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SOCIAL ACCEPTANCE OF SOLAR ENERGY AS INTENTION, WILLINGNESS, AND READINESS



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SOCIAL ACCEPTANCE OF SOLAR ENERGY

AS INTENTION, WILLINGNESS, AND READINESS

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ABSTRACT

As the world transitions from fossil-based energy to more environmentally friendly, sustainable, and decentralised energy sources, cries of ‘non-acceptance’ give way to ‘acceptance and adoption’ as part of the process of social acceptance. This multidimensional concept is interpreted differently across various disciplines. Still, its core and general conceptualisation remain vague, and no Finnish studies have thoroughly addressed social acceptance in solar energy adoption behaviour among Finnish households. This dissertation addresses how the social acceptance of renewable energies such as solar energy can be conceptualised comprehensively as an aggregate of various acceptance and non-acceptance responses or reactions that pass-through intention, willingness, and the readiness of Finns. Based on semi-structured interviews with 17 Finnish energy experts (especially the fields in solar and other renewable energies) and 25 Finnish laypersons (living in the Eko-Viikki residential area in Helsinki, where there are ten solar-integrated buildings, among other dwellings), this dissertation includes three articles on the intention-behaviour gap, willingness to adopt (WTA), and readiness to adopt solar energy in response to respondents’ personal experiences (primarily those of laypersons) and their perceptions about others. Finally, based on those empirical results, this dissertation presents a conceptual framework. It establishes the key themes – intention (including intention-behaviour gap), willingness, and readiness to adopt – as pre-behavioural mental states that create preferences among actors to express certain behavioural responses. It explains such responses as patterns of social acceptance and clarifies the conceptual and empirical status in terms of adoption, acceptance in principle, rejection, and opposition.

My empirical results, as explained in Article I and summarised in Section 4.2 of this dissertation, focus on understanding and explaining the intention-behaviour gap to adopt solar energy as an output of personal and contextual factors, the justification behind the intention-behaviour gap, and the suppressed structure of social acceptance based on three forms of the intention-behaviour gap: (a) ‘impression in principle’ intention-related, (b) “Impression in practical [practice]’ intention-related, and (c) ‘actual intention’-related. The ‘totality’ of intention can be understood through the third form of the intention-behaviour gap. Without viewing this gap merely as a deviation between intention and behaviour, the empirical investigation suggests using the ‘actual intention’ to understand the intention-behaviour gap. Article II (see also Section 4.3 of this dissertation) discloses the presence of activated, unconditional, conditional and unwillingness as states of WTA. Actors fall into five categories of ‘customer segments’ based on WTA states. The first category, ‘activated WTA adopters’, represents the adoption pattern of social acceptance. The second (‘unconditional WTA would-be adopters’),

third ('conditional WTA would-be adopters'), and fourth ('conditional WTA non-adopters') categories represent acceptance in principle in the pattern of social acceptance. The fifth category, 'non-WTA non-adopters', represents rejection and opposition patterns of social acceptance. Currently, customer acquisition often tends to approach only the unconditional WTA without regard for filling the pipeline by moving people into the next adopter group. By identifying different customer segments and showing how they represent various patterns of social acceptance under multiple pre- and post-adoption conditions, the empirical results emphasised this matter in a Finnish context. The way prepared actors in a given society adopt new technologies can determine the level of change to occur in their everyday life. Article III assesses public readiness to adopt solar energy in a Finnish context (see also Section 4.4 of this dissertation). The empirical results present public readiness to adopt solar energy in terms of existing routes of adoption and customer preferences, those who choose different routes, the links between readiness and patterns of social acceptance, and how respondents envision the future of solar energy in Finland (see Article II and Section 4.3 of this dissertation). Article III emphasises that it is crucial to consider different routes of adoption (including business models, facilities, and support structures) and the preferences of different customer segments to address solar energy acceptance behaviour of multiple actors.

This dissertation joins the empirical results discussed in articles (summarised in Section 4.2, 4.3, and 4.4) that demonstrate that the intention-behaviour gap, WTA, and readiness to adopt form the conceptual framework of social acceptance of solar energy. This framework could be practically assessed to obtain a comprehensive understanding and findings with regard to filling the pipeline by moving actors into the next adopter group without focusing solely on unconditional would-be adopters.

By compiling the empirical results, this dissertation concludes by discussing key factors in terms of personal and contextual situations the respondents mentioned so that adequate attention can be given while addressing the diffusion of solar energy among individual households in Finland. It also explains some lessons in Finnish contexts in terms of community networks, giving adequate and unruffled information, sharing feedback, mobilising community members, etc., which are expected to influence the adoption of solar energy in the country. The study then discusses how social acceptance should be approached, along with directions for future research. Although this dissertation presents the conceptual framework of social acceptance considering intention, willingness, and readiness to adopt solar energy-related data, it is open to addressing other technology acceptance issues for which individual adoption is a vital concern.

ABSTRAKTI

Maailman siirtyessä fossiilipohjaisesta energiasta ympäristöystävällisempään, kestävämpään ja hajautetumpaan energiantuotantoon kieltäytyjien protestit vaimenevat hyväksynnän ja käyttöönoton laajetessa. Tämä on osa sosiaalisen hyväksynnän prosessia. Tämä monitahoinen käsite tulkitaan eri tavoin eri aloilla. Silti sen ydin ja yleinen käsitteellistäminen ovat edelleen epäselviä, eikä Suomessa ole tehty perusteellista tutkimusta aurinkovoiman sosiaalisesta hyväksymisestä ja siitä seuraavasta toiminnasta suomalaisissa kotitalouksissa. Tämä väitöskirja käsittelee sitä, miten uusiutuvien energianlähteiden kuten aurinkovoiman sosiaalinen hyväksyminen voidaan käsitteellistää kattavasti niin, että yhteen kerätään erilaiset hyväksynnästä ja kieltäytymisestä seuraavat reaktiot ja toiminta, jotka ilmenevät osana suomalaisten aikomuksia, halukkuutta ja valmiutta. Tätä väitöskirjaa varten toteutettiin osittain jäsenhely haastattelu 17 suomalaisen energia-alan asiantuntijan kanssa (asiantuntijat olivat erikoistuneet aurinkoenergiaan ja muuhun uusiutuvaan energiaan) sekä 25 suomalaisen maallikon kanssa (nämä asuivat Helsingissä Eko-Viikin alueella, missä on mm. kymmenen aurinkopaneelin varustettua asuinrakennusta). Haastatteluiden pohjalta väitöskirjaan kirjoitettiin kolme artikkelia, jotka käsittelevät aikomuksen ja toiminnan välistä kuilua, käyttöönottohalukkuutta (WTA, *willingness to adopt*) sekä valmiutta ottaa käyttöön aurinkoenergiaa. Ilmiöiden tarkastelussa näkökulmana olivat vastaajien (enimmäkseen maallikoiden) henkilökohtaiset kokemukset sekä heidän käsityksensä muista. Näiden empiiristen tulosten pohjalta väitöskirjassa esitellään lopuksi käsitteellinen viitekehys. Se hahmottaa avainteemat (aikomus sekä aikomuksen ja toiminnan välinen kuilu, halukkuus sekä käyttöönottovalmius) toimintaa edeltäviksi mielentiloiksi, jotka saavat kuluttajat toimimaan eri tavoin. Se selittää, kuinka toimintareaktiot havainnollistavat sosiaalisen hyväksynnän kaavaa, ja selventää käyttöönoton, periaatteellisen hyväksynnän, hylkäämisen sekä vastustamisen käsitteellistä ja empiiristä tilaa.

Empiiriset tulokseni on selitetty artikkelissa I ja tiivistetty tämän väitöskirjan luvussa 4.1, ja ne keskittyvät ymmärtämään ja selittämään aurinkoenergian käyttöönottoon liittyvää aikomuksen ja toiminnan välistä kuilua henkilökohtaisten ja kontekstuaalisten tekijöiden ilmentymänä, aikomuksen ja toiminnan välisen kuilun oikeutusta sekä sosiaalisen hyväksynnän tukahdutettua rakennetta aikomuksen ja toiminnan välisen kuilun kolmen ilmentymän kautta: (a) ”periaatteellinen käsitys” ja aikomus, (b) ”käytännön käsitys” ja aikomus sekä (c) ”todellinen aikomus”. Aikomuksen ”kokonaisuus” voidaan ymmärtää aikomuksen ja toiminnan välisen kuilun kolmannen muodon kautta. Sen sijaan, että kuilu nähtäisiin pelkästään poikkeamana aikomuksen ja toiminnan välillä, empiirinen tutkimus viittaa siihen, että ”todellista aikomusta” tulisi käyttää aikomuksen ja toiminnan

välisen kuilun ymmärtämiseen. Artikkelii II (ks. myös tämän väitöskirjan luku 4.2) paljastaa aktivaation, ehdottomuuden, ehdollisuuden ja haluttomuuden ilmentymät käyttöönottohalukkuuden muodoiksi. Kuluttajat jaotellaan viiteen ”asiakassegmenttiryhmään” käyttöönottohalukkuuden mukaan. Ensimmäinen kategoria, ”aktivoituneet käyttöönottajat”, edustaa sosiaalisen hyväksynnän käyttöönottoaavaa. Toinen (ehdottomat käyttöönottohalukkaat), kolmas (ehdolliset käyttöönottohalukkaat) ja neljäs (ehdolliset käyttöönottohaluttomat) kategoria edustavat periaatteellista hyväksyntää sosiaalisen hyväksynnän kaavassa. Viides kategoria, ”käyttöönottohaluttomat”, edustaa kieltäytymistä ja vastustamista sosiaalisen hyväksynnän kaavassa. Tällä hetkellä asiakashankinnassa keskitytään usein ehdottomiin käyttöönottohalukkaisiin ja sivuutetaan kuluttajien siirtäminen seuraavaan käyttöönottooryhmään. Tunnistamalla erilaisia asiakassegmenttejä ja osoittamalla, miten ne edustavat sosiaalisen hyväksynnän erilaisia kaavoja monine käyttöönottoa edeltävine ja seuraavine ehtoineen, empiiriset tulokset toivat esiin tätä asiaa suomalaisessa kontekstissa. Tapa, jolla valmiit kuluttajat ottavat uutta teknologiaa käyttöön tietyssä yhteiskunnassa, määrittää muutoksen määrää heidän arkielämässään. Artikkelii III arvioi yleistä aurinkoenergian käyttöönottovalmiutta suomalaisessa kontekstissa (ks. myös tämän väitöskirjan luku 4.3). Empiiriset tulokset kuvaavat yleistä valmiutta ottaa käyttöön aurinkoenergiaa olemassa olevien käyttöönotto tapojen ja asiakkaiden toiveiden näkökulmasta, niitä, jotka valitsevat erilaisen käyttöönotto tavan, yhteyttä valmiuden ja sosiaalisen hyväksynnän kaavojen välillä sekä vastaajien käsityksiä aurinkovoiman tulevaisuudesta Suomessa (ks. artikkelii II sekä tämän väitöskirjan luku 4.3). Artikkelii III tuo esiin, että on äärimmäisen tärkeää ottaa huomioon erilaisia käyttöönotto tapoja (ml. liiketoimintamallit, mahdollisuudet ja tukirakenteet) sekä eri asiakassegmenttien toiveet, jotta eri kuluttajien hyväksyvää toimintaa aurinkoenergiaa kohtaan voidaan tarkastella.

Tämä väitöskirja tarjoaa lisää empiirisiä tuloksia artikkeleissa (sisältö tiivistettynä luvuissa 4.1–4.3) käytyyn keskusteluun, josta käy ilmi, että aikomuksen ja toiminnan välinen kuilu sekä käyttöönottohalukkuus ja -valmius muodostavat aurinkoenergian sosiaalisen hyväksyttävyyden käsitteellisen viitekehysten. Tämä viitekehys voidaan arvioida käytännössä, jotta saadaan kattava käsitys ja tuloksia siitä, miten kuluttajia siirretään yhdestä käyttöönotto ryhmästä seuraavaan niin, että prosessissa ei keskitytä ainoastaan ehdottomiin käyttöönottohalukkaisiin.

Keräämällä yhteen empiiriset tulokset tämä väitöskirja käsittelee lopuksi avaintekijöitä, eli vastaajien mainitsemia henkilökohtaisia ja kontekstuaalisia tilanteita. Näin voidaan keskittyä oikeisiin asioihin käsiteltäessä aurinkoenergian leviämistä suomalaisiin kotitalouksiin. Väitöskirja selittää myös suomalaista kontekstia muun muassa viestintäverkkojen, riittävän ja kiihottoman tiedon jakamisen, palautteen antamisen ja yhteisön jäsenten aktivoinnin näkökulmasta, sillä niiden oletetaan vaikuttavan aurinkoenergian käyttöönottoon maassa. Tämän jälkeen tutkimus käsittelee sitä, miten

sosiaalista hyväksyntää tulisi lähestyä, ja tarjoaa neuvoja tulevaa tutkimusta varten. Vaikka tämä väitöskirja käsittelee sosiaalisen hyväksynnän käsitteellistä viitekehystä keskittyen aikomukseen, halukkuuteen ja valmiuteen ottaa käyttöön aurinkoenergiaa, se on avoin myös keskustelulle muiden teknologioiden hyväksynnästä, kun yksilötason käyttöönotto on elintärkeässä roolissa.

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CONTENTS

| | |
|---|-----------|
| Abstract | 3 |
| Abstrakti | 5 |
| Acknowledgements | 8 |
| Contents | 12 |
| List of original publications | 14 |
| Abbreviations | 15 |
| 1 Introduction | 16 |
| 1.1 Background and scope | 16 |
| 1.2 Key concepts, research aim, questions, and objectives | 19 |
| 1.3 Dissertation structure | 22 |
| 2 Literature review of social acceptance | 23 |
| 2.1 Social acceptance as an umbrella term..... | 25 |
| 2.2 Dimensions of social acceptance | 27 |
| 2.3 Subject (actor) of social acceptance..... | 30 |
| 2.4 Object and context of social acceptance | 32 |
| 2.5 Factors that affect acceptance behaviour | 33 |
| 2.6 Acceptance passes through intention-behaviour gap | 35 |
| 2.7 Adoption or non-adoption behaviour..... | 38 |
| 2.7.1 Actors' acceptance as attitude, behaviour, or reactions | 38 |
| 2.7.2 Thoretical approaches..... | 40 |
| 2.7.3 Prevalence of some pre-behavioural mental states | 45 |
| 2.7.3.1 Intention to adopt | 45 |
| 2.7.3.2 Willingness to adopt..... | 47 |
| 2.7.3.3 Readiness to adopt | 49 |

| | | |
|----------|---|-----------|
| 2.8 | Summary of the literature and key considerations | 50 |
| 3 | Research methodology | 55 |
| 3.1 | Eko-Viikki: The site for interviewing the laypersons | 57 |
| 3.2 | Sampling method and data collection | 57 |
| 3.2.1 | Layperson interview as research data | 58 |
| 3.2.2 | Expert interview as research data..... | 60 |
| 3.3 | Interview design..... | 62 |
| 3.4 | Data analysis | 65 |
| 3.5 | Research ethics | 67 |
| 4 | Summaries of the original articles..... | 69 |
| 4.1 | Intention-behaviour gap and its impact on the social acceptance of solar energy | 69 |
| 4.2 | States of willingness to adopt, customer segments, and social acceptance | 73 |
| 4.3 | Readiness to adopt solar energy: preferred routes of adoption, routes choosers, and adoption prospects | 77 |
| 5 | Discussion: How is social acceptance conceptualised?.. | 80 |
| 6 | Conclusions..... | 89 |
| | References..... | 94 |

LIST OF ORIGINAL PUBLICATIONS

This dissertation is based on the following publications:

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- II Hai, M. A. (2019). Rethinking the social acceptance of solar energy: Exploring "states of willingness" in Finland. *Energy Research & Social Science*, 51, 96-106. doi: 10.1016/j.erss.2018.12.013
- III Hai, M. A., Mekhilef, S., & Hossain, K. (2018). Public Readiness to Adopt Solar Energy – Responses of Some Finnish Citizens. *Journal of Clean Energy Technologies*, 6(4), 268-277. doi: 10.18178/jocet.2018.6.4.473

The publications are referred to in the text by their roman numerals.

Authors' contributions in co-authored publications

Md. Abdul Hai is the principal author in all three articles. In Article I, Md. Munjur E Moula and Ullamaija Seppälä provided their valuable comments and edited the article few times. In Article III, co-authors Saad Mekhilef and Khondokar Mokaddem Hossain provided their valuable comments and suggestions to finalise the paper.

ABBREVIATIONS

| | |
|-------|--|
| ENUF | Engage, never use NIMBY, understand, and facilitate |
| ET | Finnish Energy (energiateollisuus) |
| EU | European Union |
| IPCC | Intergovernmental Panel on Climate Change |
| NGO | Non-government organization |
| NIMBY | Not-in-my-backyard |
| PIMBY | Please in my backyard |
| PV | Photovoltaic |
| RE | Renewable energy |
| REI | Renewable energy innovations |
| RES | Renewable energy sources |
| RET | Renewable energy technology |
| RQ | Research questions |
| SDH | Solar District Heating |
| TPB | Theory of planned behaviour |
| TRA | Theory of reasoned action |
| VBN | Value-belief-norm |
| VESPA | Visual/landscape, environmental, socioeconomic, and procedural aspects |
| WTA | Willingness to adopt |
| YIMBY | Yes in my backyard |

1 INTRODUCTION

1.1 BACKGROUND AND SCOPE

In this research, I aim to investigate social acceptance as the behavioural reactions generated through different actors' varied intention, willingness, and readiness issues that link with their social life. It is within the social life of actors where new energy technologies such as solar energy are developed and applied. The study of social acceptance not only concerns investigating whether people express a favourable or positive response to a technology or product; it must also consider non-acceptance of this technology or product (Lucke, 1995). Without examining it, one's understanding of social acceptance remains incomplete (see Batel, Devine-Wright, & Tangeland, 2013). The transition of the world's energy system from one that is fossil fuel based to a more environmentally friendly, sustainable, and decentralised one (e.g., via renewable energies) requires everyday energy users to be involved. It also requires extensive behavioural changes that involve the adoption and use of sustainable, clean, and green energy sources. Furthermore, use of energy-efficient technologies, investments in buildings to include and apply energy efficiency methods, and changes in energy use behaviour are needed (Steg, Perlaviciute, & van der Werff, 2015). Thus, one major way to delve deeply into the acceptance of renewable energy sources (RESs) is to comprehend them through the issues that direct actors' decisions and actions to adopt these technologies.

In the struggle against ongoing and upcoming climate change and the shift towards a low-carbon society to ensure the requisite phasing out of fossil fuels and a simultaneous expansion of RESs, EU countries have promised to reach a 40% reduction in greenhouse gas emissions by 2030 as compared to the levels in 1990. Hence, the EU has set minimum targets for a 27% share of renewable energy consumption and a 27% improvement in energy efficiency at the EU level as compared to business as usual (European Commission, n.d.). In 2010, buildings accounted for 6.4% of global greenhouse gas emissions and 32% of global energy consumption (IPCC, 2014). Although buildings present the greatest potential for reducing greenhouse gas emissions and decreasing energy consumption (IPCC, 2014), these goals will remain unattainable unless all actors involved enact extensive initiatives.

Everyday household energy users have considerable potential to help achieve the stated EU 2030 energy goals via producing or consuming distributed renewable energy. Solar energy is the most promising of these because it is the cleanest RES with the fewest negative impacts on the environment. It has received maximum public support and acceptance globally with the highest market share: a 32.6% growth rate in 2015 (BP Global, 2016; Bhalla & Tyagi, 2017). Whilst progress towards renewable

energy investments has been observed, solar energy in Finland has increased at a slow pace “in absolute numbers” (Heiskanen, Jalas, Juntunen, & Nissilä, 2017, p. 194).

In Finland, long-lasting winters with limited or no visible sun, darkness, and a cloudy sky alongside a short-lived summer with abundant sunlight may encourage people to believe that solar energy is only feasible in the summer. However, solar panels work well in cold, clean, and dustless conditions; a temperature that is too high reduces their effectiveness. Even on dark and rainy days, new panels can perform well. Furthermore, reflected sunlight from the snow can also increase the potential of solar panels. Considering the global boom in the solar energy market and progress in neighbouring countries with similar solar irradiation, such as Germany (Hirvonen, Kayo, Cao, Hasan, & Sirén, 2015; Haukkala, 2015), Finland has started to demonstrate interest in solar energy technology, and government-affiliated intermediaries now undertake various field-configuring events (e.g., conferences and seminars) to promote it (Nissilä, 2015). There is also commercial investment support for solar photovoltaic (PV) and solar thermal installations, which consists of 20% for PV projects and 20% for solar heating projects until 30 April 2019 (Ministry of Economic Affairs and Employment of Finland, 2019). For household installation, the state also provides 50% labour cost support (GEBWELL, 2017). As of 2017, Finnish legislation has allowed electricity produced from solar energy to be channelled into the national power grid. Finnish people have also witnessed large installations of solar power plants in various places, such as the Lappeenranta University of Technology in Oulu, the Suvilahhti power plant in Helsinki, and so on. Simultaneously, cutting-edge solar breakthroughs and innovations are underway in the country at different companies and places. These developments suggest that demand for solar energy will accelerate.

Solar energy continues to have a positive public image among EU citizens as a symbol of the anti-nuclear movement and ‘alternative energy’, or as a way to reduce dependency on imported fuels (Heiskanen et al., 2008). According to different studies and Gallup polls, Finnish people have very positive attitudes towards solar energy (Jung, Moula, Fang, Hamdy, & Lahdelma, 2016). Multiple studies have confirmed that people show increasing interest in solar energy (Ratinen & Lund, 2015; Child, Haukkala, & Breyer, 2017). Moreover, a recent study conducted among 1,000 Finns has found that 88% of respondents think that solar energy production in Finland should be increased (Table 1).

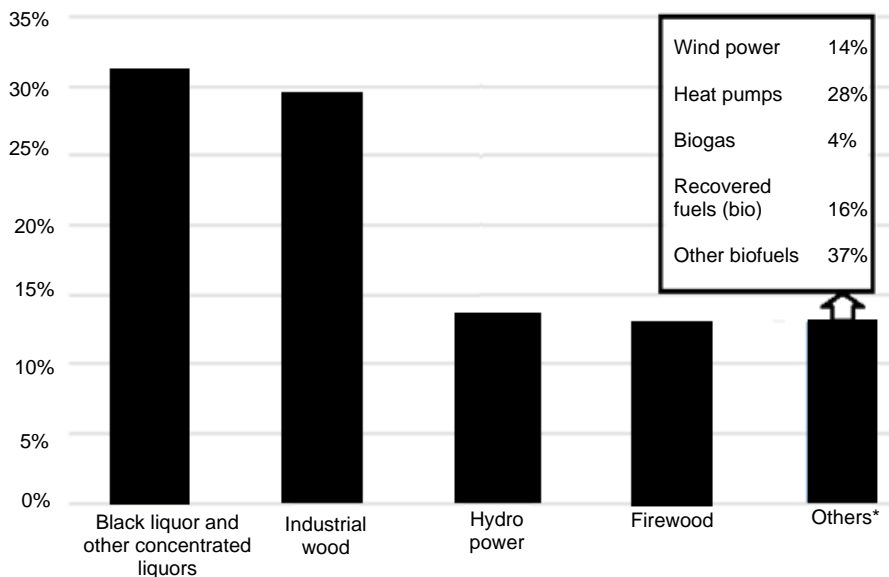
Table 1 *Public opinion on increasing Finnish solar power production (n = 1000).*

| Label | Percentage |
|-------------------------|-------------------|
| Increased significantly | 56.4 |
| Somewhat increased | 31.6 |
| No need for change | 7.1 |

| | |
|-------------------------|-------|
| Somewhat decreased | 0.7 |
| Decreased significantly | 0.5 |
| Can't say | 3.7 |
| Total | 100.0 |

Source: Finnish Energy (ET; 2018). Attitudes 2016 [codebook], pp. 14-15.

Although most people believe that solar power production must be increased and that most Finns carry positive attitudes about this, the adoption of solar energy technologies in Finland is still low. Whether people are ready and how quickly their actions will reflect their positive attitudes and intentions are still matters of contention. For instance, a recent study discovered that between 2009 and 2013, solar technologies received the lowest investment in the country as compared to other RESs (Heiskanen et al., 2017). According to Statistics Finland (2016), solar energy did not contribute to national energy consumption in 2015, although other renewable energies did (see Figure 1). In this scenario of insignificant solar energy adoption, the maximum investments and installations are made at household levels in Finland. This insignificant level of installation is a common practice among enthusiastic Finnish people, mostly in places such as holiday homes, boats, and so on.



* The divisions of the group 'Others' are partly based on data for 2014.

Figure 1 Share of renewable energy in total energy consumption in 2015 (Data source: Statistics Finland, 2016, p. 9).

