaking* through linking technology providers to adopters in order for technology providers to present the technologies (Paper 3).

The corresponding non-intermediation activity is technology development, which is an umbrella term reflecting activities related to testing and evaluation of results, adapting technologies, evaluating products and technologies, configuring technologies, and inventing new materials and products. One can assume that most of these activities are mainly related to development-oriented intermediaries, since most of them are carried out before the diffusion phase. Diffusion intermediaries are, however, involved in non-intermediation activities in the diffusion process, such as adaptation and evaluation of products and technologies, which occurs after the adopter has decided to invest (Papers 2 and 3). The data indicate that diffusion intermediaries also provide other activities such as technology evaluation and selection and installation (by configuring, adapting, testing, and demonstrating the technologies) (Papers 1, 2, and 3). They sometimes also conduct in-house R&D related to their own products (Study 2). While applying the brokering mechanism framework on these activities it is clear that they are conducted on a one-to-one basis. These findings are in line with previous literature, which has noted that intermediaries are involved in a range of non-intermediation activities linked to technology development (and scholars oftentimes view

such activities as intermediation as opposed to the rationale used in the thesis), such as testing and evaluating of results (Tran et al., 2010), adapting technologies (Abbate et al., 2013; Benouniche et al., 2016), evaluating products and technologies (Howells, 2006), configuring technologies (Stewart et al., 2008), and inventing new materials and products (Clark, 2014).

5.1.3 RESOURCE-RELATED: RESOURCE MOBILIZATION VERSUS RESOURCE PROVISION

The third intermediation activity is resource mobilization, that is, conveying financial, physical, human, or other resources from one or several sources (e.g., a bank) to another party (e.g., adopters). The results show that diffusion intermediaries are involved in resource mobilization between two or more parties using all three brokering mechanisms (Papers 1, 2, and 3).

Diffusion intermediaries are involved in resource mobilization through *transfer* (of resources to adopters, but it was not a common activity). For example, after the EIA studies are completed by the input providers and the EIA document is prepared, it is conveyed to both the county administrative board to apply for the environmental permit and to the adopters in physical and digital formats (Paper 3). Results also reveal that diffusion intermediaries are involved in *matchmaking*. For example, they link adopters to banks that supply funding (loans) for the projects (Paper 3). If adopters need capital for the investment, they articulate this to the intermediary which links the adopters to a bank that it collaborates with to facilitate the flow of resources by bringing the two parties together in order for the bank to convey funding to the adopter. This confirms the previous studies that show that intermediaries mobilize financial capital by linking actors to financial institutions (cf. Bessant and Rush, 1995; Dicecca et al., 2016; Kanda et al., 2018; Kilelu et al., 2011). Diffusion intermediaries are also involved in resource mobilization through *coordination*. This is especially visible in wind projects in relation to the EIA permit process, where diffusion intermediaries manage and synthesize inputs (resources) from various experts and service providers (mainly EIA consultants), authorities, and the general public.

The corresponding non-intermediation activity is resource provision, that is, providing resources such as education and training directly on a one-to-one basis. For example, wind intermediaries educate adopters on, for example, the functions of a computer program for wind measurements and solar PV intermediaries educate and train the board members of a housing association on the functions and the use of the installed solar PV system and provide general information on how many panels are installed, expected yearly production, how a PV system works and also gives the adopters a chance to ask any questions they may have had regarding the PV system (Paper 3). One solar PV intermediary (a wholesaler) not only sold panels to installers but also educated them so that they could handle the installation without any help of the intermediary. This confirms the previous literature which has shown that innovation intermediaries are involved in training on a one-to-one basis, such as by "providing important but expensive training in critical skills and knowledge that cannot be privately accessed by local firms" (Intarakumnerd and Chaoroenporn, 2013 p. 118). Howells (2006) noted that intermediaries provide specialized training services in the use of new

technologies or laboratory techniques. In a footnote, he stated that: "How far this is an intermediary rather than a more general collaborative arrangement within a network is difficult to determine" (Ibid, p. 723). However, the papers do not indicate that any of the diffusion intermediaries were involved in the direct provision of funding, which is mentioned in the literature as a possibility. For instance, Kanda et al. (2018) stated that intermediaries can be the source of funding (but also noted that in other circumstances the intermediaries act between companies and specialized organizations such as banks, which is in line with the results). In the same vein, Inkinen and Suorsa (2010) showed that intermediaries can directly provide funding to enterprises.

5.1.4 Actor-related: Mediation versus Actor assessment

The fourth intermediation activity is mediation, that is, linking two or more parties together to cooperate, facilitate their cooperation, or aligning their interests. The findings show that diffusion intermediaries are involved in all three types of brokering mechanisms (Papers 1, 2, and 3).

Diffusion intermediaries can be involved in mediation through *transfer,* that is, to articulate the adopter's non-technical demands or convey requests from input providers. This activity goes beyond assessing the adopters' needs and includes at least one other party (to which the demands are articulated). Results from paper 3 show that the wind intermediary articulated a demand (regarding a new public consultation if the intermediary changed the project plans) from the county administrative board to adopters (Paper 3). There are several examples of the activity in the literature such as Bessant and Rush (1995 p. 102) who described it as a "diagnostic role" while referring to consultants as intermediaries: " … the diagnostic role which consultants play in helping users articulate and define their particular needs in innovation." Similarly, Boon and Edler (2018 p. 437) asserted that demand orientation is iterative and involves attempts to: "… make users' requirements about an innovation increasingly concrete and explicit, against a backdrop of other evolving dimensions of the innovation, such as the technological make-up and infrastructural embedding."

In a diffusion context, mediation through *matchmaking* implies that the diffusion intermediary directs adopters to solution providers if they cannot solve the adopters' specific needs themselves, for example, if a buyer contacts a wholesaler thinking that it can provide turnkey solutions, the wholesaler can direct the buyer to a local PV installer (Paper 1). A second example is from Paper 3 where one of the main tasks of the intermediary was to write a joint tender document to link two real estate companies (adopters) to a solar PV installer. After the adopters had taken a decision regarding the installer they would cooperate with, a link to this installer was established and the intermediary's job was complete. The solar PV installer or intermediary then handled the rest of the implementation process. A third example, also from Paper 3, is when the intermediary linked adopters to input providers, for example by recommending an adopter to contact a specific company (e.g. a broadband installer). The linking part of mediation is quite common in the literature (cf. Kilelu et al., 2011) and has been discussed by scholars who noted that intermediaries can provide: "users with a single point of contact through which to access a wide range of specialist services" (Bessant and

Rush, 1995 p. 101). There are also examples of within-group brokering as asserted by Dutrénit et al., (2012) and Kilelu et al., (2013) who noted that intermediaries could establish links between farmers. However, most of the literature is generally concerned with linking parties between-groups. This is in line with the findings that support both within-group and between-group brokering, but mainly provides evidence on between-group brokering.

A second type of mediation through *matchmaking* is when intermediaries act as a neutral party between adopters and suppliers ahead of a final decision allowing them to exchange information and explore whether they are actually willing to cooperate before any formal decision is taken. In Paper 3, it is noticed that intermediaries, for example, invite suppliers to present and discuss their offer before a formal decision to cooperate is taken. However, in contrast to Håkansson et al. (2011 p. 266), who emphasized that "intermediaries enable potential partners to explore the benefits of cooperation and information exchange without divulging their interests and plans before contractual agreements and mutual trust mitigate the risk of opportunism," the purpose of these meetings was to reveal all interests and requirements of both the involved parties.

A third type of mediation through *matchmaking* is to resolve conflicts between parties and facilitate cooperation. This particular aspect was evident in a longitudinal project when one of the adopters decided to leave the project in the middle of the permit process, leaving the other adopters with several critical decisions to be made about making progress on their own. During this "crisis," the intermediary played an important role in finding a way forward and in making progress on the project, that is, the intermediary acted as a within-group matchmaker between the adopters in the project. The results are in line with the literature that have also underlined that intermediaries are involved in aligning interests as well as resolving conflicts by connecting parties (cf. Agogué et al., 2017; Boon et al., 2008; Tran et al., 2011). Mediation through *coordination* is also linked to align the interests of different parties, in the wind projects the diffusion intermediary had to obtain the legal rights to the wind power site which implies to interact with the land owners (who might appeal the project), in order to arrange a land lease agreement and negotiate compensation.

