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Consumer Resistance to Green Innovations: Developing a New Scale and an Underlying Framework

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The development and marketing of green innovations provide great potential to reduce carbon emissions, ease fossil fuel dependency and stabilize energy costs. The diffusion of many green innovations among consumers, however, remains low and they are often referred to as resistant innovations. Consumer resistance to green innovations is a generally under-researched area and empirical evidence is scarce. The objective of this study is therefore twofold. Building on recent advances in the literature, the study firstly aims to operationalize and empirically validate a measure of consumer resistance to green innovations. Secondly, the research aims to anchor this measure in a theoretically grounded model based around status quo bias theory (Samuelson and Zeckhauser 1988) and empirically test the relative influence of factors leading to consumer resistance to green innovations. The research presented in this study is based on a large scale study of homeowners in the Republic of Ireland. The proposed scale and framework are both empirically validated via structural equation modeling techniques, providing valuable information for marketers and policymakers.

Introduction

With the United Nations Climate Change Conference in Copenhagen 2009 having failed to deliver any internationally binding targets, the development and marketing of sustainable and low-carbon technologies has become ever more important. Green innovations like solar panels or electric vehicles provide great potential to contribute to the reduction of CO_2 emissions, ease fossil fuel dependency and stabilize energy costs. For these technologies to have a significant impact on the macro level, however, it requires the aggregate actions of individuals to undertake investments into these innovations. Yet, despite marketing and public policy efforts to encourage consumers to invest into microgeneration, in most European countries and the U.S. the uptake of green innovations remains low and they are often referred to as resistant innovations. Unlike receptive innovations, many resistant products face protracted take up times as they require consumers "to alter existing belief structures, attitudes, traditions or entrenched routines significantly"(Garcia, Bardhi, and Friedrich 2007, p.83).

The built environment provides one of the greatest potentials for energy efficiency and CO2 emission reductions. Recent technological developments have made it possible for individual households to generate their own electricity and heat from renewable sources by the use of microgeneration technologies (European_Commission 2008). Microgeneration technologies include *solar panels, micro wind turbines, solar water heating, biomass boilers, heat pumps and combined heat and power generation* (CHP).

In this study we take a closer look at consumer resistance towards green innovations in the context of microgeneration technologies. Theoretically, resistance to (green) innovations has been a traditionally under-researched area within the diffusion of innovation literature (e.g. Laukkanen et al. 2007). One reason for this is that consumer resistance has been lacking a clear definition and rigorous conceptualization. Further, few attempts to develop operational measures of resistance exist and empirical evidence is scarce (Kleijnen, Lee, and Wetzels 2009).

The objective of this study is therefore twofold. Building on recent advances in the respective literature, the study firstly aims to operationalize and empirically validate a measure of consumer resistance to green innovations. Secondly, the research aims to anchor this measure in a theoretically grounded model based around the status quo bias theory (Samuelson and Zeckhauser 1988) and empirically test the relative influence of factors leading to consumer resistance to green innovations.

The study was conducted with homeowners in the Republic of Ireland in November and December 2009 and the findings will ultimately inform marketing and public policy campaigns aiming to promote the uptake of microgeneration technologies and help Ireland meeting its renewable energy targets.1

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1 Dept. of Communications, Energy & Natural Resources (2007), Energy White Paper 2007 - Delivering a Sustainable Energy Future for Ireland. Available from http://www.dcmnr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm

Theoretical Background

Resistance to Green Innovations

The majority of studies available to date have estimated people's *willingness to pay* (WTP) (e.g. Banfi et al. 2008; Batley, Fleming, and Urwin 2000; Borchers, Duke, and Parsons 2007; Hansla et al. 2008; Nomura and Akai 2004; Wiser 2007; Zarnikau 2003) or consumers' *intention to adopt*[2] green innovations and renewable energy (e.g. Bang et al. 2000; Nyrud, Roos, and Sande 2008; Schwarz and Ernst 2008; Voellink, Meertens, and Midden 2002). Most of these studies address resistance to green innovations only indirectly as non-adoption or as no or low willingness to pay. As a result, diffusion of innovation studies have often been accused of neglecting "the fact that innovations mean change to consumers, and resistance to change is a normal consumer response that has to be overcome before adoption may begin" (Laukkanen et al. 2007, p.420). The majority of homeowners, for example, are likely to be satisfied with their existing heating and electricity system and have no intrinsic desire to change. Existing research suggests that consumer resistance cannot simply be treated as the opposite of adoption or WTP, but should be researched as a distinct behavioral response (e.g. Garcia, Bardhi, and Friedrich 2007; Kleijnen, Lee, and Wetzels 2009; Ram 1987; Ram and Sheth 1989). One can even ask if consumers' resistance is not the more common and maybe more rational response to (green) innovations (Sheth 1981)?

Although psychological antecedents of resistance to change have been widely explored (e.g. Oreg 2003), consumer resistance as an actual behavioral response has, until recently, been lacking a clear conceptualization. Based on a comprehensive literature review and qualitative research in form of focus groups, Kleijnen et al (2009) identified three distinct resistance behaviors towards innovations: *postponement*, *rejection* and *opposition*. Although this classification is not intrinsically new and is broadly in line with previous research (Bagozzi and Lee 1999; Coetsee 1999; Fournier 1998; Garcia, Bardhi, and Friedrich 2007; Garrett 1987; Gatignon and Robertson 1991; Greenleaf and Lehmann 1995; Herrmann 1993; Lapointe and Rivard 2005; Martinko 1996; Nabih and Bloem 1997; Penaloza and Price 1993; Ram 1987; Ram and Sheth 1989; Ritson and Dobscha 1999; Rogers 2003; Sen, Gürhan-Canli, and Morwitz 2001; Szmigin and Foxall 1998) Kleijnen et al addressed the lack of consistent terminology, thorough conceptualization and varying definitions across previous resistance studies.

