Green consumer behavior: determinants of curtailment and eco-innovation adoption

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Abstract
Purpose – Knowledge of green consumer behavior is important for environmental and business reasons. The purpose of this study is to examine the determinants of green curtailment behaviors and consumer adoption of innovations marketed as green (eco-innovations), and to analyze factors explaining these two types of green behaviors.
Design/methodology/approach – The results from a survey on adopters and non-adopters ($n = 1,832$) of alternative fuel vehicles (AFVs) are reported. Regression analysis on willingness to curtail car use and willingness to adopt a so-called environmentally friendly car are used to identify significant determinants across the behavioral categories.
Findings – The results show that values, beliefs, norms, and habit strength determine willingness to curtail and willingness for eco-innovation adoption. Personal norms have a strong positive influence on willingness for the behaviors and habit strength has a negative influence. The other determinants have varying influence depending on type of behavior.
Research limitations/implications – A limitation of this study concerns the focus on only one eco-innovation. However, since the adoption of AFVs is a high involvement behavior, the results carry implications for other high involvement products as well.
Practical implications – Attitudinal factors and habits in combination prove to be effective determinants for curtailment behaviors and willingness to adopt eco-innovations. In addition, previous adoption is found to be a strong determinant of future willingness to adopt.
Originality/value – The contribution of the paper is the two-sided approach on green consumer behavior and the result that values, beliefs and norms not only predict low involvement post-purchase behaviors but also adoption of high involvement eco-innovations.

Keywords Consumer behaviour, Ecology, Automotive fuels, Sweden

Paper type Research paper

An executive summary for managers and executive readers can be found at the end of this article.

Introduction

Growing concerns for the natural environment at seemingly all levels of society have led to a considerable increase in the number of products marketed as environmentally friendly. Studying the promotion of these allegedly environmentally friendly products, one can receive the impression that more consumption of these products is better than less consumption overall. This is an interesting development, which is not directly mirrored in current research. On the contrary, much research on green consumer behavior has focused primarily on non-consumption and post-consumption behaviors such as recycling and energy conservation (Follows and Jobber, 2000; Lee, 2009). Although this research on so-called curtailment behaviors has furthered the understanding of general green consumer behavior, there is still a lack of literature investigating high involvement purchases of green products. For example, studies have found that moral concerns (such as personal norms) determine several curtailment behaviors (Goldstein *et al.*, 2008; Hage *et al.*, 2009; Thøgersen, 1996). However, studies on the influence of moral concerns on consumer high involvement buying decisions with environmental implications are rare (Thøgersen, 1999). This is a problem since overlooking an influential determinant might hinder or delay successful diffusion of environmentally friendlier products and innovations.

Since there are both similarities and differences between green curtailment behaviors and green purchase behaviors of high involvement products, the overall aim of this paper is to investigate a set of determinants influencing both types of behaviors. As values, beliefs and norms (VBN theory; Stern, 2000) have been found to be successful in predicting curtailment behaviors, this theory is used as a theoretical framework. Curtailment behaviors have also been labeled habitual action behaviors (Stern, 1992), and research has

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shown that formed habits influence these types of behaviors as well (e.g. Eriksson *et al.*, 2008). Given that VBN theory has been found to be effective at predicting curtailment behaviors, and that effects of values, beliefs, and norms on everyday behavior may be disrupted by developed habits, the question arises whether these determinants also influence high involvement green purchase behaviors, and if so, in what way. This paper aims to contribute by investigating determinants of curtailment behaviors and green purchase behaviors, and by relating these two to each other. Specifically the studied empirical case concerns the curtailment of individual car use and consumer adoption of a so-called environmentally friendly innovation (eco-innovation), namely the alternative fuel vehicle (AFV). The determinants are tested, together with socio-demographic factors, on a sample of adopters and non-adopters of AFVs in Sweden.

Theoretical framework

Increasing the understanding of green consumer behavior is important for environmental and business reasons. From an environmental perspective, the lessening of negative effects of consumption is vital in order to fulfill some of the goals put forth by the international community (OECD, 2002; UNEP, 2007). From business and marketing perspectives, the development of less environmentally harmful products is not effective without consumers adopting greener technologies and lifestyles. It has also been argued that the "right" purchasing decision has the potential to reduce, and even eliminate, environmental harm in the later stages of the consumption cycle (Thøgersen, 1999). From a consumer research perspective, the behavior of reducing negative environmental impact (for example energy conservation and recycling) has received considerably more attention than the consumer behavior of purchasing products that are marketed as being environmentally responsible. Follows and Jobber (2000) suggest that this predominant focus on non-consumption and post-consumption behaviors has resulted due to the lack of environmentally responsible products available on the market previously. Specifically a gap in the understanding of green consumer behavior in relation to high involvement products marketed as green has been identified (Follows and Jobber, 2000; Thøgersen, 1999).

Within research focused on non-consumption and post-consumption green behaviors, several theoretical developments have emerged that have the potential to also further the understanding of green consumer purchase behaviors of high involvement products. One such area is the importance of values, beliefs and norms for pro-environmental intentions and behaviors. In order to clarify how these factors also might affect consumer adoption of high involvement eco-innovations, the differences between curtailment behaviors and technology choices are discussed initially.

Curtailment behaviors and technology choices

Much early research on green consumer behavior focused on behaviors that would reduce resource and energy use (Gardner and Stern, 2002). These, so-called curtailment behaviors include water and energy conservation, car use reduction, and to some extent recycling and responsible waste disposal. In this conceptualization, curtailment behaviors are made on an everyday basis, and in aggregation, they may have a substantial effect on the environment. Other characteristics of these behaviors are that they rarely cost money, involve frequent efforts, and often result in discomfort for the actor performing the behavior (Ritchie and McDougall, 1985; Ritchie *et al.*, 1981). Since curtailment behaviors are associated with changing habits and also involve some discomfort on the individual level, they have been found to be hard to implement from a policy perspective (Black *et al.*, 1985; Gardner and Abraham, 2007).