A first corresponding non-intermediation activity is needs assessment.[10] The appended papers reflect that adopters are heterogenous and have different needs that are not always explicit as they initially might only have a vague idea about the investment process. This implies that it is inherent in diffusion intermediaries' offers to evaluate what the adopters need and to organize their activities in order to match these needs even when they are not articulated to any evident input provider. Paper 2 demonstrated that intermediaries are expected to match adopters needs and motives (economic, technical, to do something for the environment, or to utilize an otherwise unexploited resource such as its roof), but to do so, intermediaries must

[10] Information compilation (as discussed in section 5.1.1) is an associated activity since it is also about compiling information or needs (mainly from the adopters).

first conduct a needs assessment. Needs assessment also includes a proactive aspect. For example, solar PV diffusion intermediaries sometimes evaluate whether the adopter has plans to invest in an electric vehicle, and make some changes to their property or change the energy consumption in order to tailor their offers to match the adopter's future needs. Most diffusion intermediaries offer some type of needs assessment, even to adopters that only purchase the technology and no other services (Study 3).

A second corresponding non-intermediation activity is the supplier's evaluation and selection. One such activity is to evaluate the suppliers based on previous experience. The results show that solar PV intermediaries usually work with a few suppliers and that they often pre-select suppliers for the adopters. An important criterion for solar PV diffusion intermediaries while evaluating and selecting suppliers is stability and quality (Study 1). The last argument is important since it implies that intermediaries can indicate to potential adopters that they collaborate with reliable input providers (Paper 1). Wind diffusion intermediaries evaluate and select suppliers on a per project basis (Paper 1), which can work as a stepping stone toward technology brokering. In the literature, this activity is quite common (cf. Balkow, 2012; Bessant and Rush, 1995; Watkins and Horley, 1986).

5.1.5 SUMMARY: ACTIVITIES THAT CAN BE CLASSIFIED AS BROKERING

The previous sections show that diffusion intermediaries are involved in four overarching brokering activities related to knowledge, technology, resources, and actors. By zooming in on each of these overarching brokering activities, it is possible to identify more activities in greater detail. First, a short summary of each of the brokering activities is provided to answer which activities diffusion intermediaries conduct that can be classified as brokering. These are also summarized in Table 4, which illustrates both intermediation and non-intermediation activities with a definition of each based on the literature review. As shown there, most of the activities can also be found in the data presented in this thesis.

- Knowledge brokering involves activities that convey knowledge between two or more parties. It includes transfer (to convey knowledge from input providers to adopters), coordination (to manage knowledge from several input providers that are conveyed to adopters), and matchmaking (to connect adopters to exchange knowledge with each other). It was found that diffusion intermediaries are involved in within-group knowledge brokering (e.g., between adopters) and not only between-group knowledge brokering (e.g., between adopters and input providers).

- Technology brokering involves activities that convey technologies between two or more parties. The main activity was to convey technologies from suppliers to adopters. Technology brokering includes transfer (from technology suppliers to adopters), matchmaking (to connect adopters with technology providers), and coordination (to manage the contacts with technology suppliers in implementation projects).

- Resource mobilization involves activities that convey financial, physical or human resources between two or more parties (i.e., resources other than knowledge and

technology). It includes transfer (from input providers to adopters), matchmaking (e.g., to link adopters with banks for funding), and coordination (e.g., to manage a series of input providers to the EIA process in the wind project).

- Mediation involves activities that seek to achieve a compromise, settlement, or agreement between two or more parties, by linking, aligning interests or articulating adopters' demands to input providers. Mediation includes transfer (e.g., to articulate adopters demands to input providers), matchmaking (e.g., to connect adopters to solution providers such as installation companies), and coordination (e.g., to manage a joint tender document for two adopters).

As is evident from this description, the intermediation activities reflect all three brokering mechanisms. Similar to previous literature, matchmaking and transfer are key brokering activities. However, the studies also provide novel insights in that diffusion intermediaries are involved in within-group brokering and coordination to a larger extent than described in previous literature (although some studies have described coordination without referring to it explicitly).

Based on these results and the results that indicate that diffusion intermediaries are involved in both intermediation and other activities – and as a reflection of the statement in Kivimaa et al. (2019 p. 2) that "the literature as a whole lacks clarity in how intermediation is defined, where it begins and ends, and where interaction in general becomes intermediation" – the next section discusses the linkages between the two types of activities and ends with an illustration of the intermediation versus the non-intermediation processes.

Table 4 Intermediation versus non-intermediation activities.

Knowledge-related		
Knowledge brokering: to convey knowledge between two or more parties	vs.	Information compilation and dissemination: information is compiled or disseminated from unspecific sources and/or to unspecific recipients
Technology-related		
Technology brokering: to convey technology between two or more parties	vs.	Technology development: adapting, assessing, configuring testing, validating, and inventing technologies
Resource-related		
Resource mobilization: to convey resources (financial, physical, or human resources, that is, resources other than knowledge and technology) between two or more parties	vs.	Resource provision: resources are conveyed directly from the intermediary

Actor-related		
Mediation: activities to achieve a compromise, settlement or agreement between two or more parties, by linking, aligning interests, or demand articulation	vs.	Actor assessment: to evaluate and select suppliers and needs assessment: analyze clients' needs

5.1.6 THE LINKAGE BETWEEN INTERMEDIATION AND OTHER ACTIVITIES

As identified in previous literature and the papers appended to this study, like other innovation intermediaries, diffusion intermediaries are involved in other activities before the actual brokering process begins such as supplier evaluation and selection, information compilation, and needs assessment, and also after the brokering process, such as monitoring services and training.[11] This is illustrated in Figure 6, which shows the relationship between intermediation and other types of activities in three stages, namely before, during, and after the actual brokering process. It illustrates that brokering and other activities are interrelated and when one cog starts turning, it oftentimes sets the others in motion.

The studies show that non-intermediation activities are sometimes conducted before intermediation takes place as a necessary stepping stone toward knowledge brokering, technology brokering, resource mobilization, and mediation. Paper 3 shows that intermediaries sometimes compile information of various kinds to broker knowledge between adopters and other parties – for example, they contact technology suppliers or other input providers for information. Some intermediaries also provide education and training (i.e., resources) both before and during the implementation process. For example, one intermediary had a demonstration plant, and another trained the adopters on a program during the implementation process. Needs assessment is an important actor-related activity performed before mediation. Before demand can be articulated to a supplier, an intermediary has to understand what the adopter actually needs, that is, they must conduct a needs assessment. This aspect was noted in the longitudinal observational study in which all the intermediaries discussed the adopters needs (sometimes) extensively before the adopter's final decision. Based on the adopter's unique needs, the intermediary must articulate the adopter's demands to one or more input providers.

Studies show that intermediaries engage in activities related to technology transfer and resource mobilization after brokering. Technology-related activities can, for example, involve providing different types of technology-related services, such as monitoring of the system (Paper 1) and support after installation (e.g., to answer questions from the adopter regarding technical functions or problems that the adopter experiences) (Paper 3). Resource-related activities primarily consist of education and training. For example, after fitting and installing a solar PV system, intermediaries sometimes train the adopters on, for example, how the

[11] Diffusion intermediaries are also involved in so-called input processes such as fitting, installing, and adapting technologies.

system works. Similarly, in wind power projects, one diffusion intermediary trained adopters on using a wind measuring program (Paper 3).

The process is most likely iterative especially in longer and more complex projects, such as wind power projects, where needs are assessed, and different types of resources are provided continuously throughout the implementation process. After installation, other activities tend to be more common than intermediation activities, but in some cases, there is a need for additional components (technology brokering) or coordination of additional actors. In smaller and simpler projects, such as solar PV implementation projects for homeowners, the implementation process is rather straightforward. Needs are assessed, demands are articulated, and the implementation is carried out (including various brokering activities). After the installation, the intermediary trains the adopter on the system and then the project is more or less done (unless the adopter needs additional support after the installation, cf. Papers 2 and 3).

