

# ENERGY EFFICIENT PRODUCT CONSUMPTION BEHAVIOR

AN ANALYSIS OF THE EXPLANATORY VARIABLES OF  
INFLUENCE ON ENERGY EFFICIENT PRODUCT CONSUMPTION  
THROUGH SURVEY RESEARCH

**University of Utrecht**  
**August 27<sup>th</sup>, 2015**

**Author:** Erik Elast  
**Student number:** 3539644  
**E-mail:** e.elast@gmail.com

**Sustainable Development – Environmental Governance Track**  
**Faculty of Geosciences**

**Supervisor and first reader:** Dr. Mendel Giezen  
**Second reader:** Prof. dr. Peter Driessen

## Abstract

High levels of energy consumption are a decade old problem in both the Netherlands and the world. Governments propose strict guidelines for businesses, but household energy consumption remains high. By addressing the behavior of purchasing energy efficient products, a sustainable method of decreasing energy consumption is instigated, as opposed to having households use their appliances less. To do so however, a better understanding is required of what drives households to purchase energy efficient products.

Literature only provides limited information regarding this specific topic, so explanatory variables are identified which influence energy efficient product consumption behavior based on models relating to pro-environmental behavior. Socio-demographic, internal and external factors are identified in literature and are operationalized in the form of a survey. By means of a test panel the applicability of the survey is further increased before collecting sample data.

218 questionnaires are collected on which statistical analysis is carried out. Descriptive statistics indicate that a large number of the exploratory variables show a relation with the dependent variable of energy efficient product consumption behavior, which is further substantiated through correlation. Over half the variables show significant correlation with the dependent variable. Further analysis through regression provides three distinct predictors that could, partially, predict the dependent variable. Self-efficacy, personal conservation and age account for a moderate amount of explained variance ( $R^2 = .212$ ).

While certain limitations are recognized, such as overrepresentation of perception questions, the research shows that the identified exploratory variables to an extent influence energy efficient product consumption behavior. As behavior is an intricate construct, and this is an exploratory study, attention should also be paid to the method applied, as comparable methods for predicting energy efficient product consumption behavior are sorely missing. While more research is needed on the topic, a strong case is made for why the findings of this research contribute to theory and practice, and new research topics are identified.

*Keywords: survey research, energy efficient products, consumption behavior, explanatory variables.*

## Acknowledgements

First and foremost I would like to thank both my assistants, Wendy van Luinen and Jocelyne Wolters, for collecting surveys by my side. If it wasn't for them, I would have never achieved the current sample size on schedule.

Next, I would like to thank my supervisor and first reader, dr. Mendel Giezen, for providing indispensable points of improvement and remaining supportive when my schedule was pressured. Additionally, I would like to thank both dr. Giezen as well as my second reader, prof. dr. Peter Driessen, for finding the time to grade my thesis at the start of a new school year.

Lastly, I would like to thank everybody that assisted me over the years and kept me on track and motivated.

## Table of Contents

Abstract.....	i
Acknowledgements.....	ii
List of figures.....	v
List of tables.....	v
1. Introduction.....	1
1.1 Research background and problem definition.....	1
1.2 Research objective.....	3
1.3 Research questions.....	3
1.4 Research framework.....	4
1.5 Relevance.....	4
1.6 Structure.....	5
2. Literature review and theoretical framework.....	6
2.1 Behavior.....	6
2.1.1 The Theory of Planned Behavior.....	6
2.1.2 Pro-environmental behavior.....	7
2.1.3 Remarks and selection.....	11
2.2 Variables.....	12
2.2.1 Dependent Variable.....	12
2.2.2 Independent Variables.....	13
3. Methodology.....	26
3.1 Procedure.....	27
3.1.1 Cognitive aspects of surveys.....	27
3.1.2 Questionnaire design.....	28
3.1.3 Self-reporting.....	29
3.1.4 Validity and reliability in quantitative research.....	30
3.2 Measuring.....	31
3.2.1 Dependent variable.....	31
3.2.2 Socio-demographic variables.....	32
3.2.3 Internal factors.....	32
3.2.4 External factors.....	35
3.3 Test panel.....	36
3.4 Sample.....	37
3.5 Statistical analysis.....	38
3.5.1 Descriptive statistics.....	38

3.5.2 Correlation .....	39
3.5.3 Regression .....	40
3.5.4 Initial assessment .....	43
3.6 Closing statement methodology .....	47
4. Results .....	48
4.1 Descriptive statistics .....	48
4.1.1 Dependent variable .....	48
4.1.2 Socio-demographic variables .....	49
4.1.3 Independent variables .....	53
4.1.4 Summary of descriptive statistics .....	61
4.2 Correlation .....	62
4.2.1 Correlation of the dependent variable .....	62
4.2.2 Correlation of the independent variables .....	64
4.3 Regression .....	66
4.3.1 Model evaluation .....	67
4.3.2 Dependent variable separation .....	70
5. Conclusion .....	72
6. Discussion .....	74
6.1 Research limitations .....	74
6.2 Method improvement .....	74
6.3 Contributions of this research .....	76
Literature .....	78
Appendices .....	89
Appendix A: Environmental Attitude Inventory (EAI) .....	89
Appendix B: Final Questionnaire .....	92
Appendix C: Additional statistics .....	98

## List of figures

Figure 1 Research framework .....	4
Figure 2 Theory of Planned Behavior from Ajzen (1985).....	6
Figure 3 The Hines Model of Responsible Environmental Behavior (Hines et al., 1987) .....	8
Figure 4: Model of Ecological Behavior (Fietkau & Kessel, 1981).....	10
Figure 5: Model of pro-environmental behavior by Kollmus & Agyeman (2002) .....	11
Figure 6: Temporary explanatory variables for energy efficient consumption behavior .....	12
Figure 7: Overview of internal factors .....	21
Figure 8 Representation of social, cultural and institutional factors adapted from Sallis et al. (2006, 2008) .....	22
Figure 9: Policy instruments for behavior change (Van Woerkum et al., 1999 in: Aarts & Lokhorst, 2012) .....	23
Figure 10: Overview of external factors.....	25
Figure 11: Breakdown of DV categories.....	49
Figure 12: Distribution age variable.....	49
Figure 13: Distribution gender variable .....	49
Figure 14: Distribution of household income variable .....	50
Figure 15: Distribution marital status variable .....	51
Figure 16: Distribution housing variable.....	51
Figure 17: Distribution education variable .....	51
Figure 18: Distribution family size variable.....	51
Figure 19: Composition of attitude items.....	53
Figure 20: Composition of motivation items .....	54
Figure 21: Composition of self-efficacy items.....	55
Figure 22: Composition of knowledge of action strategies items .....	56
Figure 23: Composition of skill in using action strategies items.....	56
Figure 24: Composition of personal responsibility items .....	57
Figure 25: Composition of perception of consequences items .....	58
Figure 26: Composition of relatedness to nature items .....	58
Figure 27: Composition of external factor items .....	59
Figure 28: Composition of subjective knowledge items.....	60
Figure 29: Composition of objective knowledge items .....	61
Figure 30: Linearity scatterplot.....	69

## List of tables

Table 1: Raw Cronbach's alpha values for all scales .....	43
Table 2: Factor loadings of the motivation scale .....	45
Table 3: Factor loadings of the self-efficacy scale .....	45
Table 4: Factor loadings of the external factors scale .....	46
Table 5: Descriptive statistics for the dependent variables.....	48
Table 6: Influence of age on DV (compressed) .....	50
Table 7: Distribution comparison age groups between sample and population.....	52
Table 8: Household income comparison between sample and population .....	52
Table 9: Mean attitude values .....	53
Table 10: Mean motivation values.....	54
Table 11: Mean self-efficacy values.....	55

Table 12: Mean knowledge and skill in action strategies values .....	56
Table 13: Mean personal responsibility values.....	57
Table 14: Mean perception of consequences values .....	57
Table 15: Mean relatedness to nature values .....	58
Table 16: Mean external factors values.....	59
Table 17: Mean objective knowledge values.....	60
Table 18: Correlation of dependent variable with independent variables.....	62
Table 19: Correlation of dependent variable with independent variables controlling for age, marital status and housing .....	64
Table 20: Correlation matrix of independent variables.....	65
Table 21: Regression results split across three subsequent models for predicting energy efficient purchasing behavior.....	67
Table 22: Further analysis of the regression models.....	68
Table 23: R-square change of separate predictors.....	69
Table 24: Regression coefficients for separate DVs.....	70
Table 25: Statistics regression models of the separate DVs .....	71
Table 26: Influence of gender on DV .....	98
Table 27: Influence of age on DV.....	98
Table 28: Influence of income on DV.....	98
Table 29: Influence of marital status on DV.....	98
Table 30: Influence of housing on DV .....	99
Table 31: Influence of family size on DV.....	99
Table 32: Influence of education on DV.....	99
Table 33: Composition of attitude scale .....	99
Table 34: Influence of attitude on DV.....	100
Table 35: Composition of motivation scale .....	100
Table 36: Influence of motivation on DV .....	101
Table 37: Composition of self-efficacy scale.....	101
Table 38: Influence of self-efficacy on DV .....	101
Table 39: Composition of knowledge and skill in using action strategies items .....	102
Table 40: Influence of knowledge and skill in using action strategies on DV.....	102
Table 41: Composition of personal responsibility items.....	103
Table 42: Influence of personal responsibility on DV .....	103
Table 43: Composition of perception of consequences items .....	103
Table 44: Influence of personal responsibility on DV .....	104
Table 45: Composition of relatedness to nature items .....	104
Table 46: Influence of relatedness to nature on DV.....	104
Table 47: Composition of external factors items.....	105
Table 48: Influence of external factors on DV .....	105
Table 49: Composition of subjective knowledge items .....	105
Table 50: Influence of subjective knowledge items on DV.....	106
Table 51: Composition of objective knowledge items.....	106
Table 52: Values of quality measures for the regression model .....	106
Table 53: Full regression coefficient table for model 4 .....	107

## 1. Introduction

One of the greatest challenges economies on all scales currently face is achieving growth in an environmentally sustainable way. Consumption and production behavior of virtually every nation has negative impacts on the environment (e.g. resource depletion, pollution, etc.). The effects of these negative impacts are felt not only in the nations of origin, but internationally, making it a cross-border issue that has seen substantial growth in interest in recent years (EUPOPP, 2009). While increased attention is paid to sustainable consumption, it is a relatively new topic of research, and the change of behavior towards the intended sustainable consumption has yet to see enough research to quench the thirst for understanding this phenomenon.

This study focusses not on sustainable consumption as it is most often seen in the form of food consumption, but on the consumption of non-food products. More specifically, consumption of energy efficient products is assessed as opposed to their non-efficient counterparts. The backbone of this research consists of a consumer survey to analyze whether what is known about pro-environmental behavior can be applied to the more specific and underrepresented energy efficient consumption behavior. By doing so it is the aim of this study to contribute to literature and provide a method for measuring and potentially predicting energy efficient product consumption among citizens, something that could benefit both policy-makers as well as businesses.

### 1.1 Research background and problem definition

Sustainable consumption finds a place in a variety of policy documents worldwide. This is a recent development and a reaction to several events of great importance to sustainability in general. The UN conference in Stockholm combined with the report 'Limits to Growth' draw attention towards environmental issues such as resource depletion in 1972 (United Nations, 1972; Meadows, 1972). Sustainable development as a whole becomes commonplace in public debate in 1987 in response to the report 'Our Common Future' (World Commission on Environment and Development, 1987). Addressed among the issues is the (over)consumption of natural resources, finding a fundamental place in scientific discourse on a global level for the first time. It takes five years for the words *sustainable* and *consumption* to be permanently linked together, in Agenda 21, the main document resulting from the 1992 Rio conference. Regarding sustainable consumption the message is clear: *"...the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production, particularly in industrialized countries..."* (United Nations, 1992: p. 18). Combined with *"all countries should strive to promote sustainable consumption patterns"* and *"developed countries should take the lead"* (p. 19) a herculean weight is put on the shoulders of these nations. Sustainable consumption is however, while used several times in Agenda 21, never specifically defined. In the past few decades there have been several viable definitions of what sustainable consumption entails exactly, most of which have roots on the international level. During the 1994 Oslo symposium on Sustainable Production and Consumption, the Norwegian Ministry of the Environment defined sustainable consumption as: *"the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations."* Albeit this is not the only definition of sustainable consumption, it is general enough to be widely applicable with strong ties to the Brundtland definition for sustainable development (World Commission on Environment and Development, 1987), but precise enough as to avoid confusion. This definition is used by the United Nations' Division for Sustainable Development (United Nations, 2015) as well as the Organisation for Economic Co-operation and Development (OECD, 2002) and is therefore deemed a more than appropriate definition.



Since and in accordance with the World Summit in Johannesburg (2002) most European nations have taken it upon themselves to formulate policy to stimulate sustainable consumption (EUOPP, 2009). The European Commission followed suit by presenting the overarching Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan in 2008 (European Commission, 2008). The action plan provides proposals on sustainable consumption and production that should contribute to improving the environmental performance of products as well as increase the demand for these products in the member states. The Netherlands was one of the nations that adopted the message of the 2002 World Summit prior to the presentation of the European Commissions' Action Plan. The main theme of the resulting Dutch Action Program was that *"sustainable development should ultimately become a natural springboard for all action at all levels of government. As such, it will serve as a touchstone as well as a guideline for policy"* (Ministry of Foreign Affairs, 2003). The attention for sustainable consumption in this program was limited however, as the activities regarding sustainable consumption and production (i.e. those proposed during the Johannesburg World Summit in 2002 and Cardiff Summit in 1998) were seen as *"[having] been on the Netherlands' agenda for some time and are already part of ongoing programs. In its program on corporate social responsibility, for example, the Netherlands is actively promoting the continued adaptation of CSR..."* (Ministry of Foreign Affairs, 2003). It is true that sustainable consumption policy is not new to the Netherlands as 1989 marked the beginning of Dutch comprehensive consumption policymaking with the first Netherlands Environmental Policy Plan (NEPP) (Martens & Spaargaren, 2005). While households were identified as environmental policy target groups in the first version of the NEPP, this was undone in the third version a decade later where ongoing product innovations became a focus point (VROM et al., 1998 in: Martens & Spaargaren, 2005). While linking household consumption to specific policy was difficult, it was not ignored. Stimulating of sustainable consumer behavior has been an increasingly important aspect of governmental action towards sustainable consumption in the last few years (CREM, 2013).

Within the research niche of sustainable consumption the sustainable consumption of food is well-explored compared to non-foods (e.g. Tanner et al., 2003; Vermeir & Verbeke, 2006, 2008; Heuer, 2014). In addition, the interest of the Infrastructure and Environment Ministry of the Netherlands is mainly focused on consumer behavior regarding sustainable clothing and food (CREM, 2013). This while household food consumption is seen as a no more of a pressing issue than other household consumptions such as energy or non-foods (OECD, 2002; EEA, 2010). The reduction of energy consumption is an important topic of Dutch policy such as the Third National Energy Efficiency Action Plan (NEEAP3) and Energy Agreement for Sustainable Growth (Ministries of Economic and Internal Affairs, 2013; SER, 2013). Energy consumption projections have been made and estimate an average of 1% to 2.5% decrease over all energy sources using existing policies and additional measures respectively (Hekkenberg & Verdonk, eds. 2015). These positive yet marginal projections relate to all fuel sources, and while a decrease in the use of natural gas and vehicle fuel consumption has been observed over recent years, electricity consumption has merely stagnated during a period of limited economic growth (ECN et al., 2014). As yet more attention is needed to combat energy consumption, much of the attention regarding energy innovations in the Netherlands is focused around technical and cost related aspects, as well as the embedding of these aspects by the government and businesses (CPB, PBL & SCP, 2014). This while households could save substantially on their energy costs and reduce their environmental impact, and nations as a whole could benefit greatly from relatively small changes spread over millions of households (Lehman & Geller, 2004). Two types of behavior are linked to changing energy consumption among households, one of which relates to using devices that use energy less, while the other relates to using the most efficient devices. While the former type of behavior requires repeated action (e.g. one has to actively change their lifestyle to lower their energy consumption), the latter mainly focusses on one-time efficiency behaviors, which could

benefit the environment without households having to put specific effort into it (Lehman & Geller, 2004). As the electricity consumption shows very few signs of decreasing any significant amount, households having such a large potential influence in the reduction of energy consumption, and one-time efficiency behaviors could be substantially more beneficial than repeated action, this research focusses on the consumption behavior of households related to energy efficient products. While the more general term energy is used, the specific focus of this research will be on electricity consuming devices.

## 1.2 Research objective

According to literature, around 30% of consumers generally have a positive attitude toward sustainable consumption, and thus have an increased intention to act sustainably (Vermeir & Verbeke, 2006), but market shares of sustainable products show very little evidence of this as market shares of environmental products sometimes do not even contribute 1% of the total market share, and never enter into double digits (e.g. Williams & Doane, 2001; De Pelsmacker, 2005; Vermeir & Verbeke, 2006). As such market shares can be seen as a direct contribution of sustainable consumption behavior (market shares do not increase if people do not buy the products), a large discrepancy between intended sustainable consumption behavior and actual behavior can be observed. This difference between intended and actual behavior is referred to as the attitude-behavior gap (Kollmuss & Agyeman, 2002). With relatively high intent but no strong behavior to back this up, environmental behavioral change becomes an important tool to attempt to close this gap. The field of research concerning environmental behavioral change is relatively young, with energy efficiency being an understudied subject in the Netherlands while energy efficiency of households is starting to become more prominent in policy and governmental discourse (e.g. Ministries of Economic and Internal Affairs, 2013; SER, 2013). A better understanding of why individuals purchase energy efficient products, and why they don't, is a necessity when it comes to closing the gap between the willingness to perform sustainable consumption, and the actual behavior. Explaining what factors influence the consumption behavior of Energy efficient products of an individual could help gain an understanding of what is needed to start closing this attitude-behavior gap, and potentially increase energy efficiency of households.

The aim of this paper is to assess which variables influence the behavior of energy efficient product consumption. As pro-environmental behavior in its general form is moderately well researched and specific variables to influence energy efficient product consumption behavior are likely to be completely missing from literature, variables that influence pro-environmental behavior will be operationalized and tested against energy efficient product consumption (Kollmuss & Agyeman, 2002; Hines et al., 1987). The identification of such explanatory variables should provide clues as to how they influence energy efficient product consumption behavior.

## 1.3 Research questions

In response to the research objective, the main research question to be answered in the course of this research reads:

To what extent can explanatory variables be identified which influence the behavior of energy efficient product consumption?

As this research question is much too intricate to resolve as is, several supporting sub-questions are constructed:

- Which explanatory variables can be identified in literature to relate to the consumption of energy efficient products?"

- What is the level of consumption of energy efficient products among participants, and how do they value the corresponding explanatory variables?
- How do the identified explanatory variables relate to participants' consumption behavior and each other?

The three sub-questions represent the three main methods applied in this research. The first sub-question will be answered through literature research, the second sub-question will be answered based on questionnaire data, and the third sub-question will be answered through statistical analysis based on findings from the survey. Finally, answering all three sub-questions will provide an answer to the main research question.

#### 1.4 Research framework

To answer the research questions the following course of action is taken. A literature review forms the starting point of this research and aims to identify the explanatory variables of influence on energy efficient product consumption. These variables are likely embedded in theory and models relating to overarching topics such as pro-environmental behavior. Thereafter the most appropriate model and relating variables is selected. This is based on the quality and applicability of the model as it relates to energy efficient product consumption, as well as the measurability of the separate variables. Next, the chosen variables are operationalized and a questionnaire is designed. The administering of these questionnaires heralds the beginning of data collection. The sample data is then analyzed through the use of descriptive and analytical statistics and subsequently interpreted in light of the posed research questions. A visual representation of the research framework can be seen in figure 1.

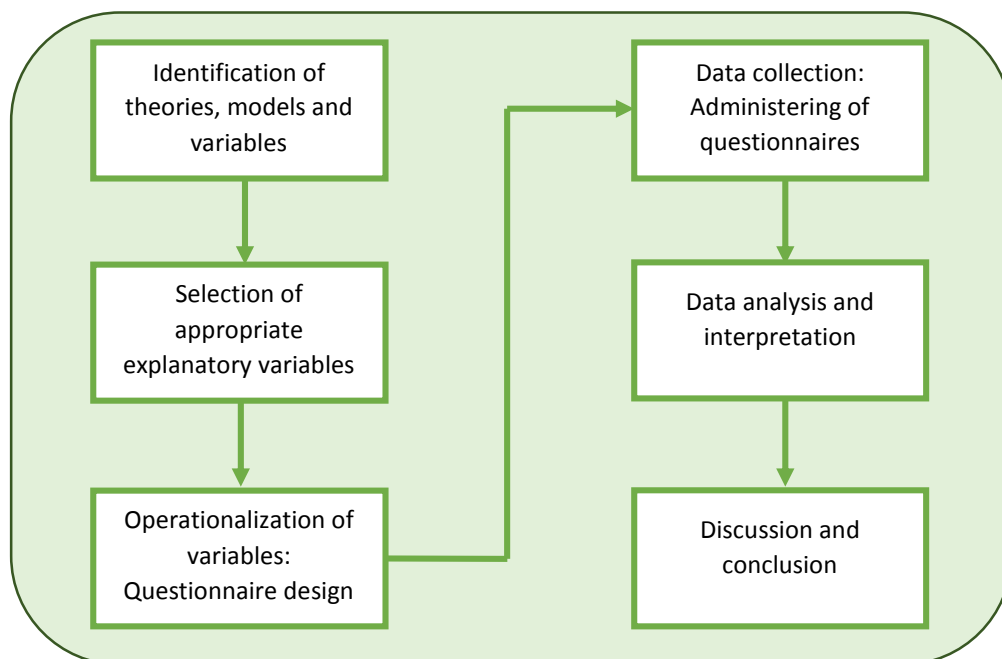


Figure 1 Research framework

#### 1.5 Relevance

As attention for sustainability is widespread, manufacturers increase the production as well as the promotion of sustainable products (Luchs et al., 2001). There is a basic understanding of and consensus on what drives consumers to buy sustainable products, or more importantly, what stops them from exhibiting their stated

attitude towards a product (e.g. Luchs et al., 2010; Vermeir & Verbeke, 2008; CPB, PBL & SCP, 2014). Products that incorporate sustainability attributes become increasingly appealing to consumers' values (Vermeir & Verbeke, 2008). However, studies show a significant attitude-behavior gap between what consumers say they are willing to do and what actions they actually take (Luchs et al., 2001; Young et al., 2010). For example, where 40% of consumers reported to be willing to buy green products, only 4% actually did so (UNEP, 2005). Closing this gap could mean substantial differences in market share for sustainable products while helping consumers understand the benefits of sustainable products. While research on the difference between reported willingness and actual market share is not a completely new field of study, the focus on sustainable products, and energy efficient products specifically, has hardly been touched upon. Most environmental behaviorists have targeted behaviors that require repeated action, as is the case with sustainable food products, while interventions that *"...focus on increasing one-time efficiency behaviors could have powerfully beneficial effects on the environment while obviating the need for maintenance"* (Lehman & Geller, 2004: p.24). By increasing what we know about why people do, or more importantly, don't, perform energy efficient product consumption behavior, the involved barriers can accurately be approached. As knowledge about the way such behaviors take place increases, both governments and business can benefit greatly. Governments set strict energy consumption guidelines for themselves and the government layers below them. Literature is lacking on what drives people to purchase energy efficient products. While the current, simplistic measures (e.g. economic incentives, banning certain products) do have an effect, they cannot last. Changing the behavior of individuals towards sustainability is the way forward to lower energy consumption at a higher rate than was projected (Hekkenberg & Verdonk, eds. 2015). As the number of household products being replaced by their more efficient kin increases, market shares of energy efficient products will grow significantly. As market shares of these products are currently so low, even slight contributions of behavioral change on a household level can give rise to large growth for those companies providing energy efficient products. While this alone might not be scientifically nor socially relevant, an increase in market share and an overall increase of energy efficient products leads to other improvements. For larger companies an increase in such sales could drive down prices through economies of scale, a basic economic principle (Buzzel et al., 1975). Additionally, an increase in demand for energy efficient products draws the attention of existing and new companies alike, promoting competition, which in turn drives down prices and increases quality and innovation. Thus, in all, all layers of society, ranging from governments and companies to the citizens themselves, benefit greatly from a better understanding in what drives behavior concerning energy efficient products.

## 1.6 Structure

Chapter two of this research paper presents the considerations and results of the literature review. In chapter three the identified explanatory variables are combined in the research methodology. Chapter four presents the results of the statistical analysis based on the survey sample data. Chapter six consists of the conclusion and a short summary. Chapter six consists of a discussion of the most relevant findings, as well as the limitations and implications of this research.

## 2. Literature review and theoretical framework

The purpose of this chapter is to convey the findings of the literature review. Theories and models relating to environmental behavior are assessed, of which those best suited for measuring energy efficient product consumption are selected. Furthermore, explanatory variables are chosen from the selected models and others when deemed important, until a complete image of the influence factors of energy efficient product consumption behavior can be constructed.

### 2.1 Behavior

In this section the main theories on human and environmental behavior, as well as behavioral change, are addressed. From these theories the relevant explanatory variables for energy efficient product consumption behavior are then identified for further research.

#### 2.1.1 The Theory of Planned Behavior

In 1975 Martin Fishbein and Icek Ajzen formulated the Theory of Reasoned Action (Fishbein & Ajzen, 1975). Ajzen later evolved the theory of reasoned action into the Theory of Planned Behavior (TPB), published in 1985 in his article "From intentions to actions: A theory of planned behavior", which to this day is the most used framework regarding the prediction of behavior from attitudinal variables (Ajzen, 2001). Ajzen (2001) states that "people act in accordance with their intentions and perceptions of control over the behavior, while intentions in turn are influenced by attitudes toward the behavior, subjective norms, and perceptions of behavioral control" (p. 43). In essence, human behavior is guided by three considerations according to Ajzen (1985): *behavioral beliefs*, i.e. beliefs about the likely consequences or other attributes of the behavior, *normative beliefs*, i.e. beliefs about the normative expectations of other people, and *control beliefs*, i.e. beliefs about the presence of factors that may further or hinder performance of the behavior. These beliefs in turn have certain effects. Behavioral beliefs give rise to a(n) (un)favorable *attitude toward the behavior*, normative beliefs constitute the underlying determinants of *subjective norms*, and control beliefs give rise to a perceived ease or difficulty of performing the behavior, or *perceived behavioral control* (Ajzen, 1985). In figure 2 the above is visualized, as well as the addition of the relation with behavioral intention and behavior itself.

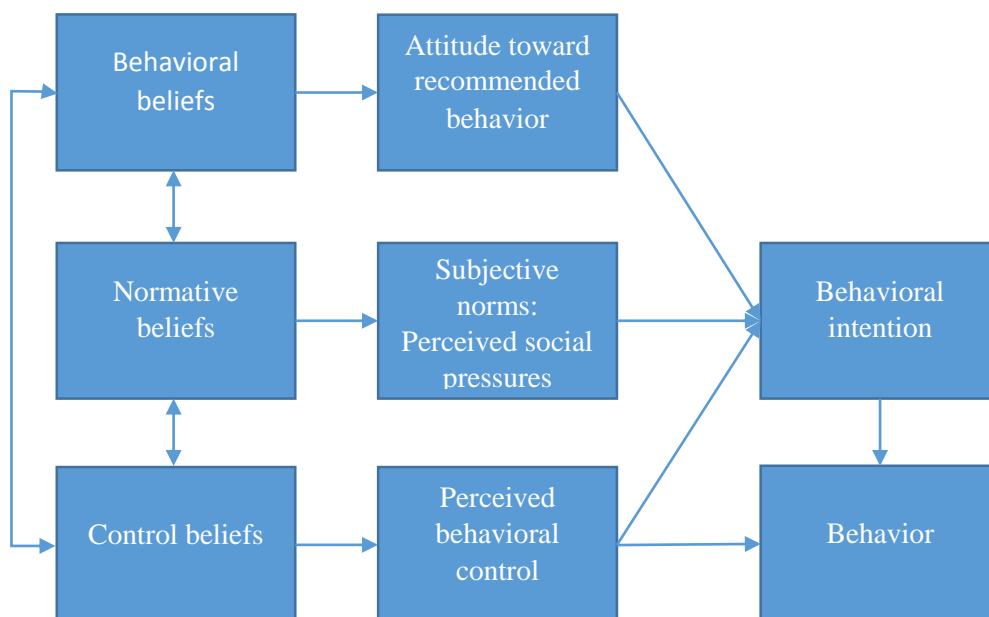


Figure 2 Theory of Planned Behavior from Ajzen (1985)

In response to several investigators that questioned parts of his work, Ajzen split the element of perceived behavioral control in two (Ajzen, 2002). He, and the peers that reviewed his work, came to the conclusion that perceived behavioral control consisted of perceived self-efficacy and controllability. Self-efficacy deals largely with the ease or difficulty of performing a behavior, largely in line with what was stated by Ajzen in 1985, but the additional controllability is defined as “the extent to which performance is up to the actor” (Ajzen, 2002: p. 680). Thus, in essence, how difficult would performing a behavior be and do you have control over it. It should be clear that these two are interwoven as the amount of control has a large impact on the difficulty of performing a behavior. Since the conception of the TPB there have been several critiques and reviews of the theory, some of which more worth addressing than others. In 2011 Ajzen published a reflection piece on the, in his view, most important raised questions (Ajzen, 2011). He states that among the addressed topics (e.g. rationality, emotions, past behavior, background factors) most are based on misconceptions of his theory, and where this is not the case the accounted for variance of the additional element is small.