Kleijnen et al (2009, p.9) defined postponement as "an active decision to not adopt an innovation at that moment in time." Their definition is similar to Nabih and Bloem (1997, p.191) who argue, that "(...) the consumer may escape from the dilemma between adoption and rejection by postponing the decision." It also seems to be broadly in line with what Bagozzi and Lee

[2] The two most commonly employed frameworks in research around adoption of innovation are the theory of planned behaviour (Ajzen, 1991) and the technology acceptance model (Davis, 1989).

(1999, p.219) referred to as consumers' indecision, meaning that consumers "will most often continue information processing until the perception of opportunity and/or threat are subjectively addressed to satisfaction."

Rejection is defined as "an active decision to not at all take up an innovation" (Kleijnen et al. 2009, p.9). Rejection is the most commonly used term in the relevant literature and has often been used interchangeably with resistance. Martinko (1996, p.321), for example, analyzed resistance to information technologies, classifying consumers' behavioral responses into acceptance, rejection and reactance. In the definition however, Martinko uses resistance instead of rejection. Szmigin and Foxall (1998) also distinguish rejection from postponement and opposition, but do not provide any clear definition of rejection as a behavioral response to innovations. Rogers' (2003, p.177) definition of rejection "as the decision to not adopt an innovation" therefore appears to be the closest to the one suggested by Kleijnen et al.

Finally, opposition is defined as an "actual active behavior directed in some way towards opposing the introduction of an innovation" (Kleijnen et al 2009, p.10). They further argue that opposition behavior can range from verbal complaints to negative word of mouth or even result in protest action. In earlier studies such opposition behavior has often been referred to as 'consumer boycott'. Gatignon and Robertson (1991) for example point out that "a variety of responses are available to consumers' including 'exit (refusal to buy), 'voice' (complaining actions) and 'loyalty' (continued patronage in hope of change)." Further Coatsee (1999, p.159) distinguishes between consumer complaint, boycotts as well as "(…) consumer resistance which directly communicates [consumers'] resistance and rejection of a particular marketing organization." Because of the variety of behavioral responses associated with 'opposition' we felt that its definition was too vague. Also, opposition is least likely to be experienced in relation to green innovations or renewable energy and was decided to be excluded from any further analysis.

Following the discussion above, in this study resistance is understood to stretch from postponement (i.e. weak resistance) to rejection (i.e. strong resistance), constituting the two end-points for the measurement of resistance.

Antecedents of Consumer Resistance

The reasons for consumer resistance are manifold and often lie in complex interactions between consumers, the characteristics of the innovation and the social context. Numerous studies have tried to disentangle the various influences that lead to consumer resistance. Garcia et al (2007, p.82) point out that resistance may arise "because the innovation conflicts with consumers' ingrained belief structures, requires acceptance of unfamiliar routines or necessitates abandoning deep-rooted traditions.” Further, Ram and Sheth (1989) broadly distinguish between functional and psychological barriers. Functional barriers can include incompatibility with existing practices or habits, the actual value of the innovation and the risk associated with a new product. In their meta-review of resistance drivers, Kleijnen et al (2009, p.3) also distinguish between two broad types of antecedents, including factors which “(...) require a change in consumers’ established behavioral patterns, norms habits and traditions” and, secondly, factors which “(...) cause a psychological conflict or problem for consumers.” As for the latter, they identify ‘perceived product image’, ‘complexity’, ‘information overload’ and ‘perceived risk’ as factors influencing consumer resistance.

Despite the above mentioned attempts to classify antecedents to consumer resistance, the various factors appear to be lacking an integrating framework or overarching theory. However, one common underlying explanation for resistance appears to be that consumers are often satisfied with their current situation and, more importantly, might prefer the status quo over change brought by an innovation (e.g. Ram 1987; Sheth 1981). This perspective has recently been used to study user resistance to change in information systems in an organizational context (Kim and Kankanhalli 2009). In order to gain a more accurate understanding of how users evaluate change related to new information systems and what factors lead to resistance, the authors applied status quo bias theory (Samuelson and Zeckhauser 1988) to findings from the resistance literature. Following Kim and Kankanhalli’s approach, this research aims to discuss and research antecedents of consumer resistance to green innovation in the broader framework of status quo bias theory.

Understanding the motives for consumers’ decisions to postpone or reject a green innovation is crucial for macromarketers and public policy makers as it provides valuable information on how to promote the uptake and overcome resistance towards microgeneration technologies more effectively.

Proposed Framework and Hypotheses

The status quo bias theory assumes that most decisions have a status quo option. Homeowners, for example, not only have the option to choose between different microgeneration technologies, but also to maintain their current status and to resist an innovation. Samuelson and Zeckhauser (1988) showed in numerous experiments and over a wide range of decisions that individuals have a strong tendency towards the status quo when presented with this alternative. They classify explanations for the status quo bias in decision making into three categories: cognitive misperception, rational decision making, and psychological commitment.