The second category of green behavior is often referred to as energy efficiency increasing behaviors or technology choices (Stern, 1992; Stern and Gardner, 1981). They are called technology choices since they often involve substituting old inefficient technology for more efficient solutions. These types of behaviors substitute capital for energy in that the individual consumer invests in more efficient innovations or products to lower the impact on the environment (Black *et al.*, 1985). Examples of these behaviors include investing in extra (or new types) of insulation for the home, investing in energy-efficient light bulbs and purchasing a more fuel-efficient, less polluting vehicle. Behaviorally, efficiency improvements typically involve one-time purchase decisions, and there is an initial financial expense and a potential for future savings. According to Black *et al.* (1985) there is no real discomfort for the individual associated with the technology choices which makes these behaviors more attractive for many consumers in comparison to curtailment behaviors.

Determinants of green consumer behaviors

Several researchers have argued that green consumer behavior is determined by a multitude of factors depending on type of behavior and involvement with the product and behavior (Black *et al.*, 1985; Cleveland *et al.*, 2005; Roberts and Bacon, 1997). Stern (2000) presents four categories of determinants of green consumer behaviors: contextual forces, attitudinal factors, habits or routines and personal capabilities. Contextual forces have been conceptualized as affecting behavior indirectly through attitudinal factors (Black *et al.*, 1985), putting the latter ones in the center for understanding green consumer behavior from both psychological and marketing perspectives (Alwitt and Berger, 1993).

Values, beliefs and norms

Attitudinal factors include values, beliefs and norms, which guide the general predisposition to act with pro-environmental intent (Stern, 2000). Within the category of attitudinal factors, Stern incorporates general values and attitudes, but also attitudes that are more specific to the certain relevant pro-environmental behaviors. This since it has been found that for a high correspondence between attitudes and behavior they must be measured at similar levels of specificity (Ajzen and Fishbein, 1977). Consumption attitudes are thus context-specific dispositions that connect personal stable values to actual consumption-level attitudes and behaviors (Cleveland *et al.*, 2005; Pickett-Baker and Ozaki, 2008). Using this notion, the value-belief-norm theory (VBN; Stern, 2000) has been developed and found valid in a wide variety of green consumer (curtailment) behavior contexts, such as household energy use (Poortinga *et al.*, 2004), conservation behavior (Kaiser *et al.*, 2005) and car use reduction (Eriksson *et al.*, 2006; Nordlund and Garvill, 2003). The VBN theory combines value theory (Schwartz, 1992) and norm-activation theory (Schwartz, 1977) in

postulating that the relationship between values and actual behavior is affected by more factors than consumption specific attitudes. These factors are:

- fundamental values;
- behavior specific beliefs; and
- personal moral norms that guide the individual's actions.

Within VBN theory, several types of individually held values have been found to affect green consumer behavior. The values most strongly related to activating pro-environmental personal norms and thus influencing green behaviors have been found to be social-altruistic, biospheric and egoistic values (de Groot and Steg, 2008; Hansla *et al.*, 2008; Stern *et al.*, 1999). The two former have generally been found to have a positive relation with green consumer behaviors, whereas the latter has been found to have a negative influence (Cleveland *et al.*, 2005; Nordlund and Garvill, 2002). Individuals with an egoistic value orientation will mainly consider costs and benefits of green behavior for them personally indicating that when the perceived benefits exceed the perceived costs they will behave in an environmentally friendly way and vice versa. Individuals with a social-altruistic value orientation will base their green consumer decision on perceived costs and benefits for other people. Finally, individuals with a biospheric value orientation will especially base their decision to act green or not on the perceived costs and benefits for the ecosystem and biosphere as a whole (de Groot and Steg, 2008). Based on these distinctions of values it is hypothesized here that biospheric values will affect both curtailment behaviors and eco-innovation adoption. However, based on previous research, it is not possible to clearly define a hypothesis as to whether biospheric values affect curtailment behaviors more than eco-innovation adoption, or if the opposite is the case.

In conjunction with values, different types of beliefs have been found to affect green consumer behavior. Within the moral norm-activation framework (Schwartz, 1977), and thus VBN theory, it has been found that if an individual is aware of environmental consequences (AC) of a behavior and ascribes responsibility (AR) to themselves for taking preventive action, a pro-environmental norm develops with a high potential to affect actual behavior (Bamberg and Schmidt, 2003; Stern, 2000). The ascription of responsibility concept, also termed responsibility denial (Schwartz, 1977), is closely related to perceived consumer effectiveness (PCE; Thøgersen, 1999). As such AR and/or PCE have been found positively associated with green consumer behaviors such as acceptability for energy policies (Steg *et al.*, 2005), recycling behavior (Guagnano *et al.*, 1995), and reduction of car use (Tanner, 1999). Building on this research, predominantly within the curtailment behavioral domain, it can be hypothesize that AR will have a positive influence on curtailment behaviors; however, it is unclear whether AR also has an influence on a pro-environmental technology choice, such as eco-innovation adoption.

The final concept, and thus the attitudinal factor closest to actual behavior in VBN theory, is the personal norm (Stern, 2000). Personal norms, experienced as feelings of moral obligation to act, are postulated to create a willingness to act pro-environmentally. Personal norms are in this aspect assumed to be formed by incorporating social norms into a consistent personal value system. Personal norms have been found to be successful predictors of green consumer behavior in a number of situations. For example it has been found that personal norms have a positive effect on the use of environmentally friendly travel modes (Hunecke *et al.*, 2001; Nordlund and Garvill, 2003). Minton and Rose (1997, p. 40) found that personal environmental norms were positively related to purchases of "a simple marketbasket of mundane, non-food, non-durable, consumer goods". Furthermore Widegren (1998) found that personal norms influenced willingness to pay higher prices for pro-environmental food, and Thøgersen (2002) found that personal norms influenced the purchasing of organic wine positively. The results lend support for the assertion that personal norms affect green curtailment behaviors and, to some extent, also low- to medium involvement purchase decisions. However, no definitive evidence suggests that this is the case for a high involvement eco-innovation such as the AFV.

Habits

Behavior change often requires breaking old habits and establishing new ones (Dahlstrand and Biel, 1997). Habit has been described as an automatic link between a goal and a specific behavior and, as opposed to more controlled behavior, demands very little attention and subsequent elaboration (Verplanken *et al.*, 1997). According to Thøgersen and Ölander (2006) there is general agreement in habit research that three requirements must be in place for a habit to evolve:

1 the behavior needs to be repeated many times;
2 the behavior must take place in stable surroundings; and
3 rewarding consequences must be available.