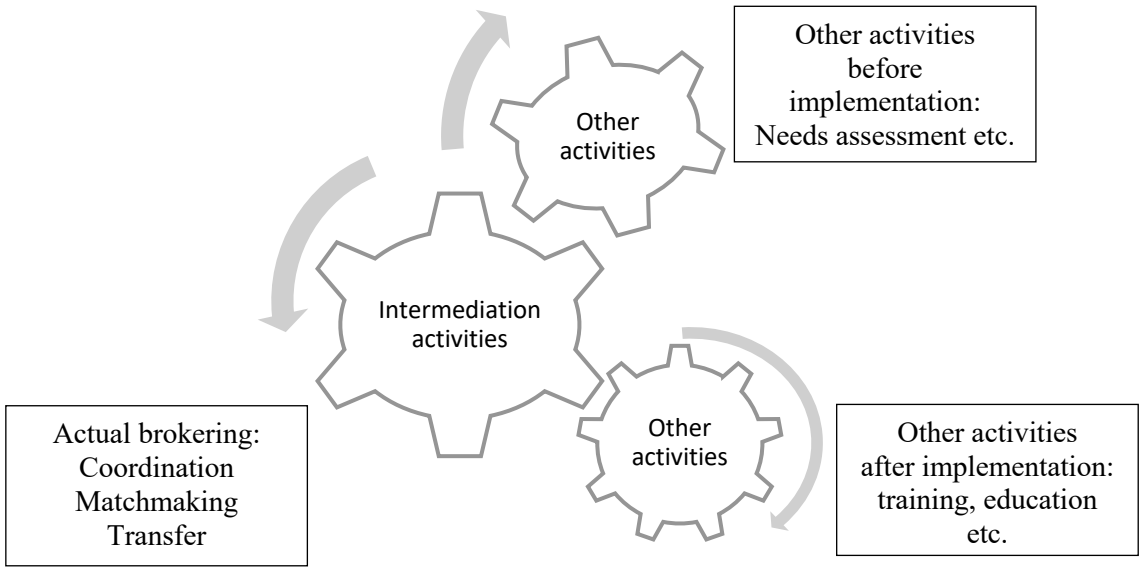

Figure 6: The relationship between intermediation and other types of activities in three stages of the process, namely before, during, and after the actual brokering.

This section has shed some light on when the intermediation process starts and when it ends, which, as stated by Kivimaa et al. (2019), is indeed hard to determine. It can be noted that the process neither starts nor ends with brokering. Most activities conducted initially are not brokering and after installation, the intermediary often offers training or support. It can be concluded that diffusion intermediaries are involved in two overarching types of activities, one where they act as intermediaries and another where they provide non-intermediation activities as service providers.

It has been revealed that both types of activities are not only included in the diffusion intermediaries' repertoires, but can perhaps also form the basis for value creation. To this end,

the next section explores the activities that are central for value creation in greater detail through the two perspectives described in the theoretical framework.

5.2 DIFFERENT PERSPECTIVES ON VALUE CREATION

The second research question focuses on what value diffusion intermediaries contribute in the implementation processes. As reflected in the theoretical framework and demonstrated in the previous section, the brokering mechanisms can work as a lens to identify the intermediation activities and other activities that diffusion intermediaries conduct. The findings from the studies also showed that diffusion intermediaries conduct both types of activities. Thus, to answer the second research question, the following sections center on the two views on value as illustrated in the theoretical framework, that is, value proposition (intermediation activities reflecting any of the three brokering mechanisms) and adopter satisfaction (other activities based on certain parts of the means-end elements).

5.2.1 VALUE PROPOSITION

5.2.1.1 Value creation through technology transfer

As expected, technology transfer is an important value creation activity for diffusion intermediaries (Papers 1, 2, and 3). In Paper 1, it was identified that the most prominent technology transfer activity was technology procurement, that is, to transfer technology from distributors or suppliers to adopters (oftentimes as part of a turnkey project). This involves assessment and selection of technology suppliers and technological options as well as stockholding in some cases. The difference between the technologies was mainly that in solar it is more common to buy to stock, whereas wind intermediaries buy turbines on a per project basis. Oftentimes, intermediaries make technology and supplier decisions on the adopters' behalf, leaving them with little influence (Papers 1, 2, and 3). Solar PV diffusion intermediaries have approximately 1-3 technologies (in different price ranges and sometimes innovative models, such as bifacial panels) that they can choose from depending on their needs. Although it has happened, it is unusual for adopters to require any other models than the ones that the intermediary has provided (Study 1 and 2). How much the intermediaries were devoted to technology transfer differs. It can be asserted that one of the intermediaries - the wholesaler – engages primarily in selling the technologies that it stores or in ordering and transferring technologies based on its clients' requests (mainly installers, that is, other types of intermediaries).

These findings confirm the previous literature on innovation intermediaries, which has emphasized that intermediaries are involved in technology brokering between different technology providers and different types of recipients (Agogué et al., 2017; Benouniche et al., 2016; Bessant and Rush, 1995; Caiazza and Volpe, 2017; Hanna et al., 2018; Howells, 2006; Karakaya, 2015; Karakaya et al., 2015; Karakaya et al., 2016; Karakaya and Sriwannawit, 2015; Leonard-Barton, 1984; Mignon, 2016; Palm, 2016; Palm, 2018; Singh, 2016; Strupeit and Palm, 2016; Överholm, 2015, 2017).

Another type of transfer is "knowledge transfer," that is, the transfer of technical information from different sources. As seen in paper 3, in longer implementation projects, intermediaries

are in contact with many different actors and transfer information from input providers to adopters (to inform them in general or to discuss how the project should progress). It can be argued that such information transfer is an essential component in combination with technology transfer, since projects can be delayed without it. The intermediaries therefore want to receive as much information as possible from suppliers to avoid postponements and issues with adopters. Activities pertaining to knowledge transfer have also been underlined in the literature (Abbate et al., 2013; Agogué et al., 2013; Hargadon, 1998; Kilelu et al., 2011; Smedlund, 2006).

5.2.1.2 Value creation through matchmaking

Paper 1 only identified one intermediary that was involved in matchmaking. However, the later studies show that matchmaking is actually quite a common diffusion intermediary activity, especially in the longitudinal projects. The results demonstrate that intermediaries are involved in and create value through activities that connect parties from different groups, such as input providers and adopters (Papers 1 and 3). Within solar, diffusion intermediaries connected adopters to solar PV installers, different entrepreneurs (e.g., broadband installers and electricians), and banks. In some cases, however, adopters wanted help with matchmaking (for example, they wanted to get in touch with an electrician for a solar PV installation) that the intermediaries did not provide (Paper 2).

In paper 3, it was also shown that both solar PV and wind power intermediaries were involved in matchmaking within-groups, in this particular example, between different adopters involved in the same project. For example, in a longitudinal solar PV implementation project, the intermediary's role was to bridge the gap between two real estate companies in order to write a joint tender document. The intermediary's main activity, besides writing the joint procurement, was to confirm that the contents of the document reflected the adopters' demands and wishes and when asked about its role, the intermediary explained that it was to: build a "bridge between the clients" and to ensure that both adopters agreed on the final contents of the document. Another example of within-group matchmaking was evident in Paper 3, where the intermediary connected a potential adopter with an adopter that had invested in battery storage. The rationale behind within-group matchmaking, to a large extent, aims at balancing several adopters' interests. In one case, an intermediary also matchmade between the primary adopter and other members of the household. A homeowner had decided to invest in solar PV but had to convince the other part in the household and to this end, the intermediary visited the family and explained the investment and answered questions, which eventually led to a decision to adopt (Paper 2). While the results did not indicate any matchmaking between different input providers, this is also a possibility.

The main difference between matchmaking in shorter implementation projects and longitudinal ones is that in the latter, diffusion intermediaries and adopters work together for a longer period of time. This provides more opportunities to link different actors to each other. This aspect was particularly evident in solar PV implementation projects involving housing associations where the adopter had to interact with input providers for certain aspects such as

handling the broadband installation, and thus the intermediary could recommend a potential installer.

The results demonstrate that diffusion intermediaries create value to some extent through matchmaking activities. Given that matchmaking is common in previous literature on innovation intermediaries (Bailey and Bakos, 1997; Bessant and Rush, 1995; Dicecca et al., 2016; Dutrénit et al., 2012; Howells, 2006; Håkansson et al., 2011; Katzy et al., 2013; Kilelu et al., 2013; Kilelu et al., 2011; Sieg et al., 2010; Winch and Courtney, 2007), it could have been expected to occur even more frequently in the empirical data. This discrepancy can be potentially explained by the fact that turnkey projects are a major means to deliver the value proposition to adopters. As part of a turnkey offer, the intermediary handles most contacts with input providers, with a few exceptions where the adopter has to be directly linked to specific input providers such as banks (Papers 1, 2, and 3). The results also complement the previous literature by providing evidence that within-group matchmaking could potentially generate value to adopters.

5.2.1.3 Value creation through coordination

Finally, coordination was shown to be a key value creation activity for diffusion intermediaries in implementation processes (Papers 1 and 3). It was a core activity, especially in larger many-to-one-to-many relationships. Wind power diffusion intermediaries are involved in long and complex projects, which involve a variety of actors that they coordinate. Wind power diffusion intermediaries are involved in the coordination of a series of input providers and stakeholders related to the EIA process, such as specialized consultants conducting various impact studies (including wind measurements, bat movement studies, geotechnology, inventories of birds, investigations of cultural and natural conservation value, acoustical engineering etc.), entrepreneurs for roads and foundations, and a lawyer assisting in writing the EIA (cf. Paper 3). Other stakeholders that have an impact on wind projects are, for example, the Swedish Society for Nature Conservation, the Swedish Ornithological Society, technology suppliers (turbine manufacturers), network owners and energy companies, and various government agencies (e.g., county administrative boards, the Swedish Civil Aviation Administration, the Swedish Transport Agency, the Swedish Armed Forces, and the Swedish Energy Agency). Wind intermediaries also have to organize public consultations with property owners, land owners, and people who live close to the site. Wind power diffusion intermediaries coordinate all these actors throughout the implementation process. Within solar, diffusion intermediaries also coordinate a number of different actors, for example, input providers for the installation process, technology suppliers, government agencies (for financial grants, tax reductions, and building permits), and energy companies, and network owners (to register the plants pre-installation and after completion).