Cognitive Misperception

Cognitive misperception refers to a phenomenon often observed in human decision making which is also known as loss aversion (Kahneman and Tversky 1974). Loss aversion implies that when making decisions, individuals often weigh potential losses higher than gains. Thus, the status quo alternative holds a natural decision advantage as perceived costs are likely to have a relatively higher influence than the perceived benefits (Samuelson and Zeckhauser 1988). This also applies to situations in which homeowners can decide to adopt or resist an innovation like microgeneration technologies. Taking the current heating or electricity system (i.e. status quo) as a reference point, homeowners are likely to weigh potential costs or losses from switching to a microgeneration system larger than they actually are. Cognitive misperception or loss aversion is therefore an important concept to keep in mind when trying to understand people's rational decision making.

Rational Decision Making

As highlighted by Samuelson and Zeckhauser (1988) individuals do evaluate the relative costs and benefits of (e.g.) adopting a new product. Naturally, when overall costs of adopting a new product outweigh the benefits, consumers will resist the innovation i.e. retain the status quo. Samuelson and Zeckhauser identified two types of costs: transition costs and costs related to uncertainty. The former are costs that occur directly while adopting an innovation or as a result of it. In the context of resistance to green innovations these can be the initial *capital costs* required to adopt a new product (e.g. Darley and Beniger 1981).

H_1: Perceived initial capital costs have a positive effect on consumer resistance.

Further, microgeneration technologies often require homeowners to significantly modify the existing infrastructure (i.e. house) to fit the new technology. These costs also include the level of disruption caused by potential building works and are likely to vary depending on the *compatibility* of the house (e.g. Schwarz and Ernst 2008).

H_2: Perceived compatibility-related costs have a positive effect on consumer resistance.

Uncertainty costs can also lead to status quo bias and refer to the risk people associate with adopting new technologies. Perceived risk is also a well established concept in the resistance literature and various studies distinguish between four main types of risk including *physical, economic, functional and social ris*k that consumers have associated with innovations (e.g. Dholakia 2001 ; Kleijnen, Lee, and Wetzels 2009; Peter and Lawrence 1975; Ram 1987; Stone and Grønhaug 1993). Physical risk refers to potential harm an innovation might cause to a person or property[3]. Economic risk reflects the fear of wasting financial resources whereas functional risk refers to performance uncertainties of a new product. Finally, social risk reflects uncertainty about how adopting the innovation might be perceived by relevant others. In the case of microgeneration, performance and financial risk are two sides of the same coin, as the performance highly determines the financial viability of the technology. In this study, perceived risk thus refers to uncertainty related to the performance (e.g. reliability) of the technology.

H_3: Perceived risk has a positive effect on consumer resistance.

Understanding the relative influence of initial cost, cost related to compatibility and uncertainty cost is of great importance for policy makers and marketers and has been identified as an area for further investigation. Kim and Kankanhalli (2009, p.580) for example state that "future studies could conceptualize switching costs as a multidimensional construct to examine in-depth effects of different dimensions of switching costs on user [and consumer] resistance. The subtypes of switching costs could also have different antecedents."

As consumers weigh potential costs against potential benefits, perceived advantages need to be accounted for and have been addressed in adoption of innovation studies. According to Rogers (2003, p.221) an innovation's perceived relative advantage reflects the degree to which it is perceived as being better than its precursor. Moore and Benbasat (1991) researched perceived relative advantage as a one-dimensional construct in relation to information system adoption. However, in a more recent study Schwartz and Ernst (2008) evaluated the influence of multiple advantages on consumers' intention to adopt water saving devices. In this study, three advantages have been included in the construction of the benefit measure, including energy savings, environmental benefits and independence from energy providers. Thus,

H_4: Perceived benefits have a negative effect on consumer resistance.

[3] During this research physical risk did not appear to be an important factor and was therefore excluded from the analysis.

Psychological Commitment

A third explanation for status quo bias is referring to people's psychological commitment. In the context of innovation, three main factors affect psychological commitment: sunk cost, regret avoidance and efforts to feel in control. *Sunk cost* refers to people's tendencies to "(...) justify previous commitments to a (perhaps failing) course of action by making subsequent commitments" (Samuelson and Zeckhauser 1988). Although maybe less relevant to resistance to microgeneration, one could imagine sunk cost in form of previously made investments into alternative energy saving measures like insulation.

A second factor leading to psychological commitment and hence status quo bias is *regret avoidance*. It refers to a phenomenon observed in decision making, where people more strongly regret negative outcomes from new actions (i.e. adopting an innovation) than equally bad outcomes stemming from inaction (i.e. resistance). Samuelson and Zeckhauser (1988, p.38) further point out that "[regret avoidance] favors adherence to status quo norms or routine behavior at the expense of innovation, and it reinforces the individual's inclination to conform to social norms." This appears to be broadly in line with findings from the resistance literature which make an "(...) explicit distinction between conflicts with traditions and norms, which relate to a societally-related context, and conflicts with existing usage patterns, which refer to the personal routines and habits of individual consumers" (Kleijnen et al 2009). Both issues have been extensively discussed in the literature around compatibility (e.g. Taylor and Todd 1995; Tornatzky and Klein 1982) and, more recently, operational measures have been developed which allow distinguishing between compatibility with existing practices and personal values (e.g. Karahanna, Agarwal, and Angst 2006).

H_5: Perceived compatibility with existing routines and habits has a negative effect on resistance.

H_{6a}: Perceived compatibility with personal values has a negative effect on resistance.

Further, the literature around microgeneration and green electricity shows that values can be an antecedent of attitude and perceived benefits of the respective technology (e.g. Hansla et al. 2008). Perceived compatibility with personal values is therefore likely to positively impact on homeowner's benefit perceptions.

H_{6b}: Perceived compatibility with personal values has a positive effect on perceived benefits.