Hence, habits influence intentions and willingness to change behavior and translate attitudinal factors into actual behavior. As such habits are conceptually close to the curtailment category of green consumer behaviors and have been found influential predominantly within this context (Dahlstrand and Biel, 1997; Eriksson *et al.*, 2008; Thøgersen and Møller, 2008). The proposition that strong habits are negatively related to (willingness for) curtailment behaviors is thus not farfetched. However, whether habits have an influence on high involvement purchases of a product marketed as green, within the same behavioral domain, is uncertain.

Personal capabilities

According to Stern (2000) personal capabilities include the knowledge and skills required for particular actions, the availability of time to act, and general capabilities and resources such as literacy, money, social status and power. Socio-demographic variables such as age, education and income may also be indicators of personal capabilities. Although several studies have found that these factors are poor predictors of green consumer behaviors (Diamantopoulos *et al.*, 2003; Roberts, 1996), they are often used as control variables. From a curtailment and technology choice perspective it can be hypothesized that a lower income is positively related to curtailment behaviors since these behaviors are less financially demanding. Previous studies have found that green purchase decisions to some extent are determined by higher income (Gatersleben *et al.*, 2002; Minton and Rose, 1997), indicating that eco-innovation adoption can be assumed to be positively related to income. Concerning age, living status (single or cohabitating) and gender, evidence exists both for and against hypothesis in either direction (Barr, 2007;

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Diamantopoulos *et al.*, 2003; Fraj and Martinez, 2006; Gatersleben *et al.*, 2002).

Summing up, the review shows that green consumer behavior has been researched predominantly from a curtailment perspective. Although this has meant that there is limited understanding of green purchase behavior in relation to green high involvement products, the VBN theory is hypothesized to be valuable in explaining these behaviors as well. Specifically it is hypothesized that biospheric values, ascription of responsibility, and personal norms have influence on curtailment of car use, as well as on eco-innovation adoption. In addition, habit strength is hypothesized to influence curtailment behaviors and eco-innovation adoption.

Research method

Empirical context

Personal car use is increasingly being associated with environmental problems (Nordlund and Garvill, 2003). A traditional solution has been to influence consumers to curtail car use and switch transportation modes to more environmentally friendly alternatives (Gärling and Steg, 2006). Another solution is a technological one where consumers adopt cars that are less environmentally harmful, for instance vehicles that run on fossil oil alternative fuels. Since cars have been defined as high involvement durables (Lambert-Pandraud *et al.*, 2005; Lapersonne *et al.*, 1995), the question whether pro-environmental attitudes, such as values, beliefs and norms, have any influence on this particular purchase decision is of essence. It has also been argued that car purchases and car use are important issues to study together since they are closely linked with high impact on the environment (Gärling and Loukopoulos, 2008).

In a European perspective the Swedish alternative fuel vehicle (AFV) fleet and sales of alternative fuels in the form of bioethanol and biogas is the highest (European Commission, 2007). According to a recent Eurobarometer (2008), Swedes report being among the most aware of climate change in the European Union, perceive they are best informed about climate change, and have the strongest belief in alternative fuels as a way to reduce greenhouse gases. In Sweden, AFVs have been available for private consumers since 2001 but the substantial take-off in sales began in 2006. At the end of 2006, when this research was conducted, the total car fleet consisted of approximately 2 per cent AFVs (Sika, 2007). In this paper, AFVs are defined as passenger cars that are able to run on gasoline/diesel-alternative fuels. There were primarily three types of AFVs in Sweden during the time of the study. The electric-hybrid AFVs run on gasoline and generated electricity, and the gas-hybrid AFVs run on natural gas/biogas and gasoline. The vast majority of the AFVs in Sweden however are so called ethanol-hybrids, which run on a combination of gasoline and bioethanol (E85, 85 per cent ethanol and 15 per cent gasoline). During the study there were approximately 700 filling stations for E85 in Sweden (out of circa 3,800 total) and circa 75 for natural/biogas (SPI, 2007). The continuous increase in sales of AFVs in Sweden has been related to an intense debate on climate change and the effects of cars, fuels and personal transportation on the environment, during the last few years. This debate can be assumed to have influenced the way traffic and cars are viewed, and the norms individuals associate with these issues. In sum, the Swedish market can be viewed as a lead market from which conclusions can be drawn about regulatory practices and consumer behavior (e.g. Beise and Rennings, 2005). Swedish consumers have also been found to be among the most eager for new automobiles in a recent cross-national comparison, which indicates the generally high acceptance rate for new products in this market (Tellis *et al.*, 2009).

Sampling

Data was collected using a postal mail-in respondent self-administered questionnaire. A random sample of 3,000 car owners from across Sweden was obtained and a stratified sample of 1,000 alternative fuel vehicle (AFV) owners was randomly drawn, resulting in 4,000 car owners. The oversampling of AFV owners was made in order to achieve a substantial group of adopters in the total sample. A total of 1,904 questionnaires were returned which gave a response rate of 48 per cent. Missing value analysis found that 72 questionnaires had more missing data than 50 per cent (including 44 blank) and were thus excluded from analysis (Hair *et al.*, 2006). In total 1,832 questionnaires were used for analysis, however, due to non-response on single items, the number reported in specific analyses might be somewhat lower. Comparing the sample with data on car owners in Sweden indicated that the sample was representative of the car owning population (SCB, 2006a; Sika, 2007).

Measures

The questionnaire, which was part of a larger study on cars, fuels and green consumer behaviors, consisted of dependent and independent constructs and control variables. Eight items were constructed to tap into the two dependent behaviors: willingness to curtail negative effects of car use (WTC) and, willingness to adopt a so-called environmentally friendly car (WTA). The WTC items focused on decreasing car use, carpooling and switching to public transportation for environmental reasons. The WTA items focused on willingness to replace the current car for a so-called environmentally friendly car, and for cars mainly fuelled by alternative fuels such as ethanol/E85, hybrid/electricity and natural/biogas. All items were measured on a five-point scale. Principal component analysis (PCA) of the eight dependent items resulted in loadings on two factors. Wording of each item, means, scale means, standard deviations (SD), factor loadings and communalities are presented in Table I. The alpha values (0.75 for WTC, and 0.73 for WTA) were found to be acceptable (Hair *et al.*, 2006; Nunnaly, 1967). The PCA explained 57.1 per cent of the total variance ($n = 1{,}782$, $df = 28$, $p = 0.000$) of the scale (WTC = 29 per cent, WTA = 28 per cent).