### 2.1.2 Pro-environmental behavior

Other authors have looked more specifically at (pro-) environmental behavior. The term environmental psychology is defined in many books and other publications along the lines of how environmental factors affect behavior and cognition (Geller, 2002). This is the initial and traditional definition. Another definition, however, has been given considerable attention as well and is enjoying growing acceptance. This definition is more on the topic of changing behavior in order to protect the environment. Studies on the application of behavioral analysis to increase environment-preserving behavior have been around for decades and some showed significant potential. During the late 1970s and early 1980s pro-environmental behavior studies peaked (Lehman & Geller, 2004). But while interest was at an all-time high, an assessment of a variety of related behavioral studies between 1970 and 1986 was carried out and showed that these behavioral community studies failed to have any notable impact on environmental preservation (Geller, 2002; Geller, 1989). Early models designed to promote pro-environmental behavior were simple and linear. These models assumed that the education of people about environmental issues would automatically result in more pro-environmental behavior. These models were soon proven wrong as research showed that in most cases the increase in knowledge and awareness did not lead to the intended behavior, this while many NGOs and some governments still base their communication on this assumption (Kollmuss & Agyeman, 2002). Thus a clear discrepancy between attitude and behavior was identified. Many of the old models have since then been scrutinized and abandoned, leaving a select few from which the most applicable and workable must be selected.

#### *Responsible Environmental Behavior*

In 1977 during the Tbilisi Intergovernmental Conference on Environmental Education (EE) several objectives for environmental education were defined, to together characterize an environmentally responsible citizen:

- Awareness – Helping groups or individuals acquire an awareness towards the total environment and its problems.
- Sensitivity – Helping groups and individuals gain experiences in, and acquire a basic understanding of, the environment and its problems.
- Attitudes – Helping groups and individuals acquire a set of values and feelings of concern for the environment and the motivation to actively participate in environmental improvement and protection.
- Skills – Helping groups and individuals acquire the skills for identifying and solving environmental problems.

- Participation – Providing groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems (Hungerford & Volk, 1990).

*The Model of Responsible Environmental Behavior (Hines Model)*

In 1987 Hines et al. analyzed 128 studies on behavior research literature in EE and formed the Hines model of Responsible Environmental Behavior as can be seen in figure 3 (Hines et al., 1987). This model is strongly related to the Theory of Planned Behavior.

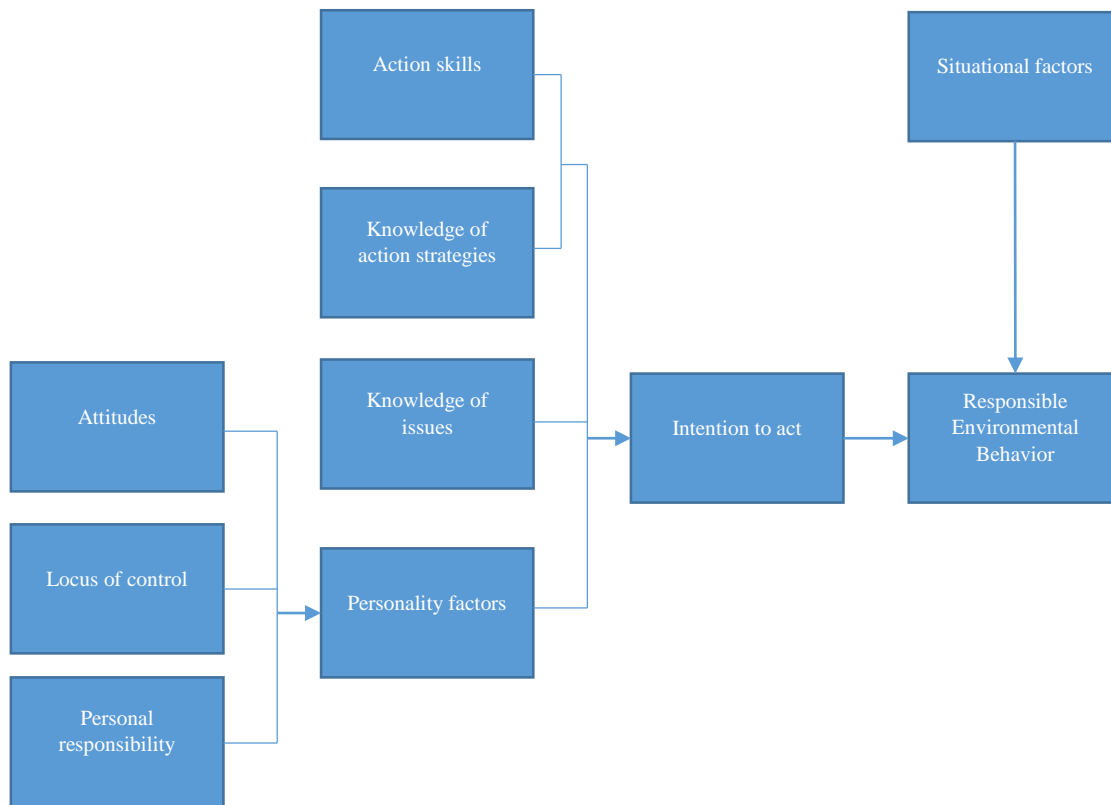


Figure 3 The Hines Model of Responsible Environmental Behavior (Hines et al., 1987)

Most importantly, an individual who expressed an intention to act (in an environmentally responsible way) is more likely to engage in said action than an individual who displays no such intention (Hines et al., 1987). This is also the backbone of the TPB by Ajzen (1985). The intention to act is subsequently influenced by several other variables. A prerequisite to action as defined by Hines et al. is knowledge of the environmental problem at hand as well as the available courses of action. Action skills as it is shown in the figure stands for the skill of an individual to apply their knowledge to a given problem. The personality factors influence an individual's desire to act, further subdivided into attitudes (toward the environment and toward taking action), locus of control (to what extent does an individual feel they have control over the issue) and personal responsibility (toward the environment) (Hines et al., 1987). Finally the situational factors are variables outside of the control of the individual such as governmental involvement through for example economic constraints, or social pressures. These factors can work towards strengthening the intention to act or counteract this intention. It is clear the Theory of Planned Behavior and the Hines Model of Responsible Environmental Behavior are strikingly similar. The TPB is more focused towards the personality factors as it is a broadly applicable model which needs to be applied in tandem with more specific variables, which is the case in the Hines Model where knowledge is also given a substantial role.

### *Other approaches towards analyzing pro-environmental behavior*

Another approach to analyzing pro-environmental behavior is through models of prosocial behavior, altruism, and empathy (Kollmus & Agyeman, 2002). Prosocial behavior is the voluntary intentional behavior that results in benefits for another, through unspecified motives (Eisenberg & Miller, 1987 In: Lehmann, 1999). Altruism and empathy are identified as subsets of prosocial behavior as individuals who have satisfied their personal needs are more likely to act ecologically due to an increase in resources to spend on issues related to the environment. The opposite is true for individuals with a strong selfish and competitive orientation as they are hypothesized to be less likely to act ecologically (Lehmann, 1999 in Kollmus & Agyeman, 2002). Kollmus & Agyeman (2002), whom carried out extensive research on models attempting to explain pro-environmental behavior and provide their own (which will be addressed in time), identify several researches as being of note. Allen & Ferrand (1999) tested the hypothesis that in order to act pro-environmentally, individuals must focus beyond themselves and be concerned about the community. According to their research self-esteem and belonging were not related to pro-environmental behavior, unlike personal control and sympathy. No other variables were tested. Stern et al. (1993) based their model on the altruism theory of Schwartz (1977), which is similar to the hypothesis tested by Allen & Ferland (1999). According to Schwartz's altruism theory altruistic behavior increases when a person becomes aware of another person's, or group of people's, suffering and feels a responsibility of alleviating that suffering (Kollmus & Agyeman, 2002). Stern et al. (1993) additionally propose that environmental concern is caused by a combination of three factors: Egoistic orientation is concerned with the removal of suffering from oneself, social orientation is concerned with the removal of suffering of other people, and the biospheric orientation is concerned with the removal of destruction and suffering in the non-human world. Stern et al. found the egoistic orientation to be the strongest, and the biospheric orientation the weakest, and thus claim that the stronger the egoistic orientation the stronger the motivation for the behavior.

Other models are based on sociological factors, like the model of ecological behavior by Fietkau & Kessel (1981) who combine sociological factors with psychological factors to create a five variable model (see figure 4). The variable *possibilities to act pro-environmentally* is defined as the external, infrastructural and economic factors that either enable or hinder a person to act ecologically while the *incentives* are internal factors that reinforce and support ecological behavior such as social desirability and quality of life (Kollmus & Agyeman, 2002). The *perceived consequences* related to the positive feedback a person has to receive to continue a certain ecological behavior. Finally, *environmental knowledge* is not seen as a direct influence of behavior but merely as a modified for the last variable, *attitudes and values*.



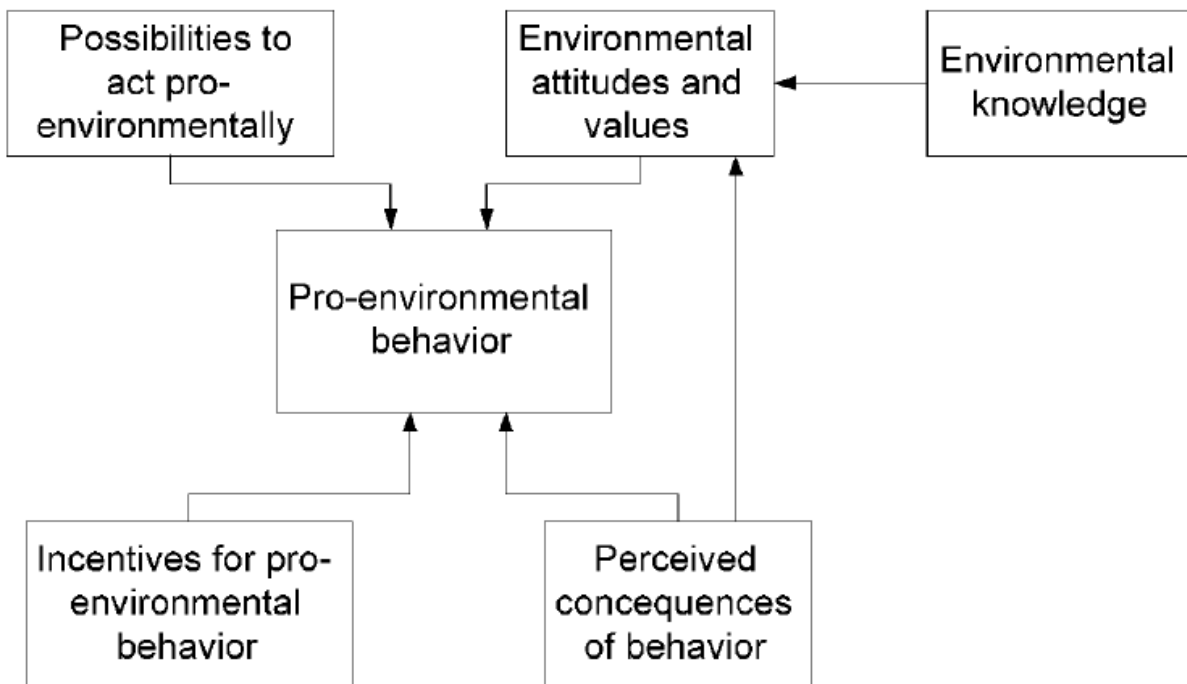


Figure 4: Model of Ecological Behavior (Fietkau & Kessel, 1981)

A barrier based approach is taken by Blake (1999) who identified three barriers that stop an individual from acting on their environmental concern. *Individuality* is the first barrier and are barriers of the personality. They have to do with the attitude as well as the temperament of the individual (e.g. laziness, lack of interest). If this barrier is overcome by the individual, the second barrier is *responsibility*, defined as the feeling by the individuals who don't act pro-environmentally that they cannot influence a situation or should not have to take responsibility for it. This barrier is close in definition to the concept of locus of control as was identified previously. The third and last barrier as identified by Blake (1999) is *practicality*. It is defined as the social and institutional constraints preventing people from action pro-environmentally, regardless of their attitudes or intentions (e.g. lack of time, money, information or encouragement).

#### Model of Pro-Environmental Behavior (Kollmus & Agyeman)

After analyzing the different models available to a researcher to explain pro-environmental behavior, Kollmus & Agyeman (2002) propose their own which is based on the model by Fietkau & Kessel (1981). Kollmus & Agyeman (2002) comment against the feasibility and the usefulness of a model that is used to incorporate all known factors of influence on pro-environmental behavior and therefore title their model more as an illustration or visual aide to help clarify and categorize such factors. Two main influence factors can be identified, the internal and the external. Environmental knowledge, values and attitudes and emotional involvement make up pro-environmental consciousness, which in turn embedded in broader personal values and shaped by personality traits and other factors (Kollmus & Agyeman, 2002). The external factors remain somewhat the same as factors outside of a person's control such as political factors and economic situation. The arrows indicate how the different factors interact and influence pro-environmental behavior while the black boxes indicate the barriers to positive influence on pro-environmental behavior.

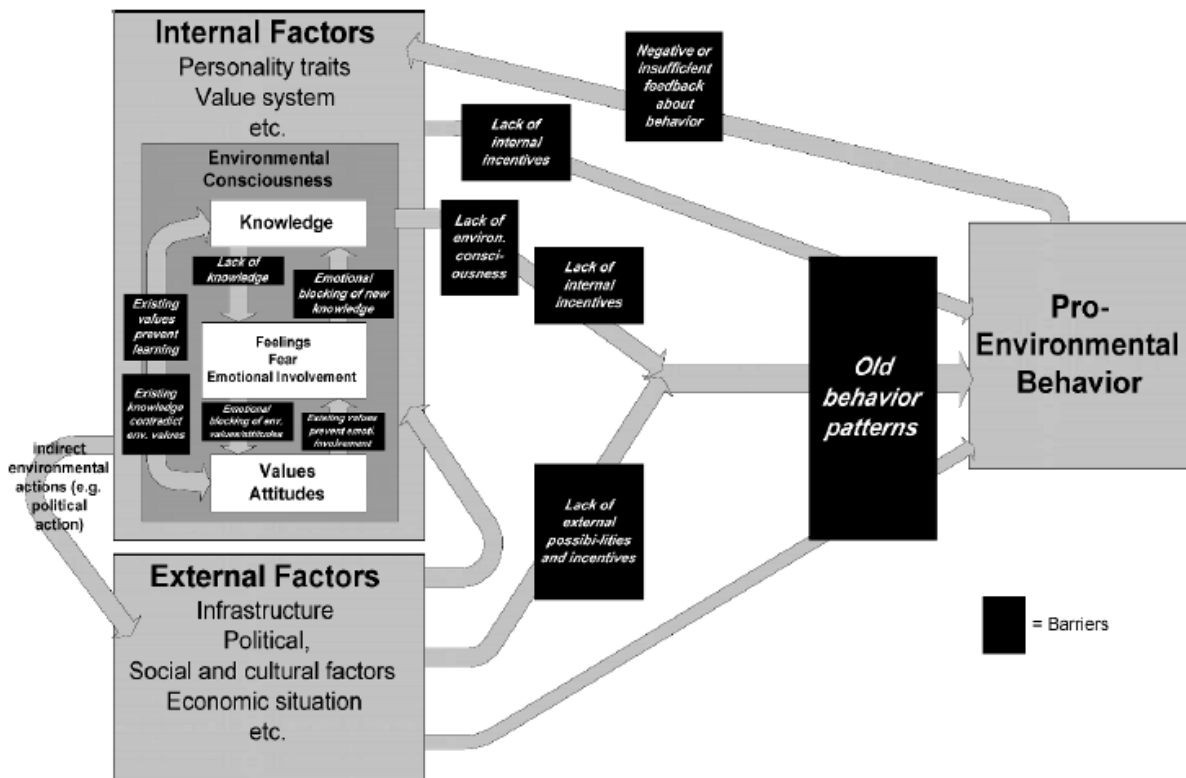


Figure 5: Model of pro-environmental behavior by Kollmus & Agyeman (2002)

### 2.1.3 Remarks and selection

A multitude of models has been identified, all possessing their own strengths, and possibly more important, weaknesses. All assessed models have limitations, thus a clear winner is absent. While a perfect prediction of an individual's pro-environmental behavior is impossible, there are models that come close. The model of pro-environmental behavior by Kollmus & Agyeman (2002) is possibly the best representation of what factors influence pro-environmental behavior and through what channels. However, as the authors have clearly expressed, this model is a mere graphic illustration of influence factors. The two models that are closest to the essence of the Kollmus & Agyeman model, and could appropriately be operationalized, are the model of Ecological Behavior (Fietkau & Kessel, 1981) and the Hines Model (Hines et al., 1987). As the model by Kollmus & Agyeman is based on the Ecological Behavior model, it could seem like an obvious choice which model to select. However, too many relations are assumed in this model, whereas these are more simplified in the Hines model. A compromise is therefore constructed. The variables from the Hines model are taken as a basis, as it is a simple representation of proven significant variables. Next, the variables that are found important by Fietkau & Kessel as well as Kollmus & Agyeman are added. This ensures that all important variables are included, but the variables still remain operationalizable (as Kollmus & Agyeman themselves noted, their model is far too intricate to apply). As new variables are added, inter-variable relations are no longer assumed as both models represent them. It is not the aim of this research to define which relations are present and which are not, but to identify the explanatory variables of influence on energy efficient product consumption behavior. The internal factors for the most part consist of the variables as they are identified by Hines et al. (1987). The variables of *attitude*, *locus of control*, *personal responsibility*, *knowledge*, and *action skills* will be further strengthened by the variables *motivation* and *emotional involvement* as identified by Kollmus & Agyeman (2002). The external factors consist of *institutional factors*, *economic factors*, and *social and cultural*

factors. See figure 5 for a visual representation of the explanatory variables as they are identified in literature. In the course of the next section these variables are subject to change as they are operationalized.

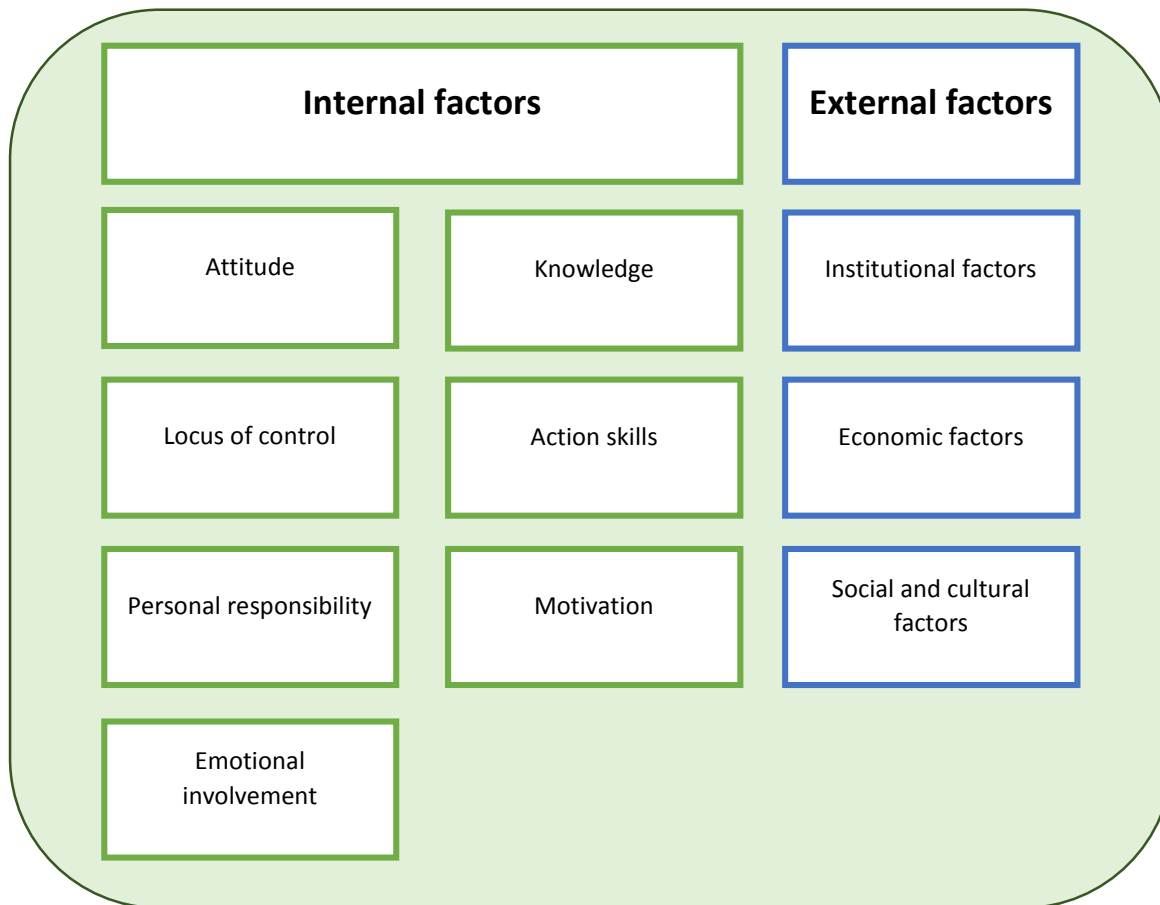


Figure 6: Temporary explanatory variables for energy efficient consumption behavior

## 2.2 Variables

The focus of this section is to operationalize the variables identified previously. As these variables are taken from theory, no scales or way of measurement are mentioned in the source literature. More literature is therefore collected to identify and compare known scales for these explanatory variables.

### 2.2.1 Dependent Variable

The dependent variable is defined as energy efficient product consumption behavior. This variable is operationalized based on a similar scale by Schultz et al. (2005) which provided a measure of pro-environmental behavior. Participants were asked to rate how often they had engaged in each of the eight behaviors in the past year on a five-point Likert type scale<sup>1</sup> ranging from never to very often (Milfont & Duckitt, 2004). Similarly, participants for this research are asked how often they engaged in purchasing a selection of products (which have both energy efficient as well as conventional editions).

<sup>1</sup> A Likert scale consists of several items rated in an ordinal manner of normally five or seven points in which individuals specify their agreement or disagreement (e.g. strongly disagree, disagree, neutral, agree, strongly agree). When using this answer format for single items it is referred to as using a Likert-type scale as it is only the answer format used, and not the multi-item Likert scale (Carifio & Perla, 2007).

## 2.2.2 Independent Variables

The explanatory variables are categorized in three groups. The first group consists of socio-demographic variables, which are also used as a control variable. The second group consists of variables pertaining to the internal factors, while the third group of explanatory variables consists of the external factors.

### 2.2.2.1 Socio-demographic variables

Socio-demographic variables, as opposed to the variables for internal and external factors, have been extensively researched in different works (see Straughan & Roberts (1999) for an overview). However, the exact influence of many of these variables is still unclear as results differ greatly among publications. Therefore, it is difficult to specifically exclude one variable over the other. To gain insight into which of these factors contributes to the behavior of energy efficient product consumption, all those identified as potentially important are included: age, gender, income, education, and housing. For creating a more complete profile the variables marital status and family size are also included.

### 2.2.2.2 Internal Factors

From the primary literature review seven variables of interest were identified to form the internal factors. Some of these variables could be directly operationalized as relevant scales were available. Other variables were slightly changed as they could not be operationalized in their current state. Finally for those variables that could not be operationalized because no appropriate or comparable scales were available at all, new scales were formed based on literature

#### *Attitudes*

“We like certain individuals or groups and dislike others; we support some policies and oppose others; we prefer some products or brands over others; and approve of some activities and disapprove of others” (Ajzen & Cote, 2008: 289). The word attitude refers to a certain degree of favorableness or unfavorableness towards a psychological object (Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975). The construct of attitudes remains popular due to the assumption that attitude (partially) predicts behavior (Prislin & Crano, 2008). While an attitude cannot be directly observed, it can be inferred from an individual’s responses to the attitude object. These responses include both overt behavior (e.g. approaching or avoiding the object) and verbal statements to covert responses (e.g. answers to an attitude question). With the focus of this research being the consumption behavior of energy efficient products a specific attitude niche is chosen. Environmental attitude has been the most often used predictor of ecological behavior for some time, and while general, has not yet been replaced (e.g. Kaiser, 1996). Bamberg (2003) reviewed several studies concerning the relationship between environmental attitude and behavior and concluded that this relation is low to moderate in all of them (e.g. Weigel, 1983; Hines, Hungerford & Tomera, 1986; Spada, 1990; Six, 1992; Schahn, 1993; Eckes & Six, 1994 and Fuhrer, 1995). This relation is too strong to be ignored, and will thus be measured. While often used, there is little consensus on the best way to measure environmental attitude (or environment concern as it is often referred to). A short summary of the scales available to measure environmental attitude is provided below.

The Ecology Scale (ES) was designed by Maloney and Ward (Maloney & Ward, 1973; Maloney et al., 1975). The ES consists of four different subscales comprising a total of 130 items. This scale referred to a broad spectrum of environmentally related perceptions, emotions, knowledge, attitudes, values and behaviors as was customary at the time. Environmental concern was not yet a scientific term but one imported from political discourse (Bamberg, 2003). A similar fate befell the Environmental Concern Scale (Weigel & Weigel, 1978) as other scales learned from and replaced their predecessors with emerging new issues (Dunlap & Jones, 2002, 2003 in Milfont & Duckitt, 2010).

The New Environmental Paradigm Scale (NEP), by Dunlap and Van Liere (1978) has been widely used in the United States for measuring environmental attitudes (Rauwald & Moore, 2002). In response to an evolving ecological worldview and outdated terminology the NEP was revised in 2000 (Dunlap et al., 2000). The revised NEP provides better comprehensive coverage of key facets of an ecological worldview than the old one. The NEP is mainly to be used for measuring general environmental concern as more specific issues are not within the scope of the scale. This general approach is the reason for its longevity and consistent usefulness since its conception (Milfont & Duckitt, 2010).

A separate scale was developed and improved by Kellert (1974, 1976, 1980) which focused on a typology of attitudes toward animals. He developed several scales to not only value orientations toward animals but also toward the natural world in general (Rauwald & Moore, 2002). The different attitude scales as proposed by Kellert were based on eight groups related to the answers of questions relating activities such as owning a pet, hunting, visiting a zoo, etc. (Kellert, 1980). The strength of this scale is its applicability on a more narrow scale involving cultural differences in environmental attitudes.

A more recent, scale is provided by Milfont & Duckitt (2010). The Environmental Attitudes Inventory (EAI) measures twelve subscales of environmental attitudes (including most if not all of the above). To cover the twelve subscales 120 items on a seven point Likert-type scale were developed to gauge an individual's environmental attitude (Milfont & Duckitt, 2010). Milfont and Duckitt also constructed item sets of 72 and 24, the short and brief versions respectively, recognizing the need for a shorter version when assessing environmental attitude is not the main goal of research. An overview of all items can be found in appendix A with the items included in the short and brief version separately indicated.

To conclude, for measuring environmental attitude the Environmental Attitude Inventory will be used as it the youngest and perhaps most accurate scale yet. It is comprised of most other scales using their strengths and replacing their flaws (Milfont & Duckitt, 2010).

