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Results of intention-behaviour gap for solar energy in regular residential buildings in Finland

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Abstract

With a purpose to comprehend intention-behaviour gap about acceptance of solar energy and solar community concept (houses and/or block of flats under specific solar power plant) among Finnish respondents, this qualitative study found respondents' positive responses towards solar energy and their rationality and honesty in admitting their real behaviour. It focuses on the qualitative interpretation of individual's intention that corresponds to specific behaviour. In terms of their 'impression in principle' by thinking solar energy as a non-polluting, inexhaustible and renewable energy source although all respondents were positive, the highest numbers were non-adopters. However, they were optimists. They mentally accepted (acceptance in principle) solar energy. They would adopt it later on after being satisfied with their most contextual conditions ('impression in practical'). This study provides recommendations that indicate more future adoption and future research direction.

Keywords: Intention-behaviour gap; Social acceptance; Solar energy; Solar community concept

1. Introduction

Social acceptance of renewable energy technologies has been hierarchically presented in the literature as adoption (users' acceptance), acceptance in principle (non-users' acceptance and postponement of adoption activities), rejection (decision not to accept) and opposition (exerting innovation/product sabotage activities) mainly (Jung et al., 2016; Hai et al., 2015; Heiskanen et al., 2014; Kleijnen et al., 2009; Rogers, 2003). The term 'opposition' is an intense form of rejection because while opposing people not only reject but also exert product/technology sabotage activities in different manners. Furthermore, after adoption one may come again in rejection category, if one does not continue the adoption (Rogers, 2003). Conversely, word-of-mouth from satisfied adopter may influence others to adopt. Actually, what people say (intention) and how they actually behave (behaviour) do not go always hand in hand (Devinney et al., 2010). Frederiks et al. (2015) argued that a sizeable discrepancy can often be observed between intention and behaviour. Such behaviour has been considered in the literature as inconsistent and non-rational (Heinzle, 2012). Among citizens of European Union (EU) "solar energy has an extremely good public image" (Heiskanen

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et al., 2008, p. 62) as a symbol of 'alternative energy' and anti-nuclear movement or to reduce dependency on imported fuels. Likewise, as a member state of EU in Finland different studies have confirmed that Finnish people are strongly in favour of solar energy (e.g., Energiateollisuus ry, 2012; Eurobarometer, 2007). Conversely, in the national consumption of renewable energy in 2014 at 32% of total energy consumption, there was no contribution of solar energy (Fig. 1). In reality, the rate of solar energy adoption at the individual level is very marginal – mostly found in summer cottages, holiday homes, boats, etc. (Hakkarainen et al., 2015; Motiva, 2015). Furthermore, such adoption in regular residential places can scarcely be found. It may be, thereby, thought that social acceptance of solar energy in Finland is more or less suppressed. So, in terms of solar energy adoption question remains: why does this intention-behaviour gap exist mostly among common people to adopt solar energy systems and solar community concept (houses and/or block of flats under specific solar power plant)?

Although there are some solar and other renewable energy studies in Finland that have focused intention-behaviour gap directly or indirectly through the assessment of individual perception, knowledge and/or attitude (e.g., Jung et al., 2016; Haukkala, 2015; Pihlajamaa et al., 2013; Moula et al., 2013), intention-behaviour gap study of solar energy among ordinary adult Finnish people is rare. The dichotomy of high public support for solar energy with its very insignificant actual adoption rate in Finland draws the attention for qualitative investigations that are dealt in a human centred manner (Sovacool, 2014). To handle the stated research question by adhering first-hand qualitative investigation relevantly this article addresses the following objectives.

The first objective is to comprehend the patterns of intention-behaviour gap in solar energy adoption. Many times personal conditions in the shape of attitude may produce opposite behaviour. So, consideration of contextual conditions is important to determine actual intention and, thereby, to locate intention-behaviour gap (if any).

The second objective is to find out whether there is any rationality in the intention-behaviour gap of individuals. People are locked-in personal and contextual conditions to take a decision and express their convenient behaviour (e.g., Belz and Peattie, 2012; Botha and Atkins, 2005). These conditions jointly or individually can create individual's rationality towards his/her intention and behaviour.

The third objective is to comprehend how social acceptance becomes suppressed as a result of intention-behaviour gap. The magnitude of social acceptance of solar energy is dependent on individual behaviour that can be expressed in terms of adoption, acceptance in principle, rejection and opposition (Jung et al., 2016; Hai et al., 2015; Heiskanen et al., 2014; Kleijnen et al., 2009; Rogers, 2003).

The subsequent part of this article proceeds as follows. Section 2 presents the literature review with conceptual clarification, theoretical underpinning and previous empirical findings on different conditions, individual intention and behaviour to illuminate the construct of intention-behaviour gap. Section 3 deals with the detailed methodology employed in the study. Results and discussion of empirical research are described in the light of the reviewed literature in Section 4; and Section 5 concludes.

2. Literature review

2.1. Intention

Actually, literature presents conative component of attitude as individual intention (e.g., Lantos, 2011; Ajzen, 1985). Purchasing intention indicates an individual's readiness to buy a product that one has preferred for oneself after some evaluations on the basis of personal experience,

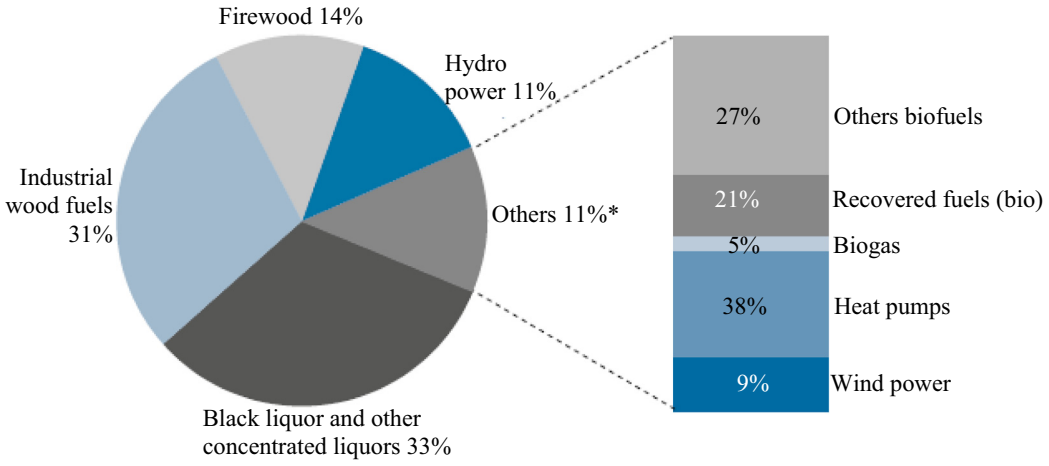

Fig. 1. Share of renewable energy in total energy consumption in 2014 (Statistics Finland, 2015, p. 9). *The divisions of the group Others are partly based on data for 2013.