As a basis for the independent attitudinal factors the value-belief-norm (VBN; Stern, 2000) theory was used. Thus, eleven items were utilized to tap into values, beliefs and norms. In accordance with VBN theory, biospheric values were measured on a general level focusing on fundamental ecological values. The four biospheric value items were adapted from Stern *et al.* (1998) who developed a short inventory of values based on Schwartz's (1992) original value scale. Beliefs were conceptualized as ascription of responsibility (AR) to oneself for environmental problems relating to car and fossil oil use. The three items were partly based on Steg *et al.* (2005) as were the three items used to tap into personal norms (PN) in relation to fossil oil and

Table I Construct measures and scale reliability for willingness for pro-environmental behavior

Willingness for pro-environmental behavior	Mean	SD	Component 1	Component 2	Communality
Willingness to curtail (WTC), summated [a]	3.25	0.99			
Decrease car travel for short distances?	3.81	1.16	0.776		0.603
Decrease car travel for longer distances?	2.98	1.28	0.728		0.542
Carpool, ride together, with others to/from work/school?	3.10	1.51	0.754		0.570
Travel more with bus/public transportation instead of using the car?	3.14	1.29	0.778		0.625
Willingness to adopt (WTA), summated [b]	2.46	0.99			
A so-called environmentally friendly car?	3.38	1.43		0.807	0.652
A car fuelled mainly by ethanol/E85?	2.71	1.43		0.736	0.542
A car fuelled by gasoline and electricity (so-called hybrid)?	1.87	1.23		0.730	0.536
A car fuelled mainly by bio/natural gas?	1.88	1.20		0.694	0.495
Cronbach's alpha			0.75	0.73	
Percentage of variance explained			29.0	28.0	

Notes: [a] Scale: 1, No, absolutely not. . . 5, Yes, absolutely. Initial statement: Would you be willing to do something for the environment; [b] Scale: 1, No, not at all likely. . . 5, Yes, very likely. Initial statement: How likely is it that you will replace your current car for. Principal component analysis, Varmiax rotation with Kaiser normalization, loadings less than 0.40 are not shown. Total variance explained = 57.1 per cent; KMO = 0.726; Bartlett's test Chi-sq. = 3,327.90, df = 28, $p = 0.000$

alternative fuels. The four biospheric items were measured on a nine-point scale and the seven AR and PN items were measured on five-point scale. The PCA of these measures is presented in Table II. A total of 78.1 per cent of the variance was explained ($n = 1{,}782$, df = 45, $p = 0.000$) and values, beliefs and norms each explained, 33.7 per cent, 22.7 per cent and 21.7 per cent respectively. The alpha values, ranging from 0.80 to 0.94, were found to be acceptable for the three separate constructs and well in line with the original scales (Steg *et al.*, 2005; Stern *et al.*, 1998).

The final independent construct measured was habit strength of car use. For this construct 12 items were used adapted from the self report index of habit strength as developed by Verplanken and Orbell (2003). The scale was adapted to fit car use and measured on a five-point scale from 1, strongly disagree, to 5, strongly agree. The PCA conducted resulted in loadings on one factor only. A total of 62.7 per cent of the variance was explained ($n = 1{,}782$, df = 66, $p = 0.000$) and the scale achieved a Cronbach's alpha of 0.93 indicating satisfactory internal scale reliability.

Table II Construct measures and scale reliability for values, beliefs and norms

Values, beliefs and norms	Mean	SD	Component 1	Component 2	Component 3	Communality
Biospheric values (Bio), summated [a]	7.42	1.62				
Protecting the environment: preserving nature	7.61	1.67	0.896			0.825
Preventing pollution: decreasing own pollution	7.30	1.79	0.895			0.844
Respecting the earth: live in harmony with other species	7.49	1.73	0.935			0.891
Unity with nature: fitting into nature	7.29	1.84	0.898			0.822
Ascription of responsibility (AR), summated [b]	3.33	1.12				
I feel partly responsible for the increase in the use of fossil fuels such as oil/gasoline/diesel	3.25	1.36		0.703		0.579
I am partly responsible for the fossil oil problems in society today	3.41	1.26		0.899		0.839
I feel partly responsible for global warming	3.34	1.28		0.883		0.839
Personal norm, (PN), summated [b]	3.27	1.17				
I would be a better person if I drove using electricity or any other biofuels such as ethanol/bio-gas	3.12	1.46			0.799	0.693
I feel a moral obligation to use electricity or any other biofuels such as ethanol/bio-gas instead of fossil fuels such as oil/gasoline/diesel	3.26	1.31			0.841	0.797
If I were to replace my car today I would feel a moral obligation to replace it for a car fuelled by electricity or any other biofuels such as ethanol/bio-gas	3.43	1.38			0.792	0.678
Cronbach's alpha			0.94	0.83	0.80	
Percentage of variance explained			33.7	22.7	21.7	

Notes: [a] Scale: 1, Opposite to my values, 2, Not important, . . . 9, Of utmost importance; [b] Scale: 1, Strongly disagree. . . 5, Strongly agree. Principal component analysis, Varmiax rotation with Kaiser normalization, loadings less than .40 are not shown. Total variance explained = 78.1 per cent; KMO = 0.821; Bartlett's test Chi-sq. = 11,486.77, df = 45, $p = 0.000$

In addition to the dependent and independent variables, several sociodemographic variables were measured (gender, age, living status, education, and income).