### *Motivation*

In environmental psychology literature the difference between attitude and motivation goes undescribed while both words are used as being influence factors for environmental concern (e.g. Milfont & Duckitt, 2010; Kollmus & Agyeman, 2002). Attitude was defined as a certain degree of favorableness or unfavorableness towards a psychological object (Eagly & Chaiken, 1993; Fishbein & Ajzen, 1975). In relation to that definition, motivation is the desire to achieve a goal (Baker, 1992). To illustrate, an item from the Environmental Attitude Inventory to assess an individual's attitude, where an object is involved: "I really like going on trips into the countryside, for example to forests or fields". An item for assessing an individual's motivation, as proposed by Schultz et al. (2005), involves a goal: "I am concerned about environmental problems because of the consequences for future generations". This explanation, however, only addresses one of the two parts motivation consists of. According to Moisaner (1998, 2007) motivation consists of primary motives and selective motives. Primary motives are the overarching motives that define categories of behavior (e.g. striving to live an environmental lifestyle) while selective motives influence specific actions. Primary motives are always present and are based on attitude and knowledge. The selective motives can either strengthen the primary motive, or undermine it. For this research the dependent variables are related to selective motives. A specific action is analyzed (purchasing energy efficient products), which can be part of a multitude of primary motives.

To assess primary motives, Stern and associates (Stern et al., 1993; Stern & Dietz, 1994) presented a tripartite classification of value orientations towards environmental concern. Schultz (2001) tested the three factor

model using the Environmental Motives Scale (EMS), formed using 12 specific items for environmental concern. Schultz confirmed the tripartite model by Stern and Dietz (1994). The EMS is separated into three categories with related items: egoistic (me, my lifestyle, my health, and my future), altruistic (people in my country, all people, children, and future generations), and biospheric (plants, marine life, birds and animals). This model of environmental motive concern has been applied in several different countries (Schmuck, 2003; Schultz, 2000, 2001, 2002; Schultz et al., 2005; Milfont et al., 2006). A comparable view is proposed by Lindenberg & Steg (2007) who identify three goals that govern or “frame” what people attend to, what knowledge and attitudes become most accessible etc. These are the *hedonic* goal (to feel better right now), the *gain* goal (to guard and improve one’s resources), and the *normative* goal (to act appropriately). However, no attempts have been made regarding measuring these frames. Using a tested scale is more preferable.

Another scale used for measuring motivation is the Motivation Toward the Environment Scale (MTES). The MTES is rooted in self-determination theory which distinguishes between three forms of motivation for certain behavior: *intrinsic* motivation, *extrinsic* motivation, and *amotivation* (Deci & Ryan, 2002). Intrinsic motivation refers to the most self-determined behavior, where an activity is performed because it is naturally interesting or fun (inherent appeal). Extrinsic motivation refers to a wider variety of behaviors separated into four types of motivation that can be ordered from least to most autonomous: external regulation, introjection, identification and integration (Villacorta et al., 2003). Amotivation reflects a perceived lack of contingency between actions and the outcomes that are produced. The MTES has been used and validated multiple times (see Pelletier (2002) for a summary). The MTES separates people into one of six motivational groups, rather than the three groups as is the case in the EMS. Both scales have ample users and publications vouching for their validity. Compared to the MTES, the EMS is a broader and simpler approach to measuring motivation. For exploratory research such as this the simpler EMS is preferred rather than the more specific MTES. A potential follow up study would include more specific scales of all variables for increased validity and reliability (see also the scale selection for the attitude variable for example).

### *Locus of Control*

Locus of control, refers to the extent to which an individual believes that a reinforcement or an outcome of their behavior is contingent on their own behavior or personal characteristics (i.e. they can control certain events themselves) versus their expectation that the event is a function of chance or fate, is under the control of powerful others, or is simply unpredictable (Rotter, 1990). Locus of control used to be referred to as internal versus external control of reinforcement (e.g. Rotter, 1966). When an event is interpreted by an individual as the result of luck, chance, fate, as under the control of powerful others, or unpredictable, it is labelled as a belief in external control, or external locus of control. When an individual perceives that the event is contingent upon his own behavior or his own characteristics, the belief is labelled as a belief in internal control, or internal locus of control (Rotter, 1966; Bandura, 1994). Locus of control is strongly influenced by self-efficacy, which is often used in tandem with locus of control as the definitions are similar. Self-efficacy can be defined as an individual’s beliefs about their capabilities to produce a level of performance that can exercise influence over events that affect their life (Bandura, 1994). A strong sense of efficacy can enhance human accomplishment and change the way an individual approaches a difficult task, by seeing it as a challenge instead of a threat to be avoided for example. Locus of control, while not identically so, is very closely linked to other concepts such as self-efficacy, self-esteem and self-worth (Meinhold & Malkus, 2005). When an individual shows concern or empathy toward the environment and in turn acts on those feelings, it can be seen as a form of pro-social development. The concepts of locus of control, self-efficacy, etc. connect pro-social development and environmental concern. When individuals show concern for the environment and act on those concerns, they demonstrate a high level of pro-social development which may allow individuals to

generate positive feelings about themselves. Experiencing positive feelings, in turn, individuals may also experience that they feel the future execution of actions and behaviors will consistently produce positive outcomes (Meinhold & Malkus, 2005). Finally, this increases the likelihood of future pro-social behavior towards the environment and other people in a positive feedback loop.

Instead of measuring locus of control, which proves to be a difficult variable to find a proper scale for, the variable perceived self-efficacy will be used instead as high locus of control does not necessarily signify a sense of enablement and well-being (Bandura, 2006). Meinhold & Malkus (2005) assessed self-efficacy by combining total self-efficacy from the Pearlin Mastery Scale with additional environmental self-efficacy questions created by the researchers, for a total of ten items. Meinhold & Malkus discuss on the potential weakness of only using three case-specific self-efficacy items as Bandura (1986) earlier identified the importance of such a case-specific approach. The teachings on measuring self-efficacy as they are provided by Bandura are accepted by a variety of authors in different research domains such as education (e.g. Tschannen-Moran & Hoy, 2001; Goddard et al., 2000) and sports (e.g. Feltz et al., 2008). Recently Bandura (2006) published a guide for constructing domain specific self-efficacy scales. Taberero & Hernández (2011, 2012) applied the teachings of this guide to assess the self-efficacy for recycling behavior and the relation between self-efficacy and environmental behavior in separate publications. As self-efficacy is extremely domain specific the only approach to test it is to use the guide as provided by Bandura (2006) and create the questions needed.

Self-efficacy items measure the level of difficulty individuals believe they can surmount. Thus, with no obstacles to overcome, an activity is easily performed and everyone is highly efficacious (Bandura, 2006). According to Bandura many areas of functioning are primarily concerned with self-regulation. In such instances the issue is not whether one can perform the activities occasionally, but rather one has the efficacy to get oneself to do them regularly in the face of different types of dissuading conditions. Such impediments as they relate to this study have been identified in literature (e.g. Blake 1999; Kollmus & Agyeman, 2002; Moisander, 2007; Crosbie & Baker, 2010) and consists mainly of: lack of time, money, effort, convenience, encouragement, product effectiveness, change in lifestyle, confusion about the quality of energy efficient products, and confusion about the benefits of energy efficient products. The locus of control variable is therefore changed into self-efficacy.

#### *Personal responsibility*

Personal responsibility is often confused with locus of control, self-efficacy, or personal efficacy. Where self-efficacy stands for the perceived influence an individual has over certain events, personal responsibility stands for whether the individual feels responsible for influencing certain events. Individuals who feel some degree of personal responsibility towards the environment are more likely to engage in pro-environmental behavior than those individuals that do not feel this responsibility (Hines et al., 1987). Other publications also attest to the significance of responsibility as a predictor of ecological or environmental behavior (see Kaiser & Shimoda (1999) for a short list). Very different approaches are taken to measuring an individual's sense of responsibility however.

Schwartz (1968, 1973, 1977) carried out substantial research regarding the perception of responsibility relating to behavior as part of normative influences. Schwartz especially recognizes the role of both responsibility and consequences, testing the correspondence between Ascription of Responsibility (AR) and Awareness of Consequences (AC) as they influence the link between norms and behavior (Schwartz, 1968). No association between AR and AC was found. A questionnaire was developed to specifically measure the Ascription of Responsibility (ARQ) of an individual (Hakstian et al., 1986). This questionnaire however only provides a broad perception of responsibility with no applicability towards environmental issues. The same is

true for other predefined responsibility oriented questionnaires as they are often developed for a specific purpose such as physical activities (Watson et al., 2003; Li et al., 2008).

According to Kaiser & Shimoda (1999), a person can feel responsible in two different ways: through morality and through conformity to social expectations. The moral responsibility feelings are based on concepts such as welfare and rights of others, and fairness, while conventional responsibility feelings are based on social customs and traditions. To test the role of responsibility as a predictor of ecological behavior a 48 item questionnaire was designed based on the composition of the two responsibility categories (Kaiser & Shimoda, 1999). After checking for empirical independence of the different scales the items were grouped in using a principal factor analysis, a multitude of items were excluded based on low factor loading scores (I.e. the factor does not affect the variable in a significant way). Three factors remained: responsibility feeling, guilt feelings, and responsibility judgment, covered by a total of 20 items.

Kellstedt et al. (2008) measure personal efficacy for global warming through three items. Two items pertain to locus of control or self-efficacy as they are used in this research, with a single variable relating to responsibility (“Human beings are responsible for global warming and climate change”).

Dietz et al. (2007) investigated the influence factors that impacted support for climate change policy. Among these factors there were those that included items on awareness of consequences and personal normative beliefs. Personal normative beliefs is comparable to responsibility as a variable as personal normative belief stands for an individual’s perception of social normative pressures that he or she should or should not perform certain behavior. Normative beliefs was also used in the Theory of Planned Behavior by Ajzen (1985, 2001). While still adhering to the importance of both consequences and responsibility, Dietz et al. (2007) constructed a shorter and more specific way to measure these variables than was the case in the ARQ by Hakstian (1986). As the specific items relate to climate change rather than the intended energy efficiency, small changes would have to be made.

While the items used by Kaiser & Shimoda (1999) seemed too numerous for a study not solely on responsibility, using a single item as was the case in Kellstedt et al. (2008) is not the appropriate approach either. The 11 items on consequences and personal normative beliefs by Dietz et al. (2007) will be adopted due to their ability to measure perceived consequences as well as responsibility, using a small number of items.

#### *Knowledge of issues*

Consensus on the strength of environmental knowledge as a predictor of pro-environmental behavior is limited. While Kollmus & Agyeman (2002) claim that most researchers agree that only a small portion of pro-environmental behavior can be linked to environmental knowledge and awareness, there is no certainty in literature. Where some publications found a strong relationship between pro-environmental behavior and knowledge (e.g. Bradley et al., 1999; Haron et al., 2005; Frick et al., 2004), others only found limited or weak correlation (e.g. Arcury, 1990; Morrone et al., 2001; Fryxell & Lo, 2003; Ellen, 1994).

Environmental knowledge has been split into separate groups by different authors. Hines et al. (1987) describe two knowledge groups: *knowledge of issues* and *knowledge of action strategies* (knowledge and recognition of environmental issues, and knowledge of courses of action available and those most effective in a given situation, respectively). Frick et al. (2004) further split up environmental knowledge into *system knowledge*, *action-related knowledge*, and *effectiveness knowledge*. System knowledge is here the general knowledge of ecosystems and environmental problems. Action-related knowledge is knowledge regarding the available courses of action to combat environmental problems. Effectiveness knowledge refers to the knowledge a person has on the benefits associated with particular behavior. Knowledge has also been divided into *objective*



and *subjective* groups where subjective knowledge is how much individuals think they know about the environment, and objective knowledge, how much the individual actually knows (Barber et al., 2009; Ellen, 1994; Vicente-Molina et al., 2013). No conclusive evidence exists for favoring objective knowledge over subjective knowledge, or the other way around (Vicente-Molina et al., 2013; Ellen, 1994; Martin & Simintiras, 1995).

In accordance with Frick et al. (2004) and Roczen and colleagues (2011; Roczen et al., 2014), and partially with Hines et al. (1987), the environmental knowledge variable is split into the three separate forms. No one environmental knowledge scale is copied. Appropriate items will be selected from the pool of available questions based on topic and relevance. The other environmental knowledge scales attempt no grouping of knowledge form, thus if possible the items they propose are grouped manually into system, action-related and effectiveness knowledge items. While no evidence exists for favoring either objective or subjective knowledge, including two subjective knowledge questions as was the case in Vicente-Molina et al. (2013) seems like an appropriate method to look after both formats. The importance of the amount of environmental knowledge questions is not included in the literature and will later be decided on.

Several authors measure environmental knowledge but do not make explicit which questions were asked, only that they are available in other publications which are not in a language known to this author (e.g. Turkish for Sadik & Sadik, 2014) or are not available for review with current subscriptions (e.g. Arcury, 1990; Ellen, 1994; Vicente-Molina et al., 2013).

#### *Knowledge of and Skills in using Environmental Action Strategies*

Action skills are defined by Hines et al. (1987) as the skill to appropriately apply the possessed knowledge to a given issue. More specifically put by Hungerford & Volk (1990) it usually regards the perceived skill of the individual in using environmental action strategies. This is further explained as “human beings believing that they have the ‘power’ to use citizenship strategies to help resolve issues” (Hungerford & Volk, 1990: p. 262). Both Sia (1985) as well as Sivek (1989) researched influence factors of environmental behavior, identifying ‘perceived skill in using environmental action strategies’ and ‘perceived knowledge of environmental action strategies’ as predictors of pro-environmental behavior. Note that these variables involve the perception of the participant, rather than the actual knowledge and skill as is the case with the issue knowledge variable. Actual skill is impossible to test within the limitations of this research. The same research variables regarding perceived knowledge and skill are used in a more recent study by Hsu & Roth (1998) and Hsu (2004), providing an exemplary scale for measuring both variables. It hinges on the differentiation between several types of environmental action strategies: Ecomanagement, consumer/economic action, persuasion, political action, and legal action. As no other acceptable scales for measuring perception of knowledge and skill in using environmental action strategies are available, the questions provided by Hsu & Roth will be altered and employed.

#### *Emotional involvement*

Kollmus & Agyeman (2002) define emotional involvement as “the extent to which we have an affective relationship to the natural world” or “one’s emotional investment in the problem” (p. 254). People with stronger emotional reactions are more likely to engage in pro-environmental behavior (Grob, 1991 in Kollmus & Agyeman, 2002). While seen as important for shaping attitudes and values, emotional involvement is poorly understood and underrepresented in literature. Emotional involvement related to pro-environmental behavior has seen very little research. A broader view however shows that on the topic of connectedness with nature ample scales are provided. Hefler & Cervinka (2009) provide a comprehensive list of connectedness with nature scales. A secondary literature search found no missing scales of importance. Of the eleven scales

identified, four are appropriate for review. Other scales were deemed inappropriate due to one of several reasons: showing no internal consistency or reliability, not publishing the used items, non-matching question format (a graphical representation or a mix of scoring methods not matching with the rest of the variables), including too many items for an exploratory research, and having no English translation for the items used (in German). The scales identified to be of use are the Connectedness to Nature Scale (CNS), the Emotional Affinity toward Nature scale (EAN), the Environmental Identity Scale (EID) and the Nature Relatedness scale (NR).

Mayer and Frantz (2004) propose the Connectedness to Nature Scale (CNS) to measure the feeling of emotional connectedness to the natural world. The CNS has been tested and validated in different studies (Mayer & Frantz, 2004). Mayer & Frantz argue in favor of a tool relating to the emotional reaction to nature, rather than tools that measure cognitive beliefs. The purpose of the CNS was to form an affective measure on a multi-item scale which could reliably predict behavior. Mayer and Frantz very verbally claim the CNS to be a better predictor of behavior than the NEP scale by Dunlap et al. (2000) because of the difference between emotional reaction to nature and cognitive beliefs. Research demonstrates the possibility that an affective relationship with nature may have a stronger impact on ecological behavior than knowledge-based information.

Kals and colleagues (Kals, 1996; Kals & Montada, 1994; Kals et al., 1999) carried out substantial research on the impact of emotions on pro-environmental behavior on topics such as the impact of resentment about other individuals' polluting activities, guilt about own environmental sins, and fear of health problems caused by pollution (Kals et al., 1999). Kals et al. set out to compare the predictive power of emotional affinity toward nature with indignation about insufficient nature protection and interest in nature. Emotional affinity toward nature is difficult to define, but can be distinguished from interest in nature, which is a more cognitive approach, or interest in the functioning of flora, fauna, and natural phenomena. Emotional affinity is motivation contact and sensual experiences, rather than having an interest which is based on knowledge and understanding (Kals et al., 1999). Kals et al. confirmed the power of emotional affinity toward nature to explain nature-protective behavior, using the predictors emotional affinity, interest, indignation, and experiences in nature. Kals et al. (1999) however only provide examples of the items used to measure these factors. A later publication by Müller et al. (2009) used the same scale, resized it to using 10 items (instead of the original 18), and published all used items for this Emotional Affinity toward Nature scale (EAN).

Clayton (2003) proposes a 24 item list designed to measure "the extent to which the natural environment plays an important part in a person's self-definition" (p. 52) in the Environmental Identity Scale (EID). The items address the salience of nature, ideology associated with the identity, and associated positive emotions (to what extent does a person interact with nature, support for environmental education and sustainable lifestyle, and enjoyment obtained in nature, respectively).

The final scale identified as appropriate for this research is the Nature Relatedness scale (NR) by Nisbet et al. (2008). Nisbet et al., having made the youngest contribution to the literature base, name all previous scales in their research. They argue that a better vocabulary is needed to express how people care about nature, as well as better measures to study human-nature relationships and conservation behavior. The EID is commented upon as being too limited, focusing on the link between environmental self-definition with self-reports of environmental behavior. According to Nisbet et al. (2008) the role of emotions and experiences, as well as the interaction between these factors, also needs to be investigated. The NR is designed to encompass one's appreciation for and understanding of our interconnectedness with all other living things on earth, while focusing on more than just the superficially pleasing facets of nature. Nisbet et al. could find no existing scales that matched all elements they viewed as important. Scales that did not include emotions and feelings were

quickly excluded (e.g. the NEP by Dunlap et al. (2000)). The CNS is argued to miss the physical aspect of human-nature relationships. Thus, to fill this perceived gap, the NR scale is designed to measure the affective, cognitive and physical relationship of people with the natural world (Nisbet et al., 2008). The NR consists of 21 items divided among the three factors NR-Self, NR-Perspective, and NR-Experience. NR-Self represents the internalized identification with nature, reflecting feelings and thoughts about a person's connection to nature. NR-Perspective represents an external nature-related worldview, concerning individual human actions and their impact on all living things. NR-Experience represents a physical familiarity with the natural world, reflecting comfort with and desire to be out in nature (Nisbet et al., 2008). Nisbet and colleagues continue to use and validate the use of the NR (e.g. Nisbet & Zelenski, 2011; Nisbet et al., 2011).

In conclusion, the fact Nisbet et al. (2008) provide the latest scale for measuring nature relatedness gives them an edge, but this is not synonymous with being the most appropriate scale. The limitations of the CNS and EID are well-founded and agreed upon, leaving the NR and EAN for final review. While the NR is the most comprehensive scale of its kind yet, it attempts to cover the items of an attitude scale as well. Nisbet et al. (2008) compare the NR to the inferior NEP scale while stronger scales have since been developed. By measuring both the NR and the EAI in this research substantial overlap in the posed items will arise as especially the NR-Perspective and NR-Experience cover some aspects of attitude. Therefore the EAN will be used as it is limited to measuring the emotional identification with nature, which for the purpose of this research is not seen as a limitation since it can be used alongside the strong attitude scale EAI. This means the emotional involvement variable is changed to the more specific relatedness to nature (as this was viewed as being more representative of the variable as opposed to the actual scale name emotional affinity towards nature).

#### *Final remarks on internal factors*

As was stated at the start of this section, the identified explanatory variables from theory were subject to change after more specific literature review. As available scales were identified to measure these variables, it became clear that not all of them were adopted efficiently from theory. Figure 7 shows how the explanatory variables have changed over the course of this secondary literature review. With three redefined explanatory variables and one new addition, a total of eight internal factors are included in the research.

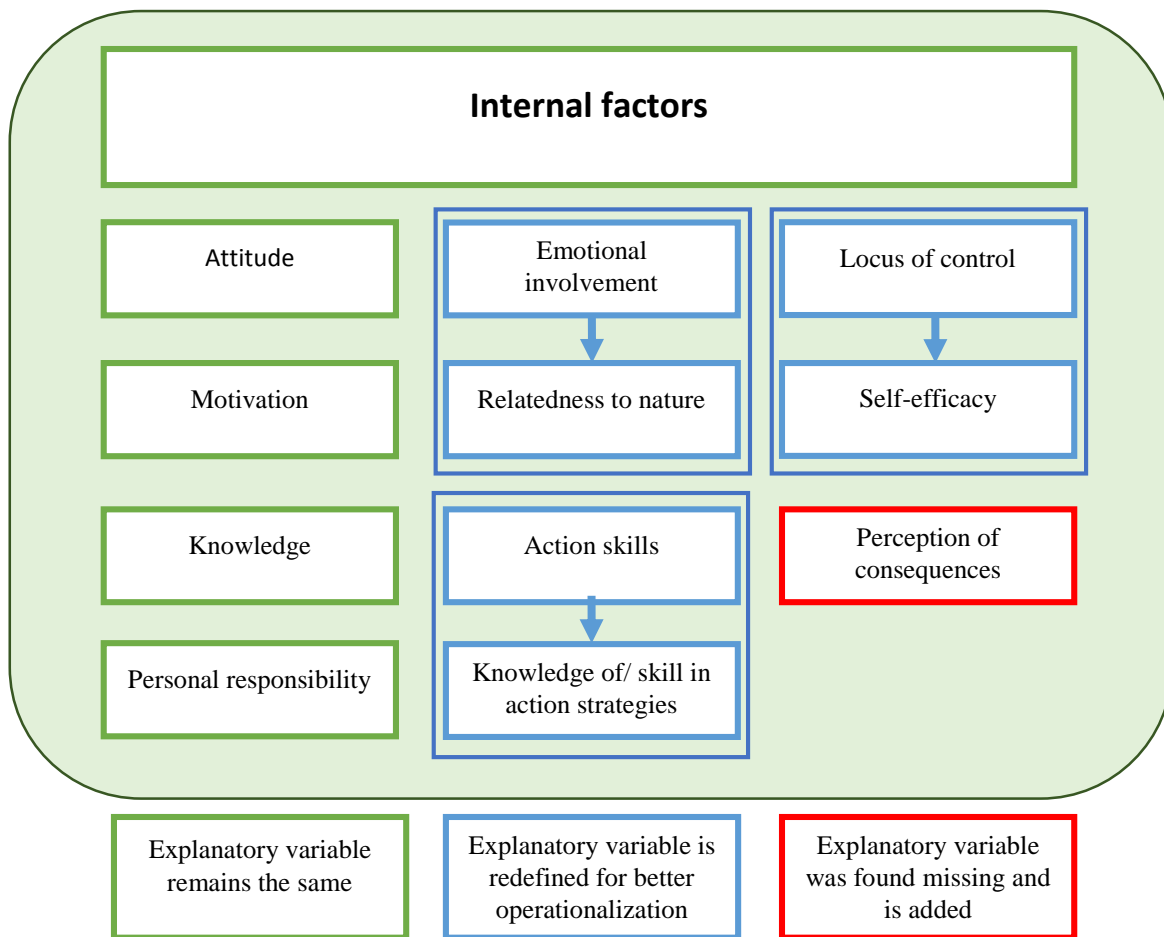


Figure 7: Overview of internal factors

### 2.2.2.3 External Factors

The third group of independent variables consists of the external factors. Where the internal factors were the factors of the 'self' which together form an intention to act, the external factors are comprised of those variables that influence behavior from the outside. External factors can both positively and negatively influence behavior. Several external factors were identified during the primary literature research, such as institutional factors, economic factors, and social and cultural factors (e.g. Kollmus & Agyeman, 2002). Research on the effects of external factors on environmental behavior is scarce. Measure methods or scales are rare or non-existent. To operationalize the external factors regardless, the following steps are taken. First, the external factors are broken down into separate items. These items then form a scale similar in format to research on ethical beliefs and business professionals by Peterson et al (2001). While the topic of this research is not comparable, the question format is clear and has proven validity. Below the appropriate items will be identified within the different available external factor groups, after which, in chapter three, they will be combined into a measurement scale.

#### *Social and cultural factors*

Sallis and colleagues (Sallis et al., 2006, 2008) provide an overview of social and cultural factors very similar to the way it is viewed in this research and the theory it is based on (Kollmus & Agyeman, 2002). The circular Ecological Model of Four Domains of Active Living is shown in figure 8. While not all subcategories match the focus of this research, it provides a clear overview of several external factors a person is influenced by. The

sphere at the center represents what is defined in this research as the internal factors as well as the socio-economic variables. The three ellipses convey different levels of external influence factors. While providing an appropriate starting point, this model is still incomplete. Mainly the social and cultural factors are addressed while others, as identified by Kollmus & Agyeman (2002) are lacking. It is therefore to be used merely as a starting point.

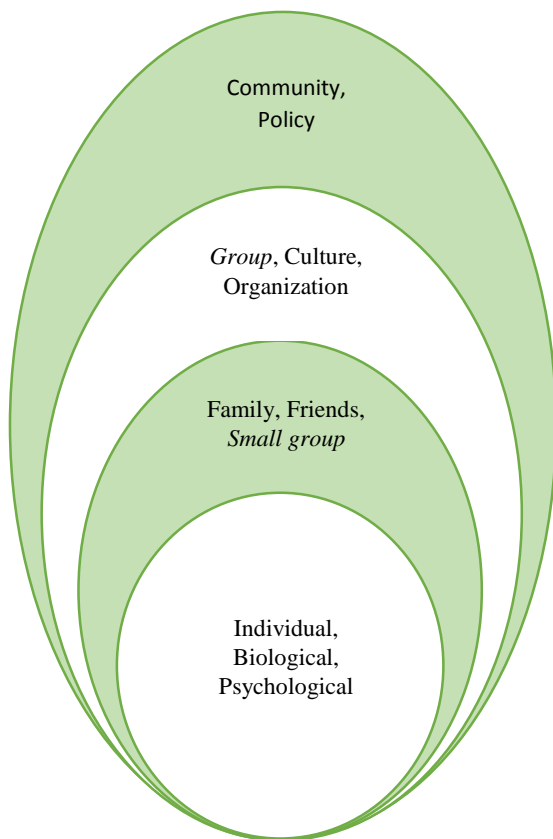


Figure 8 Representation of social, cultural and institutional factors adapted from Sallis et al. (2006, 2008)

### *Social groups*

To analyze which social groups are perceived to be the most influential on pro-environmental behavior, the different social groups need first be identified. Most categories of social groups as defined by Sallis et al. (2006, 2008) can be found in works on sociology. Henri Tajfel and contributors (2010) carried out extensive research on social identities and intergroup relations. In their work the same social groups are mentioned as they are identified by Sallis et al. (2006). While severely overcomplicated for the scope of this research, clear social groups can be identified from the work by Tajfel (2010). These groups consist of family, friends, culture and community. Culture is viewed as a separate variable below. Items taken from the social groups' variable: *family, friends and community*.

### *Culture*

Johnson et al. (2004) found that environmental belief and behavior vary by ethnicity, despite similarities for certain socioeconomic characteristics. These authors however confuse ethnicity with race, as the assessed groups are labelled by skin color/racial group. From the Oxford dictionary: "[Ethnicity is] the fact or state of belonging to a social group that has a common national or cultural tradition". While their definition of the word ethnicity is faulty, their findings still hold. Ethnicity is a difficult variable to gather data on because it is subjective, multi-faceted and it is difficult to define where an ethnic group would begin or end (Office for

National Statistics, 2003). Culture, as it is used by Sallis et al. (2006) and race, as ethnicity is used by Johnson et al. (2004), are aspects of true ethnicity. While some aspects of ethnicity are easily quantifiable other aspects of ethnicity are more difficult to define as a person’s ethnic group is self-defined (Office for National Statistics, 2003). Aspects of ethnicity include country of birth, nationality, language spoken at home, parents’ country of birth, skin color, geographical origin, racial group and religion. Rather than having an individual answer questions based on all these aspects (which they will probably dislike or outright refuse) it is proposed to use one of these items that best represents ethnicity without sounding vague. Culture was decided upon as it is more specific and would be more understandable for participants, while other items such as racial group or country of birth could provide questionable response. Item taken from the culture variable: *culture*.