Another construct often discussed in relation to resistance are *subjective norms*, which reflect a person's desire to act as others think one should act. Significant others can for example be friends, family, neighbors, political parties or religious organization and their opinion can be considered as a normative influence on a person's level of resistance. Behavior that goes against the subjective norm may result in feelings of 'shame and self-reproach' (Pollard et al. 1999). Thus, homeowners who experience a strong support or favorable opinion for microgeneration among their friends and families are likely to have a lower level of resistance. Thus,

***H_{7a}*: Subjective norms have a negative effect on resistance.**

The respective literature further shows that normative influences can significantly impact on people's perceptions of benefits and their attitudes (e.g. Paladino and Baggiere 2008).

***H_{7b}*: Subjective norms have a positive effect on perceived benefits.**

A third factor leading to psychological commitment refers to peoples efforts to feel in *control* or *self efficacy*. Individuals desire to control their situation and decisions can lead to status quo bias, given an unknown innovation like microgeneration technologies. Further, the more complex an innovation is perceived by consumers, the less people feel in control and the more likely they are to resist it. Complex innovations are perceived as difficult to use and understand (e.g. Moore and Benbasat 1991) and are therefore more likely to experience higher levels of consumer resistance.

***H_8*: Perceived complexity has a positive effect on resistance.**

Another construct often discussed in the adoption literature and closely related to control is *trialability*, which stands for the degree to which an innovation may be experimented with before adoption (e.g. Moore and Benbasat 1991). Most microgeneration technologies are impossible to try out before actually buying them. Yet, some homeowners might be able to see these technologies working at a neighbor's or friend's home or at a trade fare, allowing them to make a more informed decision.

***H_{9a}*: Perceived trialability has a negative effect on resistance.**

Perceived trialability and complexity both impact on person's level of control and might also influence resistance indirectly through the perception of uncertainty costs. Homeowners who have the possibility to learn about the technology are likely to experience lower levels of uncertainty, thus reducing the perceived level of risk.

***H_{9b}*: Perceived trialability has a negative effect on uncertainty cost.**

Further, previous studies around green innovations show that product knowledge is likely to have an impact on people's intention to buy (e.g. Nyrud, Roos, and Sande 2008; Arkesteijn and Oerlemans 2005), their risk perceptions (e.g. Klerck and Sweeney 2007), and perceptions of product benefits (e.g. Bang et al. 2000). In most studies around renewable energy or green innovations, knowledge is referring to *subjective knowledge* which can be defined as "(…) a person's perception of the amount of information about a product class stored in his or her memory" (Klerck and Sweeney 2007, p.174). Although the evidence around knowledge and the impact on product evaluation and buying decision is not conclusive, most studies in the area of renewable energy and microgeneration assume a positive relationship between knowledge and buying intention[4].

***H_{10a}*: Knowledge has a negative effect on resistance.**

***H_{10b}*: Knowledge has a negative effect uncertainty cost perceptions.**

***H_{10c}*: Knowledge has a positive effect on benefit perceptions.**

***H_{10d}*: Knowledge has a negative effect on complexity perceptions.**

The discussion above has shown that consumers, due to cognitive misperception and psychological commitments, often prefer the status quo and that resistance to (green) innovations can be a more rational behavioral response than adoption. The above discussed antecedents of resistance will therefore be integrated and added to the concepts of status quo bias theory and thus provide an integrative framework to research consumer resistance to green innovations as illustrated in Table 1. Again, consumer resistance is understood to stretch from postponement (i.e. weak resistance) to rejection (i.e. strong resistance), which constitute the two end-points of the resistance scale.

[4] This is contrary to some of findings in the marketing literature which shows that in some cases knowledge can have a negative impact on benefit perceptions and preferences for a new product (e.g. Moreau, Lehmann, and Markman 2001).

Table 1: Integrative Framework to Research Consumer Resistance to Green Innovations

Status Quo Bias Theory		Resistance/Adoption Theory	
Status Quo Bias		Resistance to Innovation	
Cognitive Misperception	Loss Aversion		
Rational Decision Making	Transition Costs	Initial Investment	
	Cost related to Compatibility	Compatibility	*Infrastructure*
	Uncertainty Costs	Risk	*Functional*
	Benefits	Relative Advantage	*Energy Savings* *Environmental Benefits* *Independence*
Psychological Commitment	Sunk Cost		
	Regret Avoidance	Subjective Norms Compatibility	*Existing Practices (Habits & Routines)* *Personal Values*
	Control	Complexity Trialability	
	Knowledge	Subjective Knowledge	

Source: Adapted from Kim and Kankanhalli (2009)

Research Methodology

To empirically test and validate the resistance measure, data were collected through a field survey of homeowners in the Republic of Ireland. Thanks to a substantial amount of external funding, a professional market research company was employed to carry out the data collection. After discussions with academics and representatives from the market research company, Computer Assisted Telephone Interviews (CATI) was chosen as the most appropriate mode of data collection. A preliminary study indicated low levels of awareness for Heat Pumps and Micro CHP among the Irish population[5] (Claudy et al 2010). Therefore, it was decided to focus on four microgeneration technologies: solar panels, micro wind turbines, solar water heating systems, and wood pellet boilers. Each respondent was only asked about one of the four technologies. The results presented in this paper stem from findings on micro wind turbines.