Results

Descriptives

As presented in Table III the sample included 616 female (33.6 per cent) and 1,216 male car owners. These numbers correspond well with the car owning population in Sweden where the approximately 3.5 million privately owned passenger cars were owned to two-thirds by men at the end of 2006 (Sika, 2007). The mean age of car owners in the sample was close to 52 years and 21.0 per cent of the households were single-person households. The measure of education level, which was found to be higher for car owners than for the general population in Sweden (SCB, 2006b), showed that 46.6 per cent had completed 12 years of school or more. The median income level of the sample was between 200,000 and 300,000 SEK. In the sample 67.9 per cent of the car owners owned a car fuelled by gasoline and 23.1 per cent a so called flexible fuel vehicle which can run on any mixture of ethanol/E85 and gasoline. Since the market for AFVs was at the early stages of sales take-off at the time of the study, the same number for the total car fleet was approximately 92 per cent gasoline cars, 6 per cent diesel cars, and 2 per cent AFVs (Sika, 2007). Of the AFVs in Sweden in 2006 the most common one was an ethanol/E85 vehicle, accounting for approximately 85 per cent of cars in the AFV group. In preparation for analysis, car owners were classified into adopters and non-adopters of AFVs based on car fuel type. The owners of gasoline and diesel cars were thus classified as non-adopters (71.5 per cent of the sample) and owners of cars fuelled by any alternative fuel were classified as adopters (28.5 per cent of the sample). Since previous research has found that consumer adoption of an innovation influences the use (Rogers, 2003), and also the willingness for future adoption it was termed necessary to control for this non-adoption/adoption variable in the subsequent analyses.

Table III Sample descriptives

	n	Per cent
Gender		
Female	616	33.6
Male	1,216	66.4
Age of car owner, years		
Mean (SD)	51.77 (14.27)	
Living status		
Co-habitating	1,325	79.0
Single	353	21.0
Years in school		
<9	372	20.6
9-12	589	32.8
>12	837	46.6
Annual income in thousands of SEK[a]		
<100	121	6.9
100-200	562	31.4
200-300	630	35.2
300-400	299	16.7
400-500	92	5.1
>500	84	4.7
Fuel of current car		
Gasoline	1,244	67.9
Diesel	66	3.6
Ethanol/E85	424	23.1
Gasoline/electric hybrid	37	2.0
Bio and natural gas	61	3.3
AFV Adoption		
Non-adopters	1,310	71.5
Adopters	522	28.5

Notes: [a]1 SEK approximately 0.13 Euros at the time of the study. $n = 1{,}832$. Due to non-responses all numbers do not add up evenly; SD = Standard deviation

Determinants of willingness to curtail (WTC)

With the purpose of investigating determinants of curtailment behaviors and eco-innovation adoption, stepwise multiple regression analyses were run using the behavioral constructs as dependent variables. Analyses were run on the full data set without replacing missing values or otherwise standardizing data, resulting in a number of 1,467 cases for the regressions. The results are presented in Table IV. Possible multicollinearity in the regressions was assessed by analyzing variance inflation factors (VIFs). The VIF values ranged from 1.03 to 1.79, which was found to be well below the cutoff threshold of 10.0 suggested by Hair *et al.* (2006).

Previous research has found that values, beliefs and norms are adequate predictors of curtailment behaviors. These constructs were therefore entered first into the regressions together with the car habit strength (CHS) measure (step one on WTC). These four determinants were all found to be significant predictors ($p < 0.01$) of willingness to curtail car use. Biospheric values, beliefs and personal norms had positive influence, whereas car habit strength had a negative influence on WTC. This first step explained 18 per cent of the variance ($n = 1{,}467$, $F = 79.50$, $p < 0.001$) in the dependent construct.

In the next step, non-adoption/adoption was entered into the regression. The results showed that adoption had a significant negative influence on WTC, indicating that adopters of AFVs were less willing to curtail car use compared with non-adopters. Although non-adoption/adoption had influence, the four other determinants were still significant with the same positive/negative relationships. In total, step two of the analysis explained 19 per cent of the variance in the dependent construct, which was a significant ($p < 0.001$) improvement over step one.

In the third and final step on WTC, the socio-demographic variables were entered together with the other determinants in order to control for effects of gender, age, living status, education and income. In addition, the other dependent construct, willingness to adopt (WTA) was entered to control for interaction effects between the two dependent constructs. The results of the final step show that values, beliefs, norms and CHS are still significant predictors of WTC. In addition, age of car owners and education level were found to have significant negative influence on WTC. This indicated that older car owners with higher education were less willing to curtail car use. There was no statistically significant influence of WTA on WTC. In total, the third step explained 21 per cent of the variance, which was a significant ($p < 0.001$) improvement over step two.

Table IV Multiple regression models with willingness to curtail (WTC) and willingness to adopt (WTA) as dependents

		Model 1 – WTC [a]			Model 2 – WTA [a]		
Step	**Independents**	**Beta**	***T***	**Sig.**	**Beta**	***T***	**Sig.**
Step 1	Biospheric values (Bio)	0.041	2.57	0.010	0.031	2.14	0.033
	Ascription of responsibility (AR)	0.145	5.76	0.000	−0.070	−3.11	0.002
	Personal norm (PN)	0.175	7.37	0.000	0.436	20.36	0.000
	Car habit strength (CHS)	−0.182	−8.71	0.000	−0.092	−4.89	0.000
	F	79.50		0.000	147.76		0.000
	Adjusted R^2	0.178			0.288		
Step 2	Biospheric values (Bio)	0.042	2.64	0.008	0.029	2.16	0.031
	Ascription of responsibility (AR)	0.121	4.77	0.000	–	–	n.s.
	Personal norm (PN)	0.228	8.80	0.000	0.294	13.59	0.000
	Car habit strength (CHS)	−0.187	−8.99	0.000	−0.080	−4.60	0.000
	Non-adopter/adopter of AFV [b]	−0.282	−4.95	0.000	0.765	16.09	0.000
	F	69.53		0.000	191.10		0.000
	F change	24.49		0.000	258.95		0.000
	Change in R^2	0.014			0.108		
	Adjusted R^2	0.191			0.396		
Step 3	Biospheric values (Bio)	0.048	3.04	0.002	0.029	2.19	0.028
	Ascription of responsibility (AR)	0.119	4.72	0.000	–	–	n.s.
	Personal norm (PN)	0.238	8.64	0.000	9.307	13.96	0.000
	Car habit strength (CHS)	−0.198	−9.45	0.000	−0.071	−3.98	0.000
	Non-adopter/adopter of AFV [b]	−0.238	−3.86	0.000	0.693	14.36	0.000
	Gender [c]	–	–	n.s.	–	–	n.s.
	Age of car owner	−0.010	−5.68	0.000	–	–	n.s.
	Living status [d]	–	–	n.s.	−0.166	−3.49	0.000
	Years in school	−0.121	−3.33	0.001	0.124	4.13	0.000
	Annual income			n.s.	0.037	2.07	0.038
	WTC	–	–	n/a	–	–	n.s.
	WTA	–	–	n.s.	–	–	n/a
	F	36.18		0.000	94.89		0.000
	F change	6.95		0.000	9.25		0.000
	Change in R^2	0.023			0.022		
	Adjusted R^2	0.211			0.416		