perception, attitude, subjective norm (the perceived pressure received from the society to perform or not to perform a behaviour), external environment and perceived behavioural control (individual's belief about how easy or difficult to perform a behaviour) related to that product. It is one's conscious plan and promise to oneself whether to purchase a product or not after evaluating personal or intrinsic aspects (e.g., personal knowledge, feelings, etc.) and surrounding or extrinsic aspects (e.g., cost, benefit, etc.) that are posited in the theory of reasoned action (Fishbein and Ajzen, 1975). Fishbein and Ajzen's (1975) interpretation of the theory of reasoned action (TRA) asserts that attitudes are often entranced in an individual's motivation, cognition, beliefs, style of thinking and behaviour preferences. These determine the way an individual may perceive and/or adopt a technology. Purchasing intention is also determined by the level of individual knowledge about a product or technology (Bhakar et al., 2015). Park and Ohm (2014) claim that earlier studies have observed that individuals' acceptance and intention to use a technology are indirectly affected by their knowledge. According to Ajzen's (1985) 'theory of planned behaviour' (TPB) attitude and perceived pressure from the society (subjective norms) determine individual's intention to act. Park and Ohm (2014) found that perceived cost and attitude as antecedents of individual intention to use renewable energy in South Korea.

2.2. Behaviour: adoption or non-adoption

Behaviour can simply be interpreted as the actions or reactions of an individual towards a stimulus or situation. Different personal and contextual conditions influence attitudinal intention, either positive or negative, towards a product, service or an activity and finally, thereby, settle on the behaviour of individuals to adopt or reject it. The actual adoption or purchase of products and services by consumers has always received the main focus in conventional marketing and consumer behaviour theory (Belz and Peattie, 2012). As discussed in Section 1, people may also express their behaviour in terms of acceptance in principle, rejection and opposition (Jung et al., 2016; Hai et al., 2015; Heiskanen et al., 2014; Kleijnen et al., 2009; Rogers, 2003). Acceptance in principle can be treated as pre-adoption behaviour (Heiskanen et al., 2014; Rogers, 2003). Rejection and opposition can be treated as both pre-adoption and post-adoption behaviour. These are pre-adoption behaviours in the sense that before adoption these decisions are already met, but on the availability or fulfilment of different conditions some may adopt later on. As stated earlier, discontinuation of adoption may also produce rejection as a post-adoption behaviour (Rogers, 2003). A satisfied consumer with a positive attitude can refer other to use the same product. Some studies have shown that the consumption experience forms stronger and predominant attitude than attitude without such experience (e.g., Kim and Chung, 2011). Likewise, an 'opposition' can be a pre-adoption behaviour, but it can also be changed once reasons to opposition become nullified. It can be a post-adoption behaviour as well because being dissatisfied one may discontinue adoption and can play product sabotage activities.

2.3. Personal and contextual conditions: roles in intention and behaviour

Literature confirms that both personal and contextual conditions/factors can influence individual intention and behaviour towards adoption or non-adoption of an innovation (Botha and Atkins, 2005). These conditions can be monetary or non-monetary consisting of product features, geographical, economic, social, cultural, political and personal conditions mainly (Sovacool and Lakshmi Ratan, 2012; Bollinger and Gillingham, 2012). Personal conditions in terms of age, gender, education, occupation, income, marital status, belief, perception, attitude, etc., can influence one to adopt solar energy. Both TRA and TPB include intrinsic and internal factors (personal conditions) in terms of skills, abilities, beliefs, etc. Ajzen (1985) argues that novel situation or new information may pose unknown threats to carry out behaviour and, thus, may create an intention-behaviour gap. This view in terms of 'unwanted distractions' is also supported by Carrington et al. (2010). If there is fluctuation in individuals' confidence and commitment, such thing could happen. Ajzen (1985) adds, "... failure to act in accordance with the intention would indicate that the person had a change of mind" (p. 24). Carrington et al. (2010) argue implementation intention as the mediator between intention and behaviour. They further stress that the execution of an intended behaviour is dependent on the strength and completeness of implementation intention.

TRA and TPB also include extrinsic and external factors (contextual conditions). According to Carlisle et al. (2015), "Contextual factors have proven to be particularly relevant to explaining support and opposition to renewable energy" (p. 837). Intention can be changed and behavioural control can be influenced also by the effect of some external factors namely time and new information (Ajzen, 1985). Therefore, intentions cannot always translate directly into behaviour. These external factors are examples of different contextual conditions. However, Ajzen (1985) was mostly concerned with internal factors. It is Carrington et al. (2010) who stress on the influence of external or contextual factors that can obstruct direct translation of intentions into behaviour. In case of solar energy different conditions namely basic ideas about solar energy (e.g., what it is, relative advantage, risks and complexity), feasibility (e.g., weather condition, compatibility, perceived ease of use and perceived usefulness), research and innovation (e.g., know-how, cost-effectiveness, trialability and observability), support schemes: (e.g., investment support, feed-in-tariff, net-metering), investment cost and return, (e.g., purchasing and maintenance costs, durability of products), legislation

(e.g., installation permission, government/municipality bindings) and political commitment (e.g., specific commitment) (e.g., Hakkarainen et al., 2015; Haukkala, 2015; Ratinen and Lund, 2015; Heiskanen et al., 2014; Pihlajamaa et al., 2013; Moula et al., 2013; Pasonen et al., 2012; Sovacool and Lakshmi Ratan, 2012) play the role to think whether to will or un-will to adopt it. Architectural feature and design of buildings are also important contextual conditions (e.g., Pasonen et al., 2012; Faiers and Neame, 2006). For instance, to have maximum effectiveness in Finland it is necessary to install south facing solar panels in the rooftops and/or on walls of buildings that are unobstructed, either by other buildings or shades of trees (Pasonen et al., 2012). According to Islam (2014), energy cost saving and technology awareness have a significant impact on the adoption probability.