5 Levels of awareness based on a nationally representative survey conducted study in March 2009: Micro CHP = 18%; Ground Source Heat Pumps = 45%; Wood Pellet boilers = 58%; Micro Wind Turbines = 66% Solar Thermal Heaters 75%; and Solar Panel = 80%

Target Population and Data Collection

The data was collected in the period from November to December 2009. Computer Assisted Telephone Interviews allowed us to utilize an adaptive survey design to identify the respective target population which were '*homeowners in the Republic of Ireland, who are aware of the technology in question and who are partly or fully responsible for making financial decisions regarding the house they currently live in.*' Further, the newly developed resistance scale was only tested with respondents who stated they have no intention to adopt/buy the technology in question within the next 12 months. Using a quota sampling approach, the final sample of n=926 respondents (n=1012 including potential adopters) was split equally across the four technologies. The quotas were based on region, gender and age to ensure an overall approximation of the overall population and more importantly, comparability of the sub-samples (Table 2). The sub sample for micro wind turbines consisted of 234 interviews.

Table 2: Comparison of Sample with Population of Irish Homeowners, expressed in %.

Variable		Micro Wind Turbines (n=234)	Population of Irish Homeowners
GENDER	Male	51.2	50.0
	Female	48.8	50.0
	Total	100.0	100.0
AGE GROUPS[6]	15-24	3.0	
	25-34	20.1	20.0
	35-44	19.7	
	45-59	34.6	45.0
	60+	22.6	35.0
	Total	100.0	100.0
REGION	Dublin	21.4	24.0
	Rest of Leinster	29.1	28.0
	Munster	29.5	28.0
	Connacht/Ulster	20.1	20.0
	Total	100.0	100.0

Source: Own Calculations

[6] The population data for homeowners in Ireland stem from the market research's company's own calculations and data from the Central Statistics Office (CSO) in Ireland. Further, the age categories for the population data are 35-54 and 55+ cannot be compared directly.

Instrument Development

Resistance Scale

In order to distinguish between consumers' decisions to postpone or reject the respective technology, a 'resistance-scale' was developed and pre-tested in two pilot runs. First, three independent and experienced reviewers evaluated the initial pool of items and provided advice on face validity, ambiguous wording as well as double-barrelled and redundant items. An initial set of 8 items was then first pre-tested via CAT interviews with a sample 100 homeowners.[7] The results led to major revisions of the scale and a second pre-test was conducted in October 2009 using a 'snowball' approach. Students in the United States and in Ireland were asked to recruit friends and family who own houses to participate in the survey and the final sample consisted of 83 responses. The technologies in both pre-tests were solar panels. In this second test, 9 items were tested, all formatted on a five point Likert-Scale stretching from 'strongly disagree (1) to strongly agree (5)'[8]. Respondents were asked questions like '*you intend to find out more about the benefits of installing solar panels on your house in the near future*' or '*if the cost of solar panels dropped significantly you would install them on your house tomorrow*'. The results of the second pre-test were analyzed via exploratory factor analysis with oblique and orthogonal rotations, resulting in the exclusion of 4 items and a one factor solution. The remaining five items explained about 53 percent of the variance and had a Cronbach's alpha of .76. For the final survey two additional items were developed, leaving us with a final pool of 7 items.

Antecedents

All other constructs were adapted from existing measures (Appendix) and formatted on a five point Likert-Scale stretching from 'strongly disagree (1) to strongly agree (5)'. They were also tested alongside the first pre-test. Based on the feedback from the market research company and the respective factor and reliability analysis, the items were revised accordingly and the final questionnaire developed in November 2009.

The survey also included a section on socio-demographic variables (i.e. age, gender, social class, education, household size, region, area) and the characteristics of the respondents dwelling (i.e. age, type, number of bedrooms, central heating and previous energy efficiency improvements).

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[7]The pre-test was administered by the same professional market research company which conducted the final study.
[8] The scale was later changed to very unlikely (1) to very likely (5) for the final questionnaire.

Instrument Validation

Resistance Scale

Prior to conducting a confirmatory factor analysis for the measurement model, we assessed the descriptive statistics and inter-item correlation matrix for the new resistance scale. The results showed that the correlations of question 6 with all other items were below .4 (Hinkin 1998). Further, a common factor analysis with non-orthogonal rotation revealed a low factor loading of -.297 for this item[9], which led to the decision to discard question 6 from any further analysis. Next we conducted a common factor analysis for the remaining 6 items (Appendix). First, the analysis was conducted across the whole sample (n=926). In a second step, the analysis was conducted for the Micro Wind Turbine sub sample (n=234) separately. The results from the common factor analysis suggest a one-factor solution for the entire sample and the subsample. Table 3 shows that all factor-loadings are higher than .6. Further, the Kaiser-Meyer-Olkin (KMO) criterion indicates that the degree of common variance among the six variables is meritorious for each sample. In the subsample for micro wind turbines, the 6 items explain about 60 percent of common variance. The inter-item reliability of the resistance scale also indicates sufficient results, with all Cronbach's α of .87.

Table 3: Estimated Factor Loadings from Common Factor Analysis*

Items	Factor Loadings	
	Across Subsamples (N=926)	Micro Wind Turbines (N=234)
	F1	F1
RST1	.82	.83
RST2	.74	.76
RST3	.70	.67
RST4	.65	.62
RST5	.70	.65
RST7	.76	.80
Initial eigenvalue	3.56	3.61
% variance explained	60.9	60.2
KMO	.89	.88
Cronbach's α	0.87	0.87

Source: own calculations
*Factor loadings were calculated with Oblique (Non-Orthogonal) rotation method.

[9] Item 6 'installing ___ in/on your house would be a great waste of money' was formulated negatively and therefore reversed for the analysis.