Notes: [a] WTC = Willingness to curtail, WTA = Willingness to adopt; [b] AFV = Alternative fuel vehicle: Non-adopter = 0, Adopter = 1; [c] Gender: Female = 0, Male = 1; [d] Living status: Co-habitating = 0, Living single = 1; n.s. = non-significant at $p < 0.05$, n/a. = not applicable. *n* for all regressions = 1,467

Determinants of willingness to adopt (WTA)

Turning to the second dependent construct, willingness to adopt (WTA), the same determinants were used as in the WTC case. In the first step, it was found that values, beliefs, norms and CHS were all significant determinants of WTA. However, the effects were not the same as for WTC. Where the ascription of responsibility (AR) belief was positively associated with WTC, these same beliefs were found to be negatively related to WTA. The first step on WTA explained 29 per cent of the variance indicating that the four determinants were better at explaining willingness to adopt, compared with willingness to curtail.

In the second step on WTA, when non-adoption/adoption was entered, the results showed that previous adoption had a strong significant influence on willingness to adopt. Thus, compared with the WTC model this direction was the opposite. It was also noted that AR beliefs were no longer a significant determinant of WTA. The total variance explained increased significantly ($p < 0.001$) from the first step to the second, to 40 per cent in total.

In the final step on WTA the results were similar to step two with the main determinants exhibiting similar strengths and directions. Living status, education and income were all found to have significant influence on WTA indicating that co-habitation, higher education, and higher income levels were associated with WTA. It was noted that education level had a negative association with WTC, but a positive in relation to WTA. The final step on WTA explained 42 per cent of the variance, indicating that this model explained more of the variance than any other model tested.

Overall, the results showed that biospheric values, beliefs, personal norm and car habit strength were all significant determinants of both curtailment behavior and eco-innovation adoption. Personal norm proved to be the strongest predictor across the models and beliefs were positively associated with willingness to curtail, but negatively with willingness to adopt (before entering control variables). The effect of previous eco-innovation adoption had a moderate negative influence on WTC, but a strong positive influence on WTA. Age and education influenced WTC negatively, whereas living status influenced WTA negatively, and education and income had a positive influence. Taken together, the determinants were more effective at explaining willingness to adopt than willingness to curtail.

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Discussion

The purpose of this study was to examine the determinants of green curtailment behaviors and consumer adoption of eco-innovations, and analyze whether similar factors were effective in explaining these two types of green behaviors. The results showed that values, beliefs, norms, and habit strength determined willingness to curtail negative environmental behavior and willingness for eco-innovation adoption. Personal norms had a strong positive influence on willingness for the behaviors and habit strength had a negative influence. Values and beliefs had moderate positive influence on the behaviors. In addition, previous adoption was found to be a strong determinant of future willingness to adopt an eco-innovation, but not for curtailment behavior. The main contribution of the study is the two-sided approach on green consumer behavior and the result that values, beliefs and norms, not only predict low involvement post-purchase green behaviors, but also adoption of a high involvement eco-innovation such as the alternative fuel vehicle (AFV). Another contribution is the finding that habits, previously primarily associated with curtailment behaviors, also have an influence on willingness for adoption. Several of these findings warrant further discussion in relation to previous research and in relation to theoretical and practical implications.

Values, beliefs, norms and high involvement behaviors

In this study, a distinction was made between green curtailment behaviors and technology choice behaviors (in the form of adoption of an eco-innovation). Since the literature review found that the majority of previous studies focused on determinants of curtailment behaviors, and not on high involvement purchase decisions, it was decided to relate determinants of these two types of behaviors within a similar context. The determinants investigated in this study were developed based on previous research on green consumer behavior, where questions have been raised as to whether personal norms guide not only low involvement behaviors, but also high involvement behavior (Thøgersen, 2002; Thøgersen, 1999). Taken as a whole, the study confirms the importance of biospheric values and personal norms for both curtailment behaviors and high involvement purchase decisions. For willingness to curtail personal car use, previous studies have found a strong influence of personal norms (Eriksson *et al.*, 2006; Nordlund and Garvill, 2003), and this is also true for other curtailment behaviors such as energy conservation and purchasing of low involvement non-durables (Black *et al.*, 1985; Minton and Rose, 1997). The present study adds to this knowledge in clarifying that biospheric values and personal norms also have a strong influence on green purchase behaviors for high involvement durables.

Another important finding concerns environmental beliefs in the form of ascription of responsibility (AR). In VBN theory, it is postulated that personal norms are activated by personal beliefs that an individual's action (or inaction) has the power to prevent harm from an existing condition. Previous research on pro-environmental consumer behavior has found that when people ascribe responsibility to themselves they are more likely to form personal norms and thus perform or support pro-environmental behavior (Hunecke *et al.*, 2001; Nordlund and Garvill, 2003; Steg *et al.*, 2005). In line with this research, the present study found that AR beliefs indeed influence curtailment behaviors. However, the effect on eco-innovation adoption is not as clear. Before entering control variables into the regression our study finds that AR is significantly negatively related to adoption. This implies that individuals who are willing to adopt an eco-innovation feel less responsibility for taking pro-environmental action. A possible explanation could be that adopters of an eco-innovation feel that they have already taken their responsibility for action, and thus currently feel less responsibility. This explanation is supported by the finding that when non-adoption/adoption is entered as a control in the analysis (step two), AR beliefs become insignificant as a determinant for willingness to adopt, while biospheric values and personal norms are still significant. In this context, feelings of personal responsibility in the form of AR should be further critically examined before insisting that they are significant determinants of high involvement green consumer adoption behavior.

Overall, it was found that values, beliefs, norms and habit strength were considerably more effective in explaining willingness to adopt compared with willingness to curtail (29 per cent compared with 18 per cent). These explained variances are in line with VBN theory research on conservation behaviors (Kaiser *et al.*, 2005), and the results are similar both before and after controlling for adoption and socio-demographic factors. Although an important finding, before drawing a definitive conclusion on the importance of values and norms for eco-innovation adoption, the specific context used for this study should be considered. Further research in other contexts would be valuable in validating these findings.