*Institutional factors*

For an individual to perform pro-environmental behavior, the necessary infrastructure needs to be in place (Kollmus & Agyeman, 2002). Institutions, which make up this infrastructure, can both constrain and enable behavior. Institutions can be defined as “the systems of established and prevalent social rules that structure social interaction” (Hodgson, 2006: p. 2). Examples of institutions are legion, thus only a select few are chosen. Institutions that were identified for this research are educational institutions, mass media, government, industry, and NGO’s. Education has a strong influence on pro-environmental behavior. Several publications used throughout this research either stress the importance of education, or focus completely on environmental education (e.g. Steg & Vlek, 2009; Hungerford & Volk, 1990; Sia et al., 1986). Mass media is seen as a strong provider of information and has, like education, been previously identified as an important influence factor (e.g. Kollmus & Agyeman, 2002; Lindenberg & Steg, 2007; Hines et al., 1987).

Another strong institution related to pro-environmental behavior is the government. Through the use of policy instruments governments “attempt to affect society – in terms of values and beliefs, action and organization – in such a way as to improve, or to prevent, the deterioration of the quality of the natural world” (Vedung, 1998: p. 21). Instruments through which governments attempt to alter behavior are shown in figure 9.

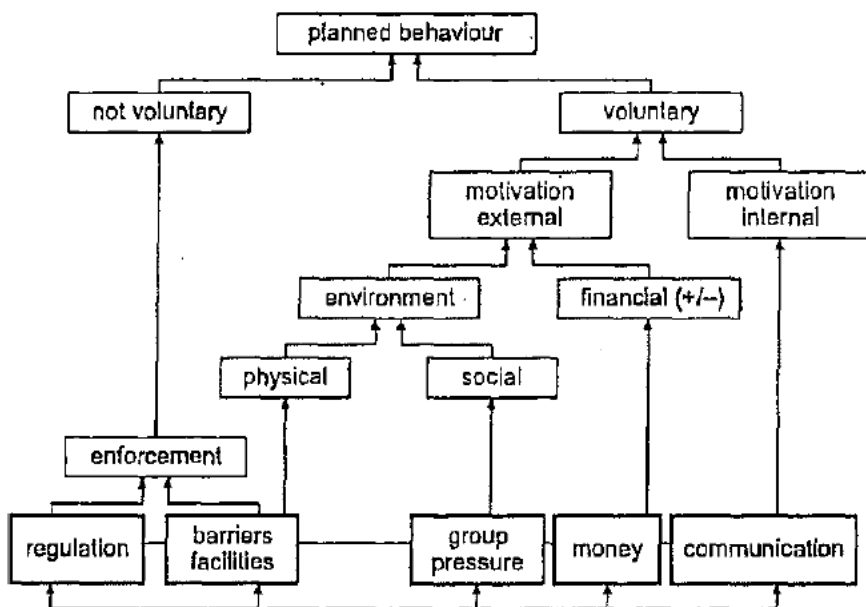


Figure 9: Policy instruments for behavior change (Van Woerkum et al., 1999 in: Aarts & Lokhorst, 2012)

There is great consensus on the successful effects of governments using policy instruments to enact behavioral change (e.g. Sonigo et al., 2012; Vedung, 1998; Aarts & Lokhorst, 2012; Stern, 2000). Due to the limited scope

of this research no differentiation is made between the effects and quality of the different policy instruments. This due to possible overlapping factors such as group pressure or communication.

Industry is also identified as being an important institution related to pro-environmental behavior (e.g. Lindenberg & Steg, 2007). For the sake of this research only the importance of production industries of energy efficient products and their competition is assessed. NGO's are the last institution to be included in this research (e.g. Kollmus & Agyeman, 2002). Items taken from the institutional variable: *education, mass media, government, industry* and *NGO's*.

#### *Economic factors*

The last factors contributed by Kollmus and Agyeman (2002) are the economic factors. They identify economic factors as being very important related to consumer behavior as well as when designing new policies and strategies to change behavior. Economic incentives or deterrents can be strong influence factors for behavior (Lindenberg & Steg 2007; De Young, 1993). However, internal factors are rarely included in economic studies, and economic factors are rarely included in psychological studies (Van den Bergh, 2008). Thus while recent research shows that price instruments are effective (e.g. Van den Bergh, 2008), the relationship to internal factors is unsure. Instead of creating specific items related to the possible economic incentives, participants are given examples of incentives and deterrents and are then asked as to how effective they view such approaches. Items taken from the economic variable: *economic incentives*.

#### *Information factors*

Many authors agree that information is an important predictor of pro-environmental behavior (e.g. Stern, 1999, 2000; Kollmus & Agyeman, 2002; Bamberg & Moser, 2007; Steg & Vlek, 2009). The provision of information directly influences the knowledge of the individual. Information can be used in different ways to promote pro-environmental behavior, such as giving practical advice or raise problem awareness (Staats et al., 2008). Again, rather than creating specific items regarding information, a broadly interpretable item is included. Other than direct information provision, giving feedback on performance may increase environmental behavior through an increased sense of (self-)efficacy or changes in social and personal norms (Staats et al., 2008). Items taken from the information variable: *information* and *feedback*.

#### *Habit*

Habits arguably do not belong in a list of external factors as they are within the control of the individual. However, the external factors as they are provided above are seen as bridging the gap between intent and behavior. The function of habit is similar, as even with great pro-environmental intentions the actual behavior can still be overwritten by habitual behavior. While identified by Kollmus & Agyeman (2002), the importance of habits in pro-environmental behavior is not defined. Other authors attribute more importance to the role of habits (e.g. Stern, 2000; Steg & Vlek, 2009). To overrule a habit the intended behavior needs to be different and consistent (Staats et al., 2008). Habits do not specifically refer to frequency of behavior, but refer to the way behavioral choices are made (Steg & Vlek, 2009). People tend to focus on information confirming their choices and neglect information which challenges that view. Items taken from the habit variable: *habits*.

*Final remarks on external factors*

As was previously mentioned, external factors, rather than being comprised of different variables, is to become a single scale. As measurement scales for different external factors are non-existent this is an adequate exploratory approach into an influence factor that is underrepresented in literature. A total of thirteen external factors have been identified (see figure 10) and are to form a new measurement scale, defined in the methodology chapter.

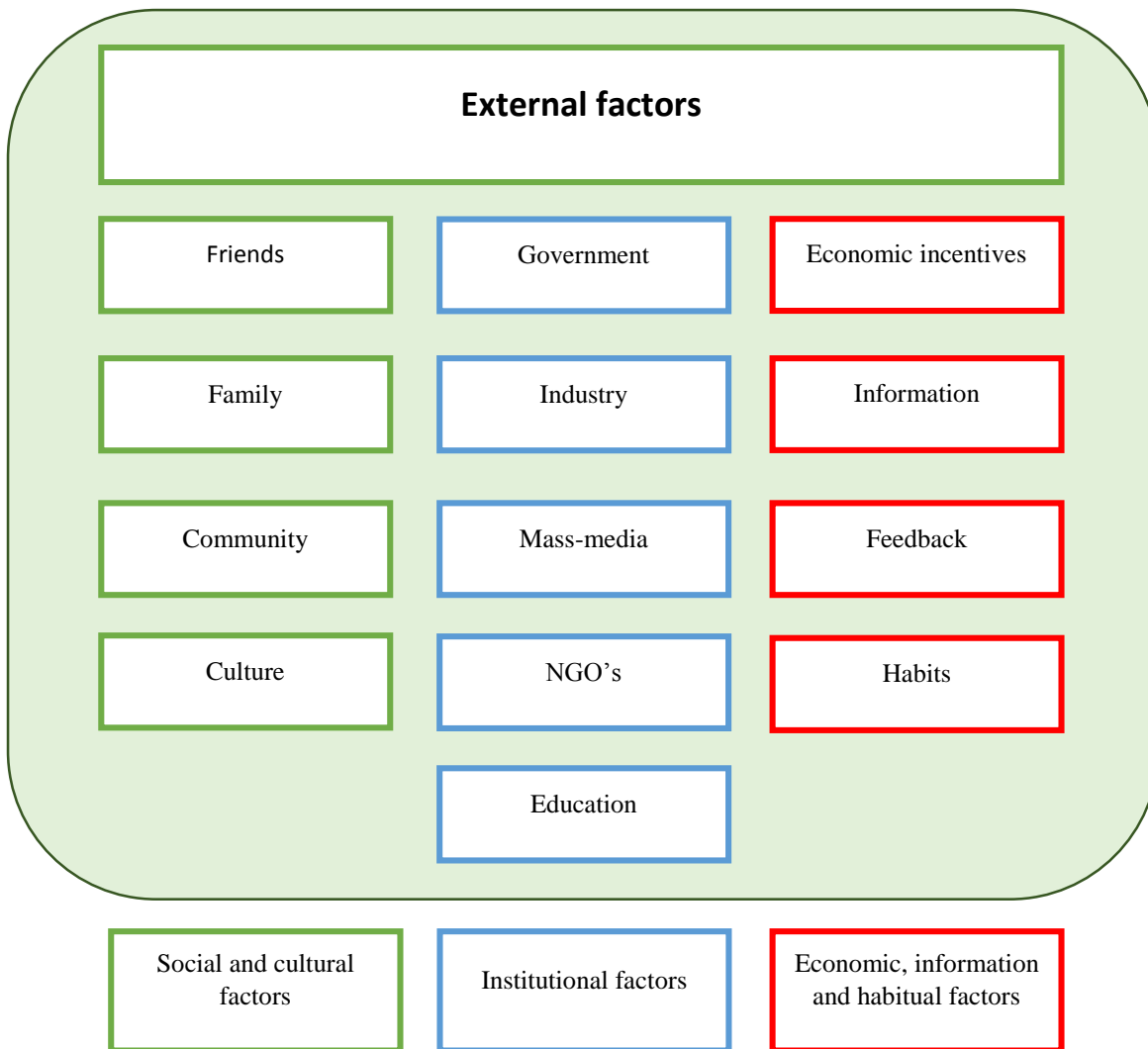


Figure 10: Overview of external factors



### 3. Methodology

The aim of this paper is to obtain a better understanding of what drives an individual to consume energy efficient products. While literature is available on variables that influence comparable behavior, they are spread over a multitude of publications with little consensus on what is important and what is not. It was therefor decided to perform exploratory research to identify which of the identified variables contribute to the behavior of energy efficient product consumption. Several methods of data gathering are available such as desk research, interviews, case studies, experiments and surveys (Verschuren & Doorewaard, 2010). While literature is available on behavior and behavioral change, desk research on the more specific topic of energy efficient product consumption does not provide the data necessary for a complete assessment. It is therefore required to gather new data to form a new view and see if this matches that of existing literature on comparable topics. Rather than performing interviews, case studies or experiments when clarity is still lacking regarding the effects of the variables identified in section two on energy efficient purchasing behavior, a broader approach is required. When focusing on breadth in a relatively young field survey research is an appropriate approach (Verschuren & Doorewaard, 2010). While such an approach sacrifices some depth of the research for an increase in breadth, this is seen as a necessity to get a significant glimpse at what influences behavior of energy efficient product purchasing. Substantial desk research is required for survey research to be effective as it is much less flexible than the other forms of data gathering. The literature review prior to this chapter as well as the extensive evaluation of the explanatory variables in this chapter properly resolves the flexibility issue and provides a sturdy basis for survey research.

Several methods of survey collection were identified and compared: web surveys, mail surveys, telephone surveys, and intercept surveys. A first distinction is made between oral and written survey methods (telephone surveys and the other three respectively). Doing an oral survey has the benefit of being able to help respondents if the question is not properly understood and lowers the chance of incomplete surveys (Baarda & de Goede, 2005). As the variables consist of a large number of items, it was decided however that there would be too many questions on different answer scales for a telephone survey. Having to read out every item to the respondent would be much too time consuming. The advantage of web and mail surveys is that a large sample can be contacted through relatively little effort. A mail survey could be set up by mailing the surveys to addresses at random. Two sub strategies of mail surveys were included in the comparison. The first traditional strategy is to mail the full survey to a number of households and hope they mail it back after filling it in. While response can be recorded in detail, it will take a large number of printouts and the potential respondent needs to perform additional actions to respond. The second strategy also includes sending envelopes to random households, but they include a flyer with the intention of the research and a website link where the survey questions are posted. This last method is very similar to the web survey, as they both use an online tool to record the survey answers. Retrieving available e-mail addresses to send the survey request to is a strong limiting factor. Of the previously assessed methods the modern survey research had the most potential. This method however severely limits the respondent availability of some demographic groups such as the elderly (e.g. CBS, 2013a). Intercept surveys was selected as the best approach because it allows for the most direct approach of potential participants and does not limit the participation of any demographic groups. While this approach is the most time and effort intensive survey method, being present when handing out the questionnaires also provides certain benefits. The author being available for questions relating to the questionnaire could improve response and data quality (by being available to answer questions etc.). As intercept surveys are relatively time consuming, and an adequate sample size is preferred, two assistants were trained to help collect surveys. They received a tutorial on the essence of this research and the researched variables. Also, the topic of approaching potential participants was addressed and practiced.

In light of the defined dependent variable the preferred survey sample consists of individuals that purchased one or more products relating to the dependent variable (i.e. lamps/light bulbs, showerheads, appliances or electronics) no matter if they are energy efficient or not. To specifically target such a consumer group it is assumed that there is greater potential in finding respondents at locations where the mentioned products are abundantly available. Therefore, rather than handing out questionnaires at for example supermarkets, hardware and electronic stores were deemed as the most appropriate survey locations. Three hardware stores and one electronics store in the city of Utrecht were selected as the locations for the intercept surveys. Utrecht was selected for having a wide variety of hardware stores as well as electronics stores compared to other cities in the province, and because it is the closest large city of the Netherlands relative to the residence of the author. Of the three hardware stores all managers granted permission to carry out several days of survey research. The manager of the electronics store refused permission due to previous experiences with survey research.

Due to the manner through which the surveys are collected (at several predefined locations), a form of non-probability sampling is performed. As opposed to probability sampling, where each element in the population has a known nonzero chance of being randomly selected, non-probability sampling does not involve such known nonzero selection probabilities (Lavrakas, 2008). Non-probability sampling can be divided into purposive sampling, convenience sampling, and quota sampling. For purposive sampling expert judgment is used to select a representative sample of elements. With convenience sampling, the primary criterion for the sample selection is the ease of obtaining the data. And finally, for quota sampling, a population is first segmented into different sub-groups after which the researcher selects the specific subjects from each segment to fill a predefined quota (Lavrakas, 2008). As no specific theoretical basis exists for the decision to perform intercept survey research at the three separate locations, this type of survey research qualifies as convenience sampling. While convenience sampling is disliked by some authors (e.g. Anderson, 2001), it is an appropriate approach for exploratory research and not uncommon for authors to utilize in pilot studies (in this publication, e.g. Roczen et al., 2014; Heuer, 2014; Schultz, 2005).

### 3.1 Procedure

The variables and corresponding items from section two cannot be adopted into a final questionnaire without being preceded by appropriate review. First, theory on questionnaire design is addressed on which the questionnaire format is based. Second, the initial formation of the questionnaire is explained including how the items differ from those in literature (if this is the case). Third, this 'beta' questionnaire is exposed to a test panel to root out issues related to the different scales, phrasing, and other details. These three steps ensure that the final questionnaire is ready for participants to receive, needing only very limited alterations.

#### 3.1.1 Cognitive aspects of surveys

Prior to any assessment on how to best form and structure a questionnaire, some conventional wisdom by Krosnick and Presser (2010) is adopted. While they may seem straightforward or obvious, forgetting even a single point could make a questionnaire too much of an obstacle to finish for participants. Such advice on question formation includes:

- Use simple and familiar words
- Use simple syntax
- Avoid words with ambiguous meanings
- Strive for specific and concrete wording
- Make response options exhaustive and mutually exclusive

- Avoid leading or loaded questions that push respondents toward an answer
- Ask about one thing at a time
- Avoid questions with single or double negations

Krosnick and Presser (2010) also mention several points of advice regarding the optimization of question order:

- Early questions should be easy and pleasant to answer, and should build rapport between the respondent and the researcher.
- Questions at the very beginning of a questionnaire should explicitly address the topic of the survey, as it was described to the respondent prior to the interview.
- Questions on the same topic should be grouped together.
- Questions on the same topic should proceed from general to specific.
- Questions on sensitive topics that might make respondents uncomfortable should be placed at the end of the questionnaire.
- Filter questions should be included, to avoid asking respondents questions that do not apply to them.

Several authors have identified different steps a participant executes before answering a question in a questionnaire (e.g. Tourangeau, 1984; Schwarz, 2008; Krosnick & Presser, 2010). First, a participant must interpret the question and from that deduce its intent. Once respondents have determined what the question refers to, the necessary information needs to be recalled from memory. Some information is readily available when a certain topic is addressed while other information may only be temporarily (Schwarz, 2008). Next, the individual will need to express their response. Open response formats, allowing for open answers, are rarely used in practice as they require too much time and effort to code prior to analysis (Schwarz, 2008). A closed response format is therefore mostly used. Two forms of closed response formatting are available, either by rating an object on a scale, or by selecting one (or more) response alternatives from a presented collection. Providing an individual with categorical response alternatives is a two-edged sword. While it clarifies the researchers' interest to the individual, it might also bias the research by limiting a person's options. When this format is used the researcher needs to be positive about there being no other influential options available. Rating scales are the most commonly used form of response formatting (Schwarz, 2008). By using a numerical scale combined with labeled (end)points an individual is provided with a clear boundary for his or her answer. Increasing the number of scale points both decreases the retest reliability as well as the clarity for the individual. A maximum of seven label points is there for advised. Finally, after having formed a response to a question, a participant may perform response editing as respondents may hesitate to report their answer in favor of a more (socially) acceptable one. The more a question is perceived as threatening by an individual, and the more the individual doubts the confidentiality of the interview (e.g. when a face-to-face interview is administered instead of a self-administered questionnaire), the higher the risk becomes of such social desirability (Willis, 2004; Schwarz, 2008). As the cognitive aspects of survey methodology play a large role in gathering reliable data they are included in the questionnaire design below.

### 3.1.2 Questionnaire design

When using a questionnaire to obtain information four different types of questions can be distinguished (Taylor-Powell, 1998). Knowledge-type questions refer to readily available knowledge a participant may or may not have. These questions can be rated as correct or incorrect. Behavior-type questions ask the participants what they have done or are yet to do, and the frequency of such behavior. Attribute-type

questions refer to the socio-demographic characteristics of the participant (i.e. who they are rather than what they are). The last type of questions refers to psychological states of the participant through beliefs, attitudes or opinions. Keeping in mind which questions belong to which type is important as question format can be of great importance to some question types. For example, questions about knowledge and behavior are more straightforward than questions about attitudes, which have substantial underlying complexity (Taylor-Powell, 1998). Questions related to beliefs and attitudes should therefore be most thoroughly formatted and phrased. Apart from the types of questions the order in which these questions are posed is also of importance. It is the aim of the questionnaire to keep participants interested and involved for the complete duration. Therefore, the simplest questions are to be addressed first and include the socio-demographic and dependent variable related items. The last and most time intensive scale, for the knowledge variable, is located at the very end of the questionnaire as it provides something new to the participants after a multitude of similar perception items. The different scales in between are sorted by how difficult a participant could find such items. For example, items on how people feel towards nature or how certain barriers affect them are put last, while items relating to specific attitudes and motivation are posed first. The questionnaire is designed this way to relieve pressure as the questionnaire is filled out rather than increase it.

According to Herzog & Bachman (1981) many researchers agree that survey instruments have a maximum length after which the probability increases for premature termination, random responding, and other behavior that result in lower data quality. This in contrast with questionnaires that appear important or interesting to the respondents, where the loss of respondents and deterioration of quality is claimed to be limited. Participant motivation is seen as the underlying concept behind this reasoning. The general assumption that shorter questionnaires yield better response rates than long questionnaires seems valid, but no clear guidelines for questionnaire length are provided in literature. Often only mail surveys or interviews are included in such literature (e.g. see Bogen (1996) for a review). While response rates heavily influence the cost-effectiveness of data collection, the data quality is not reduced. Therefore the inclusion of all scales identified as important takes precedence over limiting the questionnaire to a set number of pages. Only after all items are satisfactory included in the questionnaire will questionnaire length be of importance and will be addressed during the test panel.

### 3.1.3 Self-reporting

Questions regarding behavior and attitudes are usually measured in the form of self-reporting and are the primary source of data in psychology and social sciences (Schwarz, 1999). While self-reporting is indispensable, it is only to be used when its weaknesses are appropriately addressed. Minor changes in question wording, format and context can result in major changes in obtained data. After the process through which a participant makes sense of an asked question, a response becomes available. However, the responses that are made available to the participant greatly impact the measured data. Schwarz (1999) defines three such predicaments: open versus closed response formats, frequency scales and reference periods, and rating scales. Based on the literature review and the identified measurement scales no open response formats are used. One item (the dependent variable) addresses the frequency of behavior. However, this is measured on a rating scale rather than a frequency scale as it is based on prior research. Nearly all scales identified in literature employ a rating scale. Schwarz (1999) comments on the impact of labelling on the answers by the participants. He argues that labelling an 11-point scale from 0 (not at all successful) to 10 (extremely successful) obtains significantly different results from a scale ranging from -5 to 5 with identical phrasing. Apart from the effects of separate questions, context effects can also greatly impact the way in which a participant looks at or answers a question. The researchers' affiliation and social desirability, as well as the question order could change the data quality significantly if preventing steps are taken.

To address the above stated weaknesses of self-reporting several measures are taken. Rating scales do not include values in their labels, thus limiting the ability of the participant to take this into account when answering a question. Furthermore, in an attempt to show as little of the researchers' affiliation towards the topic a single sentence explains the essence of the questionnaire. With any research regarding sustainability participants will always feel a certain degree of social desirability. To minimize this as much as possible all scales are evenly distributed toward both ends (e.g. when one side of a scale is labelled as *never*, the other extreme is labelled as *always* rather than *very often* which is not the polar opposite). Total anonymity and confidentiality is also ensured in writing as well as orally if participants have any doubts. Additionally, participants are given a private space at a table or desk with only limited supervision from afar to provide a sense of anonymity. Finally, while most items do not specifically concern each other, participants are not allowed to redo subsequent questions (which can be supervised from a distance). This to ensure that new questions do not trigger a sense of social desirability or other effect.

A different issue found with self-reporting is that it usually pertains to perception questions. While surveys can be divided into many different groups, questions are usually either based on perception (subjective) or knowledge (objective). All but one variable in this research are not tested using objective measures as no scales are available for this purpose. While such an approach is a necessity for behavioral research, it presents issues with reliability as the researcher is unable to identify whether the participant is being truthful or accurate with his or her answers (Lavrakas, 2008). While one can never be completely sure whether a participant fills out subjective questions truthfully some measures can be taken. Making sure participants feel unbiased towards the survey and formulating clear and understandable questions with an adequate range of response options (see previous paragraphs) are measures to increase reliability (Lavrakas, 2008). The issue of self-reporting is further addressed in the discussion.

#### 3.1.4 Validity and reliability in quantitative research

As is the case with all quantitative research, reliability and validity are important constructs. Quantitative research, very rudimentarily put, is any research where data consists of numbers (Field, 2009). More specifically, quantitative research can be defined as the employment of "experimental methods and quantitative measures to test hypothetical generalizations, and [the emphasis of] the measurement and analysis of causal relationships between variables" (Golafshani, 2003: p. 597, constructed from Hoepfl, 1997 and Denzin & Lincoln, 1998). To do so, quantitative researchers utilize instruments that are administered in a standardized manner to capture the different perspectives and experiences of people into a limited number of predefined categories, in this case several measurement scales are used. Whether such instruments measure what they are intended to measure, is strongly indicated by the validity and reliability of the instruments.

"The reliability of a scale indicates how free it is from random error" (Pallant, 2005: p. 6). Two indicators of reliability which are often used are test-retest reliability and internal consistency. The test-retest reliability of a scale is measured by administering the same scales to the same individual on different occasions after which the correlation between both session can be assessed (Pallant, 2005). The essence of such a reliability test is strongly based on the replicability of a scale, which some authors see as an extension of reliability (e.g. Golafshani, 2003) while others see it as a different entity (Bryman, 2003). Because a form of non-probability sampling is performed, it is not possible to question every individual twice (the size of the questionnaire and the available resources are additional limiting factors). The second indicator, internal consistency, is the degree to which all items within a scale measure the same underlying attribute (Pallant, 2005). A value for

internal consistency can be retrieved through statistical analysis in SPSS using Cronbach's coefficient alpha<sup>2</sup>. Replicability of the answers cannot be fully ensured due to the application of non-probability sampling, but by describing the research procedure closely the research process itself can be duplicated. Additionally, internal consistency of the employed scales can (and will) also be tested for.

"The validity of a scale refers to the degree to which [a scale] measures what it is supposed to measure" (Pallant, 2005: p. 6). In addition to reliability the validity of a scale is of importance, but is not measured by any one clear indicator. The validity of a scale revolves around the collection of empirical evidence supporting its use. Validity can be grouped in different ways. First, one can distinguish between internal and external validity. Internal validity refers to the causal relationship between studied variables, while external validity ensures generalization of causal relationships to other contexts (Bryman, 2012). Furthermore, content validity, criterion validity and construct validity can be distinguished between (Pallant, 2005). Content validity, or measurement validity (Bryman, 2012), refers to the adequacy with which a scale has sampled from the available content, criterion validity refers to the relationship between scale scores and a measurable criterion, and construct validity refers to the testing of a scale against a theoretically derived hypotheses based on an underlying variable, as opposed to being tested against a single criterion (Pallant, 2005). Most scales used in this research are taken or adapted from existing scales, which have been thoroughly tested by their authors. This ensures more appropriate validity than would be the case with newly made scales. Several tests are available to measure validity (Bryman, 2012). These tests are all related to the measurement validity as was specified previously. Bryman (2012) states that, at the very least, face validity needs to be established, which is the measure reflecting the content of the question concept. Face validity is obtained through a test panel where participants are asked if the scale reflects the goal of the scale. Further validity measures are not used due to knowledge restraints regarding the topic. As was previously mentioned, the external validity of the data is said to be limited due to the use of non-probability sampling (Field, 2009; Bryman, 2012). While this means the research cannot provide the highest degree of validity one would prefer, a case can still be made for basic generalization on a smaller scale.

## 3.2 Measuring

With all explanatory variables identified that could influence energy efficient product consumption behavior, in addition to now having specified procedural rules regarding survey construction, the survey is ready to be created. First the operationalized scales for all variables are described and adaptations are noted. In addition, scales for the self-efficacy and external factors are constructed. This results in a 'beta' questionnaire, which is then exposed to a test panel to further obtain data on quality and understandability of the questionnaire. Lastly, in response to the test panel results, the questionnaire as it is to be used for data gathering is finalized.

### 3.2.1 Dependent variable

Energy efficient consumption behavior is measured on a scale similar to the eight item pro-environmental behavior scale used by Schultz et al. (2005). Self-reported consumption behavior is measured by asking participants to indicate "how often you have done each of the following in the past year" (Schultz et al., 2005: p. 461). The items used by Schultz et al. do not apply to this research, but the base statement is appropriate for any form of behavioral research. For the purpose of this research the question was changed to include substantial older behavior due to the nature and longevity of energy consuming devices: "how often have you done each of the following in the past 10 years". A selection of different item groups was chosen based on the

---

<sup>2</sup> Both the calculation method as well as the interpretation criteria of Cronbach's alpha are further explained in section 3.5.4.

availability of both energy efficient and conventional versions within the product group: purchased energy efficient light bulbs, purchased a water efficient shower head, purchased household appliances<sup>3</sup> based on a high energy label rating (A or higher), and purchased electronics<sup>4</sup> based on a high energy label rating (A or higher). The same scale used by Schultz et al. (2005) is provided with the categories *never, rarely, sometimes, often and very often*, but replacing the option of *very often* with *always* to be the opposite of *never*. For this variable a “not applicable” response was allowed if there was no opportunity for the action within the set timeframe.