From a value creation perspective, coordination is necessary for providing turnkey solutions and minimizing the adopter's involvement in the implementation process. In Paper 2, it was also stated by adopters that an important aspect while hiring the intermediary was simplicity – the intermediary should handle everything. The studies clearly show that diffusion intermediaries are aware of the importance of coordination as a key driver for their value

proposition and it has been mentioned several times in interviews that it is vital in handling everything for the adopters. The longitudinal projects show the complexity of coordination and its influence on the value created for the adopters, for example when technology suppliers cannot deliver on time, and the intermediary must explain why they cannot install the technologies to the adopters. The issue is perhaps not that the intermediary's coordination skills are insufficient, but rather that it is impossible to control everything and everyone while handling a lot of input providers on behalf of adopters. This indicates that it can be worthwhile to explain the coordination process per se to adopters, in order to inform them that the context diffusion intermediaries are a part of the process and to make them aware that the intermediary does not have anything to gain from delaying the projects. As stated by one intermediary, it is vital to explain to adopters what a turnkey solution actually includes, in order to avoid potential misunderstandings (Study 3).

In comparison with previous literature on innovation intermediaries, the importance of coordination for diffusion intermediaries is a new finding. As mentioned in Chapter 2, previous studies do not refer to coordination explicitly, although a few studies of solar PV intermediaries describe and illustrate the coordination process indirectly (Karakaya et al., 2016; Mignon and Bergek, 2016; Strupeit and Palm, 2016; Överholm, 2015, 2017).

5.2.1.4 Summary

Diffusion intermediaries take care of the entire implementation process for adopters, that is, they offer total solutions in the form of turnkey projects. This is absolutely necessary for adopters to carry out their investment – they want "the entire package" and it must be simple for them to invest (Paper 2). This is an aspect that diffusion intermediaries seem to be aware of. For example, intermediaries describe how they "provide a carefree investment" (Paper 1). In order for diffusion intermediaries to deliver turnkey plants and live up to the adopters' expectations, they have to coordinate a lot of input providers on the adopters' behalf so that adopters only have to interact with one other party, namely the intermediary. The diffusion intermediaries also provide technology transfer as part of their value proposition. This includes transfer of everything from solar panels or wind turbines to smaller components necessary for the implementation from various technology providers to adopters. The appended papers show that coordination and transfer were the two most common brokering mechanisms. However, matchmaking was more often seen in longer implementation projects with several adopters and then often involved within-group brokering between different adopters rather than brokering between different types of actors.

5.2.2 ADOPTER SATISFACTION

In line with the framework, it can be expected that activities geared toward achieving adopter satisfaction can create value for adopters. Several of the following aspects have been discussed in Paper 2 and are complemented here by findings from other papers and the longitudinal multiple case study that sheds light on more detailed aspects of how diffusion intermediaries' activities are geared toward adopter satisfaction.

The results on the *psychological utility* component show that it is important for diffusion intermediaries to provide support for adopters' sense of control over the process and provide updates on the different steps in the investment process. This was emphasized by both adopters and diffusion intermediaries (Papers 1 and 2). More specifically, it is essential to update adopters on future events and keep them informed of different milestones in the project. In Paper 2, it was disclosed that not all adopters were satisfied with this type of services, indicating that clarity and transparency are important for the adopters' sense of control. This was also visible in the longitudinal projects where one central activity was to inform adopters of the developments of the project and to interact with them in order to assess whether they have any additional needs. The results show that diffusion intermediaries have some strategies to keep the adopters updated, such as calling, sending emails, or using SMS to notify customers of the progression of the projects (Papers 1, 2, and 3). In longer implementation projects, meetings were one of the central activities that sought to keep adopters updated (Papers 2 and 3).

The *functional utility* component explains the types of support that adopters need. As mentioned in the previous sections, intermediaries assisted adopters with the design of the investment and installation of the system. They assisted adopters in plant configuration (e.g., by analyzing the number of turbines or panels that are adequate), make economic calculations, make drawings, organize the installation, and provide training on the use of the system (Studies 1, 2, and 3). However, to create adopter satisfaction, it is important to identify what the adopter's actual needs are and to help them realize those needs, such as by offering panels with high production potential or keeping capital costs down by investing in cheaper models (Paper 2). It can also be central to discussing the functions of the products. An illustrative example can be derived from Paper 2, where the adopters had planned on installing the inverter close to the bedroom but changed their minds when the intermediary explained that it would be quite noisy.

Many adopters had technical interests and wanted to take part in technical discussions. In an additional interview with one of the largest solar PV diffusion intermediaries in Sweden, it was noted that this need was central for certain adopters - and in longitudinal projects, some adopters were interested in participating in technical discussions and details whereas other adopters wanted the intermediary to handle all technical aspects without their intervention. The longitudinal studies provide evidence on how intermediaries tried to fulfill the adopters' needs by, for example, discussing the pros and cons of technical alternatives and how technological options were discussed as the project progressed (e.g., within solar, it can be a display to show the production or optimizers a product that can boost the efficiency and output of the system) (Paper 3).

The *tangible attributes* are aspects that are easy to explain and can be used to compare intermediaries. These can include offering competitive prices, such as by giving adopters several options to match their budgets and other needs. The price aspect is important since adopters collect and compare offers from several intermediaries (Paper 2). However, as noted in Paper 1, competing on price can imply that the intermediary has to make trade-offs with

regard to quality. An approach to provide value to adopters with a price focus is to elaborate on different types of technologies and send different offers to match the adopters' price ranges (and explain the difference between the most expensive panels vs. the cheapest with regard to production and other aspects). Another important aspect underlined in Paper 2 is process rapidity, for example, making the delivery on time; if the adopter is not pleased with the product or the delivery time, the adopter's issues will be discussed with the intermediary. It is essential for the intermediary to have technology providers that they trust. It has been observed and asserted by an intermediary that delays from the supplier, which the intermediary has no control over, is a factor that can leave adopters feeling dissatisfied. One particular evident example was in two solar PV projects with different intermediaries (Study 3) where both intermediaries experienced delays from the manufacturers in Shanghai and even though both adopters were dissatisfied, one of them actually claimed amends for the delay while the other was more understanding (Study 3). In an interview with the project leader representing the intermediary firm, it was stated that: *"It is much better to be a few weeks ahead of schedule to have a little margin"* (Study 3). To this end, it is important to inform the adopter about what the diffusion intermediary's role implies and to inform them about the context that the intermediary is part of. For example, the intermediary can inform an adopter that they order panels from a specific manufacturer in China and that it is impossible to foresee any delays. It can be stated that the important value that they provide as brokers between parties can also be an issue since it is impossible to have control over each aspect in the implementation of projects since quite a large extent is dependent on that the input providers deliver.

The *Intangible attributes* concern adopters' subjective opinions. Paper 2 shows that the key elements are service-mindedness (e.g., the intermediary ought to answer all kinds of questions that the adopter may have), commitment (e.g., the intermediary shows that it wants to do business with the adopter), and expertise and experience from previous installations or projects. Legitimacy is another important attribute, as it is vital for the adopter to know that the intermediary can be trusted, has a good reputation, and will not go bankrupt after the installation (Papers 2 and 3).

5.2.3 SUMMARY

The discussion above shows that value can be derived from both intermediation and other activities and that both can be important to support the value proposition and create adopter satisfaction. While brokering is a defining characteristic of all diffusion intermediaries' value propositions, elements such as price competitiveness, service-mindedness, commitment, behavioral support, expertise, and experience make each diffusion intermediary unique and can thus be an important component of their competitive advantage.

However, it is important to underline that the two types of value are probably interrelated and are necessary in order to deliver value for adopters. On the one hand, if the intermediary would not have been positioned between input providers and adopters, but solely acted in a one-to-one relationship with the adopter it could not have transferred technologies or coordinated input providers, which implies that intermediation activities are essential. On the

other hand, diffusion intermediaries' brokering activities must be complemented with one-to-one services that are geared more directly toward ensuring adopter satisfaction, which is the most visible value dimension for adopters. Indeed, adopters may take for granted that the intermediary will transfer technology, coordinate actors, and matchmake adopter with other parties if necessary. The intricate relationships that intermediaries are involved in to solve adopters' problems are not always as explicit as the one-to-one type of services and value they generate. This might explain why adopters mainly emphasized value related to adopter satisfaction as opposed to value linked to the value proposition and the brokering mechanisms (Papers 2 and 3), whereas the interviews with diffusion intermediaries provided a more nuanced picture illustrating brokering as a catalyst (Paper 1).