Positive attitudes and pro-environmental values have widely been considered as the reasons for individual decision to adopt renewable energies (e.g. Zhai and Williams, 2012; Hansla et al., 2008). Perceived risks, costs, benefits and fear about new technologies can influence individual behaviour and can cause resistance to changing energy sources (Huijts et al., 2012; Sovacool and Lakshmi Ratan, 2012). Consumers' non-adoption decision or no intention may not match with low environmental values or negative attitudes. Similarly, people may adopt solar panels to save electricity costs, but it is unwise to think that the rest of the people who do not do so are intending to waste money (e.g., Chatzidakis and Lee, 2012). Actually, different conditions determine individual's rationality for and against a behaviour that may vary qualitatively, and influence individuals' decision in varying manners (Westaby et al., 2010).

2.4. Intention-behaviour gap

The mismatch or inconsistency between consumer's expressed attitude, perception, awareness or approval and their behaviour related to adoption is euphemistically termed as the attitude-behaviour gap, value-action gap or intention-behaviour gap (Devinney et al., 2010). Attitude is a state of human mind that is expressed either in positive (favourable) or negative (unfavourable) manner towards an individual, group, object or event. In this context, attitude can be defined as "a relatively enduring organization of an individual's belief about an object that predisposes his or her actions" (Rogers, 2003, pp. 174–175). Intention is the conative component of attitude (see Section 2.1). Many researchers have found that in spite of having positive attitude and intention towards socially responsible and sustainable products people do not always thoroughly abide by their attitude and intention at the point to purchase or adopt (e.g., Carrington et al., 2010). To better comprehend how this gap is formed it is possible to differentiate between attitude-behaviour gap and intention-behaviour gap since attitude informs intention and intention informs behaviour.

In terms of attitude-behaviour gap consumers may favour sustainable and green product, but they may not adopt it due to inconvenience, price concerns, moral norms, personal beliefs, etc. that are discussed in Section 2.1. Devinney et al. (2010) consider, "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). According to Carrington et al. (2010) many researchers focusing this gap have accepted the notion that intention to adopt translates directly adoption behaviour. They maintained that this is the reason that has kept the understanding of intention-behaviour gap much shallow. It has been argued that traditional quantitative measurement issues are too simplistic in the measurement of attitudes and intentions and fail to capture different conditions (personal and contextual) in the decision making and behaviour process. Qualitative researches are considered valuable in intention-behaviour gap that can bring more and in-depth insights "into factors that might assist in reducing the intention–behaviour gap" (Hassan et al., 2014, p. 234).

2.5. Literature summary

Under the stated literature, it can be seen that both personal and contextual conditions play a significant role to decide personal intention to adopt tendency. The term intention is described to be determined by intrinsic (personal conditions) and/or extrinsic issues (external conditions) (e.g., Bhakar et al., 2015; Park and Ohm, 2014; Fishbein and Ajzen, 1975). Finally, such intention determines social acceptance in terms of acceptance in principle and actual adoption, rejection and/or opposition (e.g., Rogers, 2003; Fishbein and Ajzen, 1975). It means that according to the stated literature and nature of respondents if solar energy is comprehended suitable and crucial and if individuals have intentions to invest in it, they could be in acceptance category. Some of them could be the actual adopters and some others could be in acceptance in principle category. On the contrary, a reverse situation may produce rejection and/or opposition decision. However, if individuals think that the situation has become suitable for them, they can accept solar energy and vice versa. For example, in Germany different incentives attracted a lot of people to adopt solar energy, but a cut in feed-in-tariff has stopped such high rate of adoption. In Spain as well, non-supportive government policies have forced people towards unattractiveness of solar energy (Ratinen and Lund, 2015). So, it is also clear that from any decided activity new problems may appear and, therefore, new decisions may be produced (e.g., Carrington et al., 2010; Ajzen, 1985).

There are considerable numbers of works dealing with the approach of quantitative instrument and model development to measure, reduce or predict intention-behaviour gap (e.g., Hassan et al., 2014). Conversely, there is smaller

and more disjointed group of approaches that directs qualitative interpretation to open the 'black box' of those behaviour gaps from consumers' point of views and their rationality (e.g., Chatzidakis and Lee, 2012; Devinney et al., 2010). In this study, the later form of approach has been espoused to reflect public opinion and rationale on the basis of their intention and behaviour so that the intention-behaviour gap in solar energy adoption in their regular residential places could be understood.

3. Materials and methods

For the empirical materials of the study, two sets of qualitative semi-structured interviews were conducted on the basis of one-to-one and face-to-face interaction between interviewer and the interviewees. Interviews were conducted because one-to-one data gathering seemed to be very suitable to ascertain different facets related to the intention-behaviour gaps in solar energy adoption by capturing the point of view of respondents (Henn et al., 2006). Furthermore, as a form of the human-centred method, these interviews were conducted with a view "to uncover the multidimensional role that attitudes, habits, and experiences have in shaping energy consumption" (Sovacool, 2014, p. 11).

Following a purposeful sampling strategy, the first set of interviews were conducted in Eko-Viikki in Helsinki city with an intention to select "those who are likely to have most to say" (Newell and Burnard, 2011, p. 73) about solar energy and its adoption. According to European solar district heating (SDH) database, Eko-Viikki is the only SDH plant in Finland that is currently in operation in some buildings there (Solar-district-heating.eu., 2017). Among 10 different building solar integration (solar heating and/or solar electricity) was assured, as describe in Table 1. There are also some individual installations there. So, this place was chosen for getting the maximum variety of respondent (i.e., adopters, would be adopters and non-adopters) (Suri, 2011).