The social acceptance of solar energy has received attention in many studies at various levels of analysis, such as end-user adoption (Bollinger &

Gillingham, 2012), end-user and market acceptance (Schelly, 2014), acceptance of utility-scale solar energy (Carlisle, Kane, Solan, Bowman, & Joe, 2015), and social acceptance of PV and thermal solar energy (Upham et al., 2015). Social acceptance (in terms of actors' preferences and behaviours) influences the use and diffusion issues of renewable energies such as solar technology in different socio-political, community, and market contexts. Social acceptance has been identified as the key factor in energy transition and a key area that has been increasingly emphasised in various discussions over the last decade (Devine-Wright et al., 2017; Sütterlin & Siegrist, 2017). The current consensus among scholars is that "high public acceptance eases the implementation of technologies in society, but when acceptance is low, it hinders – or even halts – their implementation" (van Rijnsoever, van Mossel, & Broecks, 2015, p. 818).

In this study, it is my view that actors' intentions, willingness, and finally, readiness-oriented pre-behavioural mental stages shape and reshape their acceptance behaviour. Depending on whether they have a favourable or unfavourable feeling, people may intend to adopt or not adopt a technology or product based on the strength of their willingness and readiness.

1.2 KEY CONCEPTS, RESEARCH AIM, QUESTIONS, AND OBJECTIVES

This research addresses some key concepts to comprehend the "social acceptance of solar energy as intention, willingness, and readiness." Although the literature review chapter describes these concepts, a basic understanding of these key terms is necessary to establish the research aim, questions, and detailed objectives. In this research, I posit that *social acceptance* is not merely a form of an attitude or an adoption-based behaviour; rather, it is a mix of acceptance and non-acceptance (Lucke, 1995). It reveals various behavioural responses or reactions through intention-, willingness-, and readiness-related issues. *Attitude* is a state of the human mind, either a positive or negative one, expressed towards an individual, group, object, or event. What people say they would do or plan to do is called *intention*. The actions or reactions of people towards a stimulus or situation is called *behaviour*. The mismatch between the two (i.e., intention and behaviour) is called the *intention-behaviour gap*. An actor may have a plan or intention to act, but it cannot be executed positively without willingness. *Willingness* is the extent to which a person has the motivation, confidence, and commitment to do something. It is not enough to have a plan and the willingness to perform an act. An individual's readiness can determine the promptness of action. The term *readiness* denotes a state of being prepared, and it implies the qualities of swiftness, speed, and immediacy to perform an activity. The actors, consumers, and other people involved in the adoption or non-adoption process are called the *acceptance subjects*. The *object* component of

acceptance encompasses what the acceptance subjects decide to accept (e.g., subsidies, technology, or infrastructure) to a certain extent. The acceptance subjects regularly interact with other actors, evaluate, and decide whether to accept the object. The *acceptance context* refers to the environment in which the subjects relate to objects. In other words, the subject-oriented and object-oriented (e.g., legal or institutional) framing conditions are considered the context of acceptance. *Personal factors* or conditions indicate the psychological factors that originate through the nexus between an actor's characteristics and their interaction with society. *Contextual factors* denote the objective features of the product, technology, or energy alternative determined by the contexts (Perlaviciute & Steg, 2014). The subject-oriented and object-oriented context and factors at pre-adoption (e.g., cost and incentives) and post-adoption (e.g., word of mouth of an adopter) influence the evaluation and decision process for multiple subjects.

The main research question (RQ) of this dissertation is as follows: how can the social acceptance of renewable energies such as solar energy be conceptualised comprehensively as a behaviour that includes various acceptance and non-acceptance responses or reactions that pass through the intention, willingness, and readiness of actors? In support of this main RQ, I shed light on the following RQs and bulleted objectives:

RQ- 1: Why does the intention-behaviour gap to adopt solar energy systems exist?

- Comprehend various patterns of the intention-behaviour gap as the outcome of personal and/or contextual factors.
- Determine the rationality that provokes the intention-behaviour gap.
- Learn how social acceptance is suppressed as a result of the intention-behaviour gap.

Solar energy is the favourite RES among Finns. Many may plan or strive to adopt the technology but do not do so. This discrepancy between intention and behaviour demonstrates a suppressed structure of the social acceptance of solar energy. Article I provides an answer to the question of the intention-behaviour gap and satisfies the queries of the bulleted objectives mentioned under RQ 1 above.

RQ- 2: What are the patterns of willingness to adopt (WTA) solar energy among the public?

- Identify different states of public WTA solar energy.
- Determine different customer segments based on their WTA.
- Reflect on different customer segments through patterns of social acceptance.

The public often expresses a WTA renewable energies as a general response varying in different contexts (Zhao, He, Johnson & Mou, 2015). It is crucial to

comprehend various states of an individual's WTA to create market opportunities and increase social acceptance at the individual level. Consequently, this directs whom to approach followed by how to approach towards diffusing the solar energy market. In different studies, WTA has been presented as a mental state related to pre-adoption factors (i.e., why people have not yet adopted solar energy). In solar energy studies, WTA has been explained in a limited way as an outcome of both pre- and post-adoption factors (e.g., Bollinger & Gillingham, 2012; Heiskanen, Nissilä, & Lovio, 2015). Furthermore, there is limited research within the Finnish context about identifying various states (i.e., stages) of WTA, their roles in forming and categorising multiple customer segments, and the related patterns of social acceptance in regular residential places. Since willingness is connected to various personal and contextual contexts, determining the patterns of social acceptance through WTA-based customer segments seems helpful in understanding what motivates people to adopt and what factors hinder the expansion of solar energy in the country. This understanding will benefit academics, business organisations, and policymakers because it corroborates the role of social acceptance as "the most policy-relevant social science" (Upham et al., 2015, p.101) to some extent. Article II provides an answer to the question of the patterns of WTA and satisfies the queries of the bulleted objectives mentioned under RQ 2 above.

RQ- 3: What is the public readiness to invest in and adopt solar energy?

- Identify different routes of adoption and consumer preferences with a specific focus on their ownership and engagement.
- Categorise different route choosers.
- Express the prospects of solar energy as the respondents envision them.

The growing concern for the decarbonisation of energy systems motivates the drive for energy efficiency and a transformation of the present system into an RES-based system (Bertsch, Hall, Weinhardt, & Fichtner, 2016). However, success in the sustainable transition of energy technologies from non-renewables to RESs depends not only on how many new technological solutions are developed but also significantly on how end users approach or have approached these solutions in terms of the end users' acceptance and readiness to adopt and use these energy sources. Finland has already started to make progress in solar energy as demonstrated by its award-winning progress in areas of innovation (e.g., the solar thermal solutions of Savo-Solar Oy), demonstration projects (e.g., 10 solar-integrated buildings in the Eko-Viikki residential area in Helsinki), and business models, such as the Helsinki energy company Helen's shared solar project in Kivikko and Suvilahti, and the joint purchase model used by the Finnish Environment Institute (SYKE) in its Carbon Neutral Municipalities (HINKU) project (see Ludwig, 2006; SITRA, 2011; HINKU-foorumi, 2017). As stated in Section 1.1, there is also support from the state for labour costs related to the installation of solar panels at the

household level. Additionally, the price of solar energy equipment has decreased, and it is now possible to sell surplus power to the grid (Laihanen, Karhunen, & Ranta, 2016). Within this promising environment, public readiness to adopt and use solar energy can determine the change to come in Finland's energy behaviour and its diffusion of the solar energy market. Article III provides an answer to the question regarding public readiness to adopt solar energy and satisfies the queries of the bulleted objectives mentioned under RQ 3 above.

1.3 DISSERTATION STRUCTURE

This dissertation consists of six chapters, including the table of contents, references, and three articles. In this chapter (Chapter 1), I have described the background and scope, RQs and objectives, and the dissertation structure. Furthermore, I have stated the importance of and justification for this research and the topic-related concepts. I have also discussed why the RQs and related bulleted objectives are important.

In Chapter 2, I discuss the results of the literature review regarding social acceptance, major debates, theoretical backgrounds, and empirical evidence. I discuss how social acceptance has been interpreted as an umbrella term and as a multidimensional concept. I then present the dimensions, subjects, objects, and contexts of acceptance and the factors that affect it. I present the discussion on acceptance as an adoption or non-adoption behaviour by shedding light on acceptance as an attitude, the behaviour or reaction debate, alternative theoretical approaches to addressing social acceptance, and the prevalence of certain pre-behavioural mental states (e.g., intention to adopt, WTA, and readiness to adopt). I also explain that acceptance passes through the intention-behaviour gap. Finally, as a summary of the literature and key considerations, I state the theories and key concepts used in this dissertation.

In Chapter 3, I present the research methodology with a preliminary discussion on its research philosophy, the chosen paradigm, and the research design; I also indicate the sources of research data based on the three RQs of this study. I then discuss Eko-Viikki as the site of interviewing laypersons, the sampling method and data collection, and the interview design. At the end of this chapter, I discuss the choice of data analysis methods and research ethics.

In Chapter 4, I summarise the key research results obtained from the three articles and their contribution as a summary.

In Chapter 5, I provide a discussion on how social acceptance is conceptualised based on the research results and the literature reviewed. I present the operational definition of social acceptance and the conceptual framework as an outcome of the research results.

In giving a brief overview of the whole work in the conclusions (Chapter 6), I state some recommendations and directions for future research.

2 LITERATURE REVIEW REGARDING SOCIAL ACCEPTANCE

Because of the inexorable decarbonisation of energy systems and to ensure a sustainable, inexhaustible, and affordable energy supply, in recent decades, increasing research interest has emerged concerning the social acceptance of renewable energy technologies (RETs; Tabi & Wüstenhagen, 2017). Concurrently, various scholarly papers have included reviews and theoretical frameworks (e.g., Wüstenhagen, Wolsink, & Bürer, 2007; Sovacool & Ratan, 2012; Upham et al., 2015) to synthesise and summarise the existing theories and methodologies related to social acceptance of RETs. For RETs to be successfully implemented, scientific and practical understandings of their social acceptance are required. Although the existing and widely cited notion of social acceptance concentrates mainly on comprehending different responses to renewable energy (RE) policies, it rarely discusses these reactions in practical scenarios; actual manifestations of adoption, acceptance, opposition, rejection, and preferences remain mostly uninformed. Current reviews reveal that the most persuasive interdisciplinary dialogue focuses on individual-level responses, that is, the actors and their reactions (Dermont, Ingold, Kammermann, & Stadelmann-Steffen, 2017).

In this chapter, I delve deeply into the key concepts, theoretical domains, and debates revolving around social acceptance and related existing empirical evidence. I relate these notions to my RQs (Section 1.2) by combining and condensing a broad range of the most cited and relevant studies into a comprehensive, single structure that underlines established results, pinpoints the gaps in that range of literature, and finally, seeks to establish an order for this research. First, while explicating social acceptance as an umbrella term, I observe that multiple definitions, diversified meanings, and various concepts related to social acceptance require detailed and critical discussion. Since Wüstenhagen et al. (2007) have been considered as the key proponents of social acceptance, I then discuss their three dimensions of social acceptance (socio-political, community, and market acceptance), which suggest nine criteria (Section 2.2). Further discussion is required regarding the subject, object, and context of acceptance because subjects accept or reject an object (i.e., an infrastructure or a technology) in a given context. While discussing the subject (actor) of acceptance, I find that acceptance behaviour and actors' mental conditions depend on the objects and contexts of acceptance. In discussing the conceptualisation of objects and contexts of acceptance, I determine that they embody various factors, which influence actors' acceptance behaviour.

Since subjects, objects, and contexts are related to different factors and because these factors influence the decision-making of multiple actors, I narrate various factors of acceptance in Section 2.5 and argue that without

knowing the factors, it would be difficult to understand social acceptance. At the abstract level, subjects may have a positive feeling about an object of acceptance. However, at the time of implementation or adoption, they consider these factors that dictate their decision. Such factors may create discordance between what people say they would do or plan to do (intention) and what they do (behaviour). Therefore, in Section 2.6, I argue that acceptance passes through the intention-behaviour gap, which is not unusual, and I also describe how and why this happens.

Now at the backdrop of the stated points (i.e., key concepts; three dimensions; subjects, objects, and contexts of social acceptance; and the factors that influence decision-making and may create an intention-behaviour gap), how actors would behave and what would be their behavioural responses should be understood. Although Section 2.1 slightly addresses these aspects, I present the behavioural responses or reaction discussions under the heading of adoption and non-adoption behaviour in Section 2.7. I interpret actors' acceptance as an attitude, behaviour, or reaction in Section 2.7.1. Behavioural responses and positions and actors' actions are considered the patterns of social acceptance that require a suitable theoretical approach to be addressed. Thus, in Section 2.7.2, I present different theoretical approaches that draw attention to certain pre-behavioural mental states (e.g., intention, willingness, and readiness), which are prevalent in behavioural expressions. While discussing intention to adopt, it is necessary to address how attitudes, perceptions, and overall intentions are translated into different patterns of intentions, how these intentions are translated into and compared to various behavioural responses, and how these sequences of behaviour are influenced by multiple (a) personal and (b) contextual factors. In Article I of this dissertation, I address this need. My discussion of WTA demonstrates the need to understand to what extent and under which conditions individuals are willing to express their acceptance behaviour. I address these aspects in Article II of this dissertation. Finally, concerning readiness to adopt, I find that this is rarely discussed in acceptance studies. Therefore, I argue that it needs to be addressed to understand to what extent and under which conditions individuals are ready to express their acceptance behaviour. In Article III of this dissertation, I discuss this matter.

In terms of intention, willingness, and readiness to adopt, I provide the theoretical structures in my articles. As the structure of this chapter reveals, many concepts are discussed in several places because of their relevance and the need to situate the discussion in the given logical frame. In the end, I summarise the chapter and state the key considerations that combine my research and three articles.

2.1 SOCIAL ACCEPTANCE AS AN UMBRELLA TERM

The field of social acceptance of energy technologies has a large, rapidly growing literature base. Although substantial research has explored the social acceptance of various energy technologies in different complicated contexts and the same inputs have been determined when identifying factors that influence social acceptance, there is arguably much conceptual ambiguity surrounding social acceptance (Batel et al., 2013) due to its multidimensional nature (Wüstenhagen et al., 2007). Several disciplines have used it as a buzzword (van Rijnsoever, van Mossel, & Broecks, 2015; Hai, Moula, & Lahdelma, 2015). Many studies have attempted to conceptualise the broad concept of social acceptance by discussing the acceptance of a single RES, such as wind, solar, hydro (e.g., Tabi & Wüstenhagen, 2017), biomass, or geothermal (e.g., Wüstenhagen et al., 2007; Devine-Wright, 2007) energy. However, scholars have argued that focusing on one specific technology offers too narrow an understanding of social acceptance and creates bias via myopic decision-making (van Rijnsoever et al., 2015). Thus, multidisciplinary and multidimensional views of social acceptance are discussed in this dissertation.

Social acceptance is an umbrella term. Acceptance has often been used interchangeably and synonymously with *acceptability* (e.g., Leucht, Kölbl, Laborgne, & Khomenko, 2010; Adell, Várhelyi, & Nilsson, 2014; Strazzera & Statzu, 2017; Lee, Loveridge, & Joshi, 2017). Lee et al. (2017) and Strazzera and Statzu (2017) have used acceptance and acceptability for similar meanings without defining either term. Synonymous use of these terms has also been observed in their definitions (Leucht et al., 2010; Adell et al., 2014). For instance, according to Leucht et al. (2010), “acceptability is the potential willingness of acceptance subjects regarding an acceptance object” (p. 3). Likewise, acceptance is defined as “the willingness to be subjected to something (e.g., pay taxes)” (Adell et al., 2014, p. 14). On the contrary, differences between acceptance and acceptability have also been located (Huijts, Molin, & Steg, 2012; Heldt et al., 2016; Dermont et al., 2017; Fournis & Fortin, 2017). For instance, Huijts et al. (2012) consider acceptability as equivalent to attitude (attitude towards the RES in question and attitude towards probable behaviour in response to this RES) and acceptance to be synonymous with behaviour towards the RES or facility at hand (p. 526). Acceptance has also been viewed as either an attitude or behaviour (Kraeusel & Möst, 2012; van Rijnsoever et al., 2015) that supports or resists the implementation of an RES. Lucke (1995) views acceptance as being composed of both acceptance and non-acceptance behavioural responses. Acceptance is also defined as the intention to adopt a technology (Chismar & Wiley-Patton, 2003). This definition of acceptance aims for a behavioural change. Moreover, acceptance has been used to mean a subjective measure of the readiness of people to accept RE investments in their area (Bertsch et al., 2016; Ntanos, Kyriakopoulos, Chalikias, Arabatzis, & Skordoulis, 2018). While readiness of

this kind is related to large-scale investments, the subjective readiness of people at the household level to accept RETs needs to be addressed.

The synonymous use of *preference* for acceptance refers to the choices that actors make regarding the adoption or non-adoption (rejection or opposition) of energy technology; these choices are likely to vary between actors. The use of the term *support* to refer only to people's approval of any facility is too narrowly focused to mean acceptance (Batel et al., 2013) because other behavioural responses (e.g., adoption, apathy, rejection, or opposition) are ignored.

Top-down (upper level) and bottom-up (grassroots level) perspectives have also been used to define and differentiate between acceptability and acceptance. Various studies have criticised the interpretation of social acceptance as a top-down perspective that disregards a bottom-up point of view (Batel et al., 2013; Upham et al., 2015; Dermont et al., 2017). The top-down perspective views that as individuals and communities do not actively exhibit resistance, opposition, or contestation, they accept those energy technologies and infrastructures (Batel et al., 2013). Experts' opinions are considered in assessing and deciding on the construction of a specific facility (e.g., RE power plant; Bertsch et al., 2016). Acceptability is gained when the construction is rationally determined to be a reasonable burden. This is only one example, and acceptability is used in other situations as well. The bottom-up perspective considers that locals use their attitudes, intentions, willingness, and readiness when they decide to behave in any preferred manner (e.g., favourably or unfavourably). Locals may express their acceptability through their justification (rational or irrational) at an abstract level towards the construction of a power plant in their locality. At the implementation level, they may express their real support or opposition. If disregarding this bottom-up perspective in local contexts and a top-down view is applied in the acceptance of RETs, the sustainability of these RETs could be undermined. For instance, Wolsink suggests that selecting a location before consultation with locals in a top-down planning process could trigger actors' hostile reactions (Wolsink, 2007, p. 1205). Batel et al. (2013) are similarly critical and state that the application of the bottom-up perspective rather than top-down and imposed consent allows policymakers to access real support for RET projects (Dermont et al., 2017). At the household level, locals consider and justify various factors regarding whether to install RETs on their property (backyard or roof; Jung et al., 2016). According to Kraeusel and Möst (2012), "Social acceptance of new infrastructure occurs when the welfare decreasing aspects of the project are balanced by welfare increasing aspects of the project to leave each agent at worst welfare neutral and indifferent to the completion of the project, or better off and supportive of the project" (p. 5).

The interaction between subjects, objects, and multiple factors under various contexts also shape the concepts of acceptability and acceptance. For instance, Heldt et al. (2016) view acceptability as an objective property to be accepted and acceptance as an outcome that is influenced by multiple factors.

According to Langer, Decker, Roosen, and Menrad (2018), “[social] acceptance is the result of an interactive process that takes place in certain contexts, and which is interpreted by everyone involved” (p. 135).

Broad-based definitions of social acceptability and social acceptance have also been provided. For instance, Fournis and Fortin (2017) define social acceptability as “the process of collective assessment of a given project (understood as the specific embodiment of complex interactions between technology and society within a given socio-technical project), integrating a plurality of actors (stakeholders) and spatial scales (from global to local), as well as involving the specific trajectory (past present and future) of a political group or polity (community/society)” (p. 5). They further enrich the concept by distinguishing between micro-social, meso-political, and macroeconomic levels. This definition is restricted within the boundaries of a “collective assessment of a given project” (attitude), whereas broad-based definitions of social acceptance encompass “a favourable or positive response (including intention, behaviour and – where appropriate – use) relating to a proposed or in situ technology or socio-technical system, by members of a given social unit (country or region, community or town and household, organisation)” (Upham et al., 2015, p. 103).

Acceptability is assessed when the subject remains inexperienced regarding the facility and is therefore, an attitude construct. On the contrary, acceptance consists of attitudes and behavioural reactions after the introduction of a facility (Adell et al., 2014, p. 15). There are also some attitudinal and behavioural reactions that define and form social acceptance, which are described in the later part of this chapter (Section 2.7.1). Furthermore, intention, willingness, and readiness issues contribute to the formation of social acceptance in the milieu of subjects, objects, and contexts of acceptance (Section 2.7.3). In my research, I have used “acceptance” instead of “acceptability” to address the social acceptance of solar energy, which is not a new technology in Finland. In this research, I posit that social acceptance is not merely a form of attitude or an adoption behaviour; rather, it is a mix of acceptance and non-acceptance (Lucke, 1995) in which various behavioural responses or reactions are expressed through intention-, willingness-, and readiness-related issues.

These definitions and conceptual concerns specify that the acceptance must pass through the actors (subjects), specific object(s), and the contexts of acceptance at various levels depending on the breadth of the acceptance endeavour related to the acceptance object. These definitions and the diverse meanings of social acceptance are explained in detail in the following sections.

2.2 DIMENSIONS OF SOCIAL ACCEPTANCE

Since Wüstenhagen et al. (2007) have been considered the key proponents of social acceptance and because their three-dimensional perspective provides a

broad-based contextualisation of the key (research) questions of social acceptance (Dermont et al., 2017), this section concentrates on these dimensions to gain greater understanding of social acceptance. Wüstenhagen et al. (2007) identify three dimensions of social acceptance: socio-political acceptance, community acceptance, and market acceptance. In a revised version of this approach, Sovacool and Ratan (2012) differentiate between the political part and the community aspects. A mixture of these issues is named the triangle model of social acceptance (see Figure 2). Socio-political acceptance denotes the most general and broadest level in acceptance of REs by key stakeholders, policymakers, and the public. Community acceptance refers to the siting discourse of RE plants, which includes the acceptance of place attachment, landscape identity, and siting decisions for RE projects, as well as the fairness of processes in terms of procedural and distributive justice and trust from residents and local authorities. Market acceptance refers to the wide distribution of RETs within the market and the degree to which their participants (e.g., consumers, investors, and intra-firms) accept them. Since innovation is a more rapid process than civic understanding, both customer awareness and adoption or acceptance are vital for the market acceptance of innovation.

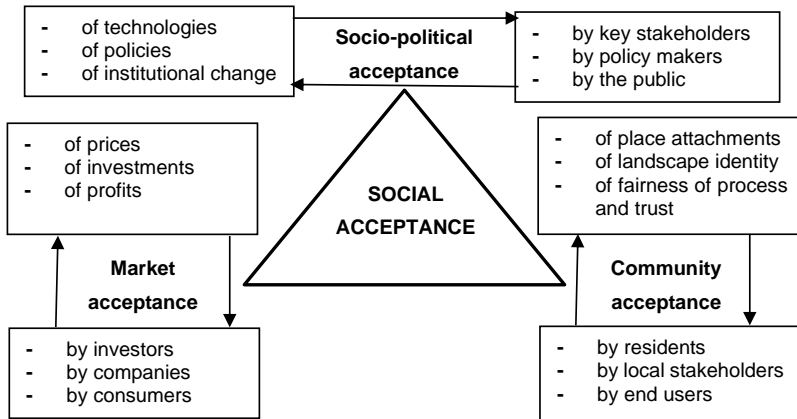


Figure 2 Triangle model of social acceptance.

Although these three dimensions of social acceptance are introduced “to contribute to the clarity of understanding” (Wüstenhagen et al., 2007, p. 2684), they do not specify the processes, the roles of actors, or actors’ reactions towards policies related to RETs (Dermont et al., 2017). In Section 2.3, I discuss the role of subjects or actors. Wüstenhagen et al.’s (2007) model has been commonly used. Still, it is “more of a problem structuring model than a ‘real theory’ of acceptance because it is not capable of explaining or predicting how acceptance is constituted or why individuals or groups accept or do not accept ideas, practices, or innovations” (Busse & Siebert, 2018, p. 240). Several studies on RETs and other issues have also referred to this triangle model in

explaining their theoretical framework and study design (e.g., Heras-Saizarbitoria, Zamanillo, & Laskurain, 2013; van Rijnsoever et al., 2015; Zhao et al., 2015). While the three-dimensional perspective has been widely cited, social acceptance studies that combine “market, socio-political, and community aspects are scarce” (Devine-Wright et al., 2017, p. 27). Ambiguities have also been observed in different studies that do not clearly mention which aspect of public acceptance they investigate and why this part is relevant to the research topic at hand (van Rijnsoever et al., 2015).

Upham et al. (2015) devised a review-based theoretical framework to contribute to the understanding of social acceptance, in which the pivotal influence of Wüstenhagen et al. (2007) is observed. As the first principle, they consider socio-political acceptance to be part of social acceptance and explain it as “acceptance at the level of an energy supply technology at the policy or national level” (Upham et al., 2015, p. 104). Concerning their second principle, Upham et al. (2015) explain community acceptance as the acceptance of a proposed technology infrastructure at the local level, where reactions of local citizens, stakeholders, and decision-makers are the matters of prime interest. They do not address the justice and trust issues that Wüstenhagen et al. (2007) emphasise. Their last principle is market acceptance, which refers to the reaction of real and prospective end users and stakeholders at the household and organisational levels towards the application of a specific energy technology. Upham et al. (2015) do not mention Sovacool and Ratan (2012).