Habits and pro-environmental behavior

Curtailment behaviors, such as saving water and energy, or reducing car use, can under certain circumstances develop into habits which is a more automated non-deliberative form of behavior (Eriksson *et al.*, 2008; Verplanken and Orbell, 2003). In this light, the finding that strong car habits have a negative influence on the willingness to curtail car use is not surprising. However, the present study also finds a significant negative influence of car habits on eco-innovation adoption. This finding indicates that previously formed habits act as barriers not only against changing low involvement behaviors, but also against performing green behaviors that require more involvement. Since the correlational nature of the present analysis does not permit drawing conclusions on causalities, the explanation might also be that individuals in the process of adopting an eco-innovation have begun deliberating on their present habits. By definition, the habit then becomes weaker (less automatic) and in this sense, adoption could be viewed as a breaking of old habits in response to the individual passing through the adoption decision-making process. Although this explanation is tentative, the implications (discussed below) might have far-reaching consequences.

Previous adoption and effects of socio-demographic variables

The sample for the present study included adopters and non-adopters of an eco-innovation. Previous adoption was significantly associated with both curtailing car use and future willingness to adopt the same eco-innovation. In the curtailment case, the effect was negative indicating that previous adoption decreases the willingness to curtail car use.

A possible explanation for this finding is the fact that previous adoption has been shown to increase the use of the product and/or product category (Rogers, 2003). This explanation also holds in the adoption case since the study found that adoption was strongly significantly associated with willingness for (continued) adoption. This in turn implies that adopters of eco-innovations, in this case the AFV, are content with their initial adoption decision and exhibit a strong willingness for confirming that decision in future purchases. The marketing implications of this finding are discussed below.

The majority of studies investigating different green consumer behaviors find that socio-demographic variables have little to no influence (Diamantopoulos *et al.*, 2003; Roberts, 1996). This study is no exception. When socio-demographic data are added to the analyses, the explained variance increases only moderately (approximately 2 per cent). However, it is notable that education has a negative significant association to willingness to curtail, but a positive relation to willingness to adopt. The explanation is likely to be that higher educated individuals (who also often have higher income) are more knowledgeable and have better financial capabilities, and thus willingness, to adopt innovations. The contribution of the present study is that it shows that the effects are opposite depending on whether green curtailment or adoption behaviors are studied. Although the effects are significant in both cases, they should be interpreted with caution since they are small compared to the other determinants in the models.

Limitations and further research

The two developed models explain up to 41 per cent of the variance in the dependent constructs, which is well in line with similar measures and conceptualizations relating to green consumer behavior and VBN theory (Kaiser *et al.*, 2005). In spite of this, there is a considerable proportion of unexplained variance left. Several researchers have argued for the inclusion of contextual factors, such as external drivers and barriers when measuring pro-environmental behaviors, and this would probably have improved the explanatory power of the models further (McKenzie-Mohr, 2000; Stern, 2000). Although contextual factors were not included in the models, the contextual setting surrounding the diffusion of AFVs in Sweden was described in order to provide a glimpse of a lead market of an eco-innovation and the consumers on that market. Further research on the use and adoption of high involvement eco-innovations would however be highly relevant when also including contextual factors. Another related limitation is the momentary survey approach. A longitudinal approach, following consumers over time in respect to willingness of eco-innovation adoption would be able to draw conclusion on whether the relationships accounted for here are consistent over time. Research focusing on other high involvement eco-innovations and the usage of these (e.g. Jansson *et al.*, 2009), in relation to curtailment behaviors would also be valuable in order to generalize the findings further.

Conclusions and implications

The research presented here shows that values, beliefs, norms and habit strength contribute in explaining curtailment behaviors as well as eco-innovation adoption. Furthermore, the study shows that not only low involvement post-purchase green behaviors are determined by personal norms, but so is adoption of a high involvement eco-innovation such as the alternative fuel vehicle. The results carry implications for several stakeholders in relation to green consumer behavior. However, the main implications of the study relate to marketing of green innovations and to strategies devised at lessening environmental harms of individual transportation.

Managerial implications and applications

For marketers of green innovations the main implication of the study is that adopters of an eco-innovation are less willing to curtail usage of the innovation, but more willing to purchase the innovation again in the future. This suggests that once consumers have adopted the eco-innovation the usage of it becomes an integrated component of their lives. It also suggests that these consumers are content with their initial adoption decision in that they are more willing than non-adopters to purchase the innovation again. From a marketing communications perspective, adopters might therefore be very useful communicators in spreading the word about their decision to adopt. Another angle is that consumers who once have adopted the eco-innovation are likely to be much more open for adoption of future improved eco-innovations. Whether this tendency to adopt eco-innovations is similar to the traditional innovativeness trait (e.g. Cowart *et al.*, 2008; Tellis *et al.*, 2009) is a fruitful avenue for future research to explore. Another important implication for marketers is that a segmentation approach is more effective when using attitudinal factors (such as values, beliefs and norms) and habits as profiling constructs compared with using only socio-demographic variables.

For strategies devised to decrease negative environmental impact of individual transportation behaviors, the findings imply that the main target of these strategies should be car habits, which is in line with previous research (Eriksson *et al.*, 2008). Since strong car habits are found to be consistently negatively related to both curtailment and eco-innovation adoption, they appear to be the major barrier to changing behavior. Once the individual's car habit is weakened, the findings imply that consumers have higher willingness for AFV adoption and higher willingness to reduce negative impact of car use. This implies that targeting car owners exhibiting strong habits and helping them to reflect on (and thus weaken) these habits could achieve both higher adoption rates of AFVs and more willingness to cut down on driving, and consequently reduce negative environmental impact. Although car habits prove important, the findings also imply that values, beliefs and norms associated with cars and fuels are essential. Policies aimed at influencing adopters to communicate their attitudes and purchase decisions to non-adopters, might prove effective for lessening the negative environmental aspects of cars and travel. Seemingly, the consumer behaviors of resource curtailment and adoption of eco-innovations can both contribute in different ways towards achieving a more environmentally sound future.