Intermediation and non-intermediation activities create value for the adopters. This implies that the relevance of viewing brokering through the lens of value creation can be questioned, at least for scholars who are primarily interested in intermediation. It is probably recommended that they focus on the brokering mechanisms framework. The downside to this is that many activities that contribute to value creation would be neglected, but the advantage is that it decreases complexity. However, increasing our theoretical understanding of the diffusion intermediary concept utilizing the value creation lens may give a more accurate and nuanced understanding of the complete sphere of activities that diffusion intermediaries conduct.

5.2.4 VALUE CO-CREATION

In addition to the findings that are directly related to research question 2, the study also sheds light on how diffusion intermediaries can co-create value with adopters. This was mainly evident in longitudinal wind and solar projects, where the intermediaries and adopters worked together throughout the implementation process. The advantage of such an approach is that intermediaries get a chance to be proactive and guide the adopters through the implementation process to explain when certain activities occur and why they are carried out in the first place (Paper 1). These features are central to value creation, and the adopters pointed out that they are missing but desirable (Paper 2).

Co-creating value can be a fruitful approach to avoid misunderstandings and is a means of providing adopter satisfaction by being service-minded. This is in line with Fyrberg and Jüriado (2009 p. 427) who argued that: "it is the customers that create the value proposition by their construction of meanings and, consequently, value." This line of thought implies that it is crucial for diffusion intermediaries to be transparent about the process so as not to create separate types of meanings and for adopters and intermediaries to work toward arriving at a consensus and adapting to each other depending on changing contextual circumstances (Paper 3). Transparency and clarity are important drivers for adopter satisfaction and such aspects are perhaps not always established initially, but develop over time (Papers 2 and 3).

The longitudinal projects are characterized by more frequent and face-to-face interactions with adopters, in which the needs and demands of the adopters are expressed continuously. The dynamics in such meetings differ. In some projects, the diffusion intermediaries were

responsible for the meetings, while in other projects, the adopter took on this task internally, and in one case, the adopter engaged an external project leader who was responsible for setting the agenda, ensuring progress of the meetings, and facilitating the progress of the project (Study 3). In longitudinal projects, diffusion intermediaries have the opportunity to co-create value with adopters, which is partly done by continuously discussing the progress and continuation of the project, by keeping the adopter informed about the progress made in the project, by answering questions, and by investigating whether adopters have any new needs that need to be considered.

Both intermediaries and adopters have actually described the importance of information exchange in longitudinal project and the main activity is for the intermediary to transfer information from input providers to adopters (Papers 2 and 3). It was emphasized by an intermediary that they wanted to work with adopters who saw value in a company that did more than just install the technologies (e.g., additional studies, having contacts with network owners, and staying updated on current legislations etc.). In the longitudinal projects, in which interactions between the parties occurred rather frequently, value co-creation was important and Fyrberg and Jüriado (2009 p. 428) underlined that the interaction with customers is a "Reciprocal development of value proposition suggested by customers". This implies that diffusion intermediaries cannot constrain their value proposition on the adopters. It is a dynamic process, which to a large extent, unfolds parallel to the development of implementation projects.

The studies also show that the procedure of adding additional fees for correctional and additional work are quite common among diffusion intermediaries involved in longer implementation projects (Paper 3), where diffusion intermediaries tend to inform the adopters that they are able to complement their initial requests during the implementation process. The diffusion intermediary also discusses different topics with the adopter who can then either accept or reject the ideas (if the adopter approves, the intermediary sends an additional invoice). This was not an issue on many occasions, since the intermediary had communicated in advance with the adopter to arrive at a consensus. One adopter explained that the intermediary had not discussed the issue of extra work, so they were not pleased about not being informed in advance. One aspect of value co-creation that seems important is being transparent with adopters, especially in indicating why additional work is necessary and having a continuous in-depth dialogue on their preferences regarding changes in the initial offer. These aspects have also been identified in the literature (cf. Prahalad and Ramaswamy, 2004). It is also important that adopters provide inputs to the intermediary in order for them to be involved in the value co-creation process and for adopters to be aware of what is included in the initial turnkey solution, and perhaps more importantly, what is not included. If value is co-created with adopters, such aspects should not come as a surprise.

6 CONCLUSIONS AND IMPLICATIONS

This section concludes the thesis by providing answers to the research questions and outlining issues for further research, managerial implications, and policy recommendations.

6.1 CONCLUSIONS: THE RAISON D'ÊTRE OF DIFFUSION INTERMEDIARIES

The purpose of this thesis was twofold: first, to study the activities of diffusion intermediaries in order to distinguish intermediation activities from other activities, and second, to examine how these activities create value for adopters. The thesis addressed the following research questions: (1) Which activities can be classified as brokering? (2) What value do diffusion intermediaries contribute to in the implementation processes?

6.1.1 WHICH ACTIVITIES CAN BE CLASSIFIED AS BROKERING?

With regard to the first research question, the results show that utilizing the brokering mechanisms framework was useful in distinguishing intermediation from other activities. By applying the framework to activities found in previous literature, four overarching intermediation activities were identified, namely knowledge brokering, technology brokering, resource mobilization, and mediation. The empirical analysis confirmed that the activities that diffusion intermediaries conduct match the brokering activities that were identified in the study. For each activity, it was also possible to identify the three brokering mechanisms that the diffusion intermediaries were involved in. The results show that all three brokering mechanisms were conducted in each of the identified activities.

The analysis also identified a link between intermediation and other activities. More specifically, the results show that diffusion intermediaries are involved in four types of non-intermediation activities that can be linked to the abovementioned intermediation activities, namely, information compilation or dissemination, technology development, resource provision, and actor assessment. The association between both types of activities was that non-intermediation activities are often necessary stepping stones toward intermediation activities and might also be necessary in supporting the adopter after implementation. The study indicates that if intermediation is considered a process, both types of activities are central in different parts of the implementation process, and in different ways.

6.1.2 WHAT VALUE DO DIFFUSION INTERMEDIARIES CONTRIBUTE?

The results show that both intermediation and non-intermediation activities are the basis for value creation. In contrast to previous literature that has focused mainly on matchmaking and technology transfer, the results show that diffusion intermediaries create value through coordination, in all types of projects, but more so in larger projects since they usually involve more input providers who have to be coordinated. In line with previous literature, technology transfer and matchmaking were also identified as common value-creating brokering mechanisms and as an important part of the offer. However, while previous studies have mainly emphasized between-group matchmaking, the findings of this thesis show that diffusion intermediaries create value through both within and between-group matchmaking.

The findings indicate that adopter satisfaction is mainly achieved on activities performed on a one-to-one basis. These non-intermediation activities can be decisive not only in solving adopters' problems but can also help adapt the intermediaries' services to suit the adopters' different drivers and motives. The results reveal that intangible attributes (service-mindedness, relevant expertise, and experience, legitimacy, and commitment) are especially crucial as core selection criteria for adopters in both solar and wind projects.

Finally, the findings show that value creation is a process that unfolds during the project and involves collaboration between the intermediary and the adopter. This indicates that it can be beneficial for intermediaries to focus on value co-creation with adopters, to understand what it implies to be responsive, transparent, and service-minded and to be able to have an in-depth dialogue with adopters about their specific needs and alter the initial offer accordingly.

6.1.3 WHY DO DIFFUSION INTERMEDIARIES EXIST?

This thesis has shown that diffusion intermediaries conduct both intermediation (brokering) and non-intermediation activities and that both are important and create value for the adopters. However, what makes diffusion intermediaries unique is their position between at least two other parties in implementation projects and the intermediation activities they are involved in, in this position. The thesis has shown that by utilizing brokering mechanisms, it is possible to identify what distinguishes intermediaries from non-brokering organizations and, thus, to understand their raison d'être. Focusing on the raison d'être of diffusion intermediaries is an approach that helps reduce complexity and draws more meaningful conclusions. While it is acknowledged that other activities exist and are important (e.g., to get satisfied adopters), it emphasizes that diffusion intermediaries exist because of the activities they conduct as brokers in between at least two other parties in the innovation implementation process (cf. Howells 2006). To this end, the following working definition of a project-level diffusion intermediary can be proposed:

> *An organization brokering in implementation projects between two or more parties. Such diffusion intermediary activities include transfer of technologies and information/knowledge; coordination of actors and matchmaking within and between actor groups.*

For those who are interested in studying companies as such and the value they create (or how they contribute more generally to innovation diffusion or transitions), rather than their role as intermediaries, a broader perspective is advised, that also includes other activities.