By separating the political part from the community aspects, Sovacool and Ratan (2012) concur with the triangle model of social acceptance and incorporate it into their formulation of a theoretical framework of social acceptance, which consists of three conditions or factors in each dimension. They identify nine criteria of social acceptance (Figure 3; Section 2.5), which they successfully apply in their research conducted in Germany, the United States of America, Denmark, and India.

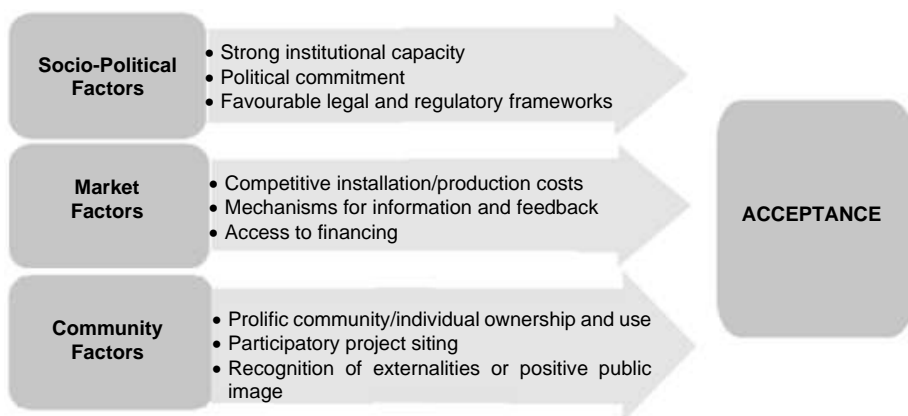


Figure 3 *Socio-political-, community-, and market acceptance-related dimensions and conditions (Sovacool & Ratan, 2012, p. 5271).*

Since the interconnectedness of these dimensions represents the social acceptance of RETs, I embrace them in this research by including these nine criteria in the formulation of the interview guide and empirical work. In the interviews, I asked what the interviewees thought about the state of these nine criteria in Finland. Three dimensions and the related nine criteria of social acceptance require further discussion of the subject, object, and context of acceptance because the subject accepts (or rejects) an object in a given context. The subject(s), object(s), and context(s) all systematise acceptance (Lucke, 1995; Upham et al., 2015; Sonnberger & Ruddat, 2017), which is detailed in Sections 2.3 and 2.4.

2.3 SUBJECT (ACTOR) OF SOCIAL ACCEPTANCE

At any level of the stated three dimensions, acceptance is bound to different subjects (actors) who play diverse roles by expressing their attitudes and behavioural responses (Lucke, 1995; Upham et al., 2015; Sonnberger & Ruddat, 2017). Actor-specific definitions of social acceptance are often incomplete, which has been repeatedly argued in earlier studies (e.g., Dermont et al., 2017). Actors have been interpreted in the literature in varying ways (e.g., Rogers, 2003; Montero, Alexander, Marshall, & Subramanian, 2010; Rico & Brewster, 2010; van Rijnsoever et al., 2015). In general, acceptance has long been interpreted without a deep focus on heterogeneous actors. Thus, it is crucial to comprehend various categories of actors.

Rogers (2003) identifies five categories of actors who accept and adopt innovation within different time frames. The first category, *innovators*, consists of technology-loving enthusiasts who joyfully adopt innovation without regard for its uncertainties. Personal factors, such as motivation to adopt innovation, seem to be their main reason for doing so. *Early adopters*, the second category, consist of visionaries for whom having the edge over the status quo seems to be the main reason for adopting innovation. Again, this is a personal factor, but it develops within the boundaries of a society. The third category, the *early majority*, consists of risk-averse people and pragmatists who confirm the innovation's proven profile for delivering value before adopting or buying it from a leading company. Hence, personal factors (e.g., motivation to buy or adopt the innovation) and contextual factors (e.g., evaluations of the innovation, risk factors, and its proven track record in value orientation) are important matters for these people. *Late majority*, the fourth category, consists of risk-averse conservatives who remain uncertain about the innovation's value-generating potential but are forced to adopt it. The coercive role of (perhaps indirect) social pressure and contextual factors becomes evident in their decision and activities. The fifth and last category, the *laggards*, consists of doubters who avoid change and are suspicious of the innovation; ultimately, it is not inevitable that all people accept it. Although these categories are narrated within various timeframes of the growth,

development, and maturity of an innovation or technology, the categories of adopters or non-adopters that exist at any moment have yet to be explored.

Wüstenhagen et al. (2007) argue that there must be three levels of social acceptance (socio-political, community, and market) among a range of actors: policymakers, regulators, key stakeholders, and the public at the socio-political acceptance level; producers, distributors, intra-firms, financial actors, and consumers at the market acceptance level; and end users, residents, and local authorities at the community acceptance level represent the categories of social acceptance of RETs. Apart from the study of Wüstenhagen et al. (2007), there is a common tendency to present different actors in two categories: (a) spectators (who do not adopt but observe and provide their opinions about innovation and users' adoption of it) and (b) users (who are adopters and users of the innovation; e.g., Montero et al., 2010). Montero et al. (2010) argue that the combination of these groups' viewpoints forms "an overall measure of social acceptance" (p. 276). Likewise, Rico and Brewster (2010) interpret social acceptance as the interplay between users' acceptance (users' feelings in performing an action) and spectators' acceptance (how users' actions are perceived by others) in the milieu of public and private sectors. Different studies have addressed users' acceptance as being based on "actual adoption and use" and spectators' acceptance as "in-principle" acceptance (e.g., Heiskanen et al., 2014, p. 4).

Although Montero et al. (2010) and Rico and Brewster (2010) have used the stated explanation of social acceptance, similar use of spectators as citizens and users as consumers appears in the work of van Rijnsoever et al. (2015) in their interpretation of the triangle model of social acceptance. According to the authors, citizens usually have indirect involvement in the development and diffusion of an innovative technology. At the socio-political acceptance level, the authors also include policymakers and stakeholders who "seek the help of political parties or engage in direct dialogue with developers" (van Rijnsoever et al., 2015, p. 818). Treating individuals and organisations as consumers at the level of market acceptance, the authors argue that it is the consumers' role to adopt the technology. At the community acceptance level, they describe the consumer's function as a voluntary or involuntary user of a technology. The authors define users as "those who use the technology or experience its consequences" (van Rijnsoever et al., 2015, p. 818). One major contribution of van Rijnsoever et al.'s (2015) categorisation is to draw attention to the roles that actors can play in various dimensions of social acceptance.

Upham et al. (2015) identify three levels of actors: (a) public acceptance, which involves consumers and citizens; (b) stakeholder acceptance, which involves organisations (i.e., major investors or commercial investors) that have an interest in the outcome but without any formal political aims; and (c) political acceptance, which involves policymakers, politicians, and agencies. This categorisation is similar to the types of actors Wüstenhagen et al. (2007) discuss.

In terms of their personal acceptance decision, the actors operating at the level of socio-political and community acceptance can adopt or reject innovation in their local market contexts. The heterogeneity of actors positions them as adopters and non-adopters in different situations, which is variously reflected in their attitudes, behaviours, and reactions (e.g., Batel et al., 2013; Dermont et al., 2017; Devine-Wright et al., 2017). Consequently, additional categories of actors can be identified based on the attitudes, behaviours, and reactions of heterogeneous actors in the presence of innovation or a new technology, as described in Section 2.7.1. Acceptance behaviour and the mental conditions of multiple categories of actors depend on the objects and contexts of acceptance, which are discussed in Section 2.4.

2.4 OBJECT AND CONTEXT OF SOCIAL ACCEPTANCE

The question “acceptance of what?” indicates the object of acceptance. The object component of acceptance is what the acceptance subjects decide to accept to a certain extent. The object component of acceptance is anything related to innovation that involves some structural change in the social system. It may include innovation, infrastructure, policies, and projects (Hanger et al., 2016). The object of acceptance has broad implications, such as acceptance of essential conditions for innovation processes, of implementation conditions, or of the consequences of such implementation. The acceptance subjects regularly interact with other actors, evaluate, and decide whether to accept the object.

Context of acceptance “refers to the environment in which an acceptance subject relates to an acceptance object – and, thus, can only be viewed in relation to both” (Fraedrich & Lenz, 2016, p. 624). In other words, the subject-oriented and object-oriented framing conditions (e.g., legal and institutional) are referred to as the context of acceptance. Institutions, organisations, the environment, situations, or settings—as contexts of acceptance in different political, market, and community spheres (Wüstenhagen et al., 2007; Sovacool & Ratan, 2012)—may shape, reshape, or inhibit (as an institutional lock-in) a subject’s acceptance of an object (Nissen, Müllerleile, Kazakova, & Lezina, 2016). The context may produce suitable or unsuitable situations involving the objects of acceptance, which depend on subjects’ willingness to exert acceptance behaviour: “For all actors involved in the decision-making process the question of acceptability is at stake” (Wüstenhagen et al., 2007, p. 2686). The context may or may not produce a suitable environment for the processes related to the creation, implementation, execution, and control of an object through the involvement of different stakeholders. For instance, regulatory inflexibility, the absence of incentives, and the high price of materials (e.g., solar panels) may create resistance in the process of acceptance (e.g., Ratinen & Lund, 2015; Child, Haukkala, & Breyer, 2017).

While the subject-, object-, and context-related social acceptance theories are further explained in Section 2.7.2, the presence of various objects and contexts translates into multiple factors that influence the acceptance process and require a detailed, critical discussion, which is provided in the next section.

2.5 FACTORS THAT AFFECT ACCEPTANCE BEHAVIOUR

Since subjects, objects, and contexts are related to different factors and because those factors influence the decision-making of multiple actors, I narrate multiple factors of acceptance in this section and argue that without knowing the factors, it would be difficult to understand social acceptance.

In simple terms, behaviour means a response or an action related to any physical (e.g., installation of solar panels) or non-physical (e.g., perceived risks in making a new investment) object. In other words, people's actions or reactions towards a stimulus or situation represent and are called behaviour. The acceptance of RETs can be influenced by both pre- and post-adoption factors. The adoption of new technologies involves investment behaviour, which is not a regular activity. Therefore, in general, people attempt to evaluate the consequences of such an investment decision. For instance, many Finnish households consider that if they install solar panels, they must spend abundant money, the payback period is long, and so on. Thus, they will not invest and adopt solar energy (see Hirvonen et al., 2015). However, nature-loving and new technology-loving adopters in Finland are termed *solar believers* (Pihlajamaa, Patana, Polvinen, & Kanto, 2013). They prioritise their emotions over consequences, which is irrational. The presence of a variety of rational and non-rational factors in the literature mostly reflects pre-adoption matters.

In everyday life, people are habituated to repeatedly and automatically use technologies as a routine activity, doing so as a learned behaviour often used to create order in daily life. If ultimately, new technology is to be habituated in use, it must be appropriate to everyday life. For instance, room and space heating, a habituated activity in Finland, was disrupted in Kerava solar village due to a system failure in solar thermal energy production, and the people of this community had to switch to other means of energy as a solution (Heiskanen et al., 2015). This discontinuation of solar energy use or a change from solar to another energy source due to a system failure is a post-adoption factor. Similarly, positive or negative word of mouth from an adopter and discontinuation of adoption due to mobility (Dobos & Artle, 2015) are considered as post-adoption factors. Thus, acceptance behaviour is also influenced by post-adoption behaviour.

Whether it is a pre- or post-adoption phase, many studies have directly or indirectly addressed numerous factors that promote actors' evaluations and

acceptance of RETs (e.g., Moula et al., 2013; Haukkala, 2015; Ratinen & Lund, 2015; Child et al., 2017; Dermont et al., 2017). These factors have been categorised in various ways. For instance, Langer et al. (2018) present four categories of factors: personal characteristics, perceived side effects, process-related factors, and geographical and technical factors. They identify these categories by analysing Hofinger's (2001) explanation of three categories: (a) thinking, the cognitive component, (b) feeling, the affective or emotional component, and (c) acting, the conative component.

Specific factor(s) have also received attention in some studies. For instance, Fast (2013) has emphasised geographical concepts that include place, space, and landscape issues. Devine-Wright (2007) has identified three categories of factors: (a) socio-demographic factors, including an actor's age, gender, and income issues, which influence their technology acceptance decisions and related activities; (b) socio-psychological factors, including political and environmental beliefs, place-based attachments, and knowledge of and experience with the technology at hand; and (c) contextual factors, such as the type and scale of the technology, institutional structure, and implementation site, which affect the acceptance of the technology. Huijts et al. (2012) have provided a framework emphasising various psychological aspects that influence the acceptance process. Based on an integrative literature review, Perlaviciute and Steg (2014) have observed that psychological and contextual factors shape the evaluations and acceptability of energy alternatives.

In a broader sense, these factors have been categorised into two areas: (a) personal and (b) contextual (Botha & Atkins, 2005). Personal factors or conditions indicate the psychological factors that originate through the nexus between an actor's characteristics and their interaction with society. Personal factors include the psychological aspects mentioned in terms of socio-demographic and socio-psychological factors. Cultural factors can also affect actors' willingness to try new things (Solomon et al., 2006), which Devine-Wright (2007) explains in terms of socio-psychological factors. Socio-psychological studies have found that if people have or are encouraged to have a favourable attitude towards disruptive technologies, they may visually or materially accept the technologies (Wolsink, 1987). Individuals' product-oriented positive attitudes and the perceived benefits determine social acceptance. Non-financial factors, such as the values and attitudes of individuals (e.g., Bollinger & Gillingham, 2012), peer effects that are either active or passive (Bollinger & Gillingham, 2012; Heiskanen et al., 2015), social networks, customers' environmental preferences, demonstration projects (Heiskanen et al., 2015), individuals' knowledge and awareness (Devine-Wright, 2007), and their innovativeness (Rogers, 2003) can influence decisions to adopt or reject RETs.

Various contextual factors also shape actors' attitudes towards RETs. Contextual factors denote the objective features of a product, which are determined by the contexts (Perlaviciute & Steg, 2014). "Contextual factors", as Carlisle et al. (2015) claim, "have proven to be particularly relevant to

explaining support and opposition to renewable energy” (p. 837). Major key issues (e.g., an information gap, customer inertia and concern about PV reliability, long payback duration, a high up-front cost, and difficulties related to installation and maintenance) may cause resistance towards accepting and adopting solar energy systems (Moula et al., 2013; Haukkala, 2015; Ratinen & Lund, 2015). Fortunately, solar PV does not require much post-installation maintenance (Pihlajamaa et al., 2013). The absence or insufficiency of key determining factors (e.g., affordability, visible attractiveness, demonstrations, proper maintenance, added value to the property, and ease of installation) can cause resistance, resulting in non-adoption, rejection, opposition, and less or no social acceptance (Heiskanen et al., 2015).

Factors can vary in terms of the nature of the technology and its implementation at any level. For instance, Sovacool and Ratan (2012) identify nine factors at socio-political, community, and market levels of acceptance. They posit that the socio-political factors of strong institutional capacity, political commitment, and favourable legal and regulatory systems; the market factors of competitive installation and production costs, mechanisms for information and feedback, and access to financing; and the community factors of prolific community and individual ownership and use, participatory project siting, and recognition of externalities or positive public image are crucial for the acceptance of a proposed energy technology. They also term these nine factors as nine criteria or conditions of social acceptance. Since these social, political, technical, and economic factors are influenced by each other in an integrated “pernicious tangle” (Sovacool, 2009, p. 4511), an alignment of socio-political frameworks with the market drivers and the interests of community stakeholders can ensure the rapid expansion of RE (Sovacool & Ratan, 2012). According to their analysis, the socio-political and market acceptance dimensions are mostly directed by the contextual factors mentioned above. The influence of personal factors is visible in the community acceptance dimension. In this dissertation, the factors that shape actors’ decisions and direct their actions on whether to adopt are considered in two broad categories: (a) personal factors related to their psychology and (b) contextual factors, as described above. Multiple factors may cause discordance between people’s intentions and behaviours, which is detailed in the following section.

2.6 ACCEPTANCE PASSES THROUGH INTENTION-BEHAVIOUR GAP

At the abstract level, subjects may have a positive feeling about an object of acceptance. However, at the time of implementation or adoption, they consider the factors that have dictated their decision. A body of studies has argued that what people say they would do or plan to do (intention) may not be corroborated by their actions (behaviour): there may be a discordance

between the two (van Rijnsoever et al., 2015; Bertsch et al., 2016; Sütterlin & Siegrist, 2017). Those factors may create such discordance. In this section, I argue that acceptance passes through the intention-behaviour gap, which is not unusual, and I also describe how and why this happens.

Actors may exhibit general support for an RE project, but it should not be assumed that they will support it at the time of implementation: “these two concepts [what people say they would do and what they do] are not to be intermingled” (Dermont et al., 2017, p. 361). With decreasing abstraction, actors evaluate the downsides as a comparison between personal and contextual factors, and their support and acceptance tend to diminish (Bertsch et al., 2016; Sütterlin & Siegrist, 2017). Investment behaviour requires forming intentions (plans). The failure to translate intentions into actions is called the intention-behaviour gap.

While analysing the intention-behaviour relationship, Ajzen (1985, pp. 18-29) argues that over the course of time, the salient exposure of negative features regarding a behaviour (more than its positive features); the occurrence or increase of unanticipated, unforeseeable events; weaker confidence; and less commitment may cause a gap between intention and behaviour. He further claims that with time, the availability of high self-monitoring (being sensitive to external cues and influenced by unanticipated events) and a state-orientation nature (focusing attention to thoughts and feelings related to the past, present, or future rather than taking actions consistent with intentions) can also disrupt the intention-behaviour relation. Ajzen (1985) notes, “failure to act in accordance with the intention would indicate that the person had a change of mind” (p. 24). He claims that strong confidence and commitment; stable intention; available time, ability, skills, and resources; low self-monitoring; and an action-oriented nature are bound to establish a notable intention-behaviour correlation.

While addressing behavioural discrepancies, Batel and Devine-Wright (2015a) argue, in line with Bell, Gray, and Haggett (2005), that attitudes towards energy sources in general are assessed at a macro level (e.g., national level) and later compared with the micro level (e.g., local level). Then, corresponding behaviours are detected towards infrastructures to be established near residential areas where NIMBYism (local people's opposition) occurs. In the context of wind power, Bell, Gray, and Haggett (2005) and Bell, Gray, Haggett, and Swaffield (2013) have called the difference between high public acceptability expressed in opinion surveys and low success rate (i.e., low acceptability) achieved in planning applications as the social gap. Bell et al. (2013), in line with Wolsink (2007), contest the assumption that NIMBYism is the only explanation for the social gap. Some scholars have commonly used the term NIMBY (not in my backyard) to understand the intention-behaviour (Wolsink & Devilee, 2009), national-local, or attitude-behaviour gaps (Batel & Devine-Wright, 2015). Bell et al. (2005, 2013) have provided two further explanations for the social gap: (a) the democratic deficit, which suggests that the opposition among minor decision-

makers in contrast to the positivity among the majority of the public towards a project (e.g., wind energy) reduces the chances of success, and (b) the qualified support, by which people support a target if the particulars of a policy commensurate with their preferences. By discussing NIMBYism within the framework of a social gap, the authors have argued that this social gap seems to depend on an individual gap (between positive individual attitudes and active opposition) because of the self-interest of locals regarding a particular project. Often, it is not the technology that people generally oppose but the processes related to fairness, selfishness, or ignorance (Batel et al., 2013; Perlaviciute & Steg, 2014; Dermont et al., 2017).

As the locals do not want to sacrifice anything, NIMBYism is commonly viewed as the selfish parochialism of misguided, irrational, and obstructionist locals who reject the implementation of RET projects (Bell et al., 2005; Wolsink, 2007; Petrova, 2013, 2016). This criticism of NIMBY is a controversial interpretation of rejection and opposition (Batel et al., 2013; Perlaviciute & Steg, 2014; Dermont et al., 2017). Aitken (2010) further adds that opponents are often labelled misinformed or deviant, which is unexpected, and she argues that people who embrace NIMBYism are unable to offer a suitable explanation for their attitudes concerning wind power. Since NIMBYism provokes a negative attribution of human attitudes and conceals the actual reasons for rejection, its explanatory power has largely been denied in the scientific community (Wüstenhagen et al. 2007; Aitken, 2010; Upham et al., 2015; Petrova, 2016). Some scholars such as Petrova (2016) have discarded NIMBYism and instead have provided a new framework to understand locals' reasons for rejection and opposition. For instance, as propounded by Petrova (2016), the VESPA (visual/landscape, environmental, socioeconomic, and procedural aspects) concept considers these elements while addressing rejection and opposition matters. The top-down perspective considers NIMBY as an attitude of selfish parochialism. Thus, the bottom-up perspective pertaining to locals' needs and fears remains unheard, unconsidered, and neglected. In an earlier study, Petrova (2013) introduces the engage, never use NIMBY, understand, and facilitate (ENUF) framework with the aim for policymakers, facility planners, and wind developers to consider this framework to successfully site wind turbines. This framework suggests that these actors will not achieve community acceptance unless they (a) engage local communities in the decision-making discussions from the beginning, (b) never use NIMBY, as it is an incomplete and pejorative descriptor of motivations, (c) understand all processes related to siting (e.g., community perceptions, siting locations, and concerns about the technology) in an in-depth manner, and (d) facilitate long-term discussions with locals so that they may become empowered to design and implement their preferred energy source.

Reverse-NIMBY concepts such as please in my backyard (PIMBY; Brinkman & Hirsh, 2017) or yes in my backyard (YIMBY; Ribbing & Xydis, 2021) have also been addressed to explain the attitudes of people towards an

infrastructure. A recent Finnish study discovered limited presence of NIMBY attitudes among Helsinki residents surveyed who opposed installing RETs on their property (backyard or roof; Jung et al., 2016). Moula et al. (2013) observed that a high percentage of Finnish interviewees (43%) strive to “adopt and use” RETs by taking practical steps, which is the expression of the YIMBY, PIMBY, or reverse-NIMBY concepts.

Instead of addressing NIMBY and YIMBY or PIMBY in this dissertation, I consider the intention-behaviour gap in adopting solar energy at the household level, which is different from wind project siting and community acceptance matters. Non-acceptance is not entirely a NIMBY attitude among locals, and acceptance is not entirely YIMBY or PIMBY. This dissertation is not confined to those concepts because they involve a complex range of factors (see Sections 2.5, 2.7.1). In the given context of the intention-behaviour gap, it would be illogical to consider actors arbitrary and to believe that their idiosyncrasies mainly cause the gap. Some actors may adopt green products (e.g., installing solar panels) to decrease costs for electricity. Still, those who do not do so cannot be considered reluctant to save money or eager to waste money (Chatzidakis & Lee, 2012). Actors have their justifications (considerations of different factors), which researchers should investigate. In this dissertation, I consider broader aspects and thoughts that may reflect both people's material and immaterial relations (see Aitken, 2010; Batel & Devine-Wright, 2015).

2.7 ADOPTION OR NON-ADOPTION BEHAVIOUR

2.7.1 ACTORS' ACCEPTANCE AS ATTITUDE, BEHAVIOUR, OR REACTIONS

In their classic work, Wüstenhagen et al. (2007) identify actors' expressions of acceptance “in various forms: attitude, behaviour and – most importantly – investments” (p. 2688); however, many other recent studies have discovered that such expressions, including actors' reactions, also create conceptual ambiguities (Batel et al., 2013; Upham et al. 2015; Dermont et al., 2017; Devine-Wright et al., 2017). Thus, Dermont et al. (2017) argue that the existing heterogeneity in conceptualising actors' acceptance concerns (a) the conceptualisation of acceptance as attitude or behaviour, and (b) actors' reactions to innovation.

Acceptance is often conceptualised as attitude. It is either expressed as positive/favourable or negative/unfavourable acceptance (Batel et al., 2013; Devine-Wright et al., 2017), but many acceptance studies have linked only the positive aspect of attitude to the conceptualisation of social acceptance (Kraeusel & Möst, 2012; Upham et al., 2015). Acceptance that represents an attitude lacking in affirmative response is often described as passive acceptance or tolerance (Batel et al., 2013). Studies have also indicated that

negative attitudes do not consistently generate opposition (van Rijnsoever et al., 2015). Some definitions consider acceptance as a person's attitude and social acceptance as the attitude of a group of people (e.g., Kraeusel & Möst, 2012).