The diversity of variation was also augmented at the time of actual fieldwork with different occupational (e.g., graphic designer, dentist, construction manager, engineer, etc.) and unemployed (e.g., 1 housewife, 2 students) respondents. On the basis of their willingness to participate in the interview in English at least for 20–25 min, respondents were chosen from those found in the open spaces like playgrounds, open fields, roads, in front of their houses and near the shopping centre. However, some interviews lasted 40–45 min. In the initial field visit while pre-testing the interview schedule it was known from the local inhabitants of Eko-Viikki that in the weekend and in weekdays mostly in the morning and in the afternoon a lot of people could easily be found walking around. Since diverse variations can aid in identifying common patterns that cut across those (variations) (Patton, 2015), it was planned to continue interviewing respondents unless it could be achieved. When it was observed that the requirements of the research were fulfilled and repeated information started to come again and again, the field work was stopped. So, finally, the sample size became 25 (see Table 2). The purpose of this sampling was to choose and study those respondents based on their anticipated richness and relevance of information who would stir up the questions under inquiry yielding insights and in-depth understanding (Patton, 2015). These types of respondents are termed in this paper as 'ordinary' respondents.

The second source of empirical materials is based on 17 interviews with expert respondents on the basis of snowball sampling strategy (see Table 2). In total, 69 references were derived from the interviewed experts. On the basis of their richness of experience, expertise, relevance to the field, time schedule and availability the sample size became 17. All of them were Finnish citizens and were working at leading government and non-government organizations. To make the research result more focused and to get a detailed understanding of the research problem their opinion about Finnish people were seemed crucial (Handcock and Gile, 2011). They resided in different places and outside Eko-Viikki. Although to some extents experts shared their own adoption or non-adoption matters, but the main purpose was to extract their opinions about all Finnish citizens' intention and behaviour related to solar energy

Table 1
Solar energy integration in some buildings in Eko-Viikki.

Type of solar integration projects and list of project partners	Contractor (m^2)	Collector m^2/storage m^3
Project name: solar heating project Eko-Viikki	1 ATT 1 (2600 m^2)	120 m^2/6,0 m^3
Project partners: Helen, AEE, Sonnenkraft, Solpros)	2 ATT2 (5000 m^2)	250 m2/12,5 m^3
	3 VVO (4500 m^2)	150 m^2/8,5 m^3
	4 Skanska 1 (4500 m^2)	230 m^2/20,0 m^3
	5 Skanska 2 (2400 m^2)	96 m^2/4,0 m^3
	6 Skanska 3 (3800 m^2)	220 m^2/12,5 m^3
	7 Helas (2050 m^2)	80 m^2/4,0 m^3
	8 ESY (2000 m^2)	80 m^2/4,0 m^3
Project name: Solar Urban New Housing (SUNH)	9 ATT (4000 m^2)	157 m^2
Project partners: Fortum, VTT, TKK		
Project name: Solar Electricity Project (PVNORD)	10 YIT (2540 m^2)	280 m2 24 kWp
Project partners: Fortum, Helen, Lumon, Solpros		

Source: Schulz, 2006.

Table 2
Profile of the respondents, their focus of opinions and adoption status.

Respondents' category	Gender	Focus of opinions and diversification	Variation in terms of adoption status
Ordinary respondents	Male = 12 Female = 13 Total = 25	Mostly about own status, least about others status and diversified (moderate)	Adoption, non-adoption and rejection
Expert respondents	Male = 11 Female = 6 Total = 17	Mostly about others', status, least about own status and diversified (strong)	Adoption, non-adoption and opposition

adoption and non-adoption. In doing so, people's intention-behaviour gap related to solar energy adoption was tried to capture. The knowledgeable and experienced experts contributed their opinion that consumed 45 min–2 h in different cases.

In the interview schedule through different semi-structured questions information related to the following key issues were intended to find out from the respondents: basic ideas about solar energy (e.g., what it is, risks and complexity), feasibility (e.g., weather condition, compatibility, perceived ease of use and perceived usefulness), research and innovation (e.g., know-how, cost-effectiveness, trialability and observability), support schemes: (e.g., investment support, feed-in-tariff, net-metering), investment cost and return, (e.g., purchasing and maintenance costs, durability of products), legislation (e.g., installation permission, government/municipality bindings) and political commitment. Since this study included different issues, only the relevant information provided by the respondents that match with the objective of this article are used here. Other findings are intended to be used in producing other articles. Furthermore, the expert respondents also mentioned different technical and policy related matters, but those are not mentioned in the findings part of this article.

All respondents were briefed earlier about the topic and purpose of the research and were given full freedom and flexibility to decide whether to participate in the interview or not. Respondents were assured that their privacy would be secured in the research process. Furthermore, with the permission of the respondents, those interviews were recorded, then transcribed and interpreted in the light of the objectives of the research. Using content analysis (Elo and Kyngäs, 2008) research findings thereafter was prepared with different arguments and reflection of the reviewed literature. It was observed that different ordinary respondents provided guessed responses in some respects. So, descriptive clarification with relevant statements was deemed suitable than quantifying those with numerical figures as data transformation. The findings and discussion were supported by relevant literature about solar energy and adoption issues in parallel so that the difference between respondents' intention and actual behaviour could be understood. However, the analysis was not constricted to any specific theory but allowed to emerge novel issues from the material. This study was constrained a bit by language problem at the time of data collection. Although all respondents participated in the interview process in English, at the time of delivering their opinion sometimes some of them faced slight difficulties to translate some Finnish terms into English. However, they tried to explain those. As observed the ordinary respondents talked more about themselves and less about others. So, diversification of their opinions seemed to be moderate. The expert respondents talked more about others than their own situations. So, strong diversification was observed in their opinions (see Table 2).

Since the qualitative format of the study forced the sample size to be small to consume maximum overt and covert information from the respondents, the findings presented in this article cannot exactly be generalized. However, insightful suggestions and evidence received from the respondents would stir up existing knowledge base and idea generation on the stated research topic.