### 3.2.2 Socio-demographic variables

Several socio-demographic items were included in the questionnaire. These variables were identified in literature to potentially relate to either pro-environmental behavior or green consumerism (Straughan & Roberts, 1999; Stern, 2000). The included socio-demographic items and answer categories are:

- **Age** (younger than 18, 18-29, 30-39, 40-49, 50-59, 60-69, 70 or older)
- **Gender** (male, female)
- **Household income** (Less than 10.000, 10.000 to 20.000, 20.000 to 30.000, 30.000 to 40.000, 40.000 to 50.000, 50.000 to 60.000, 60.000 to 70.000, 70.000 to 80.000, 80.000 to 90.000, higher than 90.000)
- **Level of education** (High school or lower, MBO, HBO, WO or higher<sup>5</sup>)
- **Marital status** (Single, married or partnership)
- **Housing** (House owner, rented house/apartment)
- **Family size** (1, 2, 3, 4, 5 or more)

### 3.2.3 Internal factors

**Attitude** was measured using the brief version of the Environmental Attitude Inventory by Milfont & Duckitt (2010), which is originally comprised of 24 items, covering twelve categories, measured on a five-point Likert scale. This in contrast with the original EAI which used a seven-point Likert-type scale. A five-point Likert scale provides an easier answer variety for participants than a seven-point scale, as the five points of ‘Strongly disagree / disagree / neutral or neither disagree nor agree / agree / strongly agree’ can be perceived as logical steps, while adding two additional points would add labels such as “disagree somewhat” or “agree slightly”. Additionally, recent research found that using a five-point scale yields data of higher quality than using a seven-point or higher scale (Revilla, 2013). No unfavorable results are expected from using a shorter measurement scale. Half the items were coded as usual while the other half was reverse coded with similar questions. Recent research by Sauro and Lewis (2011) states that the advantages of including both positive and negative questions (controlling response bias and protection against serial extreme responders) is outweighed by the disadvantages (possible misinterpretation, mistakes and miscoding). However the identified difference between all positive coding and the inclusion of negative coding is small. Therefore the coding method from the original is adopted rather than using an all positive coding version.

---

<sup>3</sup> Defined in the Dutch questionnaire as ‘witgoed’, which is a Dutch collective term for household appliances such as washing machines, fridges, dishwashers and dryers (these examples are provided).

<sup>4</sup> Defined in the Dutch questionnaire as ‘bruingoed’, which is a Dutch collective term for electronics such as computer screens and TV’s (these examples are provided).

<sup>5</sup> These levels of education are the accepted standard in the Netherlands. MBO consists of vocational learning, while HBO and WO are comparable to professional education and scientific education respectively.

**Motivation** was measured using the Environmental Motives Scale (Schultz, 2000, 2001), which originally consists of twelve items on a seven-point Likert scale of levels of importance. Again, the initial seven-point scale is replaced in favor of a five-point scale. Differentiating between low importance and slightly important, as well as very important and extremely important, are deemed unnecessary and could negatively affect the data quality. The five-point scale ranges from ‘not at all important’ to ‘very important’.

Scales for **self-efficacy** could not be identified in literature. Rather, it was proposed by Bandura (2006) to create a new scale, as the variables are extremely domain specific. According to Bandura, “perceived efficacy should be measured against levels of task demands that represent gradations of challenges or impediments to successful performance” (p. 311). Participants will be confronted with different levels of the identified impediments and asked how confident they are they can perform energy efficient purchasing behavior. The following introduction will be used:

*A number of situations are described below that can make it difficult to perform energy efficient purchasing behavior (e.g. buy appliances based on energy labels or purchase energy saving light bulbs). Please rate in each of the blanks how certain you are that you can perform energy efficient purchasing behavior on a regular basis in the following situations.*

To reduce the number of options for the participant the 0 - 10 confidence scale is preferred over the 0 - 100 point scale, both provided by Bandura (2006). The data quality should remain adequately high using the former, yet lowering the strain on the participants.

0	1	2	3	4	5	6	7	8	9	10
Cannot do at all			Moderately can do				Highly certain can do			

Combining the identified impediments from literature with the proposed item format from Bandura (2006), the following self-efficacy items were created:

The identified impediments are split into different ratings of severity:

- When I have less money to spend than I planned
- When I have less free time than I thought
- When I put less effort into making energy efficient choices
- When I don't think I have enough knowledge about the products
- When I am not encouraged to make energy efficient choices by friends and family
- When I am not encouraged to make energy efficient choices by store employees
- If I think selecting energy efficient products is inconvenient
- When I have to change my lifestyle to use energy efficient products (e.g. different lighting)
- When I am not sure about the benefits of energy efficient products
- When I am not sure about the quality of energy efficient products

**Knowledge of and skill in using environmental action strategies** are measured using the questions as provided by Hsu & Roth (1998). The original consisted of ten items on a five-point Likert scale (ranging from 1 – no extent to 5 – A great extent). Five sets of two items were presented, each set referring to one of the aspects of environmental action strategies: Ecomanagement, consumer/economic action, persuasion, political action,



and legal action. The questions are solid, yet the method of presenting the questionnaire section was bulky and needs to be improved. Originally, the five types of environmental action strategies were introduced and explained, followed by examples, closing with the two items related to that action strategy type. Explaining the definition of the type of action strategy does not benefit the participant. A short explanation of what strategies are included with the examples provides the same information to the participant without needlessly confusing them or adding to the reading material. The revised items are ranked on the same five-point scale as the original and are:

- To what extent do you feel that you are knowledgeable about environmental actions in which people work directly with the natural world to help prevent or resolve environmental issues (e.g. recycling, taking steps to reduce energy or water use, participating in community projects)?
- To what extent do you feel that you are able to use these actions?
- To what extent do you feel that you are knowledgeable about environmental actions in which people use monetary support or financial pressure to help prevent or resolve environmental issues (e.g. avoid buying products which cause pollution, stop buying from a company with disregard for the environment or that damages animal habitats)?
- To what extent do you feel that you are able to use these actions?
- To what extent do you feel that you are knowledgeable about environmental actions in which people appeal to others to help prevent or resolve environmental issues (e.g. encourage others to engage in responsible environmental behavior, encouraging others involved in negative behavior to stop)?
- To what extent do you feel that you are able to use these actions?
- To what extent do you feel that you are knowledgeable about environmental actions in which people use political means to help prevent or resolve environmental issues (e.g. voting for a pro-environment candidate, participate in or support rallies over concern for an environmental problem)?
- To what extent do you feel that you are able to use these actions?
- To what extent do you feel that you are knowledgeable about environmental actions in which people support or enforce existing laws which are designed to help prevent or resolve environmental issues (e.g. reporting pollution violations to authorities, helping authorities to enforce environmental laws by patrolling or persuading others not to break environmental laws)?
- To what extent do you feel that you are able to use these actions?

**Personal responsibility and perception of consequences** are both measured using the scales by Dietz et al. (2007). The original uses a four-point Likert-type scale. There is great discussion in whether using a four-point scale or a five-point scale is more beneficial to the data quality (e.g. in favor of 5-point Østerås et al., 2008; in favor of 4-point Garland, 1991). It is argued that using a four-point scale provides incentive for the participant to choose a side. This, however, is not always beneficial to the data quality. When no neutral ground is available the social acceptableness of the issue can push the participant towards the side he or she thinks you want them to go, thus distorting the data. For this research it is argued that when a participant is really neutral towards an item, they should be able to convey this appropriately. Thus, a five-point scale is used instead of a four-point scale as proposed by Dietz et al. (2007). Personal responsibility consists of five items, while perception of consequences consists of six. The perception of consequences items is reworked to refer to the world and the Netherlands, rather than to the world and an American state.

**Relatedness to nature** was measured using the Emotional Affinity toward Nature scale by Kals et al. (1999). The original scale of 18 items was resized to 10 (originally 11 but a double item was recorded in the appendix) by Müller et al. (2009). Müller employed a six-point Likert-type scale, which has the same impediment as the four-point scale proposed by Dietz et al. (2007). None of the authors above comment on their choice of the amount of points in their scale while this could have substantial impacts on the outcome. For the EAN scale, again, a five-point Likert scale will be used as to provide a neutral center and high data quality. The scale ranges from completely disagree to completely agree.

The **issue knowledge** items do not originate from a single scale or publication. A choice was made between 60 items on environmental knowledge by Frick et al. (2004) and 90 items from Roczen et al. (2014) of which 48 items are taken from Frick et al. and 42 newly developed items. For the selection items need to be taken from all three sub-categories of environmental knowledge (system knowledge, action- related knowledge and effectiveness knowledge) in a somewhat even manner. The amount of items is limited to around 25 to not overshadow the other scales yet still provide a sizeable measure of knowledge of participants. The number of questions per sub-group will be divided by four to keep the balance between the groups identical as with the research by Roczen et al. (2014) (thus ten system knowledge, six action-related knowledge, and eight effectiveness knowledge questions). Also, the selection is made from items varying in difficulty. This is based on the average scores found by Roczen (2011). The items are selected on applicability to the current study (e.g. a preference for energy related questions) and the country it is performed in (e.g. both publications were carried out in Germany and have some Germany-specific questions). Where possible energy related items are used, with additional ozone or CO<sup>2</sup> related questions. Forestry and agricultural questions are not used. Some questions are slightly altered to be more representative of the Dutch case.

#### 3.2.4 External factors

Several items were collected that have the potential of influencing pro-environmental behavior. The effects could not realistically be observed or measured in a way other than through self-reporting of the participants. As is the case with most of the measured internal factors, these items are measured by the perceived influence they have on the participant. All items have a similar question structure and are closed with one of the external factor items and enough examples to make the item clear for the participant:

- My behavior is influenced by my family
- My behavior is influenced by my friends
- My behavior is influenced by my community (e.g. street or neighborhood)
- My behavior is influenced by my culture (e.g. religion or nationality)
- My behavior is influenced by my education (e.g. school)
- My behavior is influenced by mass media (e.g. news or blogs)
- My behavior is influenced by the government (e.g. through laws and rules, or informative commercials)
- My behavior is influenced by industry (e.g. producers of electrical)
- My behavior is influenced by Non-Governmental Organizations (e.g. environmental or energy related organizations)
- My behavior is influenced by economic incentives (e.g. when energy efficient products are cheaper, or non-efficient products more expensive)
- My behavior is influenced by information (e.g. energy labels or information on product alternatives)
- My behavior is influenced by feedback (e.g. positive feedback from stores or government for purchasing energy efficient products)

- My behavior is influenced by habits (e.g. you buy the same products because you always have)

### 3.3 Test panel

The 'beta' questionnaire, including all items and scales presented in the previous section was presented to a test panel of six individuals. The purpose of this test panel was to 1) test the understandability and phrasing of all items, 2) check the quality of the different groups of items and scales through the noted experiences of the test participants, and 3) check the overall length of the questionnaire and individual item groups.

The six individuals varied greatly in age (ranging from 21 to 56), education (ranging from high school to university, and professional experience (including retail, IT and police). All participants were separately presented with a copy of the full beta questionnaire and were timed during their endeavor. After completion, the participants were given the opportunity to express their own opinion about the different item groups before questions were posed by the author. The majority of the test participants found the questionnaire to be on the long side, utilizing repetitive questions, and containing difficult question formats. Detailed additional questions and questions based on these comments provided a guide to construct the final questionnaire.

The item groups that were identified by the test panel to have repetitive questions were the items for attitude, motivation, knowledge and skill in action strategies, and relatedness to nature. The questions that most contributed to the perceived difficulty of the question format were the self-efficacy and knowledge and skills in action strategies groups. In an attempt to relieve the perceived repetitiveness of the items and improve the question format of the items, changes were made to some of the item groups:

- **Socio-demographic variables.** No changes were made.
- **Dependent variable.** Changes were made to the explanation of the items, the scale remains the same.
- **Attitude.** It was decided to cut the original 24 items back to 12 to lower the question demand for the participants and relieve some of the perceived repetitiveness. Only a marginal effect on the data quality is expected as all items of the original 24 were double, of which half was oppositely asked and reverse coded. Half of the normal coded items as well as half of the reverse coded items were removed.
- **Motivation.** While perceived as somewhat repetitive, the motivation questions cannot be condensed further without sacrificing substantial data quality as no one statement could be identified to be better than another.
- **Self-efficacy.** The influence of the self-efficacy scale format was difficult to judge. While some test participants viewed the scale as being strange or difficult compared to the other scales, others found it to be a welcome distraction from the usual format. The items were changed in favor of the more understandable Likert-scale, which was found acceptable by the test participants. No changes were made to the items themselves.
- **Knowledge and skills in action strategies.** All six test participants complained about the knowledge and skills in action strategies scale. Some difficulty with the scale was expected due to the difficulty of the involved matter, but such unanimity was not. As a solution, it was proposed to the participants to go back to the original question format by Hsu & Roth (1998) where the items were much longer but explained more clearly. The original differentiation between the environmental action strategies would remain. The solution was received with mostly disagreement as neither question format had much preference. Three participants individually proposed identical solutions. It was proposed to instead use the examples rather than the action strategy definitions. In response, a new question format was constructed based on the strategy examples provided by Hsu & Roth (1998). While this

could substantially influence the data quality, the threat of non-response and wrongly filled in items seemed greater.

- **Personal responsibility and perception of consequences.** No participants faulted the items related to personal responsibility and perception of consequences. Both item groups have the right amount of items and sufficient clarity.
- **Relatedness to nature.** Compared to other broader item groups, the items for relatedness to nature were perceived as being very repetitive and sometimes ‘wooly’ or ‘spiritual’<sup>6</sup>. The items “I have the feeling I can live my life to the full in nature”, “By direct contact with nature I feel respect for its uniqueness”, “By getting in touch with nature today I have the feeling of the same origin” and “I am often very much absorbed through nature (landscapes, plants, animals, water, etc.) and I do not notice how time goes by” were seen as especially out of place. To both resolve the repetitiveness and spiritual items, the above four items were omitted from the questionnaire. This leaves enough items to still grant quality data, and no reverse coded items were omitted making the difference between normal coded and reverse coded items smaller. As was the case for the attitude variable, this should make the responses more reliable.
- **External factors.** The item group for the external factors received mixed comments. Some test participants had no trouble with the items, while others found them to be vague. Especially the middle factors concerning the institutional factors were difficult to answer according to the participants. As no scale for measuring the perceived influence of external factors on behavior is available, problems with the conception of an introductory scale were expected. The vagueness, as the participants judged the item group, was partially intended to keep lines of thinking broad and give the participants the ability and room to think for themselves how they would see the influence of such factors. To formulate more specific items regarding external factors would take up too much room in a questionnaire that is already deemed lengthy. The question format from the beta questionnaire remains in the final product, and the questionnaire results will show whether the quality is up to par.
- **Knowledge.** The items used to measure actual knowledge of the participants, was received positively as ‘fun’ or ‘different’. The group of items was expected to be on the long side and the test participants felt the same way. Additionally, some questions were identified as oddly or wrongly formulated. In response to the feedback from the test participants the knowledge item group was shrunk slightly from 25 items to 20. In an attempt to keep the ratio between system knowledge, action-related knowledge and effectiveness knowledge items the same, no more than two items per item group were removed. The omitted items included all of those perceived as questionable by the test participants.

All in all the questionnaire was received positively by the test participants. Apart from the item group for knowledge and skills in action strategies no major faults were found. Formulation and grammar were all adequate, and the order in which the items were presented was well received (socio-demographic items, perception items, and knowledge items). Small phrasing changes were made for the final questionnaire. The final questionnaire is available in appendix B in English. The Dutch version, as it was carried out in the Netherlands, is available upon request.

### 3.4 Sample

The targeted population of this research was citizens of Utrecht who potentially came into contact with energy efficient products and their less efficient counterparts. Several home-improvement stores were selected in the city of Utrecht where the store owners allowed for the surveying activity. Three locations across the city

---

<sup>6</sup> These are approximate translations of the Dutch word used, which was ‘zweverig’.

of Utrecht were selected to conduct questionnaires during the months June and July. The questionnaire as it was handed out, and is available in appendix B, consisted of four pages. The appropriate sample size for this research was calculated based on several variables (Kotrlík & Higgins, 2001). The acceptable margin of error was set at 7%. While 5% is more common, 7% is an acceptable margin of error for an introductory research and not quite as high as 10%. A confidence interval of 95% was decided upon (with a corresponding Z score of 1.96). The standard deviation was set at 0.5 which is the standard without prior knowledge of the sample. The following formula was used:

$$\text{Sample size} = \frac{t^2 * pq}{d^2}$$

Here, t is the Z score 1.96, pq is the estimate of variance (based on the standard deviation for which .5 is typical), and d is the margin of error. The sample size should thus be  $(1.96)^2 * (.5) * (.5) / (.07)^2 = 196$ . The thought of adopting a 5% margin of error was entertained, but this would result in a necessary sample size almost two times as large, which based on the first week of questionnaires was deemed impossible within the available time span.

To obtain at least such a sample size with a long survey (four pages could potentially be labelled very long), several measures were applied to ensure an appropriate response rate. While mainly chosen for their skill and potential regarding the handing out of surveys, both assistants were female. While some may disagree based on a variety of reasons, response increased significantly when questionnaires were handed out by the assistants rather than the researcher alone. Additionally, participants were offered a snack or beverage for completion of the questionnaire. Finally, for those participants who thought the full eight minute questionnaire was too long only the first three pages were requested as the knowledge item group, while only measuring a single variable, accounts for more than a third of the survey time. Using these measures a total of 218 questionnaires were collected (of which only 23 lack the knowledge items).

### 3.5 Statistical analysis

Statistical analysis is used to analyze the data from the questionnaires and describe the results. The purpose of this section is to explain which analyses are used and why. The program SPSS (version 20) has been used for all analyses.

#### 3.5.1 Descriptive statistics

Descriptive statistics are used to provide a first lift of the veil regarding the questionnaire results. An overview is provided on the frequency distribution of given answers and related scales. Frequency distribution can first be used to check the normality of a sample. When data has a normal distribution the majority of the values of a sample lie around the center of the distribution with the frequency of values being present diminishes the further away from the center you go (Field, 2009). One can be more confident a sample is normally distributed when the sample becomes larger. Testing for normality is important for both correlation and regression research as normal distribution is assumed in some calculations (see section 3.3.2 on correlation coefficient). Additionally, first relations between the dependent variable and the explanatory variables are assessed through mean comparison, prior to correlation analysis.

Apart from the shape, the center of a frequency distribution can also be calculated. Three measures are used for this purpose: the mode, the median and the mean (Field, 2009). The mode is the score that occurs most frequently in a data set and is easy to calculate. The median is the middle score in a dataset ranked in order of magnitude, and has the advantage that it is not distorted by extreme data and is also easy to compute.

However neither measures are used in statistical analysis as the mode is not algebraically defined and is strongly influenced by small sample size, and the median cannot be used in further mathematical calculation as not all available information is used (Manikandan, 2011). The mean is therefore the preferred measure for frequency distribution as it is the average score of the data and can thus be used in further calculation. However, the mean has a significant weakness which relates to ordinal data. Because the difference between answer categories of ordinal data are not evenly distributed, calculating the mean of three participants of which one answers 'strongly disagree' (value 1) and two others answer 'agree' (value 4), gives a mean of three, while there is no certainty that the difference between neutral and strongly disagree is precisely twice as large as between neutral and agree. Some authors therefore advice the use of the mode as this provides a more reliable insight (e.g. Manikandan, 2011). A far more accurate approach is adding graphs for the different variables in which the answer composition can be viewed. This is preferable as not only can the reader see which value occurs most frequent, comparison between answer categories also becomes available.

To calculate how well this mean represents the gathered data several measures can be assessed such as standard deviation, variance and standard errors (Field, 2009). Standard deviation and variance both measure variability within a distribution. The standard deviation (SD) is a measure of the spread of scores within a dataset. Variance also measures the spread of dataset scores, but is calculated by taking the square of the deviation rather than the absolute to dispose of negative values. By taking the square of every deviation more weight is given to extremer scores, which could be beneficial when scores away from the mean are seen as important. The added value of the SD is that it is expressed in units of the original variable (this would be squared units for the variance measure) and is thus easier to interpret. As most of the data is measured on a Likert scale, using variance to measure variability would provide unfair weight to the higher scores (for this questionnaire usually the 'agree' and 'strongly agree' segments). The standard deviation is the preferred measure of variability within a distribution as no bias towards certain scores is involved and the expressed units are of the original variable.

Besides having a measure to calculate how well a model represents gathered data, measuring how well the sample data represents the whole population is also important as information on the whole population is not available. To measure this variance the standard error is used (Field, 2009). A low standard error thus indicates that the sample mean is close to the population mean while a large standard error implies that the sample data and actual population differ more.

### 3.5.2 Correlation

After having presented the variables separately the relation between the variables is calculated. Covariance measures to what extent changes in one variable are met with similar changes in the other variable (Field, 2009). When covariance is calculated the outcome value depends on the scales of measurement used for the variables. This means that using a different scale influences the outcome and outcomes cannot be compared. To solve this problem the covariance is standardized using a single unit of measurement, the standard deviation. This standardized covariance is known as a correlation coefficient. Values of the correlation coefficient are always between -1 and +1 for perfect negative and perfect positive correlation respectively (Field, 2009).

Two types of correlation exist: the first is the correlation between two variables (bivariate correlation) and the second looks at the relationship between two variables while controlling for the effects of other variables (partial correlation) (Field, 2009). Several bivariate correlation coefficients are available, but only those of importance to this researcher are explained. The three bivariate correlation coefficients possibly applicable to this research are Pearson's  $r$ , Spearman's  $Rho$ , and Kendall's  $tau$  (Field, 2009; Cohen et al., 2013). Pearson's  $r$

correlation measures the degree of the linear relationship between two variables and is used for interval data. To also establish whether the correlation coefficient is significant some assumptions are required based on the data. Significance can only be accurately calculated when the variables are normally distributed. Spearman's Rho and Kendall's tau are non-parametric statistics and are thus not limited by a lack of normal distribution. Spearman's Rho works by first ranking sample data from which the degree of association between two variables is calculated. As no assumptions about distribution of data are made Spearman's Rho is used for ordinal scales. Kendall's tau is preferred when using a small data set with a large number of tied ranks (Field, 2009). The sample size is appropriately large with limited tied ranks to exclude Kendall's tau from use. A point can be made for either correlation coefficient. Pearson's r is preferred for normally distributed data on an interval scale, while Spearman's Rho is preferred for data on an ordinal scale where no normal distribution is present (Field, 2009; Cohen et al., 2013). It was decided to use Pearson's for the following reasons. While most items are ordinal, these items are later combined into scales, thus greatly increasing the possible values, and are thus comparable to an interval scale. Additionally, a normal distribution is expected due to the sample size. Pearson's r will therefore be the main correlation coefficient. As all measured variables were claimed to be of influence on pro-environmental behavior, it is expected that linear relationships exist between the variables. This is necessary to use Pearson's correlation as well as regression in the next section. Next, partial correlation is applied on the same sample data, testing the exploratory variables against the control (demographic) variables. Any differences are then reported.

While correlation coefficients can show that two variables are related, they give no indication of the direction of causality for two reasons (Field, 2009). First, causality between two variables cannot be assumed because there may be other variables which affect the results (either measured or unmeasured). And second, if it was possible to exclude the effects of other variables, the correlation coefficient does not specify in which direction causality operates and thus which variable influences which. While the direction of causality cannot be specified by neither bivariate nor partial correlation, using partial correlation one could look at the relationship between two variables keeping the effects of other (measured) variables constant (Field, 2009).

### 3.5.3 Regression

Where correlation measures the relationships between two variables, regression aims to predict one variable from another by (Field, 2009). The value of a dependent variable can be predicted from one (simple regression) or more (multiple regression) independent variables. Because several variables (now predictors) have been measured which could be of influence on the dependent variable multiple regression is necessary. As was previously mentioned, linear relations are expected between the variables and will thus be tested for. To perform regression analysis the line that best fits the data is generated, which is a statistical model. The model equation for simple regression and multiple regression are closely related as the only difference is that the equation either includes a single predictor or several. Every predictor has a corresponding coefficient with which it is multiplied to predict the effect of the predictor variable(s) on the dependent variable. When multiple variables are involved the following equation is used to obtain unstandardized regression coefficients (Field, 2009):

$$Y_i = (b_0 + b_1X_{1i} + b_2X_{2i} + \dots + b_nX_{ni}) + \epsilon_i$$

In this equation  $Y_i$  is the outcome (or dependent) variable,  $b_0$  is a constant value unique to the model,  $b_1$  is the coefficient of the first predictor  $X_1$ ,  $b_2$  is the coefficient of the first predictor  $X_2$ , and so on.  $\epsilon_i$  describes the difference between the predicted and observed value of  $Y_i$ . As this research contains variables that have no usual comparable units of measurement (Likert type scales rather than for example meters or temperatures),

including the unstandardized coefficients denies the reader from making useful comparisons between coefficients (Nau, 2015). Therefore the standardized regression coefficients are outputted in the results section of this research, which are calculated by SPSS and based upon the number of answer categories. How well this model actually represents the data can be assessed using multiple R or  $R^2$ , representing the amount of variance explained by the model relative to how much variation there was to explain in the data (Field, 2009). It is therefore the correlation between the observed outcome variable and the outcome variable values predicted by the multiple regression model. While the aggregate DV is strictly speaking an ordinal variable (as the order matters but not the difference between values), due to the large amount of possible values from combining the four separate DVs, it is argued that it is acceptable to use in multiple regression (Flom, 2010). This is further supported up by the outcomes of several tests regarding goodness of fit of the model. In addition to the aggregate DV, analyzing the regression of the separate DVs could also yield results as to the composition of the aggregate DV. These separate items however are ordinal, being ranked on a five point Likert type scale. Many schools of thought exist on how to approach this issue involving three types of statistical tests (Flom, 2010):

- Multiple linear regression: The simplest to interpret of the three test types, which for that reason is also most often used and feels most familiar. While these are strong merits, when applying multiple regression to an ordinal variable, the output values might not be a true representation of the sample data.
- Ordinal logistics: This statistical test type is more likely to provide correct results, being designed for ordinal variables. However the output is difficult to understand.
- Multinomial logistics: This test needs many estimated parameters making it a complex model very hard to interpret by non-statisticians.

While there is no wrong choice, quality of the output depends on the chosen approach. For this portion of the analysis, specific results like the one for the aggregate DV are not needed, an idea of how the separate DVs influence the aggregate is enough. Therefore, multiple linear regression is selected as well for this analysis, keeping in mind its downsides for this type of DV. After calculation of the four regression models the appropriate data is analyzed regarding accuracy and linearity. Based on these observations it is then decided whether the regression models can be used or not.

To decide which variables to include in the multiple regression model different methods are available. In hierarchical regression the predictors entered first are those with known predicting value in relation to the outcome variable (from literature or own previous research). These variables are entered in order of importance. Any new predictors are added last in one go or in a stepwise manner (those assumed to be the most important could be entered first hierarchically). When forced entry is applied all predictors are put into the model simultaneously. Theoretical reasoning for including predictors is still of importance, but no assumptions are made based on the order. Finally, in stepwise regressions the order in which predictors are entered are based on mathematics. A computer selects predictors based on how well they explain the variation in the outcome variable. A forward and a backward method are available for stepwise regressions. The former starts with only the constant  $b_0$  and then predicts which predictor best predicts the outcome variable and continues this selection until the ideal model is reached (with the available predictors). The backward method starts by placing all predictors in the model and then calculating which of the predictors does not contribute significantly to the model. After removal the process is repeated until the ideal model is reached. Which method to use depends on the question of interest of the researcher and the theoretical basis of the predictors. Of the three available methods the stepwise method is seen as the least favorable (Field,



2009; Cohen et al., 2013). This is due to the fact that the researcher surrenders the available responsibility of decision making and leaves it up to the computer, which is in turn influenced by random variation in the data with makes replicating of results extremely difficult (Field, 2009). To employ the hierarchical method an unrelenting belief in the order of importance of the available predictors is needed. While literature research shows that the researched variables influence pro-environmental behavior, no assumptions are made on their specific order of importance. The most appropriate method is thus the method of forced entry as adequate research has been performed to identify the important predictors for this research, but no order of importance is assumed.