Recent studies have concentrated not only on attitude but also, more importantly, on public responses that may include apathy, resistance, or opposition, as well as active support or passive acceptance (Kraeusel & Möst, 2012; Batel et al., 2013; Upham et al., 2015; Fraedrich & Lenz, 2016; Sonnberger & Ruddat, 2017). Behavioural responses can also be observed as moving in two opposite directions—that of active opponents and that of those who are enthusiastically or actively engaged. In between these directions lies ambivalent (i.e., unconfirmed and unsettled) behavioural responses, such as undecided, indifferent, tolerant, or conditional acceptance (Scheer, Konrad, & Wassermann, 2017); approval and rejection (Langer et al., 2018); and approval, endorsement, and approbation (Kraeusel & Möst, 2012). In their conceptualisation of social acceptance, Wüstenhagen et al. (2007) attempt to cover all dynamic positions and actions (e.g., initiatives, early adoption, approval, endorsement, support, apathy, uncertainty, tolerance, ambivalence, resistance, and opposition) that they term “non-technical factors”, which are “perceived as residual questions” that are relevant for the degree of REs' innovation (p. 2683). Thus, multiple responses or reactions also exhibit adoption and non-adoption behaviours.

Heiskanen et al. (2014) differentiate between actual adoption and acceptance in principle to explain actors' behaviour in adopting innovation. *Actual adoption* denotes actors' active adoption behaviour. According to Heiskanen et al. (2014), “acceptance in principle includes but is not limited to mean that actors are willing to, capable of, or used to investing in or using a particular solution” (p. 4). In explaining consumer resistance, three forms of negative acceptance levels have been determined: postponement, rejection, and opposition (Kleijnen et al., 2009). Postponement is the state of an actor when they believe innovation is acceptable in principle but cannot be adopted unless, for instance, the situation becomes more suitable. Kleijnen et al. (2009) accept Rogers' (2003) interpretation of rejection as actors' firm disinclination to adopt innovation. Furthermore, if the actor no longer wishes to continue using the innovation after adoption, they will eventually fall into the rejection category (Rogers, 2003). Rogers (2003) terms the former (i.e., the firm disinclination) as *passive rejection* and the latter (discontinuation of innovation after adopting it earlier) as *active rejection*. When innovation-sabotage activities (e.g., negative word of mouth) are randomly exhibited in an actor's behaviour, it is called opposition. Kahma and Matschoss (2017) explain non-use as an attitudinal aspect that is expressed in six forms: lagging adoption (temporary non-use will vanish over time), active resistance (actor's steadfast disinclination to adopt), disenchantment (reluctance or partial use of the technology), disenfranchisement (shortage of physical or mental availability), displacement (having someone else adopt), and disinterest (lack

of knowledge or interest in the new technology). Actors decide to choose their acceptance positions and perform actions.

In response to an acceptance object, actors' positions and actions are effective ways to express behavioural responses as well as their reasons and affinities for the object, rather than merely expressing a positive or negative attitude. In this dissertation, subjects' behavioural responses or positions and actions are considered as different patterns (the regular or repeated ways in which something happens or is done) of social acceptance.

2.7.2 THORETICAL APPROACHES

A variety of innovation and psychological theories have addressed the issue of social acceptance in the context of the implementation and adoption of energy technology. The theory of reasoned action (TRA; Fishbein & Ajzen, 1975), theory of planned behaviour (TPB; Ajzen, 1985; Ajzen, 1991; Ajzen & Cote, 2008), technology acceptance model (TAM; Davis, 1989), value-belief-norm theory (VBN; Stern, 2000), and theory of diffusion of innovation (Rogers, 2003) are limited to explaining the acceptance behaviour of an innovated technology or any specific product. These are the most popular research frameworks "for individual-level innovation and adoption studies" (Ellabban & Abu-Rub, 2016, p. 1291). There are also sociological and geographical theories that address social acceptance. In this section, while explaining the theories and key concepts used in my research, I also express the reasons for not using some relevant theories. These unused theories are, in fact, different theories with different premises and consequences for understanding acceptance.

In the TRA, behaviour is defined by attitude (a feeling towards an action) and subjective norms (the perceived social pressures of peers, family members, and so on that affect a person's behaviour). Attitude is affected by behavioural belief (the tendency to link the performance of a certain behaviour to certain features or outcomes) and evaluation (perceiving and evaluating the possible results of a performed behaviour). At the same time, subjective norms are formed by normative belief (relevant groups' approval or disapproval of the action) and motivation to comply (obeying or disobeying the social norms of the referent groups that encompass the act). The TRA also stipulates that performing a behaviour is mainly determined by the intention to perform it. According to Ajzen, "in the original theory of reasoned action, . . . intentions are assumed to capture the motivational factors that influence a behaviour; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour" (Ajzen, 1991, p. 181). To predict a certain behaviour, the behavioural intention should be as specific as the behaviour itself. Stability of behavioural intention is required between the time it arises and the time the behaviour occurs. Although the TRA has been explicated in social psychology as a universal account of various human behaviours, it has some limitations (Ellabban &

Abu-Rub, 2016) since norms can be turned into attitudes and vice versa, and the dichotomy of attitude versus norm poses a significant risk. Furthermore, although a person is free to act if they intend to do so, time, money, ability, environment, and other factors could create resistance to actually performing the perceived behaviour.

These shortcomings of the TRA are minimised in the TPB by integrating a supplementary element of perceived behavioural control as one of the determinants of behavioural intention (Ajzen, 1991; Ajzen & Cote, 2008). The TPB postulates that an actor's intention to behave in a particular manner is affected by their attitude (a positive or negative mental state that predisposes them to certain actions), subjective norms (the social pressure they perceive with regard to engaging in the act), and perceived behavioural control (the perception of the ease or difficulty of performing the behaviour of interest; Ajzen, 1991). Perceived behavioural control is determined by an individual's entire set of beliefs about the presence of factors that may affect the performance of a particular behaviour. In other words, an individual's volitional control—a position in which “a person can decide at will to perform or not perform the behaviour”—may be influenced by different factors that constitute the perceived behavioural control component (Ajzen, 1991, pp 181-182). When supplemented by that component, the TPB can explain the relationship between behavioural intention and performed behaviour (Ajzen, 1991). This theory is suitable to study the behavioural changes of less motivated persons (St Quinton, 2016).

Given that with repeated performance, behaviour turns into a routine activity, it no longer requires conscious control of behavioural intention. Repeated performance becomes habituation, behaviour becomes automatic, and the conscious control of intentions is transferred to situational cues, which make the TPB inapplicable. Thus, St Quinton (2016) argues that to study the behaviour of less motivated or unmotivated people who are in a position to kickstart the change process, the TPB can and should be used because the control of behavioural intentions can suitably address the matter. The TPB as a revised form of the TRA has been used to formulate the research framework in many energy studies (e.g., Liu, Wang & Mol, 2013; Perri & Corvello, 2015; Rai & Beck, 2015). By adopting the TPB, Liu et al. (2013) established an analytical framework to examine possible determinants of rural public acceptance of RE deployment in the Shandong province in China. Perri and Corvello (2015) applied the TPB to predict consumers' behaviours towards smart-grid solutions and technology adoption by identifying different determinants of behavioural intention. The application of the TPB is also evident in Rai and Beck's (2015) investigation of attitudes, norms, and perceived behavioural control as related to residential solar PV adoption in Texas. To explain the intention-behaviour relation, Ajzen (1985, pp. 18-29) describes some factors (see Section 2.6), which are relevant to Article I. In my study (see Article I), I clarify the intention-behaviour gap by identifying the reasons or factors that persist between the two. I discuss different factors and

the perceived behavioural control concept in the literature review of Article I to situate the rationality issues (the logic people provide for their actions) and to address the gap factors that dictate the intention-behaviour gap analysis.

Davis' (1989) TAM is a derivative of the TRA, and it is specifically tailored to model how users come to accept and use information systems and technologies. The goal of the TAM is to explain computer usage behaviour. The theory posits two cognitive beliefs: perceived usefulness (the degree to which one considers that using a given system or technology will enhance one's job performance) and perceived ease of use (the degree to which one believes that using a given system or technology would be free of effort). Various external variables (factors) influence these cognitive beliefs, which form the attitude toward using. Consequently, behavioural intention to use is formed, and actual system use becomes evident. The study of the TAM has produced the upgraded and expanded versions: the TAM 2 (Venkatesh & Davis, 2000) and the unified theory of acceptance and use of technology (UTAUT; Venkatesh, Morris, Davis, & Davis, 2003). Although the TAM is based on information systems, it has also been applied to energy studies. For instance, Tsaur and Lin (2018) adopt the TAM to predict and explain the public acceptance of solar energy buildings by interviewing (at the personal level) and surveying (internet-based) college students in northern Taiwan. Despite its frequent application, the TAM has been widely criticised, leading to its further development. Thus, a state of confusion has resulted, in which it is unclear which version of the TAM is the commonly accepted one (Benbasat & Barki, 2007). The frameworks of perceived ease of use and usefulness ignore other issues (e.g., cost and structural imperatives) that force people into adopting a technology (Brett, 2009). According to various studies, perceived ease of use is less likely to be an element of attitude and usage intention (e.g., Hu, Chau, Sheng, & Tam, 1999; T. Pikkarainen, K. Pikkarainen, Karjaluoto, & Pahlila, 2004; Wu & Wang 2005). A study conducted in Malaysia found no influence of perceived ease of use on the adoption of online technology (see Okafor, Nico, & Azman, 2016). Some people (e.g., some enthusiastic trendsetters, early adopters, and other categories of people who adopt unconditionally) may not consider perceived ease of use and perceived usefulness in adopting a technology. Considering these points, I have not included this model in this dissertation.

Whilst the TRA, TPB, and TAM have been used in different studies, Rogers' (2003) diffusion of innovation theory has drawn substantial attention regarding the factors that impact the innovation-decision process (Noll, Dawes, & Rai, 2014). This theory involves five stages of innovation adoption: (a) knowledge, in which an actor receives information about the given technology and its operation; (b) persuasion, in which an actor develops a favourable (positive) or unfavourable (negative) attitude towards the given technology; (c) decision, which refers to an actor's involvement in activities that precede the decision to either adopt or reject the given technology; (d) implementation, in which an actor starts using the given technology; and lastly, (e) confirmation, in which an actor seeks reinforcement for an adoption

decision already made. Nonetheless, adverse information might reverse their previous decision (Rogers, 2003). Although this linear theory is simple and influential (Upham et al., 2015), it has some limitations. It does not offer a detailed picture of the acceptance categories in any specific time and space. Furthermore, it describes five segments of adopters (innovators, early adopters, early majority, late majority, and laggards) over different periods and locations. For instance, when the early adopters are described, others are categorised at the same time as non-adopters. Rogers (2003) expresses how these non-adopters gradually adopt on different time scales. Thus, at a specific time, non-adopters' levels of acceptance are not classified, and the theory only identifies rejection. Furthermore, the disappearance of non-use over time is also challenged, and non-use is identified as more than lagging adoption (Kahma & Matschoss, 2017). In the case of technology diffusion and the non-use of smart energy services in Finland, Kahma and Matschoss (2017) observe that "the most important dimensions of non-use are disinterest and disenchantment, alongside lagging adoption. Moreover, disenfranchisement also has a role in explaining non-use" (p. 27). Nevertheless, this theory has been used effectively in a variety of studies (Rai & Robinson, 2013; Matschoss, Kahma & Heiskanen, 2015). For instance, Rai and Robinson (2013) argue that peer effects have a significant influence on the innovation-diffusion process and potential consumer decision-making activity. The authors discovered that potential PV adopters in Texas benefit from and tap into the information provided by peers regarding the uncertainties and monetary costs associated with PV technology. Their peers are existing users of PV technology who know these matters. Matschoss et al. (2015) adopt the diffusion of innovation theory to identify impending qualitative differences between leading-edge users (pioneers) and the mass market of electricity for novel energy-efficient services in Finland. Their empirical results confirm the relevance of the diffusion of innovation theory for electricity service and the existence of specific pioneers of innovative energy services. In this dissertation, the acceptance categories, such as adoption, acceptance in principle, rejection, and opposition, have been included as the behavioural responses to capture a broader picture of acceptance.

The VBN theory has been considered as the most advantageous account of diverse behavioural indicators of nonactivist environmentalism (Stern, 2000). This theory views an individual's fundamental values (e.g., altruism, self-interest, and openness to change), normative beliefs (e.g., ecological worldview, advanced consequences for valued objects, and perceived ability to reduce threats), and pro-environmental personal norms (e.g., sense of obligation to initiate pro-environmental actions) as solid predictors of pro-environmental behaviour. At a certain time, an individual may believe that violating some norms that they value would have negative effects and that by acting, they would bear the responsibility for these consequences. In this case, they activate those norms. The strength of this theory is to influence an individual's decision to engage in a given pro-environmental behaviour based

on their values, beliefs, and norms regarding the goal-directed pro-environmental behaviour. Critics argue that this theory is simple and its predictive power is limited in describing technological change (Sovacool & Hess, 2017). It is unsuitable for explaining non-rational and non-goal-oriented behaviour (e.g., based on emotion). Its explanatory power decreases when the behaviour has a high financial value; it is time-consuming and difficult. Steg et al. (2015) relate this back to the fact that relatively costly behaviour is less connected to personal norms than less costly ones (e.g., the acceptance and installation of solar panels on the rooftop at household level). The theory does not consider “the effects of personal capabilities, social norms, and attitudes, which are well explained by TRA and TPB” (Inoue, 2015, p. 23). Due to these limitations, the VBN theory was not included in my research.

A diverse array of sociological theories is more practical than many psychological theories when considering social acceptance from an applied perspective. Sociological theories place greater emphasis on human interaction in their social and physical environments (Upham et al., 2015). For instance, Lucke (1995) offers her sociological explanation of social acceptance by developing a relationship triangle of social acceptance that consists of three elements: (a) the acceptance object, a thematic issue of what a subject should accept to a certain degree; (b) the acceptance subject, a person or a group who experiences constant interaction with other actors and evaluates the thematic issue concerning their own beliefs, norms, and values and in consideration of what others (including social and political actors) say, think, or do, and thereby makes decisions; and (c) the acceptance context and object- and subject-oriented surrounding conditions (legal, institutional, political, historical setting, and so on). Lucke (1995) stresses that studying acceptance also means researching non-acceptance. She further argues that sociological research on acceptance should consider the subjective analysis of tolerance (what an individual can endure physically and mentally, even if it is against their will and moral conviction) and the objective test of compatibility (the structural and cultural/subcultural compatibility of certain forms of norms and values). The relationship triangle of social acceptance has been cited as an important theoretical contribution in various studies (e.g., Leucht, Kölbl, Laborgne, & Khomenko, 2010; Schumacher & Schultmann, 2017) and is considered in this dissertation (for further clarification see Section 2.8).

The study of energy and energy futures has also been continually enriched by geographical contributions that include place, landscape, regions, distance decay, and other genres of energy geographies (Fast, 2013; Calvert, 2015). In energy studies, the energy landscape entails the modes of energy production, distribution, and use, and it locates people on two sides of relations: material (the form of landscape and living arrangements) and immaterial (perception and representation; Calvert, 2015). In the study of wind and solar energy in local contexts, the most common geographical genre appears to be the NIMBY syndrome (Batel et al., 2013; Fast, 2013; Perlaviciute & Steg, 2014; Dermont et al., 2017). Furthermore, NIMBY, not in anyone’s backyard (NIABY),

YIMBY, PIMBY, and reverse-NIMBY are some public responses observed at the implementation level of various projects (Dokshin, 2016; Calvert, 2016) and to some extent reflect those material and immaterial relations (see Section 2.6).

The above theoretical models and the three dimensions of social acceptance mentioned earlier (Figures 2 and 3) draw attention to certain pre-behavioural mental states that have a vital influence on behaviour. These are explained in Section 2.7.3.

2.7.3 PREVALENCE OF SOME PRE-BEHAVIOURAL MENTAL STATES

As earlier sections have argued, certain pre-behavioural mental states help shape social acceptance. To exhibit an action practically, one should have a balance of intention, willingness, and readiness to act. These pre-behavioural mental states are linked to a range of factors (see Section 2.5) that continually push an actor to evaluate those to exhibit a behaviour. Various energy studies and technology acceptance models and theories have viewed intention (Liu, Wang & Mol, 2013; Perri & Corvello, 2015; Rai & Beck, 2015; Sheeran & Webb, 2016), willingness (Li, Li, & Wang, 2013; Balcombe, Rigby, & Azapagic, 2013), and readiness (Bertsch et al., 2016) as the prerequisites of the final behaviour. A deeper understanding of these pre-behavioural mental states and their interrelation is necessary to understand how they contribute to forming various patterns of the acceptance behaviour of RETs.

2.7.3.1 *Intention to adopt*

Conceptually, intention refers to a course of action or plan that an actor considers necessary, and thus intends to undertake to accomplish a certain behaviour. It is an actor's conscious decision to engage in a behaviour. Behavioural theories such as TRA (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985) assume that actors' intentions are directly related to their consequent behaviour. TRA states that intention can be influenced by intrinsic (personal) and extrinsic (contextual) factors. Intention is a robust, extensively applied predictor of actors' behaviour (e.g., Fishbein & Ajzen, 1975; Ajzen, 1985; Ajzen, 1991; Ajzen & Cote, 2008). According to TRA and TPB, intention precedes behaviour. The likelihood of a behaviour being performed depends on the strength of intention: 'the stronger the intention to engage in a behaviour, the more likely should be its performance' (Ajzen, 1991, p. 181). In that sense, there are two categories intention: stronger and weaker intentions.

In the TPB, an updated version of the TRA, Ajzen (1985) proposes the concept of perceived behavioural control, which refers to the perception of the ease or difficulty of performing the behaviour of interest. In terms of perceived behavioural control, for goal-oriented behaviour, the perceived ease or difficulty of performing an intended behaviour explains limited volitional

control because a behaviour can be constrained by various non-volitional/non-motivational factors (Ajzen, 1985). Unlimited volitional control is applied for everyday activities “in the sense that people can easily perform these behaviours if they are inclined to do so” (Ajzen, 1985, p. 12).

Thus, the actor controls the expression of behavioural intention, and it depends on their volitional control, that is, willingness “to perform or not perform the behaviour” (Ajzen, 1991, p. 182). In this sense, volitional control indicates two-dimensional characters of intentions: favourable/positive and unfavourable/negative. For instance, at the policy level, vested interest has long prevented policymakers in Finland from emphasising solar energy (i.e., the allocation of subsidies, household investment support; Child et al., 2017). Recently, it has received positive attention as a consequence of the global boom in the solar energy market and the success stories of countries such as Germany, which has weather conditions that are similar to those of Finland. Since 2011, different field-configuring events have occurred to boost the solar energy market in Finland (Nissilä, 2015). Solar energy has since gradually developed a goal-oriented focus (although in a weaker form) as a part of the national share of RE targets by 2020 or 2050 (Heiskanen et al., 2017; Child et al., 2017). This means that the previous negative intention has transformed (and is transforming) into a positive intention, and some behavioural consequences have now become apparent (e.g., to some extent, it is now allowed to sell excess, individually produced solar energy to the grid in Finland; Laihanen et al., 2016).

At the individual level, actors’ behavioural intentions also vary as a result of different personal and contextual factors. Due to their personal choice, the solar believers (Pihlajamaa et al., 2013) have exhibited positive, strong intentions and have adopted solar energy. Still, many positive-minded people have not instituted their intentions to adopt solar energy, for example, because of the absence of household investment support in Finland (Ratinen & Lund, 2015; Child et al., 2017). Thus, having a positive intention is not sufficient to perform an act: stronger willingness and abilities in an actor can expedite and ensure the action is achieved. Often, what people say they would do or plan to do (intention) may not corroborate with their actions (behaviour), which causes the intention-behaviour gap (see Section 2.6). Devinney, Auger, and Eckardt (2010) argue, “intention does not imply a true assessment of what will occur, but a statement by the individual that gives his/her revealed stated reaction to something in such-and-such circumstances” (p. 51). While addressing the intention-behaviour gap, the researcher’s task is to identify the rationality of actors that causes this gap without labelling the actors as whimsical (Chatzidakis & Lee, 2012).

Article I demonstrates how attitudes, perceptions, and overall intentions are translated into different patterns of intentions, how these intentions are translated into and compared to various behavioural responses, and how all these sequences of behaviour are influenced by multiple (a) personal and (b) contextual factor; this approach thus explicates the intention-behaviour gap.

Although Ajzen (1985, 1991) has explained intention, behaviour, and the intention-behaviour gap, his TPB has been criticised for not containing the interaction effects between its key constructs. Additionally, it does not address the processes (e.g., physical activity relationship) involved in the intentions (Gourlan, Bord, & Cousson-Gélie, 2019). Furthermore, it overlooks one's needs before engaging in a certain action, which would affect behaviour irrespective of articulated attitudes. As reasons, factors, and conditions, those needs are necessary to explain the intention-behaviour gap fully. Furthermore, Ajzen's theory does not describe what patterns of intentions and behaviours can be detected while addressing the intention-behaviour gap. In my study (see Article I), I explain the intention-behaviour gap by identifying the reasons between intention and behaviour. Considering these points, and without fully relying on Ajzen's (1985, 1991) theory, I include the concept of perceived behavioural control and his explanation of the intention-behaviour gap in the literature review of Article I to address the rationality behind the intention-behaviour gap. Relevantly, other theoretical (e.g., Rogers, 2003; Botha & Atkins, 2005; Sovacool & Ratan, 2012) and empirical works (e.g., Heiskanen, et al., 2014; Ratinen & Lund, 2015; Jung et al., 2016) are discussed to present a theoretical construct of the study.

According to the theoretical construct provided in Article I (Section 2.5), personal factors and contextual factors influence intention. An intention, in general, passes through the rationality consideration (based on reconsidering various factors) and addresses the gap (if one exists) between what has been said and what has been done (behaviour as adoption, acceptance in principle, rejection, and opposition). This study also emphasises the emergence of new thoughts (e.g., types of intention) from the empirical data within the stated theoretical construct.

2.7.3.2 Willingness to adopt

Although there is a tendency for technical goods to be diffused quickly, consumers' willingness—an integral part of intention and readiness—to adopt these goods is important to technology providers, policymakers, and marketers. A person expresses willingness or unwillingness to adopt a product or technology. It is inappropriate to frame willingness as “What do you plan to do?” This question is not the same as “What are you willing to do?” The term willingness has been used as a synonym for volition (Ajzen, 1985): it is a cognitive process by which an actor makes a decision and commits to a particular behaviour (Lunde, 2016). It is a purposive striving, and it is one of the basic functions of human psychology and a prerequisite of intention in a controlled form (Ajzen, 1985). Moreover, willingness is a process of conscious activity. Over time, it becomes automatised as a habit.

Behavioural willingness indicates a lack of planning, which differentiates it from behavioural intention. An actor may have a plan or intention to act, but without willingness, it cannot be executed. Instead, willingness is the extent to

which a person has the motivation, confidence, and commitment to do something. For instance, a student might have the intention to do well on a test, but without the willingness to work hard and systematically, their intention may not result in achievement. Willingness is the first precondition to fulfil a plan, in the sense that “where there is a will, there is a way”. Willingness also reflects a person’s openness and receptiveness to acting under certain conditions. Studies have confirmed that the willingness of different actors living in the same community may not be the same, which creates variation in the level of adoption of innovation: “some do so quite rapidly, and others never do it at all” (Solomon et al., 2006, p. 538). The underlying causes create these differences. Consumers become “willing to accommodat[e] the social features of a product into his/her decision model that resonate with them in a congenial context to reveal their latent demand in actual purchasing” (Devinney et al., 2010, p. 177).

For instance, some studies have argued that although people are willing to support RE projects, in many cases, they are unwilling to be involved in the implementation of community-based projects (Zhao et al., 2015). Actors’ demands related to different personal (e.g., environmental friendliness) or contextual conditions and factors (e.g., investment costs, noise, uncertainties, and risks) dictate their willingness, and thus, different states of a WTA tendency can be identified. For instance, the adopters’ WTA resembles the notion of a strong and activated WTA; those who intend to adopt without any change in the current support structure (Ratinen & Lund, 2015; Child et al., 2017; Kahma & Matschoss, 2017) could be considered as exposing their unconditional WTA. Some, meanwhile, intend to adopt when certain desired conditions are fulfilled (Jung et al., 2016), and thus, they express conditional WTA. Some may reject (Kahma & Matschoss, 2017) or oppose (Kleijnen et al., 2009) due to unexpected obstacles, and they thus express their non-WTA. In this regard, different states (stages) of WTA and the conditions related to these states can also be identified. Based on these principles, a conceptual framework was developed, which is detailed in Article II (Figure 4).

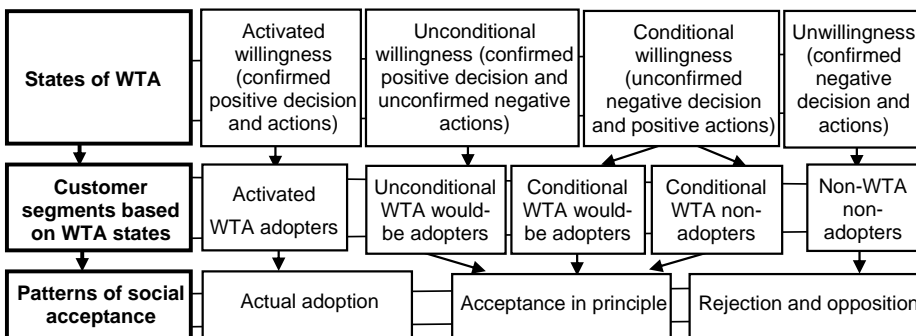


Figure 4 States of willingness to adopt (WTA), related customer segments, and social acceptance (Article II, p. 99).