Measurement Model

In a next step we assessed the above discussed antecedents alongside the new resistance scale in a confirmatory factor analysis (CFA). The measurement model was validated by assessing the convergent and discriminant validity of the individual latent constructs. The former was established by examining the standardized factor loadings, composite reliability (CR), average variance extracted (AVE) and Chronbach's α. The confirmatory factor analysis was conducted in LISREL 8.8 and the results are presented in Table 4. All path loadings were significant at the 5% level and with only one exception for subjective norms (SN2 = 0.58) exceeded the threshold of 0.6. Further, the composite reliability for all constructs including the new resistance measure exceeded the critical value of 0.7. The only exception was trialability (TRIAL = 0.68) which was, however, close to the threshold. The average variance extracted (AVE) also exceeded 0.5 for all constructs, indicating that the variance explained by the underlying latent constructs is significantly larger than the variance explained by the error term. The only exception was again TRIAL (0.44). Despite not meeting the threshold value for compositive reliability and AVE we decided to not drop this construct as it was close to the threshold values and also showed significant and sufficiently high path loadings and chronbach's α. The latter was also sufficiently high for all other constructs, exceeding the threshold of 0.7. Thus, the analysis generally confirmed the constructs' convergent validity.

Table 4: Confirmatory Factor Analysis

	RST	BEN	COST	UNCOST	COMCOST	COMPH	COMPV	SN	TRIAL	COMPLEX	KNOW
Std. Factor Loadings *	0.77	0.76	0.83	0.84	0.6	0.74	0.91	0.87	0.8	0.74	0.78
	0.84	0.75	0.89	0.71	0.83	0.84	0.84	0.58	0.64	0.6	0.73
	0.66	0.74	0.93	0.75	0.85	0.69	0.85	0.75		0.74	0.81
	0.64										0.79
	0.66										
	0.77										
CR	0.87	0.79	0.92	0.81	0.81	0.80	0.90	0.78	0.68	0.75	0.86
AVE	0.53	0.56	0.64	0.57	0.57	0.57	0.63	0.56	0.44	0.52	0.58
Chronbach's α	0.87	0.79	0.91	0.81	0.9	0.84	0.9	0.76	0.73	0.67	0.89
RMSEA = 0.034; X2/df = 1.35; CFI = 0.98; NFI = 0.90; GFI = 0.86; AGFI = 0.83											

Source: own calculations
* sign. at (t > 1.96)

We further assessed the discriminant validity of the measurement model by comparing the square root of AVE with the correlations of each construct. Table 5 clearly shows that the square roots of AVE (diagonal figures) are greater than the correlations between the respective constructs (off-diagonal figures), indicating that discriminant validity can be confirmed.

Table 5: Correlations between Latent Variables

	RST	BEN	COST	UNCOST	COMCOST	COMPH	COMPV	SN	TRIAL	COMPLEX	KNOW
RST	**0.73**										
BEN	-0.56	**0.75**									
COST	-0.09	0.16	**0.80**								
UNCOST	-0.08	0.12	0.18	**0.76**							
COMCOST	0.13	0.07	0.20	0.04	**0.76**						
COMPH	-0.47	0.47	0.12	0.16	-0.17	**0.75**					
COMPV	-0.60	0.62	0.18	0.11	0.02	0.67	**0.79**				
SN	-0.54	0.41	0.12	-0.05	0.01	0.32	0.43	**0.75**			
TRIAL	0.07	0.13	0.19	0.28	0.58	-0.16	-0.07	0.10	**0.67**		
COMPLEX	-0.04	0.15	0.05	0.01	-0.01	0.21	0.14	0.12	0.07	**0.72**	
KNOW	-0.08	0.01	-0.07	-0.12	-0.22	0.19	0.19	0.11	-0.42	0.28	**0.76**

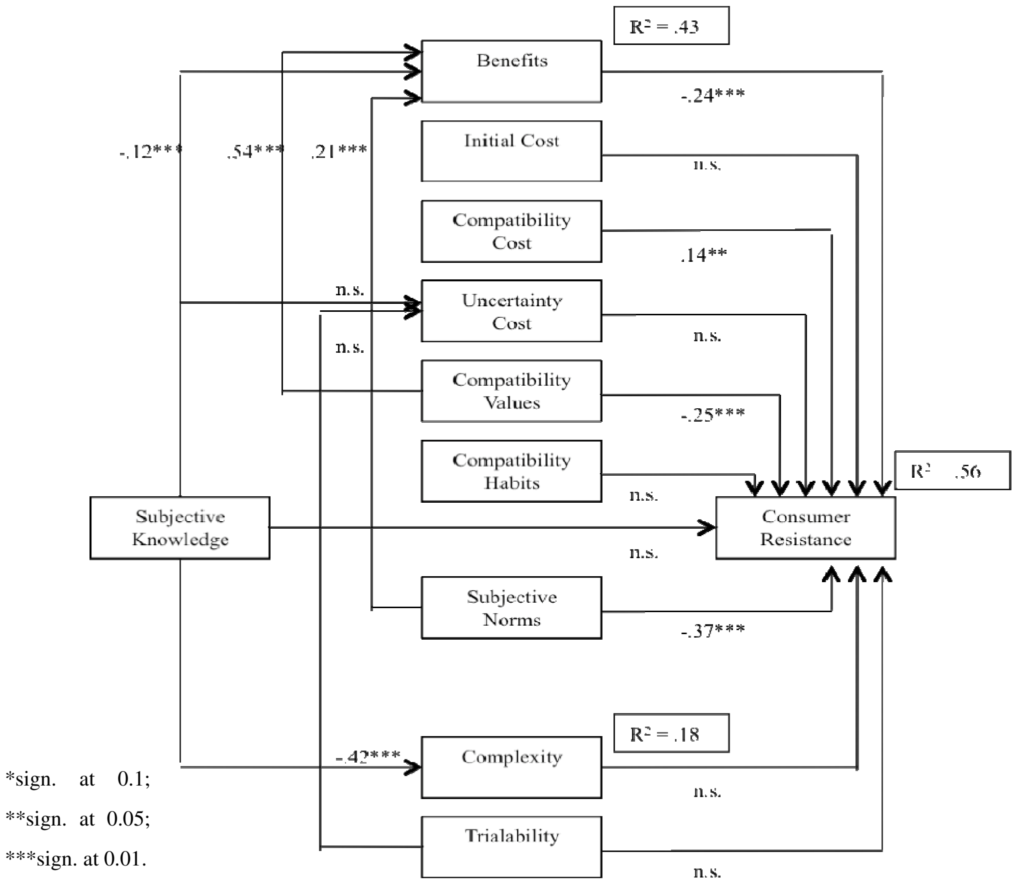
Source: own calculations
(Note: Diagonal shows the squared root of AVE for each latent variable)