### *3.5.3.1 Diagnostics and generalization*

For any method it is important to assess the accuracy of the regression model. To establish whether the model is an accurate representation of the data outliers and influential cases can be looked at (Field, 2009). Outliers are those cases that differ substantially from the overall model and thus have a relatively large influence on it. Where outliers specify a certain error in the model, specific influential cases or data points can also be identified which exert undue influence over the parameters of the model (Field, 2009). Several influence diagnostics are available to assess the importance of an individual data point. Two global measures of influence provide information about how a certain case affects the overall regression model: DFFit and Cook's D (or distance) (Field, 2009; Cohen et al., 2013). Both measures combine information from leverage values and deleted studentized residuals but are computed slightly different<sup>7</sup> (Seber & Lee, 2012; Cohen et al., 2013). Both measures are used to decide whether or not to keep a case that alone strongly influences the model. When Cook's D > 1 for a particular case it is seen as influential and should be flagged for either further study or deletion (Cook & Weisberg in: Stevens, 2012). An influence measure that is based on the same data but provides information on how specific cases affect specific regression coefficients within the equation is DFBeta (Cohen et al., 2013). A DFBeta with a value > 2 should be investigated (Stevens, 2012). By applying Cook's D, DFFit and DFBeta a strong case can be made whether the model fits the observed data well or not. Field (2009) stresses the importance of using such measures to assess the fit of the model rather than use it to remove data to effect a desirable change in the regression parameters. No cases are to be removed unless the influence measures show significantly high values and the case is appropriately reviewed.

While the nature of the questionnaire (a form of non-probability sampling) limits the accuracy of any generalization based upon it, tests can be carried out to add weight to the analysis outcomes. Especially since the nature of this research is exploratory, such details can be dealt with more loosely (when specifically mentioned why it is assumed to be acceptable). When a regression model is completed, different values are calculated and shown. Of these values the  $R^2$  and adjusted  $R^2$  are important (Field, 2009). The  $R^2$  value represents the proportion of variance in Y (the dependent variable(s) in this research) being accounted for by the regression model from the sample. The adjusted  $R^2$  on the other hand estimates the proportion of variance of Y being accounted for by the model if it had been derived from the population the sample is based on. Different formulas are available to calculate adjusted  $R^2$  of which Wherry's equation is the standard in SPSS (Field, 2009). This formula however does not indicate how well the derived equation will predict on other samples from the same population (Field, 2009; Stevens, 2012). To aid generalization Stein's equation is proposed, as it also estimates the influence of potential other samples.

---

<sup>7</sup> Field (2009) defines leverage as "[gauging] the influence of the observed value of the outcome variable over the predicted values" (p. 217) while a studentized residual is the difference between the adjusted predicted value (a value that becomes higher as the influence of a data point on the model increases) and the original value (Field, 2009).

### 3.5.4 Initial assessment

As was previously mentioned the reliability of a scale can be expressed in Cronbach's coefficient alpha. This statistic provides an indication of the average correlation among all the items that make up the scale, and has a value ranging from 0 to 1, with higher values indicating greater reliability (Pallant, 2005). For a scale to be reliable a minimum alpha of 0.7 is recommended (Pallant, 2005; Field, 2009). Another rule of thumb is provided by George & Mallery (2003, in Gliem & Gliem, 2003): 1 - 0.9 is excellent, 0.9 - 0.8 is good, 0.8 - 0.7 is acceptable, 0.7 - 0.6 is questionable, 0.6 - 0.5 is poor and anything lower is unacceptable. However, the number of items a scale consists of influences the reliability of the Cronbach's alpha. Smaller values of Cronbach's alpha are expected when the number of items drops below ten. In these situations calculating the mean inter-item correlation for the items is preferred (Pallant, 2005). The inter-item correlation is calculated by taking the correlation between the first item and the sum of the other remaining items, the correlation between the second item and the sum of the other items, and so on. The mean expresses the average of all these correlations (Gliem & Gliem, 2003). The optimal mean inter-item correlation values range from .2 to .4 (Pallant, 2005). In an effort to improve reliability of a scale, one could decide to remove one or more items from the scale. When Cronbach's alpha is reported using SPSS, an overview is provided of Cronbach's alpha of the original scale as well as the higher alpha value of the scale if some items were removed (if possible). While this can be used to improve reliability, it is only to be used when Cronbach's alpha of the original is below 0.7 and the removal of the item does not decrease the data quality. Finally, SPSS provides two alpha coefficients, a 'raw' coefficient and a standardized coefficient. The former is based on item covariance while the latter is based on item correlation. When data variance shows a significant spread, the standardized coefficient is more appropriate, while for data with a limited variance spread the raw coefficient is best applied. Since the data for this research shows limited variance, the raw coefficient is used (data is not shown).

Prior to any calculations Cronbach's alpha was calculated for all scales including the newly formed item groups for self-efficacy and external factors. An overview of is provided in table 1. Excluded from the table is the attitude scale as its purpose is to measure a dozen individual items rather than measure a single underlying variable.

Table 1: Raw Cronbach's alpha values for all scales

Scale	Cronbach's alpha	Number of items
Dependent variables	.809	4
Motivation	.904	12
Self-efficacy	.911	10
Personal responsibility	.332	5
Perception of consequences	.870	6
Relatedness to nature	.832	7
External factors	.888	13
Knowledge	.532	20

Table 1 shows several points of interest. Of the scales adopted from literature, three scales (motivation, perception of consequences, and relatedness to nature) show good to excellent alpha values, consistent with what could be expected from such tested scales. In addition to these scales the aggregate of the four separate dependent variables also possesses a high alpha value. Two scales however do not possess such reliability with a poor and unacceptable Cronbach's alpha for knowledge and personal responsibility respectively. A low

Cronbach's alpha is not necessarily a bad outcome, all it means is that there is little covariance between the item pairs (which means it is more likely the scale measures more than one underlying variable). For the knowledge scale this is a non-issue, as it was not necessarily meant to measure a specific underlying variable. For the personal responsibility this is however a vexing problem. In an attempt to increase reliability it is possible to remove the item with the biggest effect on inter-item covariance, but this barely changed the alpha value. As only a small number of items is involved and the Cronbach's alpha is small, the mean inter-item correlation is calculated. With this five item scale a total of ten possible inter-item correlations are possible, of which the mean is only .112, which is not high enough to contest the alpha. Thus, all but one scale have appropriate alpha values and are thus deemed reliable. The personal responsibility scale lacks such reliability, but can still be used when it is kept in mind there could be other strong underlying variables at play (which is the case for all scales but less so with higher values).

In table 1 two scales are present which were not adopted from literature but created specifically for this research. Both these scales possess at least good reliability. These are good initial findings but need to be expended upon. As both scales have a high Cronbach's alpha, there is a strong degree of internal consistency (i.e. the items correlate well together). During the construction of new scales, the reliability is often tested together with a second measure, which is the unidimensionality (Kidder, 1981). Rather than calculating correlation between items, as is the case for reliability, the correlation between the items and the scale is observed and valued. With no a priori hypothesis available for a scale (both scales are new and untested) exploratory factor analysis is an often used measure to identify such item groupings (Cudeck, 2000; Field, 2009). The goals of factor analysis in this research are to identify the number of underlying influences (i.e. factors) of variables and to quantify the extent to which each item is associated with the factors (Cudeck, 2000).

All factor analyses were performed in SPSS in the same manner. After selection of the items within a scale a scree plot was analyzed to the potential number of factors to be included (other methods of calculating the number of factors are available but outside the comfort zone of the author (see for example Field, 2009). In addition to the scree plot a KMO and Bartlett's test are outputted, which are measures of the adequacy and significance of the factor analysis respectively. A KMO > 0.7 is seen as acceptable while KMO > .8 is good (Tzeng et al., 2007). The Bartlett test outputs a significance value for which we find a 0.01 level of significance appropriate. Both measures are assumed appropriate unless otherwise mentioned. With both tests values being of substantial quality, the exploratory factor analysis was further edited by applying both rotation and sorting to improve interpretation (Field, 2009).

Exploratory factor analyses are performed for three scales. In addition to the scales for self-efficacy and external factors the motivation scale is included to test whether the items load on the appropriate factors as was the case in the source material (Schultz, 2000). Thus, a very similar test to the one performed by Schultz is performed. The factor loadings of the motivation items are calculated and shown in table 2. As was expected, the different items loaded on the same factors as was the case in literature. Factor 1 represents biospheric motivation, factor 2 egoistic motivation, and factor 3 altruistic motivation. This means the scale functions as it was intended to function.

Table 2: Factor loadings of the motivation scale

	Factor		
	1	2	3
Concern for land animals	1.008		
Concern for birds	.927		
Concern for marine life	.903		
Concern for trees and plants	.819		
Concern for my future		.874	
Concern for my lifestyle		.805	
Concern for myself		.768	
Concern for my health		.736	
Concern for the community			.816
Concern for humanity			.759
Concern for future generations			.714
Concern for my children			.604

No such specific groupings of items were expected for the two newly formed scales as there was no evidence in literature for such phenomena. To measure whether any underlying principles are at play these scales too are exposed to factor analysis, with the self-efficacy scale first for two factors as was decided by the scree plot (see table 3).

Table 3: Factor loadings of the self-efficacy scale

	Factor	
	1	2
Still buy when i have less free time than i thought	.898	
Still buy when I am not encouraged to make energy efficient choices by friends and family	.893	
Still buy when I am not encouraged to make energy efficient choices by store employees	.853	
Still buy when I put less effort into making energy efficient choices	.751	
Still buy when i have less money to spend than i planned	.638	
Still buy when I don't think I have enough knowledge about the products	.563	
Still buy when I am not sure about the quality of energy efficient products		.903
Still buy when I am not sure about the benefits of energy efficient products		.836
Still buy if I think selecting energy efficient products is inconvenient		.463
Still buy when I have to change my lifestyle to use energy efficient products (e.g. different lighting)		.446

Many items possess significant factor loadings (all others are by design at least sufficient at > .4) and could be used to describe the factors they are loaded on. Two distinct factor groupings are visible. The items loaded on factor 2 are comparable as they seem to relate directly to the product (quality, convenience, use), while the

items loaded on factor 1 have more to do with a state of mind as to what energy efficient products are worth (time, money, encouragement).

The second item group which was constructed for this research is the external factors scale. Exploratory factor analysis of these thirteen items revealed the factor loadings on three factors in table 4. The participants were asked to convey the influence they perceived from the particular item on their energy efficient purchasing behavior.

Table 4: Factor loadings of the external factors scale

	Factor		
	1	2	3
Feedback	.717		
Economics incentives	.637		
Information	.618		
Habits	.446		
Media		.775	
Industry		.677	
Government		.617	
NGO's		.548	
Education		.474	
Culture		.470	.444
Friends			.812
Family			.798
Community influences my energy efficient purchasing behavior			.571

The factor analysis of the external variables is extremely interesting, as they match the differentiation between items in literature to a high degree. The items loading on factor three (culture, friends, family and community) are all part of the sub-category social and cultural factors as was described in the previous chapter. The items loading on factor two with the exception of culture (which loads on both factor 1 and 2), all belong to the sub-category institutional factors. Lastly, the items loading on factor one (feedback, economic incentives, information and habits) group together to form the third separate group. While not all factor loadings are of great strength, they all possess at least sufficient factor loading to warrant interest.

While such clear findings for the factor analysis of the motivation scale were somewhat expected, the findings for the self-efficacy and external factors scales were less so. Because both new scales possess good reliability and clear separation into different factors, these scales are divided into their relevant factors for further statistical analysis. The only deviation from the factors as presented above is that the culture item of the external factors scale is attributed to the social cultural factor rather than the institutional factor for which it possesses a higher factor loading. Due to the small difference in factor loading and the support from literature this is believed to be acceptable.

### 3.6 Closing statement methodology

In this chapter the individual explanatory variables have been forged into a single questionnaire. Literature research and the application of a test panel resulted in a measurement method with substantial validity. Data gathering, while bothered by some response issues caused by the size of the questionnaire, was carried out smoothly, and from the initial assessment it has become apparent that the research possesses adequate reliability in the form of significantly high Cronbach's alpha values for most scales. Additionally, both newly formed scales (for self-efficacy and external factors) show interesting results after factor analysis. Further analysis on these and all other variables is found in the next results chapter, where the sample data is exposed to statistical analysis.

## 4. Results

In this chapter the results from the survey are presented. The order of the statistical analysis chapter is used, thus descriptive statistics are first provided, after which correlation and regression analysis is performed.

### 4.1 Descriptive statistics

In this section the composition of the participants within the data set is visualized and explained. Additionally, manually assessing the relations between the dependent variable and the explanatory variables is an important function of the descriptive statistics. This is a necessary addition prior to performing correlation, as SPSS only outputs a single correlation coefficient. While this coefficient is easy to interpret, it tells nothing of the data the coefficient is based on.

#### 4.1.1 Dependent variable

The dependent (aggregate) variable consists of four separate items measuring the purchasing behavior of different groups of energy efficient products. No missing values were allowed for this variable and thus acted as a first cut-off point for questionnaires. Therefore, all 218 respondents filled in this scale. Participants were provided with an option where they could indicate that neither the energy efficient nor the conventional product was purchased. In the past 10 years, 5.5% of participants indicated that they never bought a lighting product, 20.2% that they never bought a shower head, 11% that they never bought household appliances, and 12.4% that they never bought electronics. These participants were subsequently excluded from further descriptive statistics regarding this variable. Table 5 shows the most important descriptive statistics for both the aggregate DV and the separate DV's after exclusion of 'non-buyers'.

Table 5: Descriptive statistics for the dependent variables

	<b>N</b>	<b>Mean</b>	<b>Std. Error</b>	<b>Std. Dev.</b>
<b>Purchase of lighting product (DV1)</b>	206	3.64	.071	1.021
<b>Purchase of showerheads (DV2)</b>	174	2.70	.106	1.404
<b>Purchase of appliances (DV3)</b>	194	3.37	.095	1.318
<b>Purchase of electronics (DV4)</b>	191	2.95	.086	1.195
<b>Aggregate dependent variable (ADV)</b>	211	3.226	.0697	1.0123

As can be seen in the table, participants scored above neutral regarding the purchase of energy efficient lighting products and appliances, about neutral for electronics and slightly below neutral for showerheads. Low standard errors are recorded for all variables as the sample size is appropriately large. The standard deviation for DV2 and DV3 is slightly on the high side but no cause for concern. For the explanatory variables only the figures are recorded in the result section itself, with references to the descriptive statistics tables which will be located in the appendix. This so the important statistics such as standard error and standard deviation can be recorded without comprising the readability of the results. As was mentioned previously, while the mean is the most common measure to define the center of a frequency distribution (Field, 2009), it is not completely trustworthy because ordinal data is involved. Therefore the breakdown of these variables is important, to gain an understanding of what answer categories the mean is comprised. For example, while the difference between DV2 and DV4 is relatively small, the mean is constructed quite differently. Values for DV2 are similar across all five answer categories, while the mean of DV4 is mainly caused by the high value for the center category. This results in a much wider spread of behaviors and a higher standard deviation for DV2, showing much less consensus on the topic among participants while having a mean comparable with DV4. Figure 11 shows the breakdown of answer categories relating to the four separate DVs.

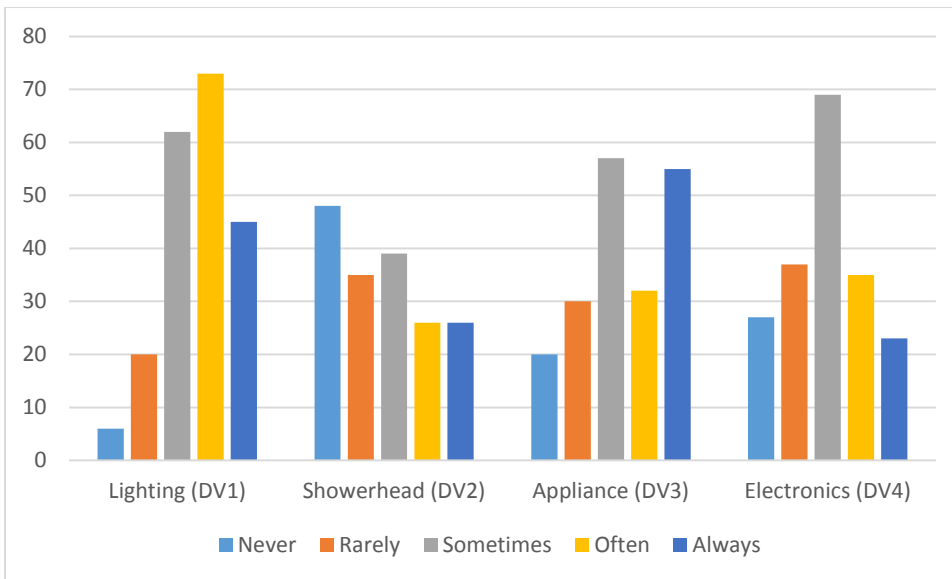


Figure 11: Breakdown of DV categories

#### 4.1.2 Socio-demographic variables

The distribution of the socio-demographic variables is provided to both show their influence on the dependent variable and compare this with the average of the Utrecht population.

##### Gender and age

Figure 12 shows the contribution of the different age groups of the participants, while figure 13 shows the gender distribution. Most participants belong to the group with ages ranging from 18-29 (27.5%), followed by the 30-39 group (18.8%), and both the 50-59 and 60-69 groups (17.9%). Of the participants, the vast majority was male. As the research aimed to mainly contact individuals of legal (as these are assumed to be the ones performing the purchasing behavior), two individuals below the age of 18 were found to live alone and make such purchases. These individuals are included in the below chart, but not in any further calculations due to the very insignificant representation.

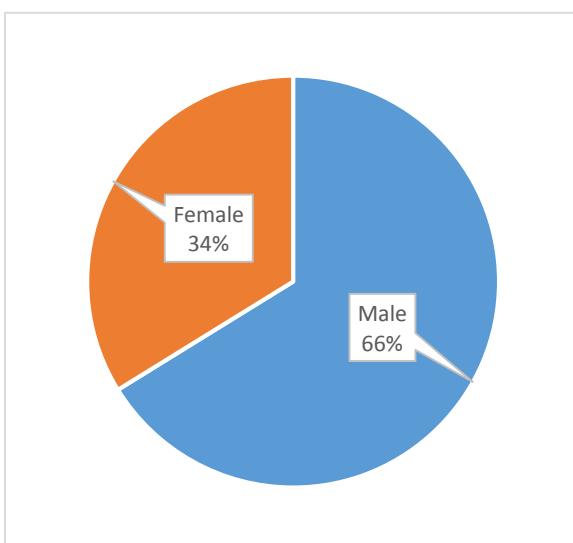


Figure 13: Distribution gender variable

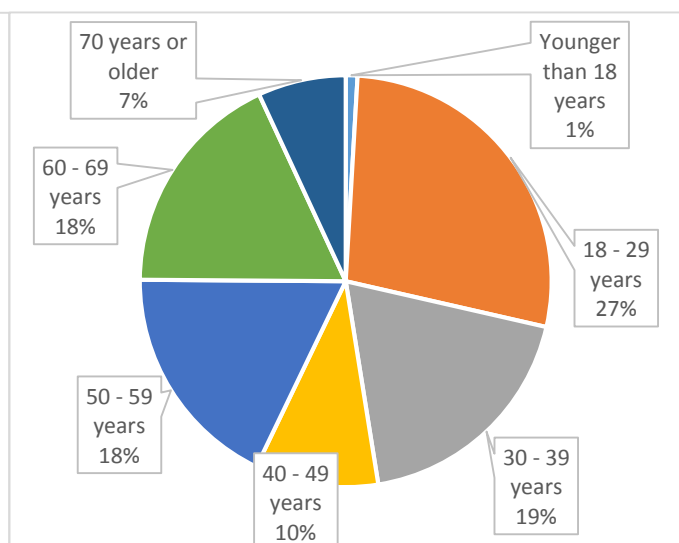


Figure 12: Distribution age variable



Age seems to influence the DV to a large degree, as the higher the age group, the higher the DV value becomes, as can be seen in table 6 (see full table 27 in appendix C). It is expected that age correlates highly with the DV in the next section, but no assumptions can be made. Male participants score slightly lower for the aggregate DV (3.175) than females (3.341).

Table 6: Influence of age on DV (compressed)

Age group	18 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 >
Mean DV	2.864	3.106	3.385	3.342	3.541	3.517

#### Income

Most participants recorded a household income between €20.000 and €30.000 (16.5%), closely followed by €30.000 – €40.000 (15.6%), €40.000 - €50.000 (15.6%) and €10.000 - €20.000 (15.1%). Eleven missing values were recorded for household income. The relatively high frequency of missing values (compared to other variables where only two or three values are missing) is due to some individuals being uncomfortable filling in this particular question. Apart from the lowest two income groups which show relatively low DV values, household income does not seem to relate strongly to the DV (see table 28 in appendix C).

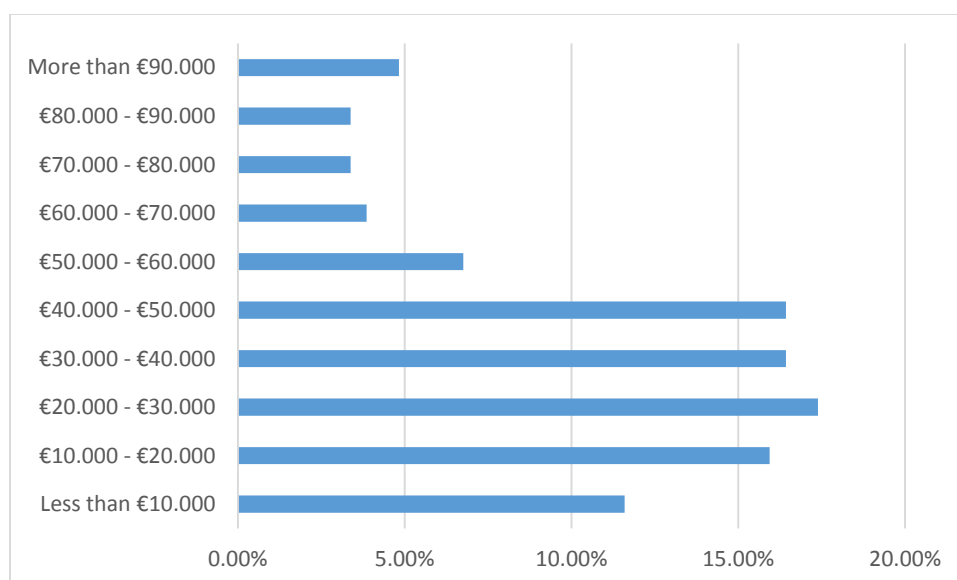


Figure 14: Distribution of household income variable

*Marital status and housing*

Of the participants the majority is either married or in a relationship (58.3%) and is a house owner (56.9%) rather than a tenant (41.7%). Both marital status and housing show to have a possible relationship with the DV (be it a small one). Being single shows a DV approximately .3 points lower than being married or in a relationship, while being a house owner shows a more than .4 point higher average DV than being a tenant (see table 29 in appendix C).

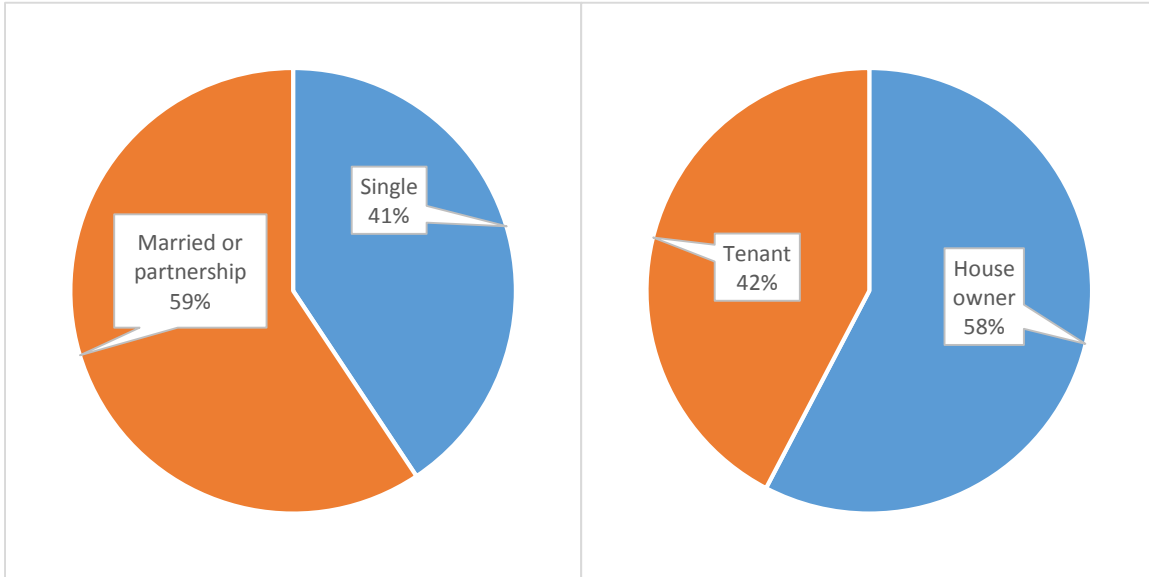


Figure 15: Distribution marital status variable

Figure 16: Distribution housing variable

*Family size and education*

A substantial number of participants recorded a family size of two people (46.3%), followed by one person households (25.5%) and four (13.3%) or three (12.4%) person households. Finally, of the participants the majority has HBO as their level of education (39%) followed by WO (30.3%) and MBO (20.6%). Family size shows some relation to the DV, with smaller households having higher DV values (with the exception of the 5 or more category). Education on the other hand shows no such relation. See tables 31 and 32 in appendix C for further clarification.

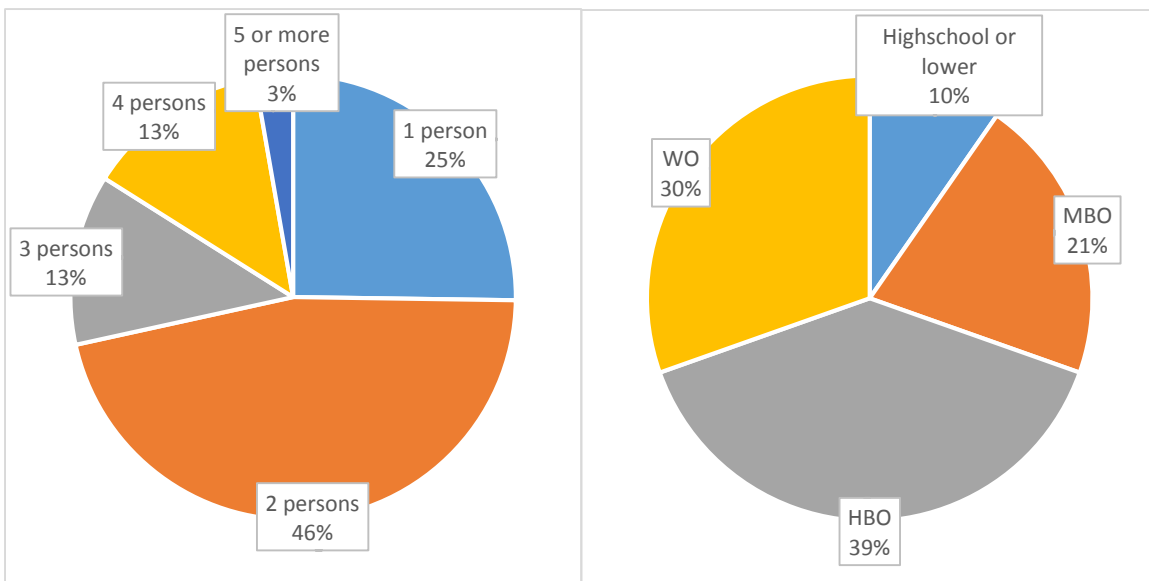


Figure 18: Distribution family size variable

Figure 17: Distribution education variable

### Comparing the sample demographics to the population

While the sample is comprised of individuals with certain socio-demographics, it is important to keep in mind that the actual population might be very different, and these differences could influence any conclusions based on the sample data. Thus socio-demographics of the smallest population group, in this case citizens of the city of Utrecht, is analyzed and compared to the sample data to identify any large differences.

The age groups in Utrecht as of 2014 were recorded as being 0-19 (22.6%), 20-29 (22%), 30-39 (17.7%), 40-49 (13.9%), 50-64 (13.8%), 65-79 (7.5%), and 80 and older (2.6%) (CBS, 2014a). Corrected for the missing group of 0-19 a more comparable spread is shown in table 7. While groupings are slightly different for older age groups, a difference in distribution can still be identified. The higher age groups in the sample, 50 and above, consist of 42.7% of the sample, as opposed to 30.1% of the population. This in contrast with the age groups 30-39 and 40-49 which are lower in the sample (total 28.4%) than in the population (40.8%).