Transitioning towards sustainable energy systems implies a stronger reliance on RESs in the future, which could be better understood if it is known “to what extent and under which conditions individuals are willing to accept and adopt renewable energy sources” (Steg et al., 2015, p. 2). This subject is also addressed in Article II of this dissertation.

2.7.3.3 Readiness to adopt

The Shakespearian character Hamlet observes that “readiness is all”, which in the case of adopting RETs, directs attention to the conceptual construct of buyer readiness. It is not enough to have a plan and the willingness to perform an act. An individual’s readiness (or preparedness) can determine how promptly the action can be done. The term readiness denotes a state of being prepared, and it implies the qualities of promptness, speed, and immediacy to perform an action. Actors’ readiness to accept a certain facility in their locality is considered the subjective measure of acceptance (Bertsch et al., 2016).

Consumers’ readiness to purchase depends, for instance, on their ability to buy or adopt innovation. This ability refers to the extent to which actors “have the resources to make an outcome happen” (Hoyer, MacInnis, & Pieters, 2012, p. 60). To perform a consumption behaviour, either through adoption or use, actors should have financial resources, emotional resources to experience empathy and sympathy, physical resources, social and cultural resources, and resources of education and age (Hoyer et al., 2012). These resources exert influence on consumers’ readiness to purchase (Kotler & Armstrong, 2012), and they are the factors that influence accepting RETs as described in Section 2.5. Buyer readiness has been theoretically conceptualised in a study on communicating with the target market audience (e.g., Kotler & Armstrong, 2012). A market is represented by consumers who display different buyer-readiness stages in purchasing a product. Kotler and Armstrong (2012) argue that consumers pass through six stages on their way to adopting a product: (a) awareness of its presence, (b) knowledge of its features, (c) affinity for it as a degree of interest, (d) preference over available alternatives, (e) conviction to purchase it, and finally (f) purchase, which can be delayed due to lack of money, time, or other related components.

Ajzen (1985) argues that the coherent execution of an intended behaviour relies on the availability of the requisite information, abilities, and skills, which he believes has bothered some researchers in their efforts to empirically reveal the correlational effect of intention and ability on the final behavioural response. He argues, “The resources and opportunities available to a person must, to some extent, dictate the likelihood of behavioural achievement” (1991, p. 183). In his view, both motivation and ability influence behavioural achievement. However, nowhere in these publications (1981, 1991 and Ajzen & Cote, 2008) does he mention readiness as a specific, separate, and composite entity like intention. He discusses resources, opportunities, skills, information, and abilities when and where necessary to situate his

psychological notion of perceived behavioural control “as a proxy for actual control and [as a] contribut[or] to the prediction of the behaviour in question” (Ajzen & Cote, 2008, p. 301). He has claimed that it may be implausible or of less practical worth to measure intention at a shorter interval between intention and behaviour. This thought restricted him to addressing actual behavioural control and readiness-related matters (see Ajzen, 1985, p. 22).

Under the influence of their resources (Ajzen, 1985, 1991; Hoyer et al., 2012), actors tend to experience distinct stages of readiness (Kotler and Armstrong, 2012): these can be stronger or weaker depending on actors’ preferences. Whilst actors are used to consuming traditional energy, the adoption and consumption of REs largely depend on their choice (Huijts et al., 2012; van Rijnsoever et al., 2015; Dermont et al., 2017). As a basic postulate of economic psychology, Solomon et al. (2006, p. 430) argue the following:

[C]onsumer demand for goods and services depends on [the] ability to buy and willingness to buy. While demand for necessities tends to be stable over time, other expenditures can be postponed or eliminated if people don’t feel that now is a good time to spend. For example, a person may decide to ‘make do’ with his or her current car for another year rather than buy a new car now.

Understanding actors’ readiness regarding the possession of various resources and their passing through multiple stages of adoption is vital to this dissertation. I address readiness to understand to what extent and under which conditions individuals are ready to express their acceptance behaviour (Article III).

2.8 SUMMARY OF THE LITERATURE AND KEY CONSIDERATIONS

Although the literature cited has conspicuously indicated the fragmented conceptualisation of social acceptance (e.g., social acceptance as acceptability, as public acceptance, as attitude, as a behaviour, or as various behavioural reactions) across many studies and interdisciplinary theoretical orientations, a comprehensive and holistic understanding is not beyond reach. Overall, the social acceptance of RETs is a holistic, dynamic, interdisciplinary, and polycentric approach that simultaneously includes top-down and bottom-up dimensions of decision-making at the socio-political, market, and community levels in the milieu of policymakers, investors, key stakeholders (product manufacturers, distributors, and so on), consumers, and others in their cultural construction of knowledge, belief, norms, values, customs, morals, laws, and any other capabilities and habits they acquire as members of a social setting (e.g., community or organisation). According to the literature reviewed, key components of a bottom-up perspective (e.g., public attitude),

top-down perspective (e.g., investment, and the position of policy actors), and project implementation phase (e.g., public reactions, and diffusion of energy technologies) embody the key issues of social acceptance as an umbrella term. These issues are shaped and reshaped along the socio-political, market, and community dimensions of social acceptance. Actors express their acceptance of an object (e.g., solar energy) by considering the contexts of those three dimensions. Since several contextual factors and related personal factors shape and reshape actors' energy behaviour, diverse and segmented interpretations of acceptance as an attitude, behaviour, or reaction have appeared across the literature.

This review also uncovers many approaches (e.g., acceptance as attitude only, acceptance as only one behaviour, and so on) that have failed to address the three dimensions of social acceptance, pre-behavioural mental states, and behavioural responses in a holistic manner. The merging of intention, willingness, and readiness as pre-behavioural mental states has rarely been addressed in the literature reviewed. Only Ajzen (1985, 1991) directly mentions intention and willingness (volition) issues and indirectly addresses readiness in terms of certain opportunities, resources, and time factors, which represent a weak merging. The behavioural interpretation of social acceptance in which these pre-behavioural mental states are well integrated can better address what people say they would do or plan to do, what they do, and the gap between the two. In this dissertation, these matters are addressed to achieve a comprehensive conceptualisation of social acceptance instead of considering it as merely a favourable behavioural response, a kind of attitude, or a positive behavioural reaction.

In some respects, Lucke's (1995) acceptance theory does capture that breadth (acceptance as well as non-acceptance) in which subjects accept objects within the influence of various contexts. Lucke's (1995) theory provides overall guidance for this study, which considers multiple actors, including laypersons and experts as subjects; solar energy, investment support, and so on as objects; and socio-political, market, and community structures as contexts. A comprehensive focus on (a) personal and (b) contextual factors at both pre- and post-adoption stages are inadequately addressed in the literature mentioned. The interpretation of the research results section provides an explanation of how intention, willingness, and readiness can be translated into various behavioural responses, including adoption, acceptance in principle, rejection, and opposition. Although they are not followed exactly, the nine conditions of Sovacool and Ratan (2012) influence the research design and research results of this dissertation. The three articles are particularly affected by some of the theories and concepts discussed in this chapter (Table 2).

Table 2 Key considerations of theories or concepts in the three articles.

| Article specific theories and key concepts | Conceptualisation of common concepts in all articles |
|---|--|
| Article I: Intention (Ajzen, 1985, 1991); Intention-behaviour gap (Ajzen, 1991) | <ul style="list-style-type: none"> • <i>Social acceptance</i>: Adoption (Rogers, 2003; Heiskanen et al. 2014); acceptance in principle (Heiskanen et al. 2014), including postponement (Kleijnen et al., 2009), undecided, indifferent, conditional acceptance, and other approval levels (Langer et al., 2018); rejection (Rogers, 2003; Kleijnen et al., 2009); opposition (Kleijnen et al., 2009) • <i>Pre- and post-adoption</i>: Pre-adoption (Heiskanen et al. 2014) and post-adoption (Rogers, 2003) • <i>Factors/conditions of acceptance</i>: (1) personal and motivational (Botha & Atkins, 2005) or psychological (Huijts et al., 2012; Perlaviciute & Steg, 2014); and (2) contextual (Botha & Atkins, 2005; Huijts et al., 2012; Sovacool & Ratan, 2012; Perlaviciute & Steg, 2014) • <i>Subject, object, and context</i>: Subject (e.g., actors including laypersons/ordinary people and experts), object (e.g., solar energy, investment support, etc.) and contexts (socio-political, community and market contexts) of acceptance (Lucke, 1995; Wüstenhagen et al., 2007; Sovacool & Ratan, 2012) |
| Article II: Adopters (Ratinen & Lund, 2015) willingness as “activated WTA”; unconditionally would-be adopters’ (Ratinen & Lund, 2015; Child et al., 2017; Kahma & Matschoss, 2017); willingness as unconditional WTA; conditionally would-be adopters’ (Jung et al., 2016) willingness as conditional WTA; and those who reject (Rogers, 2003; Kahma & Matschoss, 2017) or oppose (Kleijnen et al., 2009), their willingness as non-WTA | |
| Article III: Stages of buyer-readiness (Kotler & Armstrong, 2012); ability and willingness/preferences (Ajzen, 1985, 1991; Hersey & Blanchard, 1988; Hoyer et al., 2012) | |

As observed in Sections 2.7.3.1, 2.7.3.2, and 2.7.3.3, the concepts of intention, willingness, and readiness are closely related, but there are also differences between them. All these concepts are necessary and prerequisites for adoption or non-adoption matters. Willingness generally exists alone and sometimes works as a prerequisite of an intention. The strength of willingness “to perform or not perform the behaviour” (Ajzen, 1991, p. 182) indicates two-dimensional characteristics of intentions: favourable/positive and unfavourable/negative. Intention works as a commitment or a plan to conduct an action (behaviour) in the future. The intention may also exist alone with no positive practical behavioural orientation. For instance, one may intend to pass the exam, but without a willingness to execute the plan and prepare for the exam, they will not succeed. When an individual has the willingness, they design a course of action or a plan to be undertaken to accomplish a certain behaviour. Therefore, while addressing RQs 1 and 2 (Section 1.2), theoretical overlap can be observed, but I have addressed this in two settings to access a complete picture of the impact of intention and willingness on the exhibited behaviours of respondents. Thus, in Article I, the intention and behaviour nexus is addressed to see any gap between the two. Whether there is any involvement of willingness in this nexus is not assessed. Likewise, in Article II, only the willingness and behaviour nexus is addressed with aim to identify a WTA solar energy tendency among respondents.

Without readiness, intention and willingness do not gain a practical orientation. An individual may have a plan without willingness. Strong

willingness supports the likelihood of the plan to be executed if required preparedness is there. An individual may already have preparedness in terms of the resources needed to execute an action. For instance, a person may have adequate knowledge, information, own house, a bank balance, and other resources. If that person does not have the intention and WTA solar energy, for instance, he/she will remain reluctant. Although intention, willingness, and readiness are conceptually very close to one another at some points, and it may be thought that they overlap each other, they have their own features and uniqueness in impacting human behaviour. In this research, I explain how they impact adoption or non-adoption behaviour to gain a comprehensive picture regarding social acceptance of solar energy at the household level. I have aimed to observe how each concept has impacted the exhibited behaviour of the respondents in my research separately.

Since this research approaches social acceptance as an aggregate of various acceptance and non-acceptance responses or reactions as the translations of pre-behavioural mental states, the research objectives in Article I involve studying the intention-behaviour gap and identifying different patterns of intentions in contrast with exhibited behavioural positions. Article I addresses how attitudes, perceptions, and overall intentions are translated into different patterns of intentions; how those intentions are translated into and compared to various behavioural responses; and how all of these sequences of behaviour are rationalised and influenced by multiple (a) personal and (b) contextual factors, thus suppressing social acceptance of solar energy. To situate these matters, a theoretical construct is presented in the literature summary section (Section 2.5 in Article I). This section demonstrates that personal and contextual factors create intentions, which pass through rationality considerations and address the intention-behaviour gap (if one exists). The study has also emphasised the emergence of new thoughts (e.g., types of intention) within the stated psychological theoretical construct.

Using more market-based and economic constructs of willingness, Article II also presents new thoughts rather than being restricted to concepts related to the stages of WTA. While conventional studies have mostly concentrated on people who are unconditionally willing to adopt, Article II proposes a comprehensive view and adds extra value to the solar market landscape through the consideration of other categories of people based on their states of WTA at pre- and post-behavioural sequences.

In the same vein, descriptively, Article III articulates different routes of adoption; diverse route choosers; their preferences and proximity to adoption matters, which reflect the route choosers' purchasing/adoption ability and willingness issues; and the stages of buyer-readiness. Instead of including a theoretical discussion, a literature review based on various previous studies has shaped the article, but a later discussion of related theories in this chapter indicates their relevance to and influence on that research.

The selection of key terms and theoretical concepts in consideration of three pre-behavioural mental states (e.g., intention, willingness, and

readiness) indicates that a cognitive perspective has influenced this research. However, the presence of diverse socio-political, community, and market aspects of acceptance, pre- and post-adoption factors, behavioural reactions, and so on have made that perspective multidimensional and multifocal. Furthermore, this diversity has largely liberated this research from an individualist perspective. Without rigidly believing or depending on any specific theory, this research includes multiple key concepts and remains open to new thoughts. These features of this research are different from a positivistic research tradition. While presenting the research methodology, the next chapter describes the research tradition of this doctoral dissertation.

3 RESEARCH METHODOLOGY

The previous chapter has demonstrated how the reviewed literature plays a significant role in the conduct of this research. However, this research has not been fully restricted to those key terms and theoretical concepts, as mentioned in Table 2. Although conventional “positivistic and quantitative-dominant” researchers strictly follow preunderstanding (theories, key concepts) with a blank slate when searching for data, researchers in a qualitative tradition can use concepts, theories, and thoughts as an “idea context” (Maxwell, 2013, p. 39) or preunderstanding without being confined by them (Gummesson, 1988, p. 65). Thus, researchers are free to absorb new thoughts (Collins & Stockton, 2018). I have also maintained this tradition in my research. I have used aforementioned key terms and theoretical concepts in my research design, but again, I have kept the RQs open to absorb new thoughts (see Sections 3.3, 3.4). Although Table 2 in the previous chapter mentions the use of some key terms and theoretical concepts in Articles I–III, Chapter 3 methodologically addresses how those concepts and theories are addressed in my research that has remained open to new interpretations.

This chapter describes how different philosophical and paradigmatic issue(s) are addressed in this research. This dissertation addresses the social acceptance of solar energy from individual points of view. In this research, I have focused on how actors interpret and understand different aspects related to the acceptance of solar energy, and I embrace the view that realities are constructed through the interactions between a researcher and the research participants (see Crotty, 1998; Saunders, Lewis, & Thornhill, 2009). The ways actors make sense of the social acceptance of solar energy based on their feelings, thoughts, and experiences; the expressions and terms they use to interpret it; the nature of the knowledge they obtain and develop related to accepting solar energy through their conventions of social interaction; and based on these, how they render action (e.g., adoption or non-adoption including their intention, willingness, and readiness) are focused on multiple realities. The shaping and re-shaping of new or underlying understandings of these realities are expressed through the interaction of “the knower and known” (Denzin & Lincoln, 1998, p. 26). In Chapter 2, I have explained how social acceptance has been interpreted in diverse and fragmented ways in the existing literature.

The choice of a research paradigm influences the choice of a quantitative (numeral presentation of facts and events) or a qualitative (descriptive and analytical ways of presenting research data) research design—or a hybrid approach of the two (Saunders et al., 2009). Compared to a quantitative research design that tests theory in a deductive reasoning style, this dissertation adheres to a qualitative research design so that a detailed description and “a better fix on the subject matter at hand” (Denzin & Lincoln,

1998, p.3) can be achieved by approaching towards the actors' perspectives. A research design can employ a tight, loose, or middle-ground approach. A tight research design is characterised by short, limited questions and by strictly determined selection procedures. It is applicable when more commonly known topics are under investigation (Miles, Huberman, & Saldana, 2014). A loose research design, in contrast, is characterised by less defined concepts and, in the beginning, has a few fixed methodological procedures. It is applicable when an unknown field or complex object is selected for investigation (Miles et al., 2014). It is also possible to take a middle-ground approach that allows the researcher to embrace new interpretations that evolve throughout the research process and make changes to the initial RQs if necessary (Denzin & Lincoln, 1998). This dissertation adopts a middle-ground approach as an adaptive strategy similar to bricolage (“a pieced-together, close-knit set of practices that provide solutions to problems in a concrete situation”; Denzin & Lincoln, 1998, p. 3) in which the researcher (the bricoleur – a “jack-of-all-trades or a kind of professional do-it-yourself person”) remains open to new interpretations.

I collected empirical data from 25 laypersons in the Eko-Viikki residential area and from 17 Finnish solar energy experts to assist in determining the answers to the RQs (Table 3). While Article I concerns the intention-behaviour gap that suppresses the social acceptance of solar energy, Article II considers different types of willingness and customer segments in their adoption and non-adoption activities. Article III concerns routes of adoption, the route choosers, and various business models that address the social acceptance of solar energy. This is why the RQs mentioned in Table 3 were not addressed in the same study, and this is further explained in Sections 2.8, 3.3, 3.4, and 4.

Table 3 *Research questions and answers*

| Research questions (RQs) | Places of RQs answers |
|---|--|
| Main RQ: How can the social acceptance of renewable energies, such as solar energy, be comprehensively conceptualised as a behaviour that includes various acceptance and non-acceptance responses/reactions that pass-through actors' intention, willingness, and readiness? | Summary part (mainly) and three articles (briefly) |
| RQ- 1. Why does the intention-behaviour gap to adopt solar energy systems exist? | Article I |
| RQ- 2. What are the patterns of willingness to adopt solar energy among the public? | Article II |
| RQ- 3. What is the public readiness to invest in and adopt solar energy? | Article III |

The account of and justification for choosing a research site, the sampling and collection of two sets of data, the data collection instrument (interview design), the data analysis method, and the research ethics are detailed below.

3.1 EKO-VIIKKI: THE SITE FOR INTERVIEWING THE LAYPERSONS

The Eko-Viikki residential area in Helsinki was chosen as the study site to collect the first set of data because it consists of 10 solar-integrated (alongside other) buildings. Those solar-integrated and normal buildings (i.e., buildings without any installed solar panels) are consisted of detached and semi-detached dwellings with inhabitants including tenants, owners, and right-of-occupancy residents who represent various patterns of consumers based on their adoption and non-adoption (i.e., acceptance in principle, rejection, and opposition) status. Eko-Viikki is well known for its eco-establishments and the sustainability criteria it maintains. It won the Sir George Pepler International Award 2006 for being the best project of its kind in the Baltic Sea and North Sea areas (Schulz, 2006). Furthermore, it is the only solar community (houses or block of flats under a specifically solar power plant) still operating in Finland (Solar-district-heating.eu, 2018). It is easy to find respondents who demonstrate pre-adoption factors (the reasons people have not yet adopted solar energy) since the number of household adopters in Finland is low. On the contrary, finding adopters who demonstrate post-adoption factors is difficult. Thus, Eko-Viikki was considered the most suitable place to find the maximum variety of customers (see Suri, 2011) who could also satisfy the need to analyse the roles of several factors at pre- and post-adoption stages. While acknowledging that people living in other places have different views and that choosing a specific location has an impact on the responses, the stated reasons are crucial in the choice of Eko-Viikki.

3.2 SAMPLING METHOD AND DATA COLLECTION

I have used two sets of empirical data from both laypersons and experts. Some of the Finnish RE studies discussed in this dissertation have also used two sets of empirical data (e.g., Salmela & Varho, 2006; Juntunen, 2014; Child et al., 2017; Olkkonen, Korjonen-Kuusipuro, & Grönberg, 2017). I have categorised my interviewees into two segments: laypersons and experts. To obtain research data, I have used purposeful and snowball sampling strategies, as described in the following sub-sections. A small sample is common in qualitative research (Salmela & Varho, 2006; Durdella, 2019), although some scholars consider recruiting at least 30 participants to be essential to ensure adequate data collection and to transform qualitative data for quantitative analysis when and where this is necessary (McIntosh & Morse, 2015). The number of respondents in this study is 42 (25 laypersons and 17 experts). My purpose in using two sets of sampling, heterogeneous respondents, and having multiple perspectives and empirical materials was to add depth, breadth, rigour, and triangulation to my research.

It is useful to develop face-to-face and one-to-one contact between the interviewer and interviewees (experts and laypersons) to explore issues in detail (Henn et al., 2006). I interviewed laypersons and asked them to share their experiences with the socio-technical system (i.e., solar energy and solar-integrated buildings) and their perceptions about other components (e.g., solar energy adoption tendencies, markets, and socio-political situations). Laypersons may not have specific knowledge or specific functions (jobs or work experience) in solar energy, but experts in this field do. Thus, I also included expert interviews to obtain a broad, in-depth picture of the research topic. Although experts focused on sharing their views and perceptions about others (i.e., the acceptance of solar energy by people), laypersons exhibited less concern for others. In Articles I–III, personal experiences with the socio-technical system (solar energy and solar-integrated buildings) of the laypersons are given, and experts' perceptions about others are also presented. In some cases, experts also shared their personal experiences to shed light on their expert thinking and to justify their decision and opinions. Both laypersons and experts were asked to share their personal experiences as individuals and to share their perceptions about other aspects (e.g., solar energy adoption tendencies, markets, and socio-political situations).

The same interview guide was used for both groups (Section 3.3). There were only three specific questions regarding Eko-Viikki. The rest of the questions were more general and are detailed in Section 3.3. As mentioned in Articles I–III, I chose the experts based on their references (i.e., interviewing one expert and receiving references to other experts who could answer my RQs). Furthermore, when I approached them to confirm the interviews, I provided some information about my research and key concepts related to the RQs (including issues related to Eko-Viikki). With these in mind, the experts who agreed were interviewed. Thus, they were knowledgeable about solar-integrated buildings in Eko-Viikki and other issues concerning solar energy in Finland.

I conducted the interviews to discover various social dimensions related to social acceptance of solar energy technologies (see Henn et al., 2006). It took seven months to conduct the interviews, which began in October 2015. I conducted the last interview in May 2016. I conducted the expert interviews by appointment, and I interviewed the laypersons mainly on weekends, as detailed in Sections 3.2.1 and 3.2.2.

3.2.1 LAYPERSON INTERVIEW AS RESEARCH DATA

I visited the Eko-Viikki study site several times to conduct interviews with laypersons and collect the first set of research data. While pre-testing the interview guide, I learned that it would be easier to find many residents outside in open spaces on weekends than on weekdays. On weekdays, most of the residents go to their jobs; thus, I decided to conduct the interviews with laypersons on weekends. Many laypersons were found spending leisure time

and walking around in the open spaces on the weekends. I chose interviewees from a diverse group of people and searched for common patterns (matters that are common to the interviewees living in that community) that transcended their variations (see Patton, 2015). I maintained some strict criteria to select the respondents so that I could obtain relevant and adequate responses to my RQs (Table 4).

Table 4 *Specific sampling criteria to interview laypersons.*

| Key points | Explanation | Rationale |
|-------------------------------|--|---|
| Location | Must be resident of Eko-Viikki, the southernmost section of the Latokartano housing area | It was assumed that, by seeing different solar-integrated buildings, people of that locality would be more knowledgeable and enthusiastic about solar energy than in other places in Finland. |
| Residence type | Must represent owner-occupied, rented, and right-of-occupancy homes | These are the types of accommodation in Eko-Viikki. Respondents from all kinds of residences represent many variations. |
| Age restriction | Must be above 20 years old | It was assumed that respondents at least above 20 years old would be more representative and able to contribute more. |
| Gender specification | Both male and female | For diversity |
| Time restrictions | Must be willing to spend at least 20 to 25 minutes for the interview | To generate maximum information |
| Language requirement | Must be able to speak and participate in the research in English | Since the researcher did not know the Finnish language |
| Familiarity with solar energy | Must have at least a basic idea about solar energy | To ensure maximum responses to the research questions |
| Adoption type | Adopter, would-be adopter, and non-adopter | To identify respondents in terms of their patterns of adoption of solar energy |

To gather adequate, relevant information considering those criteria, I used a purposeful sampling method and the maximum variation strategy (i.e., diverse categories of residents were found in the weekends on Eko-Viikki) to recruit and interview (see Suri, 2011) Finnish laypersons living in Eko-Viikki. Although I found many residents on the weekends, after informing them of the interview criteria, I obtained approval from very few to conduct my one-to-one and face-to-face interviews. Thus, each weekend, I interviewed between one and three laypersons. I tried to pay attention to finding diversity in respondents (i.e., heterogeneous examples throughout the possible range; Patton, 2015). Scholars argue that 12 to 20 or more data sources are commonly needed to portray a range of possibilities and achieve maximum variation

(Kuzel, 1999; Durdella, 2019). I continued my interviews with various types of residents who represented different patterns of social acceptance until data saturation occurred (i.e., when the same type of information started to appear repeatedly). In this manner, the sample size became 25. Unfortunately, despite repeated visits to the location, I did not find any interviewees who represented the opposition pattern of social acceptance. Information about this category was drawn from the responses of the laypersons. Interviewees were readily available, and they were willing to spend at least 20 to 25 minutes on the interview and to share their responses in English. Some interviewees spent 40 to 45 minutes sharing their views.