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Executive summary and implications for managers and executives

This summary has been provided to allow managers and executives a rapid appreciation of the content of this article. Those with a particular interest in the topic covered may then read the article in toto *to take advantage of the more comprehensive description of the research undertaken and its results to get the full benefits of the material present.*

Ecologically-friendly products have increased in number due to growing interest in environmental welfare. Research in the area has increased accordingly, although "curtailment behaviors" have attracted most attention. Such behaviors largely relate to non-consumption and post-consumption activities like energy conservation, efficient disposal of waste and recycling. Taken together, it is accepted that curtailment behaviors might have a significant impact on the environment. Scholars have characterized these behaviors as rarely costing money, demanding frequent effort and often causing "discomfort" to those carrying out the task. That a change of habit is also involved makes curtailment behaviors difficult to incorporate into policy.

On the contrary, research into purchase and consumption of environmentally-responsible products is less evident. This often involves consumers adopting efficient alternatives to replace less effective technologies. Appropriate study is consequently deemed necessary to aid the penetration of such products that include insulation, energy-saving lighting and vehicles that offer greater fuel-efficiency and lower carbon emissions. Typically, these behaviors involve single purchase decisions that demand initial financial outlay but offer the potential for future savings.

Influential factors

According to different scholars, the many factors that can influence green consumer activity depend on behavior type and involvement with the product and behavior. These factors have been organized into contextual forces, habits and routines, personal capabilities and attitudinal factors. Engaging in pro-environmental behavior often involves changing old habits or routines and developing new ones. But since habits involve little attention and elaboration, they significantly determine whether consumers intend and are willing to change behavior. Analysts associate habits more closely with curtailment behaviors and remain unsure about their influence on the purchase of high involvement green products.

Whether or not people are able to engage in specific actions like green behavior depends considerably on their personal capabilities and resources. Among these are the necessary skills and knowledge, time available, status, money and literacy. Previous research has noted weak or conflicting relationships between socio-demographic variables like age or gender and ecologically-friendly activities. However, it is argued that lower income may relate to curtailment behaviors because they of their "less financially demanding" nature.

Values, beliefs and norms are key attitudinal factors that include more general values and attitudes alongside those specific to certain green consumer behaviors. A key theory relating to these factors has been utilized in studies and found significant for household energy usage, conservation behavior and reduced car use. Studies have discovered links between different individual values and environmentally-friendly activities. These values have been identified as social altruistic, biospheric and egoistic. People inclined towards social altruistic values will consider the positive and negative impact on others when taking decisions about green activities. This consideration will extend to the whole ecosystem for biospheric individuals. Both types of values usually positively impact on green consumer behaviors, unlike where egoistic values prevail. In this case, individuals will only act in a pro-environmental manner when the perceived benefits to themselves outweigh the perceived costs.

Various types of beliefs have also been noted as influencing green consumer activities. For example, analysts point out that a "pro-environmental norm" emerges when a consumer becomes aware of how their actions have environmental consequences (EC) and ascribes responsibility (AR) to themselves for taking preventive action. The considerable likelihood of these beliefs to determine actual behavior is acknowledged in different studies. This "responsibility concept" is often allied with perceived consumer effectiveness (PCE) of their actions and along with EC and AR has been positively associated with curtailment behaviors such as recycling and lower car usage.

Certain theorists believe that personal norms are the attitudinal factor seen as closest to actual behavior. In relation to green activities, the personal norm reflects a "moral obligation to act" in an environmentally responsible manner. A key assumption is that personal norms develop through the formation of a "consistent personal value system" that also incorporates social norms. Several researchers have found personal norms to accurately predict green consumer behavior with regard to such as travel modes and food.

Survey and results

Jansson *et al.* explored these issues in a study addressing the green behaviors of Swedish car owners. Car habit strength was also considered. Specifically, the study focused on willingness to curtail negative effects of car use (WTC) and willingness to adopt an ecologically friendly car (WTA). Sweden was chosen because of the nation's status as a key

market for alternative fuel vehicles (AFV) of which three main hybrid types existed at the time.

A self-administered questionnaire was distributed and the final sample of 1,832 was deemed to accurately reflect the car owning population of the country. Males accounted for 66.4 per cent of the sample and the average age of respondents was around 52 years-old. Participants were classified as adopters or non-adopters depending on car fuel type.

Findings indicated that:

- Both curtailment behavior and adoption of pro-environmental innovations were significantly determined by biospheric values, beliefs, car habit strength and personal norm, which was found to be the strongest predictor. The effect was positive apart from a negative impact of car habit strength.
- In the absence of other variables, belief was positively linked to WTC and negatively with WTA.
- The impact of previous eco-innovation adoption on curtailment behavior was moderately negative.
- A strong positive relationship was evident between previous eco-innovation adoption and willingness to adopt.
- WTC was negatively influenced by age and education.
- The impact on WTA was positive by education and income but negative from living status, defined by such as single or cohabiting.

Marketing suggestions and additional study

The overall conclusion was that the variables were collectively more influential on WTA than WTC. However, further research in other contexts is recommended in order to generalize these findings. Jansson *et al.* likewise suggest additional exploration of AR beliefs. While the authors found support for earlier claims that AR belies impacts on curtailment, a less clear picture emerges for adoption. One notion is that adopters may feel they have already made some contribution and as a result feel less responsible towards additional green behaviors.

That car habit strength had a strongly negative impact on both WTC and WTA prompts suggestions that established habits may deter both changing low involvement behaviors and engaging in green behaviors where involvement is greater. Consequently, the act of becoming adopters could require marketers to provoke some contemplation of current habits in order to prompt change.

As for adoption, the results here reflect earlier findings that previous adoption strongly increased the likelihood of similar future action. Such consumers may additionally be more receptive to other eco-innovations and could be exploited as highly "useful communicators" in the quest to persuade others to behave likewise. Another recommendation is for marketers to segment consumers based on profiles that incorporate habits and attitudinal factors as well as socio-demographic variables.

Investigating the significance of external drivers and barriers is one future research option, while Jansson *et al.* also believe that a longitudinal approach may provide further valuable insight into the adoption of pro-environmental innovations.

(A précis of the article "Green consumer behavior: determinants of curtailment and eco-innovation adoption". Supplied by Marketing Consultants for Emerald.)