Table 7: Distribution comparison age groups between sample and population

Sample age groups	18 – 29	30 – 39	40- 49	50 – 59	60 – 69	70 or older
	27.6%	18.9%	9.7%	18.0%	18.0%	7.0%
Population age groups	20 – 29	30 – 39	40 – 49	50 – 64	65 – 79	80 or older
	28.5%	22.9%	17.9%	17.7%	9.6%	3.5%

The age groups of 30-39 and 40-49 in the sample are thus underrepresented in comparison with the population, whereas the groups containing the older participants are all slightly overrepresented compared to the population. These differences can likely be contributed to the times during which questionnaires were handed out. While an attempt was made to be on location during the morning, evening and afternoon, afternoon response was substantially higher. This could result in a higher number of participants being students (i.e. younger age group) and older age groups (e.g. those individuals enjoying their pension). The summer holiday was expected to partially negate this, but either didn't or not enough.

The average household income within the sample is substantially lower than that of the population (based on province data). In table 8 the different income groups are shown for both the sample and the population based on 2013 data (CBS, 2014b).

Table 8: Household income comparison between sample and population

	< €10.000	€10.000– €20.000	€20.000- €30.000	€30.000- €40.000	€40.000- €50.000	€50.000 >
Sample	11%	15.1%	16.5%	15.6%	15.6%	21.1% (aggregate)
Population	6.5%	9.7%	12.9%	11%	8.8%	50.9%

The difference in household income between the sample and the population can be caused by a variety of reasons such as individuals with higher incomes being busier during working hours, individuals with higher incomes outsourcing the work to handymen, and the discrepancy in age groups that was previously identified as the underrepresented age groups show the highest average incomes (CBS, 2014c).

The family size of the sample strongly resembles that of the population. For the Utrecht population an average of 2.2 persons per household is recorded (CBS, 2014d) while the mean for the sample is 2.22. This number

could be slightly higher as 6 of the total 218 participants filled in the category '5 or more persons' which was calculated as 5.

Statistics for education are categorized slightly different from the options available in the questionnaire and thus cannot be compared (comparable levels of education are aggregated, such as comparable secondary and tertiary education levels). Additionally, statistics for marital status and housing also proved impossible to compare.

#### 4.1.3 Independent variables

The last variables to provide descriptive statistics on are the independent variables. The variables presented here are based on the tables and figures presented in the text, as well as tables on the scale composition and influence on the dependent variable in appendix C. The figures in this section are based on the composition tables and will thus not be specifically addressed.

#### Attitude

The attitude items were spread over twelve different groups. All negatively posed items are reverse coded to match their original purpose. Substantial differences between means of the different items can be observed, as well as differences in composition of these mean values. Table 9 shows the mean values for all twelve attitude items, and figure 19 shows the composition of these items.

Table 9: Mean attitude values

Enjoyment of nature	Conservation policies	Environmental activism	Anthropocentric concern	Confidence in science	Environmental fragility
4.28	3.89	2.41	2.87	2.45	3.78
Altering nature	Personal conservation	Dominance over nature	Utilization of nature	Ecocentric concern	Population growth
2.80	3.79	2.07	2.60	4.08	2.98

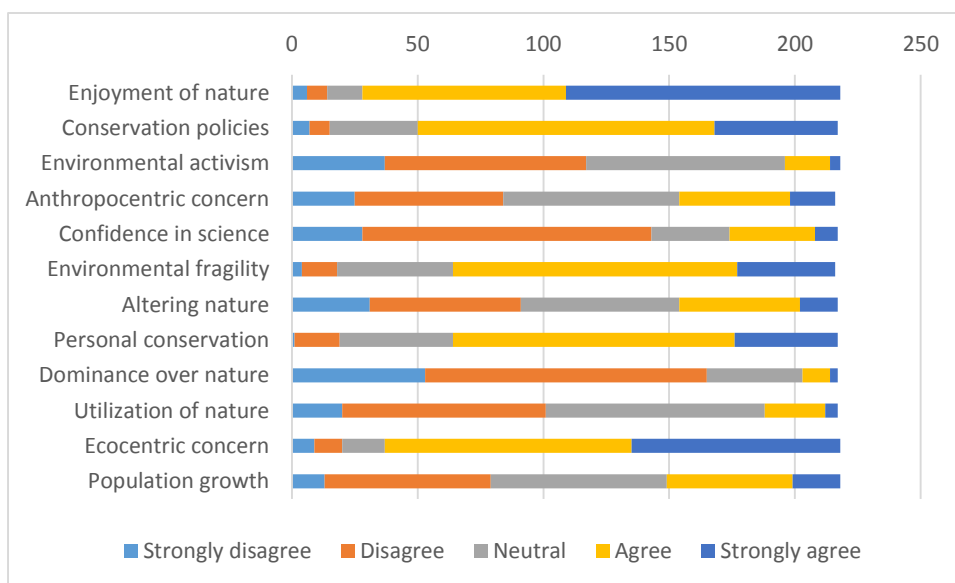


Figure 19: Composition of attitude items

The mean values for these attitude items differ greatly, between 2.07 (dominance over nature) and 4.28 (enjoyment of nature). Enjoyment of nature and ecocentric concern are valued highly by the participants, while attitudes regarding dominance over nature and environmental activism score lower. As all items measure different attitudes no aggregate scale value can be provided. Furthermore, table 33 in appendix C shows the influence of the attitude items on the aggregate DV. Many are difficult to interpret as influential, but some show potential such as environmental activism, personal conservation and utilization of nature and are expected to correlate strongly with the energy efficient product consumption behavior.

### Motivation

The next variable presented is motivation, which consists of twelve items spread over three categories (egoistic, altruistic, and biospheric). As can be seen in table 10, the sample scored relatively low on egoistic motivation and higher on both altruistic and biospheric motivation. Especially ‘concern for myself’ and ‘concern for my lifestyle’ are rated as poor motivators, whereas future generations, children, and humanity in general are perceived as strong motivators.

Table 10: Mean motivation values

Egoistic motivation	Altruistic motivation	Biospheric motivation	Total motivation
3.393	4.017	4.027	3.811

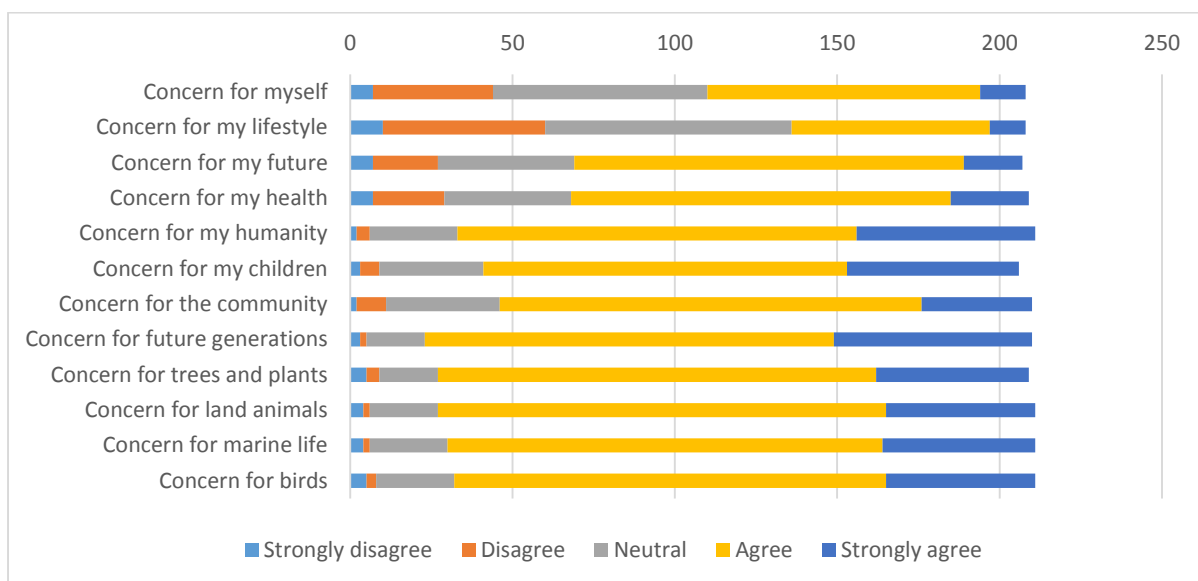


Figure 20: Composition of motivation items

Based on the compared means of motivation and the dependent variable, it is predicted that altruistic and biospheric motivation show a stronger relation with the DV than egoistic motivation, while all types of motivation show some sign of such a relation.

### Self-efficacy

The ten different items of the self-efficacy show whether a participant would still purchase energy efficient products when confronted with a certain barrier. Especially the quality and benefits of an energy efficient product seem to be important barriers as these means are the lowest. Lack of encouragement from either friends and family, or store employees, as well as the lack of free time seem to be much less of a limiting factor. These items can be further split into the appropriate factors as they were identified previously (seen in table

11). A clear difference can be recognized between the product related items, which have an about neutral mean, and the worth related items, which is significantly higher. Figure 21 shows the composition of the separate self-efficacy items. A significant influence of self-efficacy on the DV can be seen in table 37 in appendix C. Several items differ a full point between the lowest and highest answer category. Participants that are easily deterred from making energy efficient purchases are thus expected to correspond to lower DV values.

Table 11: Mean self-efficacy values

Money	Free time	Effort	Knowledge	Encouragement family/friends	Encouragement store	Worth related self-efficacy
3.11	3.75	3.49	3.35	3.82	3.78	3.54
Inconvenience	Lifestyle change	Unsure benefits	Unsure quality	Product related self-efficacy		Total self-efficacy
3.09	3.25	2.91	2.53	2.95		3.31

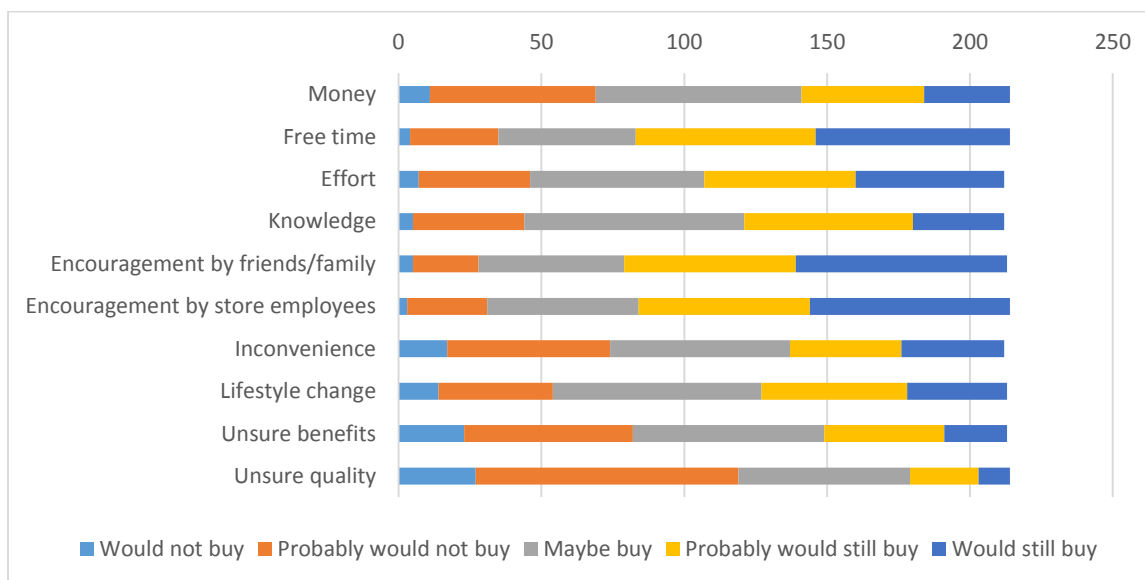


Figure 21: Composition of self-efficacy items

### Knowledge of and skill in using action strategies

The knowledge of environmental action strategies and the skill in using those strategies were overall perceived as slightly positive with no mean values below 3.45 out of 5. The difference between the five item groups (ecomangement, consumer/economic action, persuasion, political action and legal action) are shown in table 12. Both the perceived knowledge as well as the perceived skill for both ecomangement and consumer/economic action are substantial.

Table 12: Mean knowledge and skill in action strategies values

Knowledge	Ecomanagement	Consumer/ economic action	Persuasion	Political action	Legal action
	4.20	4.11	3.73	3.45	3.51
Skill	Ecomanagement	Consumer/econo mic action	Persuasion	Political action	Legal action
	4.29	4.28	3.92	3.61	3.53

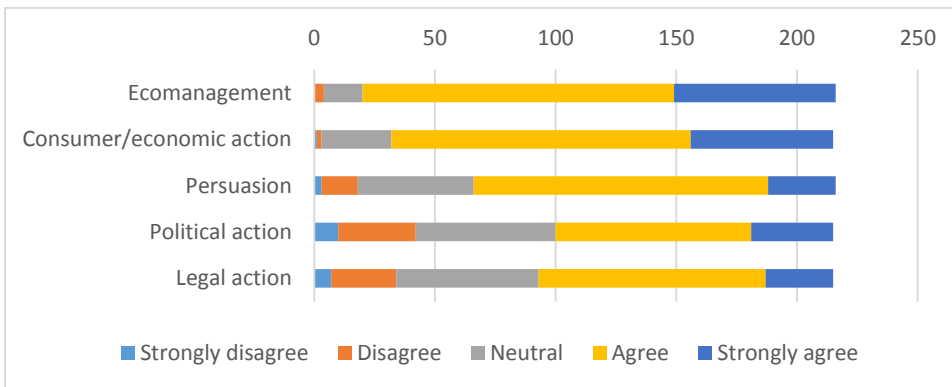


Figure 22: Composition of knowledge of action strategies items

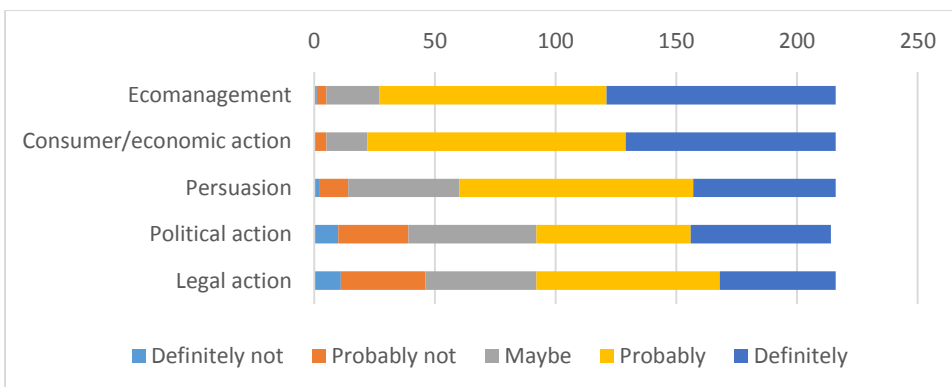


Figure 23: Composition of skill in using action strategies items

Table 40 in appendix C shows that some of the separate items show a strong potential relation to the DV, while others are the opposite. Comparison is made difficult because of lacking values in some of the answer categories.

### Personal responsibility

Personal responsibility across all items is moderately to highly positive, but as was discovered earlier, this scale has poor reliability. Based on the mean comparison with the DV, it is not expected that the personal responsibility scale has much of an influence on the DV. Of the five items the scale is comprised, only one shows a potential link to the DV.

Table 13: Mean personal responsibility values<sup>8</sup>

<b>I worry that the next generation will feel we didn't do enough to prevent climate change (PersResp 1)</b>	3.25
<b>We have a responsibility to future generations to deal with climate change (PersResp 2)</b>	4.23
<b>There is an urgent need to take measures to prevent climate change today (PersResp 3)</b>	3.56
<b>Even if only some species are threatened by climate change, we should act to protect them (PersResp 4)</b>	3.73
<b>It's not too costly for the Netherlands to reduce use of fossil fuels (PersResp 5)</b>	3.70
<b>Total personal responsibility</b>	3.69

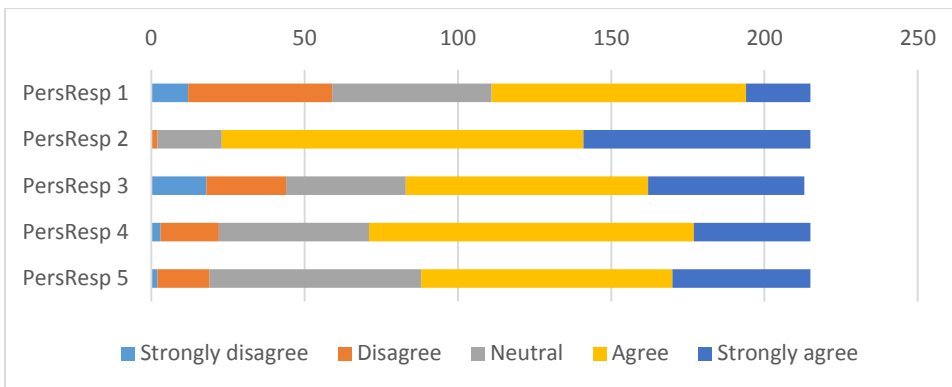


Figure 24: Composition of personal responsibility items

### Perception of consequence

Perception of consequence enjoys an overall high score among participants. Interestingly, the perception of consequences for the degeneration of the environment is higher regarding the world than it is for the Netherlands (be it by a small margin). Based on the influence of this scale on the dependent variable (table 44 in appendix C) no relation is expected between perception of consequences and the DV.

Table 14: Mean perception of consequences values

Health decrease Netherlands	Standard of living decrease Netherlands	Decrease animal species Netherlands	Total perception of consequence Netherlands	Total perception of consequence
3.76	3.33	3.78	3.62	
Health decrease world	Standard of living decrease world	Decrease animal species world	Total perception of consequence world	
3.93	3.56	3.98	3.83	

<sup>8</sup> Both the third and fifth item in this scale have been reverse coded as they were presented reverse to their intention for the scale in the questionnaire, as was the case in the source literature (Dietz et al., 2007).



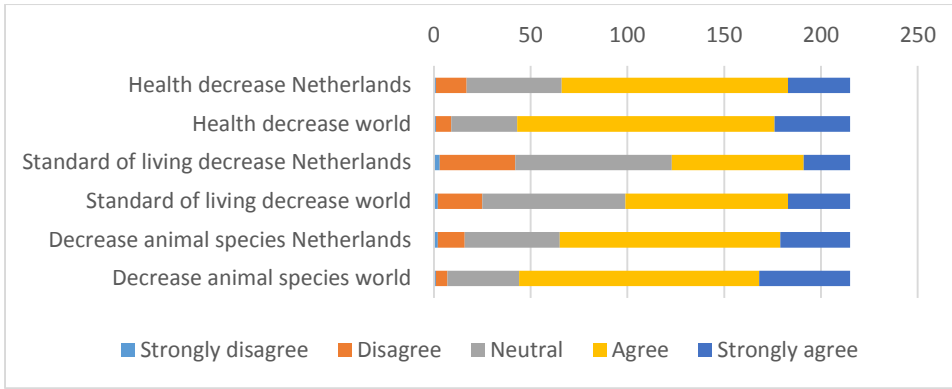


Figure 25: Composition of perception of consequences items

### Relatedness to nature

Overall a high relatedness to nature score was recorded as can be seen in table 15. An aggregate mean of 3.9 is shown for the combination of seven items. Table 46 in appendix C shows a weak to moderate relation between relatedness to nature and the DV as values between strongly disagree and strongly agree differ significantly, but are not equally divided.

Table 15: Mean relatedness to nature values<sup>9</sup>

<b>When I spend time in nature I feel free and easy (Nature1)</b>	4.21
<b>I do not feel especially at ease whenever I spend time in nature (Nature2)</b>	4.33
<b>I feel relaxed and have a pleasant feeling of intimacy when spending time in nature (Nature3)</b>	3.43
<b>When surrounded by nature I get calmer and I feel at home (Nature4)</b>	3.99
<b>I do not feel especially at ease whenever I spend time in nature (Nature5)</b>	4.14
<b>Whenever I spend time in nature I do not experience a close connection to it (Nature6)</b>	4.03
<b>Sometimes when I feel unhappy I find solace in nature (Nature7)</b>	3.29
<b>Total relatedness to nature</b>	3.92

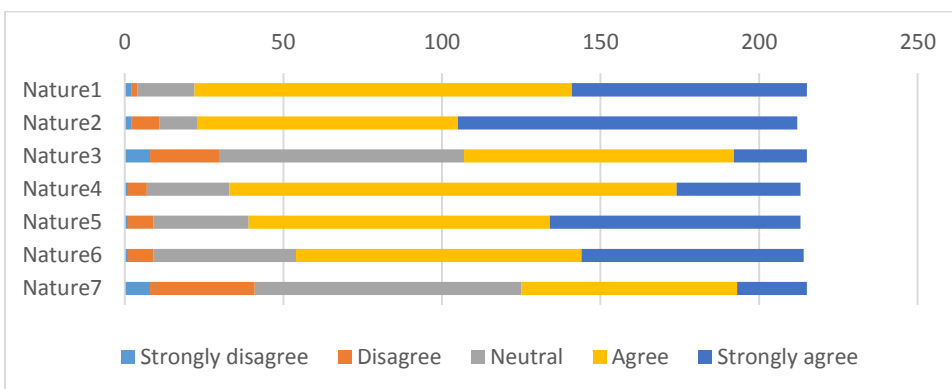


Figure 26: Composition of relatedness to nature items

<sup>9</sup> The second, fifth and sixth items in this scale have been reverse coded as they were presented in reverse to the participants, in was the intent in the source literature (Müller et al., 2009).

*External factors*

According to the sample data the questionnaire participants were influenced by the external factors in different ways, which was also previously mentioned during the factor analysis. Table 16 shows the three separate factors as they were identified with the factor analysis. The ‘rest’ group, composed of information, habits, economic incentives and media, was seen by participants as the biggest influential factors for their energy efficient purchasing behavior, followed by the institutional group. Social-cultural influences were seen as being the least influential.

Table 16: Mean external factors values

<b>Family</b>	<b>Friends</b>	<b>Community</b>	<b>Culture</b>		<b>Social-cultural group</b>
2.46	2.54	2.22	2.22		2.37
<b>Education</b>	<b>Media</b>	<b>Government</b>	<b>Industry</b>	<b>NGO’s</b>	<b>Institutional group</b>
2.73	2.96	2.90	2.73	2.66	2.80
<b>Economic incentives</b>	<b>Information</b>	<b>Feedback</b>	<b>Habits</b>		<b>Rest group</b>
2.97	3.14	2.77	2.97		2.96
<b>Total external factors</b>					
2.72					

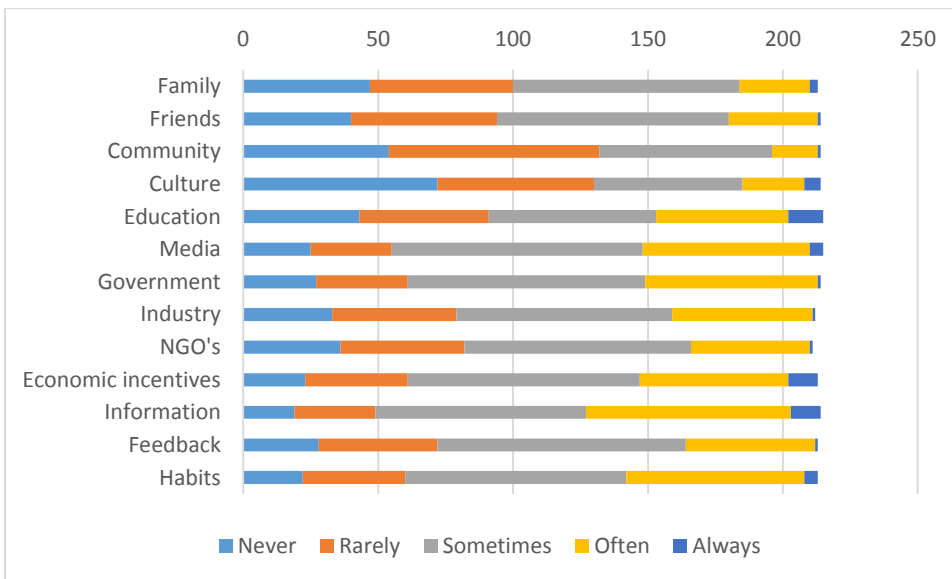


Figure 27: Composition of external factor items

No clear assumptions can be based on the mean comparison between the external factors and the DV (See table 48 in appendix C). No relation between external factors and the DV is expected.

*Objective and subjective knowledge*

The participants of the questionnaire specified their perceived knowledge of both environmental issues (mean 3.38) and energy efficient products (mean 3.45) to be slightly above neutral. Additionally, a relationship

between subjective knowledge and the DV is expected based on the mean comparison data (table 50 appendix C).

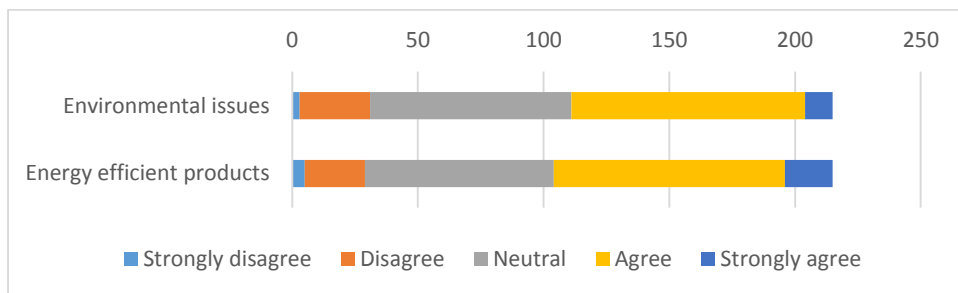


Figure 28: Composition of subjective knowledge items

The mean system knowledge, action-related knowledge and effectiveness knowledge of participants can be subsequently viewed in table 17. The items these aggregate scores are based on can be seen in figure 29. While the mean scores for the three knowledge groups are similar, significant differences exist between items. As the context and sample is very different, similarities and differences between the answers between those found in this research and those in the source material (e.g. Roczen, 2011) cannot be compared. However, certain expectations were based on this prior research relating to the rate at which correct answers were given. For example, 95% of candidates answered the question ‘What does the abbreviation CO<sub>2</sub> stand for?’ correctly in the source material, while only 66% did so in the current study. Interestingly, only Q8, Q13 and Q18 were answered wrong by more than half of the participants (Q13 had the option of being partially right). This is a substantial difference between this research and the source material. Such differences are likely caused by the addition of ‘partially right’ answers to test approximate knowledge of participants rather than absolute knowledge. Some questions contain partially right answers because multiple answers are right, while others were coded partially right because they were viewed as being close to the ultimate answer. For example, for question 19 more partially right answers were given than right answers as participants thought lowering their house temperature by 1 °C the average energy consumption would be reduced by 4%, as opposed to 6%. While this is case specific, a reduction of 6% is very feasible but not so identified by participants. Other questions where participants know there is to be gained from energy efficient products but underestimate such gain are questions 16 and 17 relating to showerheads and lighting respectively.