Before conducting the interviews, I briefed the interviewees about the topic and purpose of my research. When they agreed to participate, before starting the main interview, I explained the RQs to them: I told them that people could have an interest in installing solar panels on the rooftops of their houses. Solar energy can be used to produce electricity and solar thermal energy. To do so, in many countries, there are different kinds of supports and services, such as investment and labour cost subsidies; cost-based payments provided for supplying RE electricity to the grid through a net-metering system (having one meter that measures excess power generation after household consumption and sends the excess power to the grid) or a feed-in-tariff system (having two meters that measure consumption and generation); and others from the government, the electricity company, business organisations, and the municipality. People had different political and non-political interests, personal feelings, and expectations. After delivering this type of background information, I started the main interview. I asked them to share their personal experiences and their perceptions about others ((i.e., the acceptance of solar energy by people) while answering the main RQs.

While some of the laypersons (e.g., a housewife, construction builder, bus driver, and advertising worker) required this kind of background information, others (e.g., doctors, engineers, teachers, graphic designers, and NGO workers) required less.

3.2.2 EXPERT INTERVIEW AS RESEARCH DATA

I gathered the second set of data containing more in-depth information based on the responses of key Finnish experts. With their specialised knowledge in renewable energies (mainly solar energy) and working experience in various organisations, the experts were the most representative group (see Atkinson & Flint, 2001; Handcock & Gile, 2011) to share responses and ideas about the acceptance of solar energy among Finnish citizens in diverse social contexts. In my research, experts are those people who have a high level of knowledge and/or skill, and who hold a high-profile and trustworthy role to make wise decisions and produce good results that people around them see; people grasp the need for these experts' work and their invaluable contributions mainly in the field of solar and/or other RE resources. In Article II, I offer a detailed

account of the organisational affiliation of these experts. I applied snowball sampling—the most extensively used non-probabilistic sampling technique—to obtain relevant data from 17 Finnish experts. To recruit experts in the interview process, I initially assembled a long list of experts that included 69 references. I then recruited 17 experts by considering their relevance to the field, organisational affiliation, richness of experience, time, and availability (see Browne, 2005; Table 5). I informed them about the topic and purpose of my research in interview request e-mails. Thus, those 17 experts already knew about my research, and they provided advantageous responses when the interviews were conducted. The interviews with the experts lasted between 45 minutes and two hours. Their answers about the social acceptance of solar energy among Finnish citizens included relevant information in the areas of socio-political, community, and market acceptance.

Table 5 *Experts, expertise, and main organisational affiliation in Finland.*

| Experts and their expertise | No. of experts | Type of organisation in which they work |
|---|-----------------------|---|
| Expert in energy efficiency | 1 | Real estate |
| Academic, researcher (solar energy expert) | 1 | University |
| Academic, researcher (solar energy expert) | 1 | University |
| Solar architectural and engineering expertise | 1 | Municipality urban development area |
| Expert in energy solutions (and solar energy projects) | 1 | Energy company |
| Energy expert and specialist in corporate social responsibility | 1 | Energy company |
| Adviser, consultant and researcher dealing with solar energy | 1 | Energy (e.g., solar energy) consulting firm |
| Specialist in climate change, energy, and carbon neutrality | 1 | A Finnish organisation that funds for Innovation |
| Expert in managing energy-related programs | 1 | A Finnish funder for technology and innovation |
| Engineer and renewable energy expert | 1 | A Finnish environment institute |
| Energy expert | 1 | Municipality environment centre |
| Managerial expertise in solar energy materials business | 1 | Energy systems business organisation |
| Energy expert and adviser | 1 | Finnish ministry |
| Energy expert | 1 | Environmental services authority |
| Energy expert | 1 | Municipality construction agency |
| Expert in climate change mitigation and energy | 1 | Bioenergy organisation |
| Expert in eco-labelling of power production by energy companies and firms | 1 | An environmental protection and nature conservation NGO |

3.3 INTERVIEW DESIGN

As a common method of collecting qualitative data, the use of structured (closed-ended), semi-structured, or unstructured (open-ended) interviews depends on the research topic and the epistemological position of the researcher. The strictness with which the researcher wants to maintain predetermined guidelines determines whether the interview questions are fully predetermined (using mostly structured questions), co-created (using mostly unstructured interview questions), or a combination (see Munck af Rosenschöld, 2017). I formed a semi-structured interview guide as an instrument to collect information (see William, 2003). While interviewing, I tried to observe each interview as a “co-production of the interviewer and the subject” (Kvale, 1996, p. xvii). Therefore, I tried to develop a positive relationship with the respondents by getting to know them, starting the interview with background information on the research (see Sections 3.2.1 and 3.2.2), and facilitating the interview when and where necessary (e.g., explaining the interview questions if needed).

The allocation of “probes” and “prompts” to various question stems allowed the respondents “to elaborate, qualify, and expand upon their answers, and to provide examples as evidence” (Henn et al., 2006, p. 162; McIntosh & Morse, 2015). All respondents were provided a preliminary brief on the purpose and background (including some terminology used in the interview guide) of the interview in advance (see Sections 3.2.1 and 3.2.2). After receiving this background information, they were asked to respond to the interview guide based on their own experience and their perceptions about others when and where applicable.

In the interview guide, background questions (e.g., interviewees’ age, gender, education, and occupation; Q 1) occurred at the beginning. Questions related to their adoption and accommodation status; their perception, intention, willingness, and readiness to adopt solar energy; the barriers to adopting solar energy; and relevant solutions to those barriers followed. Since social acceptance is the key term in this research, the three dimensions of social acceptance (Wüstenhagen et al., 2007) that Sovacool and Ratan (2012) summarise in a review of relevant literature through nine points (Figure 3) were included in the guide in a revised form (by allowing both positive and negative responses and deleting adjectives). This revision was implemented with aim to absorb new thoughts. Subjects’ acceptance and non-acceptance of objects in different contexts (Lucke, 1995) and these nine points were addressed in the interview guide.

In terms of the socio-political dimension, I used political commitment (Q 11) and legal and regulatory systems as legislative issues (Q 10). Questions related to institutional capacity were not directly included in all interviews, but related information was gathered through the interviewees’ responses to questions regarding “solutions to barriers and to increase the rate of solar energy adoption” among Finns (Q 14) and “technological barriers” (Q 12).

“Investment support structure” (Q 7) and “the feed-in tariff and net metering” (Q 8) reflect the factors related to the socio-political dimension.

For the market dimension, information related to installation and production costs, mechanisms for information and feedback, and access to financing were derived mainly through two questions: “Describe the existing barriers to the adoption and market diffusion of solar energy in Finland” (Q 9) and “Describe the solutions to remove those barriers and to increase the rate of solar energy adoption among the public” (Q 14). Some insights related to the market dimension were also received in responses to the following question: “Please describe the reasons for the poor adoption rate of solar energy by the public” (Q 6).

Community dimension issues (e.g., community or individual ownership and use, participatory project siting, and recognition of externalities or public image) were addressed mainly through the following questions: “Please describe public perception and preference related to solar energy adoption as a clean energy source in Finland” (Q 3) and “Describe social barriers” (Q 13). Community issues specific to Eko-Viikki were also addressed in the last five questions of the interview guide (Q 18–22).

Experts were more knowledgeable when responding to these questions. Since laypersons live in different apartments (either in the rented or right-of-occupancy category) and buy houses or apartments, and they observe others purchasing houses, installing solar panels, and so on, the last five questions were also asked to learn their views, experiences, and perceptions regarding others (i.e., the acceptance of solar energy by people).

For Article I, the background-related question (Q 1), respondents’ adoption status and intention to adopt solar energy (Q 2), public perception and preferences related to solar energy adoption (Q 3), and some of the questions related to the three dimensions of social acceptance (Q 7, Q 8, Q 10, Q 11, Q 12, Q 13, and Q 14) were included in the interview guide to obtain information about the intention-behaviour gap. Although I intended for Q 7 to elicit information related to support structures, specific supports (namely the feed-in tariff and net metering) were included separately in Q 8.

Article II also includes the same background information of the respondents (Q 1). Although a conceptual framework is presented in Article II, Section 3 notes, “Based on the stated literature as an initial outcome of pre-testing of the research in the Eko-Viikki residential area in Helsinki, this study determined the key terms (related to states of WTA and customer segments), and the conceptual framework was developed” (Article II, p. 98). Thus, the interview guide was not strictly designed based on the key concepts of the theoretical framework of that article; rather, it was a co-production of the literature and the pre-testing of the interview guide. The pre-testing phase helped me include and modify Q 2, Q 5, Q 6, and Q 14. It also helped me realise that most of the Eko-Viikki residents could be found on the weekends, and I obtained the same information from one of the respondents while pre-testing my interview guide in Eko-Viikki. The first part of Q 2 “Please tell me about

your adoption status, type of residence” is also included in this article to present respondents’ common background information. To elicit information on WTA (its states, customer segments, and associated patterns of social acceptance), the article includes questions on the public awareness of solar energy adoption in Finland (Q 4), expressions of types of WTA solar energy (Q 5), the reasons for the poor adoption rate of solar energy by the public (Q 6), and the existing barriers to the adoption and market diffusion of solar energy in Finland (Q 9).

Likewise, in Article III, Q 1 and the first part of Q 2 are included as background information. It also includes the article-specific questions; different routes of adoption and related business models (Q 15); the existing and potential route choosers (and their own situation) based on their preferences (Q 16); and the present and projected (future) tendencies of solar energy systems to be installed, owned, and used by people in Finland (Q 17). To obtain relevant case-specific insights from Eko-Viikki, the last five questions of the interview guide (Q 18–22) are addressed in all three articles. It is important to note that some background information on some of the experts was already known. In such cases, they were not asked those questions. Table 6 lists the questions asked during the interviews, and it presents how the questions were distributed among the three articles.

Table 6 Interview questions (Q) and their use in three articles.

| Interview questions | Use in articles |
|---|--|
| Q 1. Background information related questions (age, education, expertise and occupation, and organisation of work) | All articles in different respects |
| Q 2. Please tell me about your adoption status, type of residence and your plan to adopt. Please also discuss your ideas about the intention (plan) of Finnish people who want to adopt solar energy. | The first part of Q2 (i.e., please ... residence) in all articles Rest of Q2 in Article I |
| Q 3. Please describe [your and] the public’s perception/thoughts and preferences related to solar energy adoption as a clean energy source in Finland. | Article I |
| Q 4. Please describe [your and] the public’s awareness related to solar energy adoption in Finland. | Article II |
| Q 5. Please describe the types of willingness [you and other] people express to adopt solar energy. | |
| Q 6. Please describe the reasons for the public’s poor adoption rate of solar energy. | |
| Q 7. Please describe the investment support structure related to solar energy adoption. | Article I |
| Q 8. Please describe the feed-in tariff, and net-metering matters related to solar energy (if known). | |

| | |
|---|---|
| Q 9. Please describe the existing barriers to the adoption and market diffusion of solar energy in Finland. | Article II |
| Q 10. Please describe legislative issues related to solar energy adoption. | Article I |
| Q 11. Please describe political commitments related to solar energy. | |
| Q 12. Please describe technological barriers related to solar energy. | |
| Q 13. Please describe social barriers related to solar energy adoption. | |
| Q 14. Please describe the solutions to remove those barriers and to increase the rate of solar energy adoption among the public. | |
| Q 15. Please describe different routes (different ways) of adopting solar energy and related business models. | Article III |
| Q 16. Please describe the existing and potential route choosers based on their preferences. [Please also indicate your position.] | |
| Q 17. Please describe the present and projected (future) tendencies of solar energy systems to be installed, owned, and used by people in Finland. | |
| Q 18. Please share your ideas about the solar-community concept, considering the example of solar energy integration in 10 buildings in Eko-Viikki. | All articles where applicable, but different phrasing was used. |
| Q 19. Please describe its impact on people. | |
| Q 20. Please describe the involvement of residents in terms of their ownership feeling and maintenance issues. | |
| Q 21. Please describe the challenges of the solar-community concept. | |
| Q 22. Please describe its prospects in Finland. | |

3.4 DATA ANALYSIS

I have used a content analysis strategy (see Elo & Kyngäs, 2008; McIntosh & Morse, 2015) to gain an in-depth understanding and generate knowledge from the raw empirical data. Since, epistemologically, qualitative content analysis works as the co-creation of the researcher and the respondent during the data-gathering period and also as the co-creation of the researcher and the transcribed text during the interpretation period (Graneheim, Lindgren, & Lundman, 2017), I have adopted this approach in my data analysis not only to categorise explicit content but also to include implicit themes through the interpretation of the latent content in relation to the RQ at hand.

I transcribed the audio-taped interviews for each research topic. Respondents were identified with their basic information, which helped me to comprehend their responses and interpret the research results. This was only for data analysis purposes; in presenting the research results, I avoid using any basic information that could reveal the respondents' identities. After transcribing the raw data, I read it several times to obtain a general sense of the data and to reflect on its meaning. This also enabled me to look beyond the

“surface description and general summaries” (Graneheim et al., 2017, p. 30) and to assess the deeper meaning of the research data.

In categorising respondents based on their adoption or non-adoption status, I adhered to maintain the patterns of social acceptance concepts discussed in the literature review chapter (see Section 2.7.1 and Table 2): adoption (adopters/users), acceptance in principle (unconditionally or conditionally positive-minded, reluctant, and undecided people), rejection (rejecters), and opposition (those who opposed solar energy) to align with the “previously generated understanding” (Wolsink, 2019, p. 275). My research data also produced new insights (e.g., active adoption by being involved in the installation process, passive adoption by not being involved in the installation process but adopting and using the energy system, unconditional would-be adoption, and conditional would-be adoption). While determining the patterns of social acceptance based on the research results, I categorised the respondents based on their own positions and other Finnish people based on the respondents’ opinions about their positions (adoption status, preference, choices, and reasons for adoption and non-adoption). These patterns were interpreted and assessed based on the literature reviewed on the adoption of solar energy, policy issues, and the preferences of people in Finland. Additionally, some statements indicate that social acceptance is a dynamic position that changes to different patterns depending on people’s preferences. Thus, interchangeability of acceptance patterns that depends on different factors and conditions according to individual preferences was also identified.

I then identified statements related to the socio-political, market, and community dimensions of social acceptance. From these statements, I identified the personal and contextual factors and conditions that impacted the respondents’ adoption or non-adoption status and that of others in the respondents’ opinions. These factors were further categorised at pre- and post-adoption stages.

Although I have adopted the qualitative content analysis in this dissertation, the simple quantification of some qualitative data is presented in Article I to make the research results more approachable based on the reviewers’ comments. Thus, in Article I, some numerical percentages are plotted based on the intention and acceptance status (existing behavioural position) of ordinary (layperson) respondents (see Figure 2 in Article I). Since some experts did not provide details about their own intentions, they were not included in the percentages. However, expert opinions were considered crucial to comprehending the intention-behaviour gap in adopting solar energy among Finns. Article I focuses specifically on the intention-behaviour gap. Three categories of intentions are identified (based on the responses to Q 2 and Q 3): impression in principle, impression in practice, and actual intention. Furthermore, actual intention has three sub-categories: (a) firm and confirmed intention, (b) (un-)conditional intention, and (c) no/negative intention. These themes are explained in the article. The respondents mentioned various factors and rationalities (based on their responses to Qs 2,

3, 7, 8, 10, 11, 12, 13, and 14) related to the stated categories of intention and their behavioural responses (patterns of social acceptance) mentioned above.

Public WTA-related statements are assessed in Article II. Based on the objectives of this article and the statements respondents gave, relevant themes are categorised into three broad areas. Among those categories, states of willingness and customer segments based on WTA states are new themes. The last broad category is patterns of social acceptance, which is a behavioural response with the four sub-categories. The WTA states are sub-categorised as activated willingness, unconditional willingness, conditional willingness, and unwillingness. Although WTA-based patterns of customer segments—activated WTA adopters, unconditional WTA would-be adopters, conditional WTA would-be adopters, conditional WTA non-adopters, and non-WTA non-adopters—are mentioned in the theoretical construction section of this article, Article II also presents other important categories such as active adopters and passive adopters. Although the responses to Q 5 are the main source for these categories, interviewees' responses to Q 4, Q 5, Q 6, and Q 9 reveal the personal (and motivational) and contextual factors that impact the WTA-based customer segments in their patterns of acceptance at pre- and post-adoption stages (see Table 2 in Article II). Further consideration of the pre- and post-adoption factors as identified in terms of socio-political, market, and community dimensions is provided in this article.

Article III clarifies public readiness to adopt solar energy in Finland. I broadly categorise the statements related to this article as route preferences, route choosers, and future prospects based on the respondents' responses to Q 15, Q 16, and Q 17. This article also accommodates patterns of social acceptance as “lenses of social acceptance”. Moreover, these categories have different sub-categories, which are presented in this article.

Eko-Viikki case-specific responses (based on Q 18, Q 19, Q 20, Q 21, and Q 22) were also assembled and analysed to determine their applicability in the three articles. The solar-community concept, its positive and negative sides, matters related to the feeling of ownership and maintenance of a solar energy system in a solar community, existing challenges, and the concept's prospects were identified. Responses to the probes and prompts are also analysed in each article where specific interviews have allowed.

Throughout the dissertation, including this chapter, I have used patterns instead of types or categories, mainly to indicate that the typologies identified (patterns) are different forms of regular or repeated ways in which different pre-behavioural mental states take form and are revealed as behavioural responses or reactions.

3.5 RESEARCH ETHICS

I provided the respondents full freedom to decide whether to participate in the interviews. I explained the purpose of my research and asked them to spend

some time answering my RQs. I also assured them that their personal information would not be disclosed and that the research data would be used only for research and academic purposes. Thus, after transcription, I destroyed the records and the list that contained their identification. I tried to elicit information from interviewees without any kind of manipulation. I have acknowledged relevant literature with proper references, and I have also sincerely attempted to reflect on the literature mentioned earlier and my contribution to this research to maintain its originality and avoid any duplication. Moreover, I report the funds and grants I received for this research and to finalise my dissertation. I acknowledge the support and contributions of different people and funding institutions that supported my research and study in the acknowledgements of this dissertation. Additionally, I mention the contribution of my co-authors in my articles. Finally, I report the support I received from doctoral seminars (e.g., Postgraduate Seminar on Social Policy) held at the Faculty of Social Sciences at the University of Helsinki.

4 SUMMARIES OF THE ORIGINAL ARTICLES

In the first chapter, I have posed the following three RQs:

- RQ 1. Why does the intention-behaviour gap to adopt solar energy systems exist?
- RQ 2. What are the patterns of WTA solar energy among the public?
- RQ 3. What is the public readiness to invest in and adopt solar energy?

In this chapter, I reflect on the answers to these questions based on the findings of the original publications (i.e., Articles I–III).

4.1 INTENTION-BEHAVIOUR GAP AND ITS IMPACT ON THE SOCIAL ACCEPTANCE OF SOLAR ENERGY

Various studies have addressed translating perception, attitude, intention, and other pre-behavioural states into behaviour (Ajzen, 1985), and intentions have been identified as the closest stage and the final instigator towards the exposure of a behaviour. Article I emphasises the merging of perceptions and attitudes with intentions and the comprehension and identification of different patterns of intentions (based on different levels of interpretation) in contrast with exhibited behavioural positions to assess and explain the intention-behaviour gap. Hence, Article I is a qualitative investigation conducted concerning some Finnish respondents (laypersons and experts), which is a novel approach compared to previous studies (e.g., Liu, Wang & Mol, 2013; Perri & Corvello, 2015; Rai & Beck, 2015). The inclusion of the TRA and the TPB in Article I serves more as a portion of Article I’s theoretical and empirical review of literature than as a theoretical guide. Thus, unlike the TRA and the TPB, which include Ajzen’s key themes (volitional control and perceived behavioural control), Article I addresses how attitudes, perceptions, and overall intentions are translated into different patterns of intentions, how these intentions are translated into and compared with various behavioural responses, and how all these sequences of behaviour are rationalised and influenced by multiple (a) personal and (b) contextual factors to explain the intention-behaviour gap and suppress the social acceptance of solar energy.

While identifying and categorising intentions as those “who have exhibited their firm intention by their current adoption status”, “who have a plan to adopt”, “who want to adopt”, “who like solar energy, but have no plan to adopt or have a conditional plan to adopt”, and “who have a negative intention (not

to adopt)”, all sorts of responses were treated and compared to the current behavioural positions of respondents. Respondents stated some forms of intentions they identified, which were appropriately placed into the abovementioned categories. For instance,

For doing any work, it is important to have a plan. The people who want to adopt solar energy also have their intention. Some may simply like solar energy. Some may like it and want to adopt it, but they cannot execute their intention because of some practical things. They may want some support or wait to accumulate money for the investment. Some may think that it is an extra cost and does not find a strong logic to install. Others may love the energy and have a specific plan to adopt without any change in the adoption [process] of solar energy (Expert 4).

I think people try to do what they intend. So, those [who] intend to adopt solar energy, also make an effort according to their intention to adopt solar energy. If your intention is strong, you may adopt it quickly. It is weak in the sense that you consider many things before you adopt. If those are okay or become okay, then you adopt. The adopters of solar energy have already shown their strong intention in their action to adopt (Expert 6).

I like the energy. I have no plan to adopt solar energy right now. Some people may plan to adopt when they get the basic knowledge of solar energy. However, when they consider the practical contexts of adoption, many of them remain inactive. They may think that the price is high, the climate condition, lack of investment support and services from the government, etc. (Layperson 12).

Article I presents the intention-behaviour gap through three forms of intention (mainly based on the responses to Q 2 and Q 3, Section 3.4): namely, (a) impression in principle, (b) impression in practice, and (c) actual intentions. These forms of intention influence behavioural responses (adoption, acceptance in principle, rejection, and opposition). They are the outcomes of three different interpretations of intentions. The inclusion of expert opinions has been effective in clarifying such interpretations while using laypersons’ opinions: experts have more knowledge, and they have their own predictions about solar energy adoption.

The article demonstrates that *impression in principle intentions* are mostly attitude-laden intentions (by translating attitudes into intention), which are largely the abstract positions of actors who have a weak commitment or unclear plan to adopt solar energy. The impression in principle intention to adopt solar energy is further explained by respondents’ “should-do” thinking and positive thoughts (e.g., solar energy is a non-pollutant, green energy, abundant, renewable, and better than many other energies) and emotions (e.g., green-loving and green-voting mentalities) that they relate to solar

energy. In this research, impression in principle intentions are those behavioural dispositions of individuals who underlie weak commitment or an unclear plan to adopt solar energy. Attitudes are mainly concerned with any behavioural dispositions towards a behavioural object, while impression in principle intentions indicate a weak commitment or unclear plan to adopt. For instance, one respondent said, “I am a non-adopter, but I like this [solar] energy. I have not yet decided to install these [solar panels] in my residence. Maybe I will think about it later”. Both experts and laypersons argued that demonstration effects (e.g., seeing solar-integrated buildings in Eko-Viikki) and peer effects (seeing some of the homeowners’ installation of solar panels in that locality or receiving positive motivation to adopt solar energy) can also generate positive impressions of this energy source. The article stresses that since solar energy adoption in regular residential buildings in Finland is not profitable (at the time of interview), although individual consumption is appreciated, the respondents and others who have adopted solar energy are mainly driven by their personal interests. Likewise, such interests were found among some lay interviewees’ adoption statuses (12%), but most of the respondents conspicuously remained non-adopters. Previous studies have also found that most Finnish people prefer solar energy, but the number of adoptions is low (e.g., Finnish Energy, 2018; Energiategollisuus ry, 2012). The article argues that intention does not typically provoke the accompanying behaviour if it is interpreted as an impression in principle, which suppresses social acceptance.

The article identifies the second pattern of intention, called *impression in practice*. This is a specific form of intention which includes elements that are actually heard or known about in broader social contexts and that relate to one another (e.g., a high investment cost may demotivate actors from adopting solar energy). The article argues that contextual factors have been people’s dominant consideration before adopting a technology such as solar energy. The impression in practice intention includes a decreased level of abstraction and is mainly practically oriented; desires are read considering rationalities and practicalities. For instance, interviewees recognised the following as unexpected contextual conditions: not knowing about a political commitment to support solar energy for household investment in solar energy and a lack of cost-effective energy solutions through solar energy innovation as socio-political contexts; high investment cost, long-term return on investment, and complexities in obtaining financing for solar investments as market factors; and viewing solar energy as a hobby, difficulties in achieving consensus and financing for solar community project including its maintenance, and controlling matters as community factors. However, some enthusiastic people have already adopted solar energy (12% of laypersons) and converted their firm intention into actual action (adoption), while others unconditionally plan to adopt it (have confirmed their intention but have not yet executed it in action; 4% of laypersons). Thus, they do not express the intention-behaviour gap (16%). The rest of those with positive perceptions and attitudes but who

have not yet adopted solar energy nor say when they will do so because of the contextual practicalities (including some personal reasons, such as not owning a house, a dislike of relying on the intermittent power supply from solar energy, and desire to have more than one source of power in their houses) exhibit the intention-behaviour gap (84% of laypersons). The article demonstrates that they have explained their reasons for non-adoption honestly and have expressed a gap between their positive attitudes and non-adoption activities.