6.2 IMPLICATIONS

The thesis has addressed the question of why diffusion intermediaries exist by focusing on their role as brokers and how they create value through both intermediation and non-intermediation activities. It has also provided a more nuanced understanding of activities covering the entire implementation process and emphasizing the co-creation of value by intermediaries and adopters. Some implications and recommendations can be drawn based on this. This final section outlines issues for further research, managerial implications, and policy recommendations based on the content discussed in this thesis.

6.2.1 ISSUES FOR FURTHER RESEARCH

While this thesis has identified the activities that can be classified as brokering, how diffusion intermediaries create value for adopters, and why diffusion intermediaries exist, further empirical and conceptual research can focus on deep longitudinal case studies of diffusion intermediaries. These case studies are necessary to provide a more detailed understanding of the activities associated with brokering in other empirical contexts. Such studies can also provide additional insights into the connection between intermediation and other types of activities and how different types of activities create value at the project level. These insights can be used to conceptualize the interactive process between diffusion intermediaries and adopters, including an investigation on how interactions with adopters change over different implementation phases, if and how value is co-created, and how that contributes to adopter satisfaction. It can also help investigate the extent to which the value emphasized (and created) by diffusion intermediaries and adopters is geared toward a transition to a sustainable energy system rather than merely toward project-level implementation and adopter satisfaction.

Another direction for future research is to compare longitudinal projects and identify how different diffusion intermediaries create value for adopters and how their strategies converge or diverge. It can also be relevant to study an even larger sample of adopters to increase our understanding of their motives and needs for adoption and to examine and compare the dynamics in cooperating with diffusion intermediaries.

It should be noted that while longitudinal studies provide very good insights into the activities of an organization and can contribute to a more objective understanding of the evidence as opposed to solely conducting interviews, a main barrier is that it can be hard to identify organizations that will allow a researcher to follow their projects over a longer period of time. A recommendation is to have a discussion beforehand with the organization, discuss what such studies imply, and what the organization can expect from the researcher, and perhaps write a contract to formalize the agreement.

The interviews in this thesis revealed that new companies are especially entering the solar development industry and that some of them are trying to create value by offering cheaper panels and lower prices in general. The question is how this will affect the industry and the quality of the offer in general. Many adopters seem to appreciate a lower price, but the question is what trade-offs are necessary to achieve this. Finally, further research can focus on

the national and local barriers to the diffusion of wind power in Sweden. Since the studies show that single stakeholders have great power to stop wind power projects.

6.2.2 Managerial implications

Given that adopters perceive different kinds of value and that their perceived kinds of value are linked with how they select a service provider, one recommendation is for managers to focus on adapting their services to match the adopters' needs and wishes. This would require intermediaries to adapt their turnkey solutions to suit the adopters' needs instead of providing a standardized package. This may not work to increase revenues instantly, but can definitely result in more satisfied adopters who recommend the company and can thus result in increased legitimacy, higher market share, and more satisfied adopters, which is, in effect, a win-win situation that can eventually lead to added revenue. Managers engaged in turnkey projects should clarify what this implies for adopters so that they are aware of which parts of the implementation are included and explain why they cannot (or choose not to) provide other parts. The studies also show that adopters want and need a lot of information and intermediaries should therefore not constrain themselves with regard to communication, since it is a central aspect of adopter satisfaction. Managers face similar issues in longitudinal implementation projects. Striving toward establishing a transparent and open dialogue with adopters is one step toward facilitating the implementation process for both adopters and the intermediary. Given the fact that adopters' value perceptions may change during the development of a project as they increase their knowledge base, it is important to consider the implementation as a dynamic process, which implies that adopters can participate in the different implementation stages actively.

Solar and wind intermediaries should consider the differences within the industries and possibly try to learn from each other. This is probably more relevant within the solar industry, since it is developing rapidly, and this speed can create challenges for the management in determining ways to create value for adopters. Further, the industry's rapid development affects the adopters' views on investing in general. It is important that adopters receive information from the right sources so that their initial perceptions are correct. This places challenging demands on the management, whose activities might have to go beyond individual projects. They also have to keep track of changes in policy and identify the best ways to best communicate with their stakeholders. To this end, diffusion intermediaries could play an important role in the diffusion of innovations at a system level.

6.2.3 Policy recommendations

This thesis arguably exists based on the fact that environmental mitigations are necessary and that an initial idea was that diffusion intermediaries may be central actors that can contribute to the transition to a sustainable energy system. Although policy has not been the main focus of the thesis, the covering paper and the three appended papers still contribute to policy development with different perspectives. In Paper 1, we recommended that policymakers should be aware of the value the diffusion intermediaries create in implementation projects, and also in the diffusion process as a whole, given the crucial role they play for solar PV and wind power implementation. It was also suggested that policy makers may consider a

certification scheme to help potential adopters choose from among diffusion intermediaries. In Paper 2, we recommended that policy makers should not underestimate the intangible attributes and psychological utility components, given that these attributes are vital from a sustainability transition perspective for increased diffusion and for additional investments in renewable electricity technologies. This covering paper has zoomed in even further on the activities that diffusion intermediaries conduct and has clarified that diffusion intermediaries exist in order to broker between at least two parties, specifically, between adopters and a series of input providers that are necessary for the implementation of the project. Diffusion intermediaries engage in an otherwise complex process and conduct various intermediation and non-intermediation activities to provide turnkey projects to adopters. Without them, either adopters may not be able to invest at all or may have to bear a considerably more complex and time-consuming process. To this end, it is vital for policy makers to realize the central brokering activities that diffusion intermediaries conduct that can speed up the diffusion process of solar PV and wind power.

REFERENCES

Abbate, T., Coppolino, R., Schiavone, F., 2013. Linking Entities in Knowledge Transfer: The Innovation Intermediaries. Journal of the Knowledge Economy 4, 233-243.

Aggarwal, P., 1997. Surrogate buyers and the new product adoption process: a conceptualization and managerial framework. Journal of Consumer Marketing 14, 391-400.

Agogué, M., Berthet, E., Fredberg, T., Le Masson, P., Segrestin, B., Stoetzel, M., Wiener, M., Yström, A., 2017. Explicating the role of innovation intermediaries in the "unknown": a contingency approach. Journal of Strategy and Management 10, 19-39.

Agogué, M., Yström, A., Le Masson, P., 2013. Rethinking the Role of Intermediaries as an Architect of Collective Exploration and Creation of Knowledge in Open Innovation. International Journal of Innovation Management 17, 1350007.

Andersen, P.H., Dubois, A., Lind, F., 2018. Process validation: coping with three dilemmas in process-based single-case research. Journal of Business & Industrial Marketing 33, 539-549.

Aspeteg, J., Bergek, A., 2019. The value creation of diffusion intermediaries: Brokering mechanisms and trade-offs in the case of solar and wind power in Sweden. Submitted to a scientific journal.

Bailey, J.P., Bakos, Y., 1997. An Exploratory Study of the Emerging Role of Electronic Intermediaries. International Journal of Electronic Commerce 1, 7-20.

Balkow, J., 2012. In the middle: on sourcing from China and the role of the intermediary. Doctoral dissertation, Jönköping International Business School.

Baxter, P., Jack, S., 2008. Qualitative case study methodology: Study design and implementation for novice researchers. The qualitative report 13, 544-559.

Benouniche, M., Errahj, M., Kuper, M., 2016. The Seductive Power of an Innovation: Enrolling Non-conventional Actors in a Drip Irrigation Community in Morocco. Journal of Agricultural Education and Extension 22, 61–79.

Bergek, A., 2019. Diffusion intermediaries: a taxonomy and characterization based on the case of renewable electricity technology in Sweden. . Submitted to a scientific journal.

Bergek, A., Mignon, I., 2018. Innovation intermediaries: Towards a better understanding of key concepts. . Submitted to a scientific journal.

Bessant, J., Rush, H., 1995. Building bridges for innovation: the role of consultants in technology transfer. Research Policy 24, 97-114.

Boon, W., Edler, J., 2018. Demand, challenges, and innovation. Making sense of new trends in innovation policy. Science and Public Policy 45, 435-447.

Boon, W., P, C., Moors, E., H, M., Kuhlmann, S., Smits, R., E, H, M., 2008. Demand articulation in intermediary organisations: The case of orphan drugs in the Netherlands. Technological Forecasting and Social Change 75, 644-671.