4. Results and discussion

The whole findings disclose the fact that very often intention was interpreted by the respondents as attitude towards solar energy. But when approached the matter of adoption they mentioned different personal and contextual conditions that actually shaped their intention and related behaviour. Few expert respondents did not exactly provide their own intention or own behavioural status in terms of solar energy adoption. So, their opinions about others played a significant role to capture the intention-behaviour gap scenario and, thereby, to look at whether social acceptance of solar energy is suppressed or not. To tackle attitude-behaviour gap and intention-behaviour gap issues under the banner of just 'intention-behaviour gap', the themes emerged from the interviews were used. Fig. 2 is a reflection of dialogue between stated literature and findings of the study. It is adorned with major themes derived from the study. To sum up the research findings, it is also supplemented by the stated literature. The detailed findings and discussion are given in the following subsections as an explanation of Fig. 2. Importantly, the percentages presented in Fig. 2, are based on the situations of ordinary respondents. To supplement the comprehension of the qualitative findings, these quantitative inputs are drawn. Fig. 2 gives separate calculation for every major point based on whether any gap was observed among

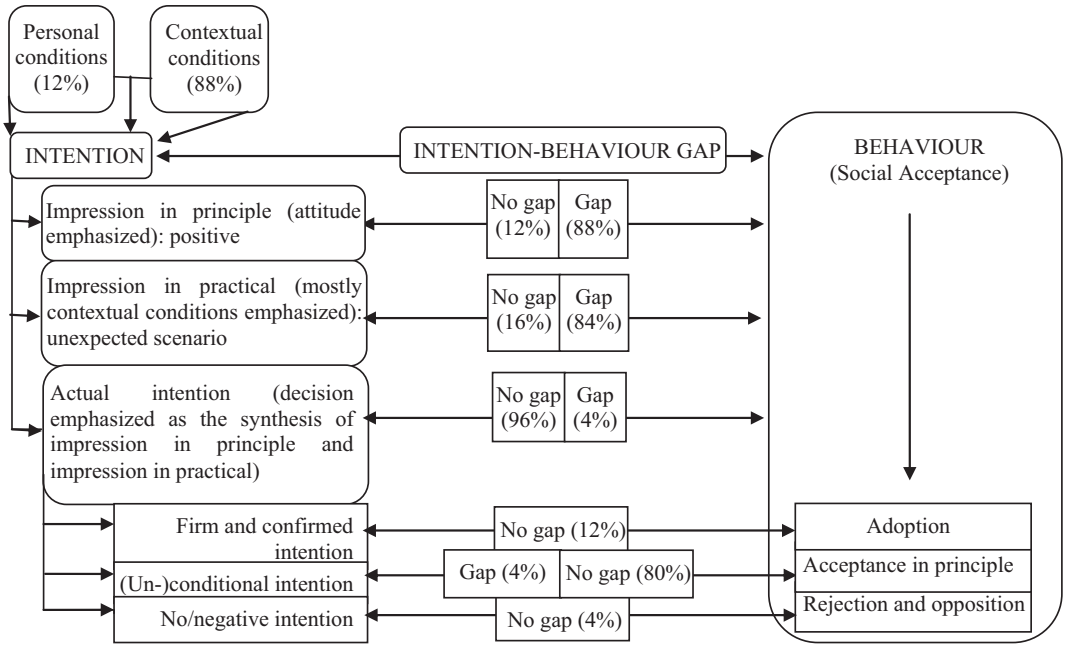

Fig. 2. Intention-behaviour gap in social acceptance.

respondents or not. However, experts' opinions are also shared side by side where relevant in the findings.

4.1. Impression in principle and behaviour

'Impression in principle' as presented in Fig. 2 stands for the attitudes of people towards solar energy in general. It also includes what people generally think about solar energy. Furthermore, it also includes people's 'should do' pattern of thinking. Such thinking is related to their sentiment and emotion. It was found that all respondents generally and ideologically thought or imagined solar energy as a positive source of renewable energy, as stressed by Energiateollisuus ry (2012) and Eurobarometer (2007). Verbally, all respondents appreciated solar energy and they expressed their full support for it. Substantial numbers of ordinary and expert respondents did not find any considerable reason for people being negative towards solar energy. They also did not find any complaint about solar energy. For instance, one ordinary respondent confessed that public complaints about wind energy could be heard, but she did not hear such complaints about solar energy, as stressed by Jung et al. (2016). So, she considered the later form as a better source of energy than the former. So, statements like "Finnish people have a very positive attitude towards solar energy" (38 years old 'non-adopter' male ordinary respondent), and "I cannot think why they would be negative" (42 years old 'non-adopter' female ordinary respondent-1) etc., came from most of the respondents. Furthermore, most of the expert and some ordinary respondents argued that such positive attitude would continually increase day by day.

``*People's attitude and opinion about solar energy – I think it is really positive. It is getting better all the time. Installing solar panels in one's second home: summer cottage is the most common thing in Finland*" (37 years old `non-adopter' male ordinary respondent).

All respondents showed their pro-environmental interest in terms of their neck for thinking positively about the environment. To them, Finnish people are mostly concerned about natural things. According to the stated literature, Finnish people appreciate 'nature' very much and they have a positive idea about solar energy (e.g., Energiateollisuus ry, 2012; Eurobarometer, 2007; Haanpää, 2007) what was also believed by the respondents. All respondents objectively mentioned solar energy as one of the non-polluting, inexhaustible and free renewable energy sources and thought that using solar energy would be good in terms of environmental concern, as stressed by Zhai and Williams (2012) and Hansla et al. (2008). As respondents had more or less green loving and green voting personality (Haanpää, 2007), from their mental urge and what they 'should do' feeling all of them showed their positive response towards solar energy. Some of them perceived solar energy as more suitable and environment-friendly source of energy than nuclear energy, as stressed by Heiskanen et al. (2008). In the words of one respondent, "If we use the wind and solar energy, we don't need to use that much nuclear energy. Then we don't need to build another building (plant) for that may be. There are options" (32 years old 'non-adopter' female ordinary respondent).

In contrast to the stated positive attitude, a significant negative behavioural response was reported by the respondents. So, what the respondents were thinking and what they really were doing were mostly opposite to each other. In spite of positive attitude, gaps in behaviour were observed among 88% ordinary respondents. There was

no gap among 12% ordinary respondents who had already purchased their flats in solar energy integrated block of flats in Eko-Viikki and were living there on regular basis. They did it as being motivated by their personal conditions or internal factors (e.g., nature loving and positive attitude) mainly (Hansla et al., 2008; Ajzen, 1985; Fishbein and Ajzen, 1975). One expert 'adopter' respondent, who shared his own status, did not express any gap between his intention and behaviour. Although few expert respondents did not directly share their status, most of them shared their non-adoption status in their opinions. So, behaviour gap was observed among them. Likewise, all respondents acknowledged the matter and argued that the existence of such gap could be a common fact among most of the Finnish people.