The article presents three major differences between impression in principle and impression in practice levels of intentions in contrast with respondents' exhibited behaviours. First, the former deals with the general, abstract level of respondents' views. Conversely, the latter is concerned with practical scenarios. Second, while the former deals only with the attitudinal aspects that govern the intentions, the latter mostly represents the contextual factors and intentions (plans) of the actors. Third, the former demonstrates a gap in behaviour between actors with a positive attitude and their non-adoption status. The latter considers the intention-behaviour gap by including those who have plans to adopt solar energy soon, disregarding any change in the current contextual factors (e.g., support from the government).

Whilst impression in principle intentions address executed intentions versus non-executed intentions and while impression in practice intentions consider executed and confirmed-to-be-executed versus other intentions, to gain a full picture of the intention-behaviour gap, the totality of intention must be understood. Thus, as a synthesised view of the former two, the third pattern of intention, *actual intention*, is introduced in the article. It includes (a) firm and confirmed intentions that are executed, (b) confirmed-to-be-(un)conditionally executed intentions, and (c) negative intentions. The first sub-category represents adopters who display no intention-behaviour gap. The second sub-category refers to those who unconditionally confirm adoption but have not yet adopted and who have expressed their conditional intention by revealing no behaviour gap. Thus, the second sub-category represents acceptance in principle behaviour, where the behavioural gap is expressed by those who have unconditional intentions. The last sub-category is the no/negative intention, which represents the rejection and opposition types of social acceptance; people with this intention do not express any intention-behaviour gap.

Article I stresses that the analysis of conditional intention and related contextual factors (including personal factors) has mainly focused on suppressing the social acceptance of solar energy in Finland. It finds a positive impression among respondents towards solar energy, but the intention to adopt is mainly conditional. It also finds rational reasons for non-adoption. This article notes that it is unwise to use an impression in principle-based pattern of intention as the final base for assessing social acceptance because with decreasing abstraction, the downsides as a comparison between personal and contextual factors become apparent, which may diminish social

acceptance. It happens at the impression in practice-based pattern of intention. The novelty of this article lies in its interpretation of research results in three patterns of the intention-behaviour gap by introducing three types of intentions and by assessing the intention-behaviour gap based on individuals' actual intentions. These intentions, behavioural expressions, and conditions (needs/factors) also explain the intention-behaviour gap.

Article I discloses how different patterns of identified intentions vary from the exhibited behaviours of people (see Figure 2 in Article I), which differs from previous studies. It also considers how some people corroborate their intention with their existing behaviour and what makes them do so. Unlike those studies that rely only on the factors that arise from the discrepancy between intention and behaviour (e.g., positive intention but non-adoption), this study emphasises what factors impede the adoption decision of those who have the intention or no/negative intention and what factors enabled the intention of some to corroborate their actions through the adoption of solar technology. The factors affecting no or negative intentions have been found important since the interviewed laypersons live in a community that sees or knows about solar technology installations and adoption. Like some previous studies (e.g., Aitken, 2010; Batel & Devine-Wirght, 2015), this article also discloses the fact that, generally, people are not arbitrary; rather, they are honest and have rational reasons for their actions. When there is the intention to act and the individual possesses control over the action through rational considerations, it seems crucial to investigate the obstacles that inhibit triggering the decision. Therefore, perceived behavioural control is determined by the consideration of both the personal and contextual factors that influence the decision-making process. Such research can expose the reality and the reasons for the intention-behaviour gap, which can also help authorities implement the necessary initiatives to foster the market. Necessary initiatives could be, for instance, introducing investment incentives, disseminating information, or conducting promotional activities.

4.2 STATES OF WILLINGNESS TO ADOPT, CUSTOMER SEGMENTS, AND SOCIAL ACCEPTANCE

Article II identifies consumer segments of Finnish households based on their WTA solar energy. Consumer segmentation based on WTA can help with devising targeted strategies to quicken the diffusion of solar power to both affluent and low-income households. I describe various states of WTA in the four categories of activated willingness, unconditional willingness, conditional willingness, and unwillingness. This article assesses the segmentation of actors based on their states of WTA solar energy in five categories: activated WTA adopters, unconditional WTA would-be adopters, conditional WTA would-be adopters, conditional WTA non-adopters, and non-WTA non-adopters. It also discusses various patterns of social acceptance and that these

customer segments express and represent adoption (implied by activated WTA adopters), acceptance in principle (implied by unconditional WTA would-be adopters, conditional WTA would-be adopters, and conditional WTA non-adopters), and rejection and opposition (implied by non-WTA non-adopters). Based on the literature review conducted in Article II, I have identified these four states of WTA and five categories of customer segments concerning various patterns of social acceptance. This work develops a conceptual framework as a result of the literature review and pre-testing of the already prepared interview guide. To reiterate, Q1, the first part of Q2, Q4, Q5, Q6, and Q9 were used to obtain the required empirical data from the respondents (25 laypersons and 17 experts) through semi-structured interviews.

The findings of the article confirm the presence of four states of WTA solar energy among interviewees. The article presents *activated willingness* as the WTA state of those who have already activated their willingness after the successful conclusion of their decision and actions related to adoption. The second WTA state, *unconditional willingness*, refers to those who are willingly ready to adopt solar energy without being restrained by other factors. They aspire to adopt solar energy with little delay. The third WTA state, *conditional willingness*, is entangled with conditional factors (e.g., seeking support from the government and/or proper arrangement for the adopter households to sell their produced or surplus solar power to the grid). At the time of the fieldwork, there was no specific government support for the installation of solar panels at the household level (e.g., Ratinen & Lund, 2015), and selling individually produced solar power to the grid was possible (see Laihanen et al., 2016) but mostly unwelcome because the buy-back rate was lower than the market price (see Child et al., 2017). According to the article, people with this WTA aspire to adopt solar energy and perform relevant activities to satisfy their willingness if their concerns related to several factors are partially or fully satisfied. Those who have no WTA (due to different reasons or a dislike) or who may act against adopting solar energy (by saying negative things about it or by performing other similar actions) are assigned to the *unwillingness state*.

This article further delineates five categories of customer segments drawn from these WTA states. The *activated WTA adopters* are those who have adopted solar energy. They have the ability and strong WTA tendency, and they take prompt action and adopt solar energy. The *unconditional WTA would-be adopters* are characterised by their firm willingness and positive decision. Their actions are positive towards adopting solar energy, but their non-adoption does not imply any negative activity. Customers in this segment are those who are willing to install solar energy technology without any change in the current conditions. Both activated WTA adopters and unconditional WTA would-be adopters have certain pre-adoption characteristics, such as being lovers of new technology, having a green-loving mentality, being financially solvent, owning their house/apartment, and exhibiting a serious desire or enthusiasm. Additionally, in the article, I note that in Finland, renting a residence is enough for a green electricity connection since residents

make their contracts with the energy provider. Furthermore, discounting the fact of one owning or renting accommodation, an individual could become an adopter by investing in a solar power plant (e.g., the energy company Helen's Suvilahiti and Kivikko solar power plants).

The article then describes *conditional WTA would-be adopters* who express their consent to adopt solar energy if some or most of their desired conditions (factors) are satisfied. A similar category is the *conditional WTA non-adopters*, who have mentally accepted solar energy but have not yet decided to adopt and perform related activities. Both conditional WTA would-be adopters and conditional WTA non-adopters share some common pre-adoption conditions: they favour new and environmentally sound technology with cost as their main concern; they are financially solvent or insolvent but are unwilling to absorb higher prices for solar power compared to cheap, grid-based basic electricity; they may or may not own their house or apartment; they are unwilling to rely on fluctuating solar power unless cost-effective backup solutions are available; they seek different supports (e.g., household investment support, net metering, and/or feed-in tariff); they want accurate, full, and properly disseminated information about feasibility, investment cost and return, support structures, and business models; they desire an equivalent market price for solar energy produced when selling it to buyers; they want to see more practical demonstrations and successful cases of the installation of solar power systems; and they seek political commitment (there is no specific target for solar energy in the country; see note for Table 2 in Article II).

The last customer segment is the *non-WTA non-adopters*, who are unwilling to adopt because of unsuitability, unaffordability, or non-profitability concerns, and they may exert opposing activities towards the adoption of solar energy for these reasons. The article further identifies certain pre-adoption conditions (e.g., financial solvency or insolvency, owning or not owning a house or apartment, unwillingness to allow a higher cost for solar power compared to cheap, grid-based basic electricity, and unwillingness to rely on fluctuating solar power caused by long winters with a mostly dark sky and short summers in Finland). The article further stresses that those who become non-adopters after adoption are characterised by their discontinuation of adoption or use as a result of changing energy sources, selling property, or moving to another location.

Finally, the article reveals how these categories represent different patterns of social acceptance. The behavioural response of adoption is represented by activated WTA adopters through their activated state of WTA. These elements (adoption, activated WTA adopters, and activated state of WTA) represent the post-adoption stage, in which there are opportunities to continue or discontinue adoption or (de-)motivate others towards solar energy. Acceptance in principle is represented by unconditional WTA would-be adopters, conditional WTA would-be adopters, and conditional WTA non-adopters through their unconditional and conditional states of WTA. These aspects correspond with the pre-adoption stage, in which, as before, there are

opportunities to continue or discontinue non-adoption (i.e., one could shift to adoption, rejection, or opposition). According to the respondents at this stage, personal and, most importantly, contextual factors play a significant role in actors' decisions and actions. Non-WTA non-adopters present rejection and opposition patterns of social acceptance as their behavioural response through their unwillingness state of WTA. These terms (rejection, opposition, non-WTA non-adopters, and the unwillingness state of WTA) relate to the pre- and post-adoption stages, where there are also opportunities to continue or discontinue (non-)adoption (i.e., one could shift to any other pattern of social acceptance) or demotivate others from solar energy. The article stresses that, at this stage, personal and contextual conditions play a significant role in actors' decisions and actions.

Article II stresses that these states of WTA solar energy help identify actors of heterogeneous groups who represent three (or four if rejection and opposition are separated) patterns of social acceptance because of their various states of WTA. These are the results of different personal and contextual factors at the pre- and post-adoption stages. This diversity of WTA states, heterogeneity in customer segments, and the patterns of social acceptance indicate that some may adopt. In contrast, others may remain unwilling and will not adopt, though this will depend on the demand and the social and contextual features (i.e., factors) of the product or technology in question. Understanding and identifying such heterogeneous customer segments based on their needs and expectations—the pre- and post-adoption conditions—facilitates “segmented communication approaches” (van Rijnsoever et al., 2015, p. 818). This can also improve the acceptance of renewable energies such as solar energy. By explaining “to what extent and under which conditions” (Steg et al., 2015, p. 2) actors are willing to accept or adopt solar energy, this article further contributes to the understanding of sustainable energy transition.

The idea of identifying reasons for WTA and segmenting consumers based on WTA states is novel. The identification of heterogeneous consumer segments and various pre- and post-adoption factors for each customer segment is distinct, which is expected to help with targeted intervention. People's WTA is distinguished into four states to know what form and how people express their willingness to perform a specific behaviour. Based on these four states of WTA, five categories of customer segments are also found to respond to their decisions, and the actions to adopt are not the same. For instance, some may have the WTA, but they may not decide to render an action. Some people having WTA may have made the decision but are constrained by time management or needed labour for the installation process. Thus, the treatment of all people should not be the same for the expansion of the solar energy market. Being in the same WTA state, people may behave differently. These thoughts have expressed the necessity to have four states of WTA and five categories of customer segments. Customer acquisition often tends to approach only the unconditional WTA without

regard towards moving people into the next adopter group, which this article addresses. Although Article II discusses WTA patterns, customer segments based on WTA states, and their relevance to the patterns of social acceptance, it does not offer a clear account of the readiness aspect in terms of available and preferred routes of adoption or the diverse route choosers in the acceptance of solar energy. Article III emphasises these matters.

4.3 READINESS TO ADOPT SOLAR ENERGY: PREFERRED ROUTES OF ADOPTION, ROUTES CHOOSERS, AND ADOPTION PROSPECTS

Article III focuses on public readiness to invest in and adopt solar energy. Despite the solar energy market's advancement through various field-configuring events, the decreasing price of solar panels, the positive functionality of solar panels in cold and dustless weather conditions, the improvement of innovation in solar thermal heating, the introduction of various and highly appreciated business models, the impact of award-winning demonstration projects (e.g., the Eko-Viikki solar-integrated residential area in Helsinki), and the popularity of solar community projects (e.g., the Kivikko and Suvilahti solar plants in Helsinki), people have long been hesitant to rely on solar energy. It has not been widely accepted in Finland (see also Karjalainen & Ahvenniemi, 2019). This article examines public readiness to invest in and adopt solar energy while focusing on (a) the identification of various routes of adoption and preferences, (b) the determination of the route choosers, and (c) the prospects for solar energy based on the opinions of respondents. While the focus is on consumer/citizen adoption or investments, the findings include some business activities (e.g., a discussion of business models, solar power plants, and the Helen Energy Company). This study presents more of what both laypersons and experts say about possible adoption—rather than focusing in detail on the real routes of adoption—to emphasise the social dimension of acceptance, for which readiness is one of the crucial components.

Throughout the article, readiness to adopt is defined as the promptness of individuals to adopt solar energy based on the resources they have (ability) and their interest. The article first presents respondents' opinions about the nature of the social acceptance of solar energy in Finland concerning readiness to adopt. The article emphasises that for those who have already adopted solar energy, their readiness is already expressed by their adoption status. The article further argues that most Finnish people belong to the acceptance in principle category, which lies in contrast with the low number of individual adopters. Those who are unconditionally willing to adopt but are constrained only by lack of time or mental strength to adopt demonstrate the next level of readiness, in which adoption could happen soon. Some actors exhibit their interest but seek favourable conditions that would enable them to adopt solar

energy. Thus, they have a weaker level of readiness. Furthermore, there could be many people who have not yet thought about adopting solar energy; their readiness status is unsettled. The rejection and opposition patterns of social acceptance are briefly presented in the article as a reflection of Finnish citizens' attitudes and preferences. There is no concern for their readiness due to their unwillingness. The high prevalence of acceptance in principle and low level of adoption also confirm the findings of previous studies (e.g., Jung et al., 2016). Additionally, they corroborate the assertion that "the highly positive imagery of solar power is relativized" (Sütterlin & Siegrist, 2017, p. 356). The causes are mentioned in terms of personal and contextual factors at pre- and post-adoption stages.

This article offers an account of several routes of adoption that are mostly unknown or partially known to laypersons. According to the respondents, there is scope for direct individual adoption, and the actor can choose *production for own consumption*, *production for consumption and selling*, and *purchase from energy company* options at the individual level of adoption. *Passive* and *partial adoption* is also possible "by purchasing flats in solar energy-integrated buildings" and "by consuming solar district heating system captured in the summer by energy companies like Helen". Furthermore, the community-level adoption of solar energy is also possible through production for own consumption or production for commercial purpose. The article identifies four business models available to actors: turnkey solutions, the facilitator model, utility-side solar PV, and the joint purchase model. In explaining these routes of adoption, the article also stresses various relevant contexts and factors which influence actors' preferences, such as the Finnish do-it-yourself mentality, which the respondents preferred. As the respondents argued, it is also the Finns' highest preference. This is confirmed by previous studies that have revealed that household adoption of solar energy is the strongest segment in Finland and is ahead of other sectors, such as non-profit organisations, the agriculture and forestry service sectors, other industries, and energy companies (e.g., Heiskanen et al., 2017).

The article also emphasises the actors as route choosers. Based on the responses of laypersons and experts, the article presents four groups of route choosers with different sub-categories. In terms of age group, the article presents young people as the most environmentally concerned group, who are interested in adopting solar energy but remain non-adopters because they lack money and a personal home or apartment. Most of the middle-aged people expressed that they possess the conditional form of acceptance (i.e., acceptance in principle). However, most adopters of solar energy were middle-aged. Some stated that both middle-aged and old-aged groups of actors could be interested in installing solar energy. However, some mentioned that older people would be more dubious about doing so, as a recent study has also observed (Karjalainen & Ahvenniemi, 2019). The article also mentions the price-sensitive group of actors. Respondents noted that household investment

would be suitable only for “rich” people due to the high investment cost and long-term return on investment. Furthermore, some of the non-adopters considered the adoption of solar energy by others to be a matter of fashion. The respondents also reflected on geographic orientation: due to better sun, actors in Southern Finland would be more interested in installing solar panels than those living in the north. The opinions of some experts included that some parts of northern Finland (e.g., the coastal city of Oulu) with brighter days could attract actors to adopt solar energy there, as well. The respondents felt that environmental enthusiasts and new technology-loving actors remained the forerunners in adopting solar power, and these groups would represent most adopters in the near future. By identifying route choosers, the article expresses actors’ abilities in terms of their financial resources (e.g., money), emotional resources to experience empathy and sympathy (e.g., love for green technology or a “saving the environment” mentality), physical resources (e.g., body power or having one’s own house or flat to install solar panels), social and cultural resources (e.g., social network, living standard, or being referred or receiving guidance from others to purchase a product), and resources of education and age (e.g., having adequate knowledge and information; older people may not be interested in new ventures or investments).

The article also addresses the prospects of solar energy adoption among Finnish citizens. Respondents are optimistic about the diffusion of solar energy in Finland (Finnish Energy, 2018). However, they note some challenges that inhibit the pace of adoption. Solar energy’s unsuitability in the dark winter, investment benefits, and solar power storage (e.g., solar thermal energy) for the long-lasting winter were some of the technical areas of confusion. This article also highlights the apathy of politicians who consider solar energy non-worthwhile, the consistently low price of grid-based traditional electricity, the lack of security and confidence in investing in the intermittent power source, the lack of knowledge among common people about the energy, and other challenges as factors that impede the market growth of solar energy in Finland. The article also demonstrates that the public popularity of solar energy is increasing, and more adoption will occur if solutions to those challenges can be found. Finally, the article makes recommendations regarding the diffusion of solar energy in the country.

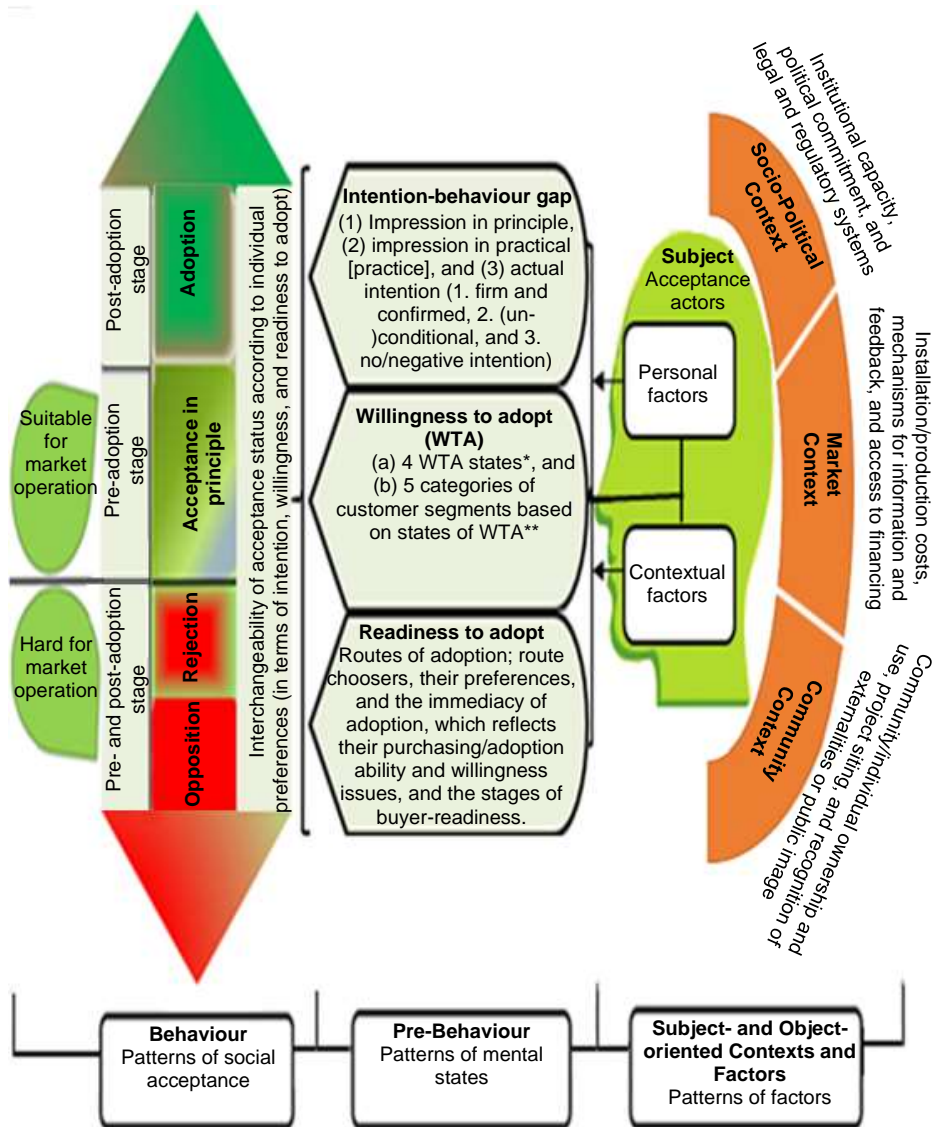
This article differs from previous studies in that it presents different facets of the readiness to adopt solar energy. The findings reflect laypersons’ and experts’ opinions about Finnish citizens, their preferences, and matters related to solar energy adoption. The article identifies the conditions that reveal the extent of the ability and the resources of various categories of route choosers. The article also provides a brief account of the prospects for solar energy. Furthermore, the findings suggest that public readiness will be greater (e.g., will involve more adoption) in the future.

5 DISCUSSION: HOW IS SOCIAL ACCEPTANCE CONCEPTUALISED?

Instead of using acceptance as the only attitude (acceptability), this dissertation considers different behavioural responses and reactions. Since behaviour is the outcome of some pre-behavioural mental states in which intention-, willingness-, and readiness-directed evaluations play pivotal roles, an understanding of social acceptance would be incomplete without them. Both personal and contextual factors in socio-political, community, and market contexts influence actors to evaluate the main object in question (e.g., a technology, product, or service) and to decide whether to adopt it. These points are part of the operational definition and the framework of social acceptance in this dissertation based on the acceptance of solar technology by actors in Finland. This makes its conceptualisation different from those of earlier studies discussed in this dissertation; therefore, it is expected to contribute a comprehensive view of social acceptance.

While conceptualising social acceptance, I have presented the research findings in terms of the intention-behaviour gap, WTA, and readiness to adopt solar energy with examples from the Eko-Viikki residential area. While previous Finnish studies on solar energy have addressed issues of attitude, intention, or willingness, there has been an absence of studies aiming to comprehend these issues concerning behavioural expressions such as adoption, acceptance in principle, rejection, and opposition in a single study. While studying social acceptance, public readiness to adopt must be addressed because consumers' preparedness in each community to accept a new technology can determine the future change in their lives through their behavioural expressions. This dissertation argues that both actors' pre-behavioural mental states and existing behavioural positions must be addressed to achieve a comprehensive understanding of social acceptance. Based on the empirical findings, I have summarised and operationalised the term social acceptance. This definition of social acceptance is based on the adoption of solar technology at the Finnish household level. This definition is applicable in the acceptance and adoption processes of solar technology where roles of individual actors matter a great deal. Furthermore, this definition is open to other technologies according to their contexts and actors of acceptance. I define social acceptance as follows:

Social acceptance can be defined as the behavioural response (inaction, actions, and reactions) relating to an offered or on-site technology or socio-technical system based on the intention-directed (which includes attitude), willingness-directed, and readiness-directed evaluations of various personal and contextual factors derived from socio-political, community, and market contexts by the actors of a particular social unit (see Figure 5).



Here, * (1) activated WTA, (2) unconditional WTA, (3) conditional WTA, and (4) non-WTA.

** (1) activated WTA adopters, (2) unconditional WTA would-be adopters, (3) conditional WTA would-be adopters, (4) conditional WTA non-adopters, and (5) non-WTA non-adopters.

Figure 5. Social acceptance – the conceptual framework.

This operational definition also explains the conceptual framework of social acceptance (see Figure 5). This framework derives its main insights from three articles and Lucke's (1995) social acceptance theory. The triangle model of social acceptance (Wüstenhagen et al., 2007) and its nine criteria (Sovacool

& Ratan, 2012) have also contributed valuable perspectives. In this framework, I consider behaviour as patterns of social acceptance, pre-behaviour as patterns of mental states, and subject- and object-oriented contexts as patterns of factors. Respondents also exhibited these factors in the interviews. The key features and logical grounds of this definition and the explanation of the conceptual framework are related to each other in Figure 5.