Breukers, S., Wolsink, M., 2007. Wind power implementation in changing institutional landscapes: An international comparison. Energy Policy 35, 2737–2750.

Breyer, C., Bogdanov, D., Aghahosseini, A., Gulagi, A., Child, M., Oyewo, A.S., Farfan, J., Sadovskaia, K., Vainikka, P., 2018. Solar photovoltaics demand for the global energy transition in the power sector. Progress in Photovoltaics: Research and Applications 26, 505-523.

Caiazza, R., Volpe, T., 2017. Innovation and its diffusion: process, actors and actions. Technology Analysis & Strategic Management 29, 181-189.

Caloffi, A., Rossi, F., Russo, M., 2015. The emergence of intermediary organizations: a network-based approach to the design of innovation policies' in Cairney, P. and R. Geyer (eds.) Handbook on Complexity and Public Policy, Cheltenham: Edward Elgar.

Castrogiovanni, G.J., Domenech, J., Mas-Verdú, F., 2012. Variations in SME Characteristics and the Use of Service Intermediaries for R&D. Canadian Journal of Administrative Sciences / Revue Canadienne des Sciences de l'Administration 29, 154-164.

Chen, S.-H., Egbetokun, A.A., Chen, D.-K., 2015. Brokering knowledge in networks: institutional intermediaries in the Taiwanese biopharmaceutical innovation system. International Journal of Technology Management 69, 189-209.
Chesbrough, H., 2006. Open Business Models: How To Thrive In The New Innovation Landscape. Harvard Business Press, Boston (MA).
Clark, J., 2014. Manufacturing by design: the rise of regional intermediaries and the re-emergence of collective action. Cambridge Journal of Regions, Economy and Society 7, 433-448.
Dahlander, L., Gann, D.M., 2010. How open is innovation? Research Policy 39, 699-709.
Dalziel, M., 2010. Why do innovation intermediaries exist? DRUID Summer Conference 2010.
Deng, Y., Blok, K., der Leun, K., 2012. Transition to a fully sustainable global energy system. Energy Strategy Reviews 1, 109-121.
Denzin, N.K., 2006. Sociological methods: A sourcebook. Aldine Transaction.
Dewald, U., Truffer, B., 2012. The local sources of market formation: explaining regional growth differentials in German photovoltaic markets. European Planning Studies 20, 397-420.
Dicecca, R., Pascucci, S., Contò, F., 2016. Understanding reconfiguration pathways of agri-food value chains for smallholder farmers. British Food Journal 118, 1857 - 1882.
Dutrénit, G., Rocha-Lackiz, A., Vera-Cruz, A.O., 2012. Functions of the Intermediary Organizations for Agricultural Innovation in Mexico: The Chiapas Produce Foundation. Review of Policy Research 29, 693-712.
Dutrénit, G., Rocha-Lackiz, A., Vera-Cruz, A.O., 2012. Functions of the Intermediary Organizations for Agricultural Innovation in Mexico: The Chiapas Produce Foundation. Review of Policy Research 29, 693-712.
Edler, J., Yeow, J., 2016. Connecting demand and supply: The role of intermediation in public procurement of innovation. Research Policy 45, 414-426.
EIA, P., 2018. Trends 2018 in Photovoltaic Applications. Available at: http://www.iea-pvps.org/fileadmin/dam/intranet/task1/IEA_PVPS_Trends_2018_in_Photovoltaic_Applications_03.pdf Accessed: 190510.
Fabrizio, K.R., Hawn, O., 2013. Enabling diffusion: How complementary inputs moderate the response to environmental policy. Research Policy 42, 1099–1111.
Fyrberg, A., Jüriado, R., 2009. What about interaction? Networks and brands as integrators within service-dominant logic. Journal of Service Management 20, 420-432.
Geels, F., Deuten, J.J., 2006. Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lessons from reinforced concrete. Science and Public Policy 33, 265–275.
Gliedt, T., Hoicka, C.E., Jackson, N., 2018. Innovation intermediaries accelerating environmental sustainability transitions. Journal of Cleaner Production 174, 1247-1261.
Hanna, R., Leach, M., Torriti, J., 2018. Microgeneration: The installer perspective. Renewable Energy 116, 458-469.
Hargadon, A., Sutton, R.I., 1997. Technology Brokering and Innovation in a Product Development Firm. Administrative Science Quarterly 42 716-749.
Hargadon, A.B., 1998. Firms as knowledge brokers: Lessons in pursuing continuous innovation. California Management Review 40, 209-227.
Hargreaves, T., Hielscher, S., Seyfang, G., Smith, A., 2013. Grassroots innovations in community energy: The role of intermediaries in niche development. Global Environmental Change 23, 868-880.
Herrmann, A., Huber, F., Braunstein, C., 2000. Market-driven product and service design: Bridging the gap between customer needs, quality management, and customer satisfaction. International Journal of production economics 66, 77-96.
Howells, J., 2006. Intermediation and the role of intermediaries in innovation. Research Policy 35, 715-728.
Håkansson, L., Caessens, P., Macaulay, S., 2011. InnovationXchange: A case study in innovation intermediation. Innovation: Management, policy & practice 13, 261–274.

Inkinen, T., Suorsa, K., 2010. Intermediaries in Regional Innovation Systems: High-Technology Enterprise Survey from Northern Finland. European Planning Studies 18, 169-187.
Intarakumnerd, P., Chaoroenporn, P., 2013. The roles of intermediaries in sectoral innovation system in developing countries: public organizations versus private organizations. Asian Journal of Technology Innovation 21, 108-119.
IPCC, 2014. Summary for Policymakers. *In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
IPCC, 2018. Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, Maycock, M. Tignor, and T. Waterfield (eds.)]. *World Meteorological Organization*, *Geneva, Switzerland, 32 pp.*
Jami, A.A., Walsh, P.R., 2017. From consultation to collaboration: A participatory framework for positive community engagement with wind energy projects in Ontario, Canada. Energy Research & Social Science 27, 14-24.
Jansen, H., 2010. The logic of qualitative survey research and its position in the field of social research methods. Forum Qualitative Sozialforschung 11, Art 11.
Johnson, W.H.A., 2008. Roles, resources and benefits of intermediate organizations supporting triple helix collaborative R&D: The case of Precarn. Technovation 28, 495–505.
Kanda, W., Hjelm, O., Clausen, J., Bienkowska, D., 2018. Roles of intermediaries in supporting eco-innovation. Journal of Cleaner Production 205, 1006-1016.
Karakaya, E., 2015. Diffusion of dynamic innovations: A case study of residential solar PV systems. Doctoral dissertation, KTH Royal Institute of Technology.
Karakaya, E., Hidalgo, A., Nuur, C., 2015. Motivators for adoption of photovoltaic systems at grid parity: A case study from Southern Germany. Renewable and Sustainable Energy Reviews 43, 1090-1098.
Karakaya, E., Nuur, C., Hidalgo, A., 2016. Business model challenge: Lessons from a local solar company. Renewable Energy 85, 1026-1035.
Karakaya, E., Sriwannawit, P., 2015. Barriers to the adoption of photovoltaic systems: The state of the art. Renewable and Sustainable Energy Reviews 49, 60–66.
Katzy, B., Turgut, E., Holzmann, T., Sailer, K., 2013. Innovation intermediaries: a process view on open innovation coordination. Technology Analysis & Strategic Management, 25, 295–309.
Kilelu, C.W., Klerkx, L., Leeuwis, C., 2013. Unravelling the role of innovation platforms in supporting co-evolution of innovation: Contributions and tensions in a smallholder dairy development programme. Agricultural Systems 118, 65-77.
Kilelu, C.W., Klerkx, L., Leeuwis, C., Hall, A., 2011. Beyond knowledge brokerage: An exploratory study of innovation intermediaries in an evolving smallholder agricultural system in Kenya. Knowledge Management for Development Journal 7, 84-108.
Kingiri, A.N., Hall, A., 2012. The Role of Policy Brokers: The Case of Biotechnology in Kenya. Review of Policy Research 29, 492-522.
Kivimaa, P., 2014. Government-affiliated intermediary organisations as actors in system-level transitions. Research Policy 43, 1370-1380.
Kivimaa, P., Boon, W., Hyysalo, S., Klerkx, L., 2019. Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. Research Policy 48, 1062-1075.
Klerkx, L., Leeuwis, C., 2008. Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. Food Policy 33, 260–276.