Hypothesis Testing

After we established the validity and reliability of the measurement model, we examine the fit of the data to the model. The χ^2 / df measure of model fit is 1.40 and the RMSEA (0.037) is below the threshold of .05, indicating a good fit of the model. Comparing our specified model with the null model, the Comparative Fit Index (CFI = 0.97) and Normed Fit Index (NFI = 0.92) also suggests a good fit. The Goodness of Fit Index (GFI = 0.85), is lower than the recommended threshold (Schumacker and Lomax 2004), yet close enough to conclude that the model fits the data reasonably well. Taken together, the overall results show that the model fits the data reasonably well (Hooper, Coughlan and Mullen, 2008) so that it is appropriate to examine the hypotheses within in the structural model.

The results presented in Figure 1 clearly show that perceived benefits (H_4), perceived compatibility-related costs (H_2), subjective norms (H_{7a}) and perceived compatibility with personal values (H_{6a}) all have a significant influence on resistance. Together they explain about 56 percent of the variance in homeowners' level of resistance. Further, the analysis shows that subjective norms (H_{7b}), knowledge (H_{10c}) and compatibility with personal values (H_{6b}) all had a significant influence on homeowners' benefit perceptions, explaining about 43 percent of its variance. As expected, the model further shows that knowledge has a significant affect on perceived complexity (H_{10d}) explaining 18 percent of its variance. However, some of the hypotheses (H_1, H_3, H_5, H_8, H_{9a}, H_{9b}, H_{10a} and H_{10b}) were not supported by the data.

Figure1: Proposed Model of Consumer Resistance



χ^2/df = 1.40, RMSEA = 0.037; CFI = 0.97; NFI = 0.92; GFI = 0.85; AGFI = 0.82

Discussion of Findings

In this study, home owners who have an intention to buy a small wind turbine in the next 12 months were not included in this analysis. One reason for excluding them was that they already had formed an intention and would not have to be persuaded by marketing or public policy campaigns anymore. The more interesting group in our opinion constituted resistant homeowners. Resistance was understood to stretch from postponement (i.e. weak resistance) to rejection (i.e. strong resistance).

Our model provides several significant findings. First, the study indicates that initial cost does not appear to have a significant effect on the level of resistance. This finding is contrary to what one would expect. However, one explanation might be that initial cost might provide an immediate barrier to buy, yet makes no difference to whether a homeowner postpones or rejects the technology completely. In other words, the decision to reject a green innovation completely is influenced by other factors than the upfront investment. Some of the other findings seem to support this view. For example, cost (e.g. disruption) associated with retrofitting the existing infrastructure (i.e. house) had a significant effect on resistance. This implies that homeowners who believe that a small wind turbine can only be installed at their home with major additional work are more likely to reject them. Perceived functional risk also had no significant impact on resistance. Like upfront cost, uncertainty related to product performance might not be an important issue for homeowners who have no immediate intention to buy.

Second, the results suggest that the perception of benefits has a significant impact on whether homeowners can generally see themselves buying a small wind turbine in the future or reject the technology completely. This is consistent with previous findings (e.g. Schwarz and Ernst 2008), showing that homeowners who perceive little benefits with an innovation are more likely to resist it. Also in line with previous studies (e.g. Paladino and Baggiere 2008), our findings show that normative influences had direct and indirect influences on resistance through the perceptions of benefits Thus, homeowners who experience strong support for renewable energy and microgeneration in their immediate social environment are less resistant towards micro wind turbines.

Third, the findings show that resistance towards micro wind turbines is significantly affected by homeowners' perceptions of the compatibility with their own value system. Further, we tested the influence of value compatibility on perceived benefits and the results also show a significant effect. Karahanna, Agarwal and Angst (2006, p.788) for example state that "technologies that are consistent with one's value system are likely to be perceived as helping foster and promote such values, thereby contributing to enhanced perceptions of instrumentality." The findings indicate that innovations which help promote 'green values' (e.g. small wind turbines) are generally perceived as more beneficial by homeowners who care more strongly about the environment and green energy. Compatibility with habits and routines on the other hand did not have a significant effect on the level of resistance. One reason might be that once a wind turbine has been adapted, the actual production of electricity interferes very little with homeowners' daily routines.