There is a tendency to deal with positive responses to address social acceptance and many existing studies have found this (e.g., van Rijnsoever et al., 2015; Dermont et al., 2017; Langer et al., 2018). The stated definition includes the behavioural response, which is open to positive or negative responses. The findings of my three articles confirm Lucke's (1995) assertion, which emphasises the need to consider both acceptance and non-acceptance in the conceptualisation of social acceptance. According to my empirical results, 12% of laypersons were in the adoption category, 84% were in the acceptance in principle-oriented category, and 4% were in the rejection and opposition categories (see Article I). Although the highest percentage of laypersons was non-adopters, they had a positive attitude towards solar energy. Article I presents the acceptance in principle category as a combination of unconditional would-be adopters, conditional would-be adopters, and non-adopters. In Figure 5, the suitable for market operation and hard for market operation parts indicate positive (adoption and acceptance in principle areas) and negative (rejection and opposition areas) response areas, respectively, which are supported by the research findings. Both laypersons and experts reported that most Finns have positive feelings towards solar energy and that the solar market situation is changing in this direction. For instance, one respondent said, "I think more people will adopt solar energy in the future. The interest of people for solar energy is increasing day by day" (Expert 15).

The behavioural response is characterised by inaction, actions, and reactions which are again open to adoption (Rogers, 2003; Heiskanen et al., 2014; Scheer et al., 2017; Langer et al., 2018); acceptance in principle (Heiskanen et al., 2014); rejection (Rogers, 2003; Kleijnen et al., 2009; Langer et al., 2018); opposition (Kleijnen et al., 2009); and other in-between responses such as indecision, postponement of adoption decision, indifference, conditional acceptance, and approval (e.g., Kleijnen et al., 2009; Scheer et al., 2017; Langer et al., 2018). Figure 5 portrays the patterns of social acceptance adoption (active users' acceptance), acceptance in principle (non-users' acceptance and postponement of adoption activities, undecided, indifferent, conditional acceptance, and approval), rejection (decision not to accept), and opposition (exerting innovation/product sabotage activities). In the three articles, adoption is interpreted as (a) the firm and confirmed intention of those who have (b) activated their WTA and (c) exhibited their readiness through their adoption activity; acceptance in principle as the (a) (un-)conditional intention of those who have (b) unconditional WTA and conditional WTA, and (c) expressed their unconditional and conditional

readiness to adopt; rejection as the (a) lack of intention of those who have (b) non-WTA and have (c) not expressed their readiness to adopt; and opposition as the (a) negative intention of those who have (b) non-(negative) WTA and (c) have expressed their readiness by speaking or working against the technology. The opposition type of readiness became apparent when a respondent expressed unwillingness to adopt and stated that solar energy could not be a better option than other available sources by citing the high investment cost, the intermittency of solar power, or CO₂ emissions while manufacturing solar panels.

Figure 5 further labels these patterns of social acceptance as pre- and post-adoption stages. The positive-minded adopter may continue using solar energy and express positive aspects or share their adoption experience with others. For instance, one adopter layperson expressed, “What kind of energy do you use? If it is a clean energy like wind or solar, then it is, of course, better than those that are producing carbon and polluting the environment” (Layperson 20). Acceptance in principle is included in the pre-adoption stage because of the actors’ non-adoption status. In the case of technological innovation, acceptance in principle can be a pre-requisite, but actual adoption and use determine its market success. Positive-minded people representing acceptance in principle may not actually adopt RETs (as observed in the three articles), but actual adoption palpably demonstrates a strong, positive acceptance that can help the solar market grow. Rejection and opposition fall into pre- and post-adoption stages because one may reject innovation before adopting it. On the contrary, after adoption, the cessation of the innovation’s use or discontinuation shifts the adopter into a rejection pattern that is a post-adoption stage (see Article II in Table 2). The term opposition is an intense form of rejection because opposing actors not only reject but also engage in product/technology sabotage activities (e.g., negative word of mouth). Furthermore, after adoption, people may fall into the rejection category again if they do not continue the adoption. The behaviour part in Figure 5 also includes the variable and flexible nature of actors who can shift to any other pattern of acceptance from their current position based on their preferences (in terms of intention, willingness, and readiness to adopt). For instance, as mentioned in Article II, one adopter purchased his apartment in a solar-integrated building in Eko-Viikki from a previous owner who fell into a discontinuation of adoption based on selling that property. However, both laypersons and experts opined that more people would adopt solar energy in the future. For instance, one layperson said, “I think the time is now ready, and people will soon start installing solar panels on a greater scale” (Layperson 21). This means that many non-adopters would become adopters. In this way, the research findings present social acceptance as a dynamic and polycentric approach.

By describing intention-directed, willingness-directed, and readiness-directed evaluations, the abovementioned definition covers the pre-behavioural mental states that actors must pass through to exhibit a chosen

pattern of acceptance towards a proposed or on-site technology or a socio-technical system (in this study, solar energy). Although intention-directed evaluations (Ajzen, 1985, 1991; Carlisle et al., 2015; van Rijnsoever et al., 2015;) and willingness-directed evaluations (Ajzen, 1985, 1991; Zhao et al., 2015; Steg et al., 2015) have been included in previous literature in a different manner, the inclusion of readiness-directed evaluation as described in Sections 2.7.3.3 and 4.3 and in Article III has remained marginal in solar energy studies (e.g., Bertsch et al., 2016). In Article III, I explain various routes of adoption and preferences (individual and community adoption) and route choosers (who would invest and adopt). For instance, I found that there is a greater tendency towards the individual (household) adoption than community adoption. Although young people are the most interested group, financially solvent middle-aged homeowners hold a greater possibility of adopting than other demographic groups. While explaining who the route choosers are, one respondent said, "I think those who want to adopt solar energy are the route choosers of solar energy. Those who have enough money and who are ready to spend a lot of money on solar energy find out the routes and ways to adopt solar energy" (Layperson 5). Many laypersons remain unaware of the different solar business models to address individual adoption; this is considered an information resource lack, as the respondents explained. While reading business literature, I learned in detail about the consumer-readiness issue. I included it as the third pre-behavioural mental state in the study of the social acceptance of solar energy. Although some of these matters (e.g., business models, customer preferences, and so on) have previously been studied (e.g., Ruggiero, Varho, & Rikkonen, 2015), there is a gap in the social acceptance studies to address customers' readiness issues.

In Figure 5, the pre-behaviour area includes intention, willingness, and readiness as patterns of mental states that are closely related to each other. In my research (Article I), the synthesis of impression in principle-based intention and impression in practice intention reveal (a) firm and confirmed intention, (b) (un-)conditional intention, and (c) no/negative intention. The firm and confirmed intention, activated WTA, and required readiness to adopt are expressed in the adoption activity. If the unconditional intention in association with unconditional WTA does not corroborate required readiness, the adoption process is delayed. Likewise, unconditional WTA and readiness without unconditional intention may not produce an adoption activity. As one expert said, "Many people may like solar energy, and many may also have the willingness to adopt, but only some of them have concrete intention" (Expert 5). The adoption process could also be delayed if the unconditional intention and required readiness fail to corroborate the essential willingness (unconditional WTA). For instance, one respondent said, "You will also find some people who have a strong willingness, and they are financially solvent. However, they are not so enthusiastic about sparing time to get relevant information and to install solar panels" (Expert 5). If there is strong intention (unconditional intention) and willingness (unconditional WTA) with no

deficiencies in readiness to adopt, the adoption process is not delayed: “some people with strong interest and willingness invest without making much delay” (Expert 5). Conditional intention combined with conditional WTA cannot succeed in adoption unless those conditions are met according to the expectations of individuals. Likewise, no or negative intention and non-WTA cannot succeed in adoption no matter what kind of readiness an individual has. The results of my research stress the positive balance in the pre-behavioural mental states to be succeeded in the adoption of solar technology. How keen an individual is and what their focus towards a goal or purpose is can determine how effective an intention is. To execute an intention into action, the level of preparedness an individual has determines how promptly the work could be done. Thus, Figure 5 presents the intention, willingness, and readiness points as pre-behavioural mental states that are interlinked and necessary to execute an action. This is why, Articles I–III demonstrate how intention, WTA, and readiness to adopt influence the acceptance of solar technology in terms of adoption, acceptance in principle, rejection, and opposition patterns of social acceptance.

The definition also mentions personal and contextual factors that are subject (actor)- and object-oriented. The type of actor and the item of acceptance are dependent on a variety of factors. Actors evaluate these to make decisions and behave accordingly. Personal factors indicate the psychological factors that originate through the nexus between an actor’s characteristics and their interactions with society. Contextual factors denote the objective features of a product, technology, or energy alternative at hand as determined by the contexts (Perlaviciute & Steg, 2014). In Eko-Viikki, most of the respondents revealed a positive attitude towards solar energy. Sceptical responses such as “there is a common feeling that solar energy is unsuitable in Finnish weather” (Layperson 20) and “having solar panels on the rooftops is a hobby thing of the adopters” (Layperson 13) were also provided. In Article I in Section 4.1, for instance, personal factors are detailed under the “Impression in Principle and Behaviour” heading. The definition also states that these factors emanate from socio-political (institutional capacity, political commitment, and legal and regulatory systems), community (community/individual ownership and use, project siting, and recognition of externalities or public image), and market (installation/production costs, mechanisms for information and feedback, and access to financing) contexts that are relevant to the actors in different respects in their process of adoption. These contexts have also been identified in earlier studies (e.g., Devine-Writh, 2007; Wüstenhagen et al., 2007; Sovacool & Ratan, 2012; Dermont et al., 2017; Devine-Wright et al., 2017). The respondents mentioned the lack of domestic investment support, high investment cost, lack of political commitment, long-term investment return, failure to own a house, the complexity of installing solar panels on the rooftops of rented blocks of flats, and the fact that green electricity (e.g., solar PV) costs are higher than traditional electricity as contextual factors that slow the adoption process. In Article I in Section 4.2, for instance, contextual factors

are detailed under the “Impression in Practice and Behaviour” heading. In Figure 5, the factors and contexts area includes these contexts, from which the personal and contextual patterns of factors emanate. Actors evaluate these factors and thus shape their acceptance behaviour. The factors that influence the adoption decision are broadly discussed in all articles. While Article I and Article III present this aspect in the results and discussion section in a descriptive manner, Article II provides a list of pre-adoption and post-adoption factors in Table 2.

The definition also states that actors (subjects) of different social units make evaluations. Although several studies have categorised actors into various groups (e.g., Rogers, 2003; Montero et al., 2010; Rico & Brewster, 2010; van Rijnsouwer, van Mossel & Broecks, 2015), the definition is open to all. The possibility of adopters becoming non-adopters or performing opposition activities has been mentioned in Section 2.7.2 and in the Results and Discussion sections in Article II (see Sections 4.1 and 4.2). This definition treats every person as an actor and as having a position in the patterns of acceptance. Furthermore, these actors may represent any social unit.

Since the conceptual framework treats all actors as subjects, it is applicable to all dimensions of social acceptance, as outlined by Wüstenhagen et al. (2007). For instance, at the socio-political level, the acceptance of politicians or policymakers could represent the acceptance principle pattern of social acceptance if the object of acceptance is assessed positively. Thus, to ensure acceptance in principle at this level, logical assessment of the pros and cons of the given technology is required. For this intention, willingness or readiness are needed by the decision-makers and key stakeholders. Arguably, without acceptance in principle at the socio-political level, no prospect of a proposed technology can be envisioned in the market. In this case, no legal and policy support can be expected, and without this, the proposed technology cannot access the market. According to the respondents, there is no firm rule in Finland that could prevent growth of the solar market. For instance, one layperson said, “I think the legislation does not prohibit installing solar panels generally” (Layperson 1). Furthermore, there is investment support for municipalities, companies, and other legal entities (e.g., a legal social group that is eligible to access investment support). Additionally, as one expert said, “There is domestic labour cost support which can be received from the government” (Expert 4). No domestic investment support is available to install solar panels in Finland, which means there is already acceptance in principle to some extent at the socio-political level.

At the community level, there are individual installations. People also purchase apartments and live in solar-integrated buildings (e.g., the solar-integrated buildings in Eko-Viikki), but this is not a typical practice in Finland. One layperson said, “I think there is more awareness among people [living in Eko-Viikki] than other areas” (Layperson 8) to clarify that the installation of solar panels is not visible in most communities in Finland. Nevertheless, unlike the acceptance of wind farms at the community level, the acceptance of

solar energy by purchasing an apartment in a solar-integrated building or investing in a community-shared solar project of an energy company like Helen Ltd. (e.g., Helen's personal panel product) is easy and accessible. For instance, in Helen's solar power plants (e.g., Messukeskus, Kivikko, or Suvilahti solar power plants), individual customers can rent a panel at 4.40 euros per month, and they can deduct the energy each panel produces from their monthly electricity bill as a customer of the company. According to the key experts working at Helen, the community shared projects of the company have already received outstanding popularity, and now the company has become the forerunner in the utilisation of solar energy in the country. Interviewee experts of that company argue that some other energy companies have also started similar kinds of projects.

Regarding market acceptance, the respondents said that the price of solar panels continually decreases; there will be more information flow, and there are already some financing mechanisms to support the installation of solar panels. Thus, the market structure is becoming more acceptable every day. Actors at both the community and market levels can represent the stated patterns of social acceptance. However, at the market acceptance level, the organisations, investors, and consumers cannot be the adopters unless they adopt the technology in their organisational premises or residences. Their support and services resemble acceptance in principle. On the contrary, at the community level, actors have the option of representing any of the stated patterns of social acceptance depending on their intention, willingness, and readiness, as described in this dissertation (see Figure 2 in Article I, Figure 2 in Article II, and Figure 3 in Article III).

The novelty of this conceptual framework is that it includes both pre- and post-adoption factors while considering social acceptance. Actors' adoption mainly determines the level of a proposed technology's diffusion. It is important to assess their behavioural responses so that their active and passive interest, support, and opposition-related matters can be understood, and suitable policies can thus be drafted and executed. To reiterate, studying acceptance also means conducting research on non-acceptance (Lucke, 1995). The conceptual framework does not separate intention, willingness, and readiness from behavioural responses. This thereby allows one to gain a comprehensive conceptualisation. Although attitude or intention issues have been addressed in many of the studies cited, the specification and discussion of readiness to adopt as a pre-behavioural issue remain unaddressed (aside from some points of readiness) in solar or other RE studies. The empirical results confirm that the resources and opportunities available to actors dictate the likelihood of behavioural achievement. The conceptual framework also argues that intention, willingness, and readiness are not isolated and distinct entities but rather are connected to various factors on multiple levels; thus, different patterns of social acceptance are revealed. In all cases, the points mentioned in this framework offer interwoven links which must be addressed and assessed to comprehend social acceptance. A negligent or reluctant

approach to the key components of the framework may prevent a true understanding of social acceptance.

In the next chapter, I discuss social acceptance as a dynamic and polycentric approach, present a brief and preview-like summary of the empirical results, and highlight several lessons for the Finnish energy sector regarding how social acceptance should be addressed and what future research should pursue.

6 CONCLUSIONS

In this dissertation, I have emphasised how social acceptance is a dynamic, polycentric (i.e., it has more than one centre, such as adoption, acceptance in principle, rejection, and opposition) approach to the diffusion of RETs, especially solar energy. To the best of my knowledge, this is the first study to explicitly operationalise the concept of social acceptance by accommodating three pre-behavioural mental states—intention (including the intention-behaviour gap), willingness, and readiness—concerning existing behavioural positions of multiple actors. The study proposes a relevant conceptual framework. This dissertation addresses how various personal and contextual factors related to socio-political, community, and market contexts generate behavioural responses (four patterns of social acceptance: adoption, acceptance in principle, rejection, and opposition) by influencing pre-behavioural mental states. Personal and contextual factors can reflect pre- and post-adoption situations, including a case in which an adopter refers others to adopt or discontinue solar power connection (see Sections 2.5 and 4.2). I argue that actors' behavioural responses can freely shift from one behavioural response to any other.

My empirical results focus on the comprehension and explanation of the intention-behaviour gap to adopt solar energy as an output of personal and contextual factors, the rationality behind the intention-behaviour gap, and the suppressed structure of social acceptance based on three forms of the intention-behaviour gap: (a) impression in principle intention-related, (b) impression in practical [practice]'intention-related, and (c) actual intention-related. The “totality” of intention can be understood through the third form of the intention-behaviour gap. The empirical investigation reveals that the intention-behaviour gap should be treated at the actual intention level of analysis. This dissertation also discloses the presence of activated, unconditional, conditional, and unwillingness states of WTA. There are five categories of customer segments based on WTA states. The first category (activated WTA adopters) represents the adoption pattern of social acceptance. The second (unconditional WTA would-be adopters), third (conditional WTA would-be adopters), and fourth (conditional WTA non-adopters) categories represent the acceptance-in-principle pattern of social acceptance. The fifth category (non-WTA non-adopters) represents rejection and opposition patterns of social acceptance. This dissertation further presents public readiness to adopt solar energy regarding existing routes of adoption and customer preferences, the route choosers and links between readiness and patterns of social acceptance, and how respondents envision the future of solar energy in Finland. These empirical findings suggest several lessons for the Finnish energy sector and researchers interested in social acceptance research.

According to most Finnish studies (see Section 1.1), most Finns have a positive attitude towards solar energy, and in my empirical results, I found the same mentality among most laypersons. According to my conceptual framework and empirical results, they fall into the acceptance in principle pattern of social acceptance. Generally, they display a weak ability coupled with strong or weak willingness. As an exception, I found that the unconditional would-be adopters category also represents acceptance in principle. Laypersons in this category had a strong ability and willingness. Still, they were not sufficiently ready (e.g., because of laziness or a lack of managing spare time to install solar panels) to make the adoption quickly. I also found conditional would-be adopters and conditional positive-minded non-adopters in the acceptance in principle-based category who represent weak ability and WTA. They were not ready to adopt solar energy. Their conditions (personal and mainly contextual factors) should be heard and addressed with strategic actions to foster the adoption of solar or other similar renewable energies in Finland.

Contextual factors can determine the ability or inability of and the rationality among actors to make decisions and render actions towards adoption or non-adoption. In terms of policy-support contexts, the absence of household investment support to install solar panels worried some laypersons and prevented them from making an adoption decision. Furthermore, the lack of properly disseminated information (e.g., different business models), high investment cost, long-term investment return, lack of owning a house, living in rented apartments, and so on were marked as the contextual problems that prevented or stalled their adoption decision. In addition, fear about the feasibility of solar energy in Finnish weather, personal laziness, a lack of strong inner motivation or adequate peer references, and a failure to manage spare time to install solar panels and so on also slowed their adoption decisions. Since personal factors are related to the person and society, related psychological matters should be considered with great care. Thus, the consideration of both personal and contextual factors is important. It is necessary to adjust existing solutions to the problems narrated in terms of personal and contextual factors and conditions. Policymakers and energy companies should address these matters from their respective sides.

This dissertation suggests that the diffusion of solar energy could be enhanced even without changing the present support structure in Finland if the categories of actors under the patterns of social acceptance are properly approached with adequate information related to costs and benefits, support schemes, and business models. By developing a system of information sharing and inviting feedback and continuous (periodic or in any agreed-upon manner) follow-up, more actors could be motivated to adopt solar energy. This could be done at community housing committee meetings. For instance, every building area has a housing association, and the owners usually meet annually to discuss different issues. Concerned authorities (e.g., municipalities) could pass on appropriate information for those meetings, which could be

disseminated to attendees and non-attending owners. A continuous follow-up would also help. Furthermore, it could change the mindsets of other actors towards adoption because there is typically more or less an emulation tendency among people in the community to follow others in such cases. This would accelerate adoption for a considerable number of unconditional would-be adopters. The turnkey model, for instance, adopts the responsibility to plan and establish solar power systems, arranges generation equipment and grid connection, and offers the possibility of selling surplus power to the utility. This may push the unconditional would-be adopters to adopt without much delay. The joint purchase model, which offers cost-effective, easier purchase, may also attract many in the community to adopt. By having appropriate information and observing the adoption actions of the unconditional would-be adopters, many conditional would-be adopters could adopt solar energy. Furthermore, many of the conditional would-be adopters and conditional, positive-minded non-adopters could consider the passive adoption of solar energy without being involved in practical installation actions by seeing the current adopters and having a clear knowledge about the utility-side solar PV business model, which the energy company Helen has already launched.

Establishing more shared solar plants (e.g., Helen's Suvilahti solar power plant) and attracting more actors towards those plants and green electricity (e.g., solar PV-based) could also enhance the adoption of solar energy. Energy companies could develop their marketing strategies to address this matter. For instance, they could contact key persons of the community housing committee/associations, disseminate information, and offer presentations on their solar products in that community. They could also invite key actors from different communities to organise such presentations. The public display of successful demonstration projects could also promote more adoption.

As observed in Eko-Viikki, most laypersons had little knowledge about how solar panels function, the amount of energy they produce, and the cost-benefit matters in the solar-integrated buildings. If this information is displayed in solar-integrated buildings in a visible manner, inhabitants will become more knowledgeable and confident, and their tendency to refer to other actors will increase. Furthermore, seeing installations and displayed information could inspire outsiders to buy apartments in solar-integrated buildings, adopt solar panels in their residences, or purchase green electricity connections for their apartments.

The development of community peer cafés could allow actors from different communities to visit solar-integrated buildings or houses in the community, exchange their views, and share knowledge. This would also influence the acceptance and adoption process.

The development of community-to-community virtual networks and the dissemination of success stories (e.g., starting discussions about solar energy adoption, the number of adopters, would-be adopters, conditional would-be adopters, conditional positive-minded non-adopters, and so on) would further motivate actors of different communities to adopt solar energy.

If municipalities and energy companies contact different housing associations, a broader picture of actors who represent different patterns of social acceptance could be obtained, adequate information could be disseminated, and essential steps could be taken to quicken expansion of the solar market. In this way, both the affluent (e.g., for household installation) and low-income (e.g., for passive adoption through the utility-side solar PV business model), green-loving Finns could be included in the adoption process.

This dissertation further reveals that the existing Finnish adopters of solar energy display strong ability and willingness through such adoption activities. If the aforesaid steps are considered, these adopters would be motivated and gain better scope to refer to other actors. The rejection of and opposition to solar energy is very low among Finns, and I discovered the same result among laypersons as I did among the experts in my research. According to my respondents, actors who represent these patterns of social acceptance mainly express their unwillingness to adopt solar energy. The above steps could also attract these actors, and consequently, there could be a shift in their acceptance behaviour.

Social acceptance should not be treated as a literal positive attitude or a positive behavioural response (e.g., adoption and acceptance in principle) while disregarding the negative aspects (rejection and opposition). Examining adoption and acceptance in principle alone is not sufficient to comprehend the full meaning of social acceptance or to assess the prospects and challenges of innovation. The range of acceptance should be broadened to include non-adoption aspects, and the reasons of non-adopters for their rejection or opposition should be included. The various analyses and insights are regularly related back to the development of a more nuanced understanding of social acceptance of solar energy. This dissertation has brought to the surface a host of factors that are important for understanding when and how people are likely to consider accepting or adopting solar energy.

I propose to invest more effort in identifying the causes and factors that underlie the intention-behaviour gap to adopt renewable energies, such as solar energy. The intention-behaviour gap related to actual intention should be identified. Likewise, heterogeneous customer segments based on their WTA states and the conditions associated with their existing position at pre- and post-adoption stages should be identified because doing so could contribute to understanding the specific conditions and factors that are necessary for adoption. A further study of readiness to adopt would not only locate the determinants of readiness in terms of the resources, skills, and other abilities of the route choosers (customer segments) but would also specify their route preferences (i.e., preferred routes of adoption, including business models, facilities, and support structures), their ownership and engagement issues, and how promptly they aspire to adopt a technology, such as solar energy. Such an undertaking would allow us to not only address the forecasted solutions (e.g., the support and services already available) but also to entertain

actual, need-based remedies if required. This dissertation thus focuses both on forecasted solutions and actual need-based remedies that are not restricted to solar energy but are rather applicable to other renewable energies and innovations for which individual adoption and use matter.

Future research could be directed towards the acceptance, willingness, and readiness of actors at various times and in various spaces to understand what change has happened because of providing information, motivation, and follow-up activities or adding novel support for the installation of solar energy technologies. Additionally, future research could include a broader sample of respondents to obtain more comprehensible findings and discover solutions for the diffusion of solar energy technologies. Such a project would also be helpful in differentiating the actors into different customer segments, as described in this dissertation in terms of the WTA state. Additionally, the application of the intention-behaviour gap through the consideration of actual intention in future research would create a more accurate picture of the potential actors and the strategies and policies required to address the underlying personal and contextual factors. To achieve the targets of climate change mitigation through the decentralised generation of power from RESs, more studies that address pressing concerns related to social acceptance should be conducted.

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