4.2. Impression in practical and behaviour

In Fig. 2 'impression in practical' includes things that are actually heard or known in broader social contexts and have relations and a form of belongingness to one another (e.g., less irradiation may be thought to cause less feasibility of solar energy). It includes contextual conditions "relevant to explaining support and opposition to renewable energy" (Carlisle et al., 2015, p. 837). In terms of impression in practical all respondents, more or less, identified and/or imagined that there were lack of properly disseminated information, lack of technical knowledge among common people (including ordinary respondents), no subsidy, no political commitment, high cost in investment, long-term investment return, seasonal variation with predominating winter, non-feasibility of solar energy mostly in the winter, higher energy cost in comparison to general grid-supplied electricity and non-supportive government approach towards solar energy.

The respondents asserted that the summer-winter disparities of the availability and variability of sunlight were responsible for confusion and scepticism about the practicality of solar energy in Finland. So, they realized that it would be unwise and risky to rely only on such source of energy. Furthermore, they thought that having two or more sources of energy connection would not be cost effective for electricity or heating or both. Among respondents, replacing grid power connection into solar electrification in residences was considered as a matter of risk and threat to energy security and additional cost instead of cost saving (Islam, 2014).

Most of the ordinary and few expert respondents pondered that solar energy would be feasible mainly in summer cottages in remote areas where connection to the grid would not be cost-efficient. Most of them thought that solar energy would be less feasible in Finland due to its long lasting winter with scarcely found sun and huge energy demand for heating and electricity at that time (Pöyry Management Consulting Oy, 2011). For instance, one ordinary respondent said, "The cloudy sky and snow prohibit the utilization of solar energy in the winter. There is short lived summer with abundant sunlight" (32 years old non-adopter female respondent). So in that sense, safety risks and uncertain costs in repair and maintenance demotivated mostly the ordinary respondents to adopt solar energy in their residence (Huijts et al., 2012; Sovacool and Lakshmi Ratan, 2012; Sovacool, 2009). Actually, very little maintenance is required for solar panels (Pihlajamaa et al., 2013), as stressed by the expert respondents. Although three adopter respondents were living in solar energy integrated block of flats in Eko-Viikki, the ordinary respondents including them did not think of solar integrated buildings as a 'solar community' concept. But when the researcher explained the matter, they considered that it would be a hard task to motivate all apartment owners to initiate such concept in other blocks of flats. All expert respondents also agreed that such a concept could hardly be found throughout Finland, as stressed by Solar-district-heating.eu. (2017) and Heiskanen et al. (2015).

Most of the non-adopters had the fear that there would be a risk of non-profitability to invest in solar energy in Finland. In terms of investment in solar energy, financial consideration was found to be the top priority among them in the decision making, as stressed by Haukkala (2015) and Moula et al. (2013). To some ordinary respondents, adoption of solar energy would be possible only for rich and environmentally enthusiastic people. For example, one ordinary respondent argued, "One thing is that yes, we are positive about solar energy, but when it comes to deciding on whether we pay extra, then people might use the fossil fuel based energy" (42 years old non-adopter female respondent-2), as stressed by Salmela and Varho (2006). Furthermore, the respondents argued, "People always look what they get back from an investment because in every investment you first need to put some money and hopefully you get some benefits" (42 years old non-adopter female ordinary respondent-1). All respondents firmly considered that the investment in solar energy would not be cost effective at that time when the interview was conducted. Few ordinary and all expert respondents thought that investment return would be a long-term process. According to their presumption, the investment cost would be high and it would be an extra cost for investors who already had their grid connection. One expert respondent argued,

> *"Of course, there are some people who do not really need this and who think that it does not make sense. There are also skeptic people who are thinking that the payback is still too long, which is true. In any case, if you are just counting on the money, the payback period still today is too long*" (Manager in a multinational organization).

Although all respondents had a very positive perception regarding Finnish know-how and research base, the lack of any proven cost-effective mechanism for storing solar energy was also undesirable to them. However, they mentioned that using solar energy would not be cost effective

since the general grid supplied electricity price was much lower at the time of interview than that. One ordinary respondent stated, "How to save energy in summer and use it in the winter? It will be a big answer to our problem. It is very dark in the winter" (52 years old would be adopter female respondent). Actually, there are batteries like Tesla Powerwall with the capacity to store solar energy and to be used in the night and lean period (Rodríguez-Molina et al., 2016) what was unknown to all ordinary respondents. All respondents thought that storing solar energy at individual household level would cost a lot for heating and electricity mostly in winter.

The absence of incentives for individual house owners also created apathy among them to install solar panels. All expert respondents stated that according to the Ministry of Employment and the Economy 25% support has been allocated for commercial PV projects as mentioned in the Energy Support Guidelines for 2016 (Ministry of Employment and the Economy, 2016) and none of the ordinary respondents knew about it. Furthermore, as the expert respondents informed, there is provision for individual investment support such as labour cost. All ordinary respondents were honest enough to acknowledge their lack of knowledge about the availability of any incentives and support schemes from the government.

Some respondents further said that the absence of any proper system of selling produced solar electricity was unpleasantly perplexing and complicated and they disliked it. In fact, selling fluctuating and small-scale solar electricity is hard in Finland since regulation does not allow selling it to the neighbours and it is hard to find buyers giving the equivalent market price (Pihlajamaa et al., 2013), as the expert respondents argued. They added that one does not have to pay any tax for producing small-scale solar photovoltaic electricity for own consumption (Pihlajamaa et al., 2013). All ordinary respondents were unaware about the matter. As one ordinary respondent said,

> *"I am not sure. But if you put some solar panels in your summer cottages, it is easy. If you want to plug it into the power grid, that sounds a bit complicated and I am not sure how it is regulated*" (37 years old non-adopter male respondent).