Fourth, factors which are likely to influence homeowners' self efficacy (i.e. knowledge, perceived complexity and trialability) had no direct influence on the level of resistance. Knowledge and trialability both had no significant affect on the level of uncertainty associated with wind turbines. As one would expect, the results also show that knowledge does have a significant effect on the level of complexity associated with small wind turbines. The findings also reveal that knowledge has a significant impact on the perception of benefits. However, this affect was negative, contrary to our hypothesis. As shown in previous studies, the relationships between knowledge structures, different types of innovation and the perception of benefit are rather complex. Moreau, Lehmann and Markman (2001), for example, show that for discontinuous or radical innovations (e.g. digital cameras), experts in a related product category (e.g. analog cameras) often associate fewer benefits and have lower preferences for these innovations. One explanation is that people with more knowledge around a particular product category (i.e. experts) ‘know what they don’t know’, often not appreciating the novelty of the innovation (see also: Mukherjee and Hoyer 2001).

Theoretical Implications

First, the study addressed the lack of operational measures in resistance research and empirically validated a measure of consumer resistance to (green) innovations. Further, by applying this newly developed measure via survey methodology, this study contributes to the relatively scarce empirical evidence in the area of consumer resistance (Kleijnen, Lee, and Wetzels 2009).

Second, the new scale was anchored in a theoretically grounded model, which combined constructs from both the innovation adoption and resistance literature under the umbrella of status quo bias theory (Samuelson and Zeckhauser 1988). Although a quite similar approach was applied by Kim and Kankanhalli (2009) in the area of user resistance towards IS implementation, as far as the authors are aware, this framework has never been tested before with consumers. The study therefore contributes to the theoretical understanding of consumer resistance towards (green) innovations.

Third, costs related to innovation adoption have so far been treated as one-dimensional constructs. In this study we looked at the various dimension of costs (i.e. investment, uncertainty, disruption) and thus provided a more holistic approach to the concept of cost in relation to green innovation resistance.

Practical Implications

The study offers suggestions to marketers and public policy makers about how to overcome homeowners’ resistance towards small wind turbines and promote these green innovations more effectively in consumer markets. First, the findings show that the level of resistance is significantly affected by homeowners’ perceptions of costs, which are related to potential disruption and retrofitting of the house. In order to change these perceptions, macromarketers could communicate the installation requirements for wind turbines more clearly to homeowners and demonstrate the application of wind turbines in densely populated areas to effectively illustrate the technology to homeowners.

Further, the study has shown that the perceived level of benefits associated with micro wind turbines significantly lowers the level of resistance. Emphasizing the advantages of these technologies in consumer markets is therefore likely to yield lower levels of resistance and higher rates of adoption. Arguments could highlight the energy saving aspect in relation to increasing oil and gas prices as well as issues around self-sufficiency. Although homeowners seem to reject micro wind turbines for other reasons than upfront capital cost, previous studies have shown that initial cost are a significant barrier when it comes to actual decision to adopt (e.g. Scarpa and Willis 2010). Offering new payment vehicles and micro financing options to homeowners are therefore important to alleviate the initial financial burden and increase consumer's willingness to pay.

The study also shows that normative influences have a direct negative effect on resistance but also influence resistance indirectly through the perception of benefits (Ajzen 1991). Information campaigns that continue to appeal to people's environmental responsibility are therefore likely to increase the normative pressure on homeowners, ultimately lowering levels of resistance. Further, manufacturer of wind turbines should also provide densely populated areas with showcase wind turbines to increase awareness, foster word-of-mouth and utilize normative social influences to lower levels of resistance.

The negative influence of knowledge on perceived benefits also needs to be addressed. The results indicate that homeowners who claim to know more about micro wind turbines, associate fewer benefits with them, and thus have higher levels of resistance. Knowledge therefore provides an important segmentation criterion for marketers and public policy makers. The findings, however, indicate that potential early adopters of micro wind turbines may have relatively little knowledge around renewable energies in general which is consistent with earlier findings around radical innovations (e.g. Moreau, Lehmann, and Markman 2001).

Limitations and Further Research

The findings of this study are subject to certain limitations. First, the data were collected in the Republic of Ireland and only focused on one particular green innovation, i.e. micro wind turbines. It would therefore be interesting to apply this framework to a different category of green innovations in order to test its robustness across different product categories. It would also be interesting to compare findings from Ireland with those from other countries in Europe or the U.S. Further, this study focused solely on homeowners. Although appropriate for this study, future research could include a wider target group, again, testing the robustness of the proposed model.

Whereas this research focused on the level of resistance among non-adopters, it would be useful to compare different subgroups like potential adopters and postponers more thoroughly. Adaptive survey designs therefore provide a valuable tool in research around resistance as they provide a relatively simple method to classify consumers. The findings further suggest some inconclusive results around knowledge and resistance and it would be useful to examine if this relationship holds for different product categories or among different consumer segments.

Conclusion

Building on recent advances in the field, this study provides a new measure to empirically research consumer resistance to green innovations. Further, the new scale was validated in a theoretical framework based around status quo bias theory (Samuelson and Zeckhauser 1988). In so doing, the research addresses an acknowledged lack of empirical evidence and contributes to a more comprehensive understanding of consumer resistance to green innovations. In particular, the findings highlight the importance of compatibility-related costs, the perception of benefits and normative social influences as key determinants of homeowners' resistance towards micro wind turbines. It further highlights the direct and more importantly indirect influence of environmental values and subjective knowledge on resistance through benefit perceptions.

The study thus contributes to both the consumer resistance and innovation literature, by providing a more in-depth explanation of the underlying antecedents of non-adopters' decisions to postpone or reject green innovations. The findings offer recommendations to macromarketers and public policy makers on how to overcome homeowners' level of resistance and more effectively stimulate the uptake of green innovations in consumer market.

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