Klerkx, L., Leeuwis, C., 2009. Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. Technological forecasting and social change 76, 849-860.
Leonard-Barton, D., 1984. Diffusing Innovations When the Users A re Not the Choosers. Knowledge 6, 89-111.
Leung, D.Y.C., Yang, Y., 2012. Wind energy development and its environmental impact: A review. Renewable and Sustainable Energy Reviews 16, 1031-1039.
Lichtenthaler, U., 2013. The Collaboration of Innovation Intermediaries and Manufacturing Firms in the Markets for Technology. Journal of Product Innovation Management 30, 142-158.
Loring, J.M., 2007. Wind energy planning in England, Wales and Denmark: Factors influencing project success. Energy Policy 35, 2648–2660.
Mantel, S.J., Rosegger, G., 1987. The role of third-parties in the diffusion of innovations: a survey. In: Rothwell, R., Bessant, J. (Eds.), Innovation: Adaptation and Growth. Elsevier, Amsterdam,. 123–134.
Marsden, P.V., 1982. Brokerage Behavior in Restricted Exchange Networks. Social Structure and Network Analysis, edited by Peter V. Marsden and Nan Lin. Beverly Hills: Sage, 201-218
Mathison, S., 1988. Why triangulate? Educational researcher 17, 13-17.
Mignon, I., 2016. Intermediary–user collaboration during the innovation implementation process. Technology Analysis & Strategic Management 29, 735–749.
Mignon, I., Bergek, A., 2016. System-and actor-level challenges for diffusion of renewable electricity technologies: an international comparison. Journal of Cleaner Production 128, 105-115.
Mignon, I., Kanda, W., 2018. A typology of intermediary organizations and their impact on sustainability transition policies. Environmental Innovation and Societal Transitions 29, 100-113.
O'Donoghue, T., Punch, K., 2003. Qualitative educational research in action: Doing and reflecting. Routledge.
Osterwalder, A., Pigneur, Y., 2010. Business Model Generation. John Wiley & Sons, Hoboken (NJ).
Osterwalder, A., Pigneur, Y., Tucci, C.L., 2005. Clarifying Business Models: Origins, Present, and Future of the Concept. Communications of AIS 15.
Owen, A., Mitchell, G., Gouldson, A., 2014. Unseen influence—The role of low carbon retrofit advisers and installers in the adoption and use of domestic energy technology. Energy Policy 73, 169-179.
Palm, A., 2016. Local factors driving the diffusion of solar photovoltaics in Sweden: A case study of five municipalities in an early market. Energy Research & Social Science 14, 1–12.
Palm, J., 2018. Household installation of solar panels – Motives and barriers in a 10-year perspective. Energy Policy 113, 1-8.
Paraga, Y., Jandab, K.B., 2014. More than filler: Middle actors and socio-technical change in the energy system from the “middle-out”. Energy Research and Social Science 3, 102-112.
Polzin, F., von Flotow, P., Klerkx, L., 2016. Addressing barriers to eco-innovation: Exploring the finance mobilisation functions of institutional innovation intermediaries. Technological Forecasting and Social Change 103, 34-46.
Poncet, J., Kuper, M., Chiche, J., 2010. Wandering off the paths of planned innovation: The role of formal and informal intermediaries in a large-scale irrigation scheme in Morocco. Agricultural Systems 103, 171-179.
Popp, A., 2000. “Swamped in information but starved of data”: information and intermediaries in clothing supply chains. Supply Chain Management: An International Journal 5, 151-161.
Prahalad, C.K., Ramaswamy, V., 2004. Co-creating unique value with customers. Strategy & Leadership 32, 4-9.
Reddy, S., Painuly, J.P., 2004. Diffusion of renewable energy technologies — barriers and stakeholders’ perspectives. Renewable Energy 29, 1431–1447.
Rekers, J.V., 2016. What triggers innovation diffusion? Intermediary organizations and geography in cultural and science-based industries. Environment and Planning C: Government and Policy 34, 1058–1075.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J.J.E., society, 2009a. Planetary boundaries: exploring the safe operating space for humanity. Ecology and society 14, 32.
Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., Schellnhuber, H.J.J.n., 2009b. A safe operating space for humanity. Nature 461, 472-475.
Rogers, E.M., 1983. Diffusion of Innovations, 3rd ed. The Free Press, New York.
Rogers, E.M., 2003. The diffusion of innovation 5th edition. Free Press, New York.
Roxas, S.A., Pirolic, G., Sorrentinod, M., 2011. Efficiency and evaluation analysis of a network of technology transfer brokers. Technology Analysis and Strategic Management 23, 7-24.
Ryall, M.D., Sorenson, O., 2007. Brokers and competitive advantage. Management Science 53, 566-583.
Saidur, R., Rahim, N., Islam, M., Solangi, K., 2011. Environmental impact of wind energy. Renewable and sustainable energy reviews 15, 2423-2430.
Saldaña, J., 2003. Longitudinal qualitative research: Analyzing change through time. Rowman Altamira.
SCB, 2018. Elektricitet i Sverige. Available at: https://www.scb.se/hitta-statistik/sverige-i-siffror/miljo/elektricitet-i-sverige/ Accessed 181207.
Sieg, J.H., Wallin, M.W., Von Krogh, G., 2010. Managerial challenges in open innovation: a study of innovation intermediation in the chemical industry. R&D Management 40, 281-291.
Singh, K., 2016. Business innovation and diffusion of off-grid solar technologies in India. Energy for Sustainable Development 30, 1-13.
Smedlund, A., 2006. The roles of intermediaries in a regional knowledge system. Journal of Intellectual Capital 7, 204-220.
Spiro, E.S., Acton, R.M., Butts, C.T., 2013. Extended structures of mediation: Re-examining brokerage in dynamic networks. Social Networks 35, 130–143.
Stankiewicz, R., 1995. The role of the science and technology infras- tructure in the development and diffusion of industrial automation in Sweden. In: Carlsson, B. (Ed.), Technological Systems and Economic Performance: The Case of Factory Automation. Dordrecht, Kluwer,. 165–210.
Stewart, J., Hyysalo, S., 2008. Intermediaries, users and social learning in technological innovation. International Journal of Innovation Management 12, 295-325.
Stovel, K., Golub, B.M., Eva M Meyersson, 2011. Stabilizing brokerage. Proceedings of the National Academy of Sciences 108, 21326-21332.
Stovel, K., Shaw, L., 2012. Brokerage. Annual review of sociology 38, 139-158.
Strupeit, L., Palm, A., 2016. Overcoming barriers to renewable energy diffusion: business models for customer-sited solar photovoltaics in Japan, Germany and the United States. Journal of Cleaner Production 123, 124-136.
Toke, D., Breukers, S., Wolsink, M., 2008. Wind power deployment outcomes: How can we account for the differences? Renewable and Sustainable Energy Reviews 12, 1129-1147.
Tran, Y., Hsuan, J., Mahnke, V., 2011. How do innovation intermediaries add value? Insight from new product development in fashion markets. R&D Management 41, 80-91.
Tremblay, D.-G., Dossou-Yovo, A., 2015. Territory, innovation processes in SMEs, and intermediary actors: the case of the ICT sector in the Greater Montreal Area. International Journal of Technology Management 69, 1-19.
van Lente, H., Hekkert, M., smits, R., Waveren, B.v., 2003. Roles of systemic intermediaries in transition processes. 7, 247–279.
Velamuri, V.K., 2013. Hybrid value creation. Springer Science and Business Media.
Wang, S., Wang, S., 2015. Impacts of wind energy on environment: A review. Renewable and Sustainable Energy Reviews 49, 437-443.
Watkins, D., Horley, G., 1986. Transferring technology from large to small firms: the role of intermediaries. In: Webb, T., Quince, T., Watkins, D. (Eds.), Small Business Research. Gower, Aldershot. 215–251.

Westbrooke, V., Guenther, M., Bewsell, D., Greer, G., 2018. Meat processing company staff as innovation intermediaries: developing a framework from New Zealand's red meat sector. The Journal of Agricultural Education and Extension 24, 123-135.
Winch, G.M., Courtney, R., 2007. The Organization of Innovation Brokers: An International Review. Technology Analysis & Strategic Management 19, 747-763.
Wolpert, J.D., 2002. Breaking out of the innovation box. Harvard Business Review 80, 76-83, 148.
Yang, H., Klerkx, L., Leeuwis, C., 2014. Functions and limitations of farmer cooperatives as innovation intermediaries: Findings from China. Agricultural Systems 127, 115–125.
Yin, R.K., 2013. Case Study Research: Design and Methods. SAGE Publications.
Zott, C., Amit, R., Massa, L., 2011. The Business Model: Recent Developments and Future Research. Journal of Management 37, 1019-1042.
Överholm, H., 2015. Collectively created opportunities in emerging ecosystems: The case of solar service ventures. Technovation 39, 14-25.
Överholm, H., 2017. Alliance formation by intermediary ventures in the solar service industry: implications for producteservice systems research. Journal of Cleaner Production 140, 288-298.