In addition, the respondents presumed that the lack of strict political commitment and initiative towards solar energy would not create awareness and motive people towards solar energy. It was unwelcomed by them. Substantial numbers of respondents perceived that due to economic pressure existing Finnish government had not shown much interest in solar energy. However, few responded that Green Party would be more green energy oriented than other parties, as stressed by Ratinen and Lund (2015).

Most of the ordinary respondents did not mention much about any aesthetic issue that, according to Faiers and Neame (2006), is a key consideration in adoption of solar energy. All respondents stressed that in Finland it is necessary to install south facing solar panels to have maximum effectiveness in the rooftops and/or on walls of buildings that are unobstructed, either by other buildings or shades of trees (Pasonen et al., 2012). According to some 'would be adopter' ordinary respondents since the rooftops of their dwellings were not south-faced, they preferred to set up solar panels in their sauna place. All ordinary respondents considered that legislation would not be a barrier to installing solar energy technologies. But all expert respondents argued that in Finland there is no uniform housing legislation in all municipalities: in some places, for example, aesthetic concerns may prevent individuals from installing solar panels in their building rooftops but that generally varies from one municipality to another (Pöyry Management Consulting Oy, 2011).

All ordinary and few expert respondents confessed the lack of properly disseminated information about solar energy installation issue in Finland. However, most of the ordinary respondents showed their apathy to invest too much time and to take extra workload for searching information or installing solar panels. While describing the installed solar panels in different buildings in Eko-Viikki, one respondent admitted, "I do not know if the solar panels installed in these buildings are working well in the winter or not" (27 years old non-adopter female ordinary respondent). However, some of them heard that those installed panels in some buildings were not in operation due to lack of maintenance, monitoring mechanisms and expert controlling (Hakaste et al., 2005). They informed that they lack any visible information about the functioning of installed solar energy in Eko-Viikki. All ordinary respondents acknowledged that information about solar energy might be available in different manners but those were not so exposed to them. One responded argued

> *"In the current era of information overload, even important facts about solar energy opportunities will hardly reach the users or potential producers unless communicated clearly and through appropriate channels. Effectiveness should be achieved not only in the policies but also in how the information is created and shared*" (31 years old non-adopter female respondent).

Both ordinary and expert respondents argued that it is a common tendency among people to be motivated by visibility and reference group (Heiskanen et al., 2014; Bollinger and Gillingham, 2012). According to some non-adopter ordinary respondents, to maintain the status quo some residents of Eko-Viikki had already adopted solar energy. It indicates that there is also social influence (contextual conditions) on the adoption decision by the side of personal conditions, as stressed by Carlisle et al. (2015) and Fishbein and Ajzen (1975). All respondents argued that although there was little visibility of solar installation in Eko-Vikki, actually individual installation in regular resi-

dential places could hardly be found throughout Finland. On the basis of their common sense and guessed ideas most of the ordinary respondents stated that community solar would be a difficult job in terms of agreeing, financing, executing, maintenance and controlling to be done by community people. Furthermore, the adopter respondents were confused about the role, engagement and ownership issues of community people in community solar project done at the institutional level that they had encountered in their block of flats in Eko-Viikki.

One major point mentioned by most of the ordinary respondents who had no house or apartment of their own was that for the adoption of solar energy they first need their own residence. Some of them showed positive intention to adopt solar energy technology but the lack of their own residence was one of the major contextual conditions to them.

Considering the unexpected scenario in terms of contextual conditions as a whole it was observed that there was no behaviour gap among 16% of total ordinary respondents (see Fig. 2). To reiterate, 12% respondents had already adopted. Additionally, 4% respondents had assured that they would adopt solar energy without any change of current opportunities and situations. Behavioural gap was observed among the rest 84% respondents who possessed a positive attitude towards solar energy but aspired to adopt it later on once they would find solutions to the aforesaid conditions. The expert respondents stated that the adoption rate would be increased at the solutions to the stated matters.

4.3. Actual intention, behaviour and social acceptance

Fig. 2 presents actual intention as a synthesis of both 'impression in principle' and 'impression in practical' that emanates (a) firm and confirmed intention, (b) unconditional and conditional intention, and (c) no/negative intention. By considering intention as 'actual intention', in general, no behavioural gap was observed among 96% of all ordinary respondents between their intention and their behaviour at the time of interview. However, a behavioural gap was observed among 4% ordinary respondents. By explaining the stated three forms of intention it will be easier to understand the matter.

12% ordinary respondents expressed their firm and confirmed intention, and correspondingly they adopted it (by purchasing flats in solar energy integrated block of flats in Eko-Viikki). So, apparently, there was no gap in their behaviour. However, according to them, the extracted solar power was used in common spaces of those blocks of flats. They had their own contract with the electricity company for electricity. Therefore, they were passive users of solar energy.

4% ordinary respondent unconditionally intended to adopt solar energy but was taking time meanwhile to confirm an appropriate behaviour. The respondent intended to take initiative with her husband in suitable time. Such situation is a part of 'unwanted distractions', as stressed by Carrington et al. (2010). It is also a kind of intention-behaviour gap because actions are becoming prolonged and thereby, remaining inconsistent with intention. 80% ordinary respondents conditionally intended to adopt solar energy. No gap was observed in their behaviour at the time of interview. According to social acceptance literature both unconditionally and conditionally intended ordinary respondents represented their 'acceptance in principle' status. They were honest to admit their real intention and also showed rationality for their intention and behaviour. Following Haanpää (2007) based on the findings of the study, it can be stated that those respondents who showed their conditional intention (see Fig. 1) had controlled their 'green' loving nature in the adoption of solar energy by justifying their personal and contextual conditions and reasons. So, instead of Fishbein and Ajzen's (1975) notion of volitional control (the wilful control over behaviour), a form of situational and rational control was observed among them. All respondents argued that most of the Finnish citizens favour solar energy, but, to them, "the question is how many people are there so much interested in making an effort" (37 years old non-adopter male respondent). It means that there was a dearth of such enthusiastic people as well.

4% ordinary respondent showed negative intention to adopt solar energy and revealed no behaviour gap at the time of interview. The respondent had no intention to adopt solar energy since he considered it to be non-feasible in Finland mainly due to summer-winter disparities and variability of solar irradiance. So, according to acceptance literature, his behavioural status fell in 'rejection' category. Although he had a positive idea about solar energy, he considered it non-feasible in Finland and not cost effective. One expert respondent expressed her opinion in opposition of using just solar energy. She stressed that much concentration should be given to the already proven technologies like bio-energy or even wind energy. However, she aspired that if cost-effective technological innovations could come and address solar energy storage and utilization of it in lean periods (e.g., in winter, in the night), the prospect of solar energy adoption would increase.

On the grounds of stated findings following Frederiks et al. (2015), it would be, furthermore, difficult to state a form of 'sizeable discrepancy' lie between people's intention and their behaviour. Rationality and consistency were observed for the respondents' intention-behaviour gap or no gap, as opposed by Heinzle (2012). However, on the basis of personality structure, some respondents may hide information in different social and time contexts or researchers may be interested in more quantitative issues than the qualitative exploration of a situation. In such cases, discrepancies, inconsistencies and irrationality may be observed in the gaps between public intention and their opposite behaviour. It was also observed that respondents did not express their positive opinions towards solar energy due to 'such-and-such circumstances', as stressed by

Devinney et al. (2010) (see Section 2.4). They showed their rationality both for their positive attitude and adoption or non-adoption behaviour. They were honest to admit that personal conditions and mostly contextual conditions for their adoption or non-adoption behaviour, as stressed by Carrington et al. (2010), Westaby et al. (2010) and Botha and Atkins (2005). However, the respondents argued that intention-behaviour gap could be incurred by some people, but most people have their reasons for their behaviour in terms of adoption or non-adoption of solar energy.

5. Conclusion

In an attempt to open the 'black box' of intention-behaviour gap in the acceptance of solar energy technology and solar community concept by assessing individual opinions, this qualitative study discloses the fact that people may have positive attitude and intention, but this does not necessarily and always lead to a great number of adoptions.

As concern to the first objective, according to the findings of the study, the conative component or intention in terms of 'impression in principle' and 'impression in practical' formed the 'actual intention' of the respondents. The findings declare a strong positive stand of respondents' towards solar energy, but when approaching their own actual intention issue most of them showed their apathy to adopt. On the basis of such actual intention, their behaviour was moulded and their acceptance towards solar energy and solar community concept was expressed differently. 'Impression in principle' was considered as the intention of respondents in general that emanated from their sentiment of what they 'should do'. But when the respondents encountered reality and practical scenario from their own comprehension (impression in practical), their actual intentions (intention decision) were revealed and most of them responded to conditional intention (see Fig. 2). According to them, this is a common tendency among most of the Finnish citizens.

As concern to the second objective, the findings of the study confirm that respondents had their rationality and consistency for their intention-behaviour gap. Likewise, both the adopters and non-adopters had their rationality in their behaviour and none of them was unwise in their decision and action (see Chatzidakis and Lee, 2012). The adopters showed their rationality for environment and nature loving matters. The non-adopters showed their rationality for the contextual conditions mostly as stated in Section 4.2. Thereby, their rationality was based on personal and contextual conditions, with contextual conditions predominating and it is unwise to translate positive attitude and intention directly into behaviour.

Concerning the third objective, the findings of the study stressed that social acceptance of solar energy seemed to be suppressed in Finland as a result of stated undesirable contextual conditions mainly. In terms of adoption, acceptance in principle, rejection and opposition, most of the respondents represented the acceptance in principle form of social acceptance. Although it is a good sign, it requires much focus by the policy makers and energy support-service providers to respond to the opinions of common people and their expectations.

Solar community concept had not yet been developed as a mental construct among the respondents. It is because of the fact that the development of such concept is at its beginning stage in the country. None of the ordinary respondents had any idea about solar community concept. But when explained, they emphasized that it would be difficult to derive people's consensus to set up or develop such a concept. Thereafter, engagement and ownership feeling issues were also emphasized since the adopters felt a lack of those due to institutional installation and maintenance. According to the respondents, for heating, the development of cost-effective solar heat storing breakthrough is required so that even in the lean period the stored energy could be used. The respondents also wanted more visible practical examples that would attract more consumers towards the adoption of solar energy and solar community concept.

It is the common tendency of people to respond to what they think they 'should do' more than what they actually do. So, many times the proliferation of quantitative findings may assert that most of the people are (strongly) positive towards solar energy in Finland, but it is the credit of qualitative research to attempt and to open the 'black box' of the intention-behaviour gap to see the causes of negligible rates of adoption. Studying intention-behaviour gap in the adoption of solar energy would assist policy makers, marketers, academicians, researchers, engineers, architects and even manufacturers (e.g., development of more efficient products) to find out underlying causes and direct for strategic actions to bridging up the gap. As such it would attract more consumer adoption and increasing market share. Technology promoter and policy makers should consider public attitudes and environmental changes by the side of ensuring cost-effective solar energy technologies and its diffusion because positive attitude may take a U-turn at the time of adoption. Furthermore, it can be said that if they have accurate and adequate information about solar energy, investment cost and return, government incentives, feed-in-tariff and net-metering, legal issues and clear idea about the feasibility of solar energy, the installation rate will increase more. So, if those issues are addressed from grass-root to supreme (state) levels, a bright prospect of solar energy market and solar community concept could be envisioned. Thereby, the mismatch between consumers' approval and their behaviour for green product alternatives like solar energy will also be decreased.

Since solar community concept, as explained in this study, is at its very initial stage, future research can focus on the determinants of the concept. In this study, better findings on solar community concept could be achieved, if all the households living in the solar integrated buildings

were interviewed. Both institutional/company oriented and small-scale community oriented studies are also required. Furthermore, since the patterns of most of the houses in Finland are blocks of flats, further research can also focus on how to integrate housing and real estate organizations with also the consideration of detached or semi-detached houses. Both for solar electricity and solar heating either at individual or community level, further research may also be directed to policy issues to make proper room for individual and community people if the work is intended non-commercially. Studies are also required in the development of cost-effective and durable solar heat and electricity storing mechanisms in different climate and geographical conditions. So, technological, business and behavioural studies are simultaneously admirable.

Declaration

This article is a part of a broader study. The findings of the main study are intended to be used in producing other articles where the sample size and basic attributes of the respondents would remain the same.

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