Table 17: Mean objective knowledge values

System knowledge	Action-related knowledge	Effectiveness knowledge	Total knowledge
.653	.643	.665	.661

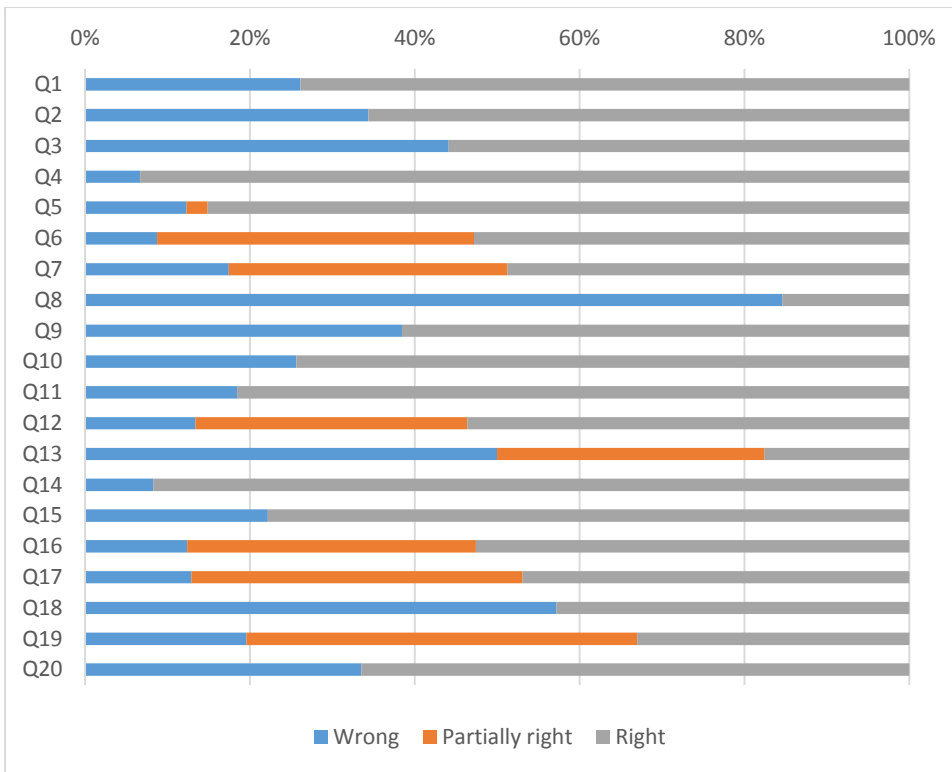


Figure 29: Composition of objective knowledge items

#### 4.1.4 Summary of descriptive statistics

The descriptive statistics section of the results showed a multitude of interesting values on which assumptions could be based for testing. Participants on average possess a slightly higher than neutral tendency to purchase energy efficient products, of which lighting products and appliances are bought most in their energy efficient form. The socio-demographic composition of the sample is different from the Utrecht average in gender distribution, age, and income. A large portion of these differences is probably due to the natural composition of the average hardware store customer. An attempt was made to gather customer data from these stores, but this request was denied, thus this assumption could not be checked. Furthermore the difference in age groups, other than the natural composition of customers, could be due to the vacation period in which the survey was taken. Of the socio-demographic variables age, marital status, housing and family size showing a potential relation to the DV. For the independent variables several items or sub-groups are identified to potentially relate to the DV. Items for attitude (environmental activism, personal conservation, utilization of nature), motivation (altruistic, biospheric), self-efficacy (whole scale), knowledge and skill in action strategies (political and legal action), relatedness to nature, and subjective knowledge. Comparing means for objective knowledge and the DV does not provide usable data so no assumptions are made. In the next section the correlation of all variables with the DV is calculated, allowing for judgment regarding the assumptions made in this paragraph. Furthermore the influence of control variables can be controlled for.

## 4.2 Correlation

After having formed a clear picture of all variables separately, they can now be correlated. In consensus with the research question, the correlation of the dependent variable with the independent variables is of importance. First, the aggregate dependent variable is correlated with all independent variables, after which the correlation of the independent variables are assessed. Scales were used if these were available, if not, separate items were used.

### 4.2.1 Correlation of the dependent variable

As table 18 shows, a multitude of variables correlate with the DV some of which strongly. As a whole, the attitude variable seems to have a weak relation with the DV as only four items correlate significantly with the DV, one of which at the .01 level. This one item, personal conservation, does possess one of the highest correlation measures within the whole sample. Of note is that two items within the attitude scale are correlated negatively with the DV (the only two within the whole sample to do so significantly). The scales for motivation and self-efficacy both show strong correlation with the DV, with nearly all scales and sub-groups showing significance at the 0.01 level. For the variables of knowledge and skill in environmental action strategies correlations differ. The former shows relations with the DV in ecomanagement and political action, while the latter shows significant relations in all items but legal action. The scales for personal responsibility, perception of consequences, and external factors all fail to form a significant relation with the DV. Relatedness of nature does show such a significant relation. Of the knowledge variables, the subjective knowledge provides a very strong measure of correlation with the DV (both a high Pearson correlation as well as significance at the .01 level), while the variable for objective knowledge only shows a relation with the DV for system knowledge and total knowledge.

Table 18: Correlation of dependent variable with independent variables

Variable	Scale or item	Pearson correlation with DV
Sociodemographic	Age	.247**
	Gender	.077
	Income	.098
	Marital status	.156*
	Housing	-.214**
	Family size	-.058
	Education	-.065
Attitude	Enjoyment of nature	.087
	<b>Conservation policies</b>	<b>.156*</b>
	Environmental activism	.123
	Anthropocentric concern	-.016
	Confidence in science	-.138*
	Environmental fragility	-.023
	Altering nature	-.034
	<b>Personal conservation</b>	<b>.355**</b>
	Dominance over nature	-.139*
	<b>Utilization of nature</b>	<b>-.103</b>
	Ecocentric concern	.030
	Population growth	.013
Motivation	Egoistic motivation	.145*
	<b>Altruistic motivation</b>	<b>.221**</b>
	<b>Biospheric motivation</b>	<b>.141*</b>
	<b>Total motivation</b>	<b>.192**</b>
Self-efficacy	<b>Worth related</b>	<b>.359**</b>

	<b>Product related</b>	<b>.320**</b>
	<b>Total self-efficacy</b>	<b>.377**</b>
Strategy knowledge	Ecomanagement	.145*
	Consumer/economic action	.056
	Persuasion	.066
	<b>Political action</b>	<b>.140*</b>
	Legal action	.034
Strategy skill	Ecomanagement	.141*
	Consumer/economic action	.189**
	Persuasion	.161*
	<b>Political action</b>	<b>.174*</b>
	Legal action	.131
Personal responsibility	Total personal responsibility	.089
Perception of consequences	In the Netherlands	.133
	In the world	.119
	Total perception of consequences	.134
Relatedness to nature	<b>Total relatedness to nature</b>	<b>.179*</b>
External factors	Social cultural influence	.032
	Institutional influence	.107
	Residual influence	.074
	Total perceived influence	.094
Subjective knowledge	Environmental issues	.200**
	<b>Energy efficient products</b>	<b>.294**</b>
Objective knowledge	<b>System knowledge</b>	<b>.188*</b>
	Action-related knowledge	.118
	Effectiveness knowledge	.072
	Total knowledge	.182*
** . Correlation is significant at the p = <0.01 level (2-tailed).		
* . Correlation is significant at the p = <0.05 level (2-tailed).		

Many of the significant correlations were expected from the visual analysis of the descriptive statistics. Variables that were missed belong to the variables for attitude (conservation policies, confidence in science, dominance over nature), motivation (egoistic), knowledge and skill in action strategy (several), and objective knowledge. Relations also proved weaker than expected for some items such as utilization of nature and knowledge and skill in legal action, providing perfect illustration why testing for correlation is required.

In addition to the independent variables, the DV is also correlated with the socio-demographic variables, which here represent the control variables. By doing so the socio-demographic variables that show a strong relation with the DV are identified, after which their effect on the correlations between DV and independent variables can be observed. The variables age, marital status and housing were found to strongly correlate with the DV, and are thus likely of influence on the relation between DV and independent variables (additionally, they strongly correlate among themselves). The bold scales and items in table 18 show significant correlation with the DV after controlling for the effects of the control variables. While some significant relations disappeared (which were thus likely based on the influence of the control variables), most correlations remain. Table 19 shows the scales and items which still correlate significantly with the DV after controlling for the influence of age, marital status and housing.

Table 19: Correlation of dependent variable with independent variables controlling for age, marital status and housing

Variable	Scale or item	Pearson correlation with DV after control	Pearson correlation with DV before control
Attitude	Conservation policies	.163*	.156*
	Personal conservation	.327**	.355**
	Utilization of nature	-.171*	-.103
	Altruistic motivation	.222**	.221**
	Biospheric motivation	.146*	.141*
	Total motivation	.203**	.192**
Self-efficacy	Worth related	.335**	.359**
	Product related	.280**	.320**
	Total self-efficacy	.343**	.377**
Strategy knowledge	Political action	.150*	.140*
Strategy skill	Political action	.183*	.174*
Relatedness to nature	Total relatedness to nature	.197**	.179*
Subjective knowledge	Energy efficient products	.306**	.294**
Objective knowledge	System knowledge	.181*	.188*
**. Correlation is significant at the $p < 0.01$ level (2-tailed).			
*. Correlation is significant at the $p < 0.05$ level (2-tailed).			

In table 19 the effects of the control variables can be clearly seen as one of two things happened. After control, some correlations became stronger. In these cases the control variables suppressed the relation between the DV and the independent variables. An extreme example within this table is the item for utilization of nature, which before control was not significantly correlated with the DV. After control however the item showed a significant negative relation with the DV. As is the case with all significant correlations present before but no longer after control, the control variables can also mediate the relation between DV and independent variables. Seven scales or items were only significantly correlated with the DV because of the mediating effects of the control variables. Especially the variables for strategy skill and subjective knowledge were strongly dependent on this mediation of the control variables.

#### 4.2.2 Correlation of the independent variables

Apart from the correlation of the DV with the independent variables the correlation among the independent variables is also of importance. When two or more independent variables correlate strongly, it is called multicollinearity (Field, 2009). When perfect collinearity occurs, the correlation of one variable is a perfect linear combination of the other variable. This in turn means the variables are interchangeable, thus making it impossible to base coefficients on as an infinite number of combinations of the variables provide identical effects. What this means for this research is that when two independent variables are strongly correlated one cannot be sure if one variable causes a correlation with the DV, or the other. The simplest method of testing for multicollinearity is by analyzing the correlation matrix available in appendix C. As only the variables which correlate significantly with the DV (after control) are of interest, only these are calculated. Table 20 shows the correlation matrix of these fourteen variables. Within the matrix, some correlation is expected. Especially correlation between scales and sub-groups within the same scale are likely to occur (however this does not happen exclusively so). Significant correlation is highlighted in green, while correlation between variables likely caused by the relation to their scale are shown in bold.

Table 20: Correlation matrix of independent variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	X													
2	.074	X												
3	-.258**	-.119	X											
4	.155	.239**	-.240**	X										
5	.131	.303**	-.198*	.635**	X									
6	.176*	.361**	-.182*	.864**	.802**	X								
7	.189*	.316**	-.184*	.205*	.224**	.223**	X							
8	.226**	.276**	-.207*	.141	.206*	.202*	.668**	X						
9	.222**	.328**	-.210*	.196*	.236**	.234**	.947**	.871**	X					
10	.372**	.149	-.337**	.190*	.178*	.179*	.166	.344**	.259**	X				
11	.281**	.077	-.151	.023	.076	.077	.252**	.264**	.281**	.566**	X			
12	.248**	.245**	-.253**	.253**	.237**	.211*	.420**	.302**	.407**	.231**	.283**	X		
13	.113	.354**	-.135	.159	.285**	.230**	.439**	.286**	.413**	.208*	.168	.150	X	
14	.015	.168	-.183*	.072	-.073	-.045	.236**	-.009	.152	.015	-.035	.128	.266**	X

- (1) Conservation policies
- (2) Personal conservation
- (3) Utilization of nature
- (4) Altruistic motivation
- (5) Biospheric motivation

- (6) Total motivation
- (7) Worth related self-efficacy
- (8) Product related self-efficacy
- (9) Total self-efficacy
- (10) Knowledge of political action

- (11) Skill in political action
- (12) Total relatedness to nature
- (13) Subjective knowledge on energy efficient products
- (14) System knowledge

According to Field (2009) multicollinearity can be identified by looking at variables with very high correlations of  $> .8$ . It should be noted that this is a rough estimate, with more detailed methods being much too exhaustive for the scale of this research. Four correlations match this criteria, but these correlations only occur within the same scale. While acceptable, these values need to be kept in mind for the regression section of the research. Only the total motivation and total self-efficacy are to be included, rather than adding the sub-groups as well. By not excluding the sub-groups a strong bias towards that particular variable can be created, which significantly lowers the quality of the outcome. While of less importance for, some additional correlations are of note. Even though these values are far below the 0.8 mark, they are important outcomes that should not be ignored. In fact, correlation exists between many of the variables with the correlation matrix of table 20. The only variables that show limited correlation with the other variables are the variables for subjective knowledge on energy efficient products, system knowledge, and perceived skill in political action. Because these three variables correlate significantly with the DV, but only limitedly with other variables, it could be argued that they provide unique insight into which variables influence the DV as no other variable provides such correlation.

In summary, a large number of explanatory variables were found to significantly correlate with energy efficient product purchasing behavior, consisting of age, housing, marital status, several attitude items, motivation, self-efficacy, several knowledge of/skill in action strategies items, relatedness to nature, subjective and objective knowledge. This did not come as a surprise as most of these relations were already expected from the descriptive statistics. Further analysis shows that after controlling for socio-demographic variables the number of significant relations drops but a substantial number remains as attitude items, self-efficacy,



knowledge of/ skill in political action, relatedness to nature and sub-groups of subjective and objective knowledge remain. Lastly, by testing for multicollinearity it was proven that the relations that have been observed through correlation analysis did not occur because of correlation between explanatory variables. Building on these findings, where correlation in the sample data is proven, further analysis in the form of regression is needed to be able to partially predict the influence of the explanatory variables on energy efficient product purchasing behavior.

### 4.3 Regression

After having identified the independent variables that correlate significantly with the dependent variable, the next step is to see which of the variables have the ability to partially predict the DV. The way to do so, with a multitude of variables, is multiple regression. It should be noted that, while this aggregate DV is still technically ordinal, because of the high number of possible values through combining four variables the aggregate DV could be used in multiple regression (which mainly prefers interval or ratio variables). Statistics regarding the regression model are to be analyzed if this assumption is correct. All variables are included (excluding the scales that overlap with their sub-groups as these too strongly correlate together) and exposed to regression analysis through forced entry. The first model that rolls out, possessing all variables, consists of a lot of variables that do not contribute significantly to the regression model. To obtain a workable model, all variables with a significance value of over .500 are excluded. This second model contains 21 predictors of the DV. Still, many of these predictors did not significantly contribute to predicting the value of the DV, thus again some had to be excluded. All predictors in model 2 with a higher significance value than .200 were excluded to form model 3, now consisting of ten predictors. To remove all predictors that had no significant influence on this third regression model, the least significant predictor is removed after which the regression model was recalculated. This finally resulted in three predictors significantly contributing to predicting the value of the dependent variable. The predictors, their significance and the corresponding standardized regression coefficient  $\beta$  are portrayed in table 21 for models two through four.

Table 21: Regression results split across three subsequent models for predicting energy efficient purchasing behavior

Predictor	$\beta$ Model 4	$\beta$ Model 3	$\beta$ Model 2
Worth related self-efficacy	.262**	.202**	.165
Personal conservation	.229**	.242**	.276**
Age	.144*	.133*	.107
Altruistic motivation		.151	.145
Antropocentric concern		.125	.162
Biospheric motivation		-.122	-.130
Personal responsibility		-.120	-.129
Perceived skill in political action		.117	.115
Subjective knowledge EE products		.112	.143
Relatedness to nature		.107	.107
Product related self-efficacy			.111
Marital status			.083
Utilization of nature			-.075
Subjective knowledge environmental issues			-.057
Perceived skill in legal action			-.056
Population growth			-.045
Ecocentric concern			-.040
Enjoyment of nature			.029
Dominance over nature			.023
Perceived skill in persuasion			.014
Perceived knowledge of consumer/economic action			.005
**. Significant at the p = <0.01 level.			
*. Significant at the p = <0.05 level.			

The sub-group of self-efficacy consisting of those items relating to worth, the attitude item relating to personal conservation, and the age variable contribute significantly to predicting the energy efficient purchasing behavior of the sample. Because the regression coefficients are shown as standardized in the table as opposed to unstandardized, they relate to their standard deviation rather than their original units (which makes them comparable). This means that (Field, 2009):

- As the variable worth related self-efficacy increases by one standard deviation, the dependent variable increases by .262.
- As the variable personal conservation increases by one standard deviation, the dependent variable increases by .229.
- As the variable age increases by one standard deviation, the dependent variable increases by .144.

These interpretations are only true if the other two corresponding variables are held constant. After having calculated these coefficients, and thus having created the final regression model, it is important to understand a number of things such as the degree to which the regression model fits the sample data as well as the population, the difference between the models, and finally the influence of the predictors included in the model.

#### 4.3.1 Model evaluation

The quality of a regression model can be assessed through different methods. By looking at Cook's distance, DFFit and DFBeta the accuracy of the regression model can be assessed. According to these values, the model fits the sample data well as no values come anywhere near the values where investigation of the data would be needed (see table 52 in appendix C).

After having ascertained that the accuracy of the regression model is adequate the goodness of fit of the model in relation to both the sample data as well as the population can be assessed. Table 22 shows several

statistics on the three regression models, including  $R^2$ , adjusted  $R^2$ , standard error of the regression and the Durbin-Watson value. The  $R^2$  value is a measure of seeing how well a model fits the sample data. It is important to note that  $R^2$  is merely a measure of fit between the regression equation and the sample data, and is also a somewhat biased estimator due to the influence of sample size and the number of predictors (Nau, 2015). The adjusted  $R^2$  is based on the  $R^2$  and represents the goodness of fit of the regression model if the model had been derived from the population (Stein's equation is used rather than the standard SPSS equation by Wherry's as this also includes the influence of a potential different data sample). Ideally the adjusted  $R^2$  and  $R^2$  are the same value or close to it (Field, 2009). Table 22 shows that especially for model 4 the  $R^2$  and adjusted  $R^2$  are very close. Especially for an adjusted  $R^2$  derived from Stein's equation rather than Wherry's (which is usually lower as less variables are looked at) this is a substantial finding and signifies good cross-validation of the regression model. A substantial weakness of the  $R^2$  and adjusted  $R^2$  is that there is no 'appropriate' value for  $R^2$ , as this depends on the applied predictors and the number of possible values of the dependent variable. It merely defines what portion of the dependent variable is significantly estimated by the regression model.

Other interpretations of the fit of the regression model are also available. The confidence interval, provided in table 53 in appendix C, provides an indication of how representative the predictors for model 4 are (Field, 2009). Regression model 4 consists of three different predictors all positively related to the dependent variable. Apart from the regression coefficients and significance values used for table 22, a 95% confidence interval is provided. A small confidence interval indicates that the coefficient value in the sample is close to the true value within the population, while a wide confidence interval (or one that crosses zero) is less or not at all representative. The confidence intervals for all three predictors are appropriately narrow and above zero, increasing the likelihood that the regression model is representative for the population.

In addition to the adjusted  $R^2$  and confidence interval, the standard error of the regression can be observed to assess the goodness of fit of the regression equation. This goodness of fit is an estimate of the precision of a model (Nau, 2015). Table 22 shows only a minor increase in the standard error between models, which signifies that the precision between using model 4 and using the other models is comparable, with model 4 being the only significant model. These standard errors of the regression are in the units of the dependent variable and can thus not be compared to a given standard.

*Table 22: Further analysis of the regression models*

Model #	# of predictors	$R^2$	Adjusted $R^2$	SE of the regression	Durbin-Watson value
2	21	.324	.139	.8906	2.193
3	10	.284	.200	.8773	2.105
4	3	.212	.184	.9040	1.999

The last values provided in table 22 are the outcomes of the Durbin-Watson test, which tests for serial correlations between prediction errors, or residuals (Field, 2009). A value between 0 and 4 is provided by the test with a value of 2 (generally) meaning that the residuals are uncorrelated. Model 4 has a Durbin-Watson value of nearly 2, which means that there is a very high probability that the residuals do not influence each other negatively or positively.

The measures previously applied prove that model 4 is the most appropriate model of the three, and is most likely to accurately estimate the dependent variable based on the predictors. For this model, the last level of analysis pertains to the influence of the individual predictors on the regression model. In table 23 the individual

contribution of the three predictors is provided. This was calculated by omitting each predictor from the regression model and observing the change in R<sup>2</sup>.

Table 23: R-square change of separate predictors

Predictor	Worth related self-efficacy	Personal conservation	Age
R <sup>2</sup> change	.132	.061	.019

The predictor worth related self-efficacy by itself is responsible for the largest contribution to regression model 4 (13.2%), followed by personal conservation (6.1%) and age (1.9%).

A final segment of the analysis is to check the assumptions of the model. Collinearity within the data has been observed (section x) and the Durbin-Watson test has been used to check the independence of the residuals (Field, 2009). An important assumption made when doing multiple regression is the assumption of data linearity. The scatterplot in figure 30 is used to check the linearity of the data.

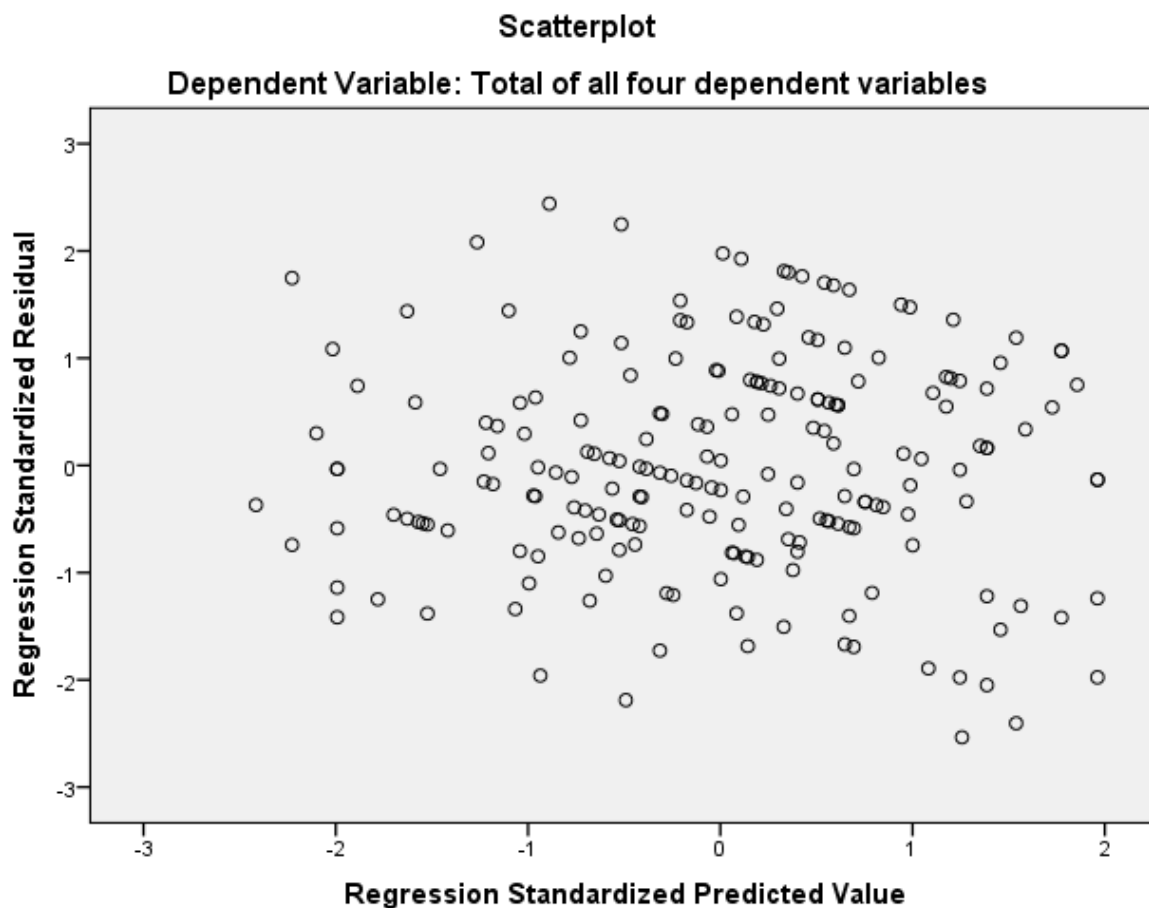


Figure 30: Linearity scatterplot

On the Y axis the scatterplot shows the standardized residuals, which are the standardized differences between the observed data and the values that the model predicts. The X axis represents the standardized predicted values of the dependent variable based on the model. Any groupings of the values within the scatterplot other than a random array of values evenly dispersed around zero could mean that the assumption

of linearity is wrong (Field, 2009). If the scatterplot strongly fans out, chances are that there is heteroscedasticity (correlation between modelling errors) in the data while a curve in the scatterplot might point to the data having broken the assumption of linearity. Figure 30 shows neither of such phenomena, as the data seems to be appropriately spread out around zero without any links to either heteroscedasticity or non-linearity. A strong case can thus be made for the assumption of linearity and thus increased quality of the outcome of this analysis.

### 4.3.2 Dependent variable separation

After testing the regression model on several levels, a significant outcome was achieved where three predictors were identified that to an extent could predict the value of the dependent variable. This dependent variable is however an aggregate value, comprised of four different purchasing behaviors. In addition to creating a regression model for the aggregate DV, it could also be interesting to check how the four different purchasing behaviors influence this model.

All separate DVs are exposed to the same regression method as it was applied to the aggregate DV. By starting out with all variables and removing those that are least significant, eventually the significant predictors are identified. While the quality of the model is assessed in the same way (e.g. Cook’s distance, Durbin-Watson test, etc.), no comparison is made between regression models of the same DV, as in this section it is not the aim to identify the most appropriate prediction model, but merely test which predictors shaped the regression model for the aggregate DV. Repeating the process for all four separate DVs provides four regression models of which the predictors are shown in table 24.

Table 24: Regression coefficients for separate DVs

Predictor	$\beta$ DV 1	$\beta$ DV 2	$\beta$ DV 3	$\beta$ DV 4
Worth related self-efficacy	.230**		.300**	
Personal conservation	.298**	.318**		
Age	.143*			
Conservation policies	.164**			
Marital status		.144*		.155*
Anthropocentric concern		.183*		
Ecocentric concern		-.184*		
Relatedness to nature		.195*		
Housing			-.205**	
Product related self-efficacy				.271**
Perceived skill in persuasion				.169*

To answer the question why these separate regression models are of interest, attention needs to be shifted towards the above table. The regression model of the aggregate DV showed three predictors, of which their significance could be based on one of two things. Either all separate DVs show similar relations between predictor variables and the DV, or the outcome of the regression model of the aggregate DV is caused by predictors spread over different separate DVs of which the average causes the formation of the aggregate DV. Table 24 shows that only the regression model for lighting consumption behavior (DV1) possesses all predictors from the aggregate regression model. The regression models for showerhead consumption behavior (DV2) and appliance consumption behavior (DV3) have one predictor in common, while electronics consumption behavior (DV4) has no predictors in common with the aggregate regression model.

After the multiple regression the same variables were exposed to ordinal regression statistics to test whether the outcomes would hold under more specific scrutiny. Several calculations are made of which the outcomes

can provide a sense for the acceptability of the regression model. Table 25 shows several of these values. The first value represents the significance of the Chi<sup>2</sup> statistic. The Chi<sup>2</sup> provides model fitting information and tells you whether the regression model gives better predictions than guesses made based on marginal probabilities for the outcome categories (NCRM, 2011). A significant value here means that the regression model is a significantly better predictor than the baseline model. Next the significance of two goodness of fit statistics are shown (based on the Chi<sup>2</sup>). These statistics are intended to test whether the observed data are consistent with the fitted model. As the null-hypothesis for this statistic is that the fit is good, a significance for these statistics means that the observed data is not consistent with the fitted model (i.e. higher is in this case better). Lastly, three pseudo R<sup>2</sup> statistics are shown. For ordinal regression it is not possible to compute the same R<sup>2</sup> as is available in multiple linear regression, thus approximations are calculated. The interpretation of these values however remains the same as they represent the proportion of variance in the outcome that can be explained by the predictors. Keep in mind that only the significance of the first three statistics is of importance as the ordinal regression is used to test whether the above multiple regression is in any way acceptable. Specific values of the ordinal regression will not be used.

*Table 25: Statistics regression models of the separate DVs*

<b>Variable</b>	<b>DV1</b>	<b>DV2</b>	<b>DV3</b>	<b>DV4</b>
<b>Chi<sup>2</sup> significance</b>	< .001	< .001	< .001	.001
<b>Pearson</b>	.020	.606	.485	.149
<b>Deviance</b>	1.000	1.000	.329	.920
<b>Cox and Snell</b>	.381	.366	.261	.220
<b>Nagelkerke</b>	.406	.382	.274	.231
<b>McFadden</b>	.172	.144	.098	.081

While all four ordinal regression models are better than the baseline, there is no goodness of fit. Thus while the pseudo R<sup>2</sup> values show explained variance, the models do not fit the collected data. The predictors provided in table 25 are therefore not trustworthy enough to allow for any meaningful comparison.

## 5. Conclusion

The aim of this research is to explain which explanatory variables influence the behavior of energy efficient product consumption. Three sub-questions support this main theme and are answered in order in this section to be able to answer the main research question.

The first sub-question relates to the identification of explanatory variables that could be identified in literature to potentially influence energy efficient product consumption. Extensive literature research led to the identification of several models and theories, which at some point in history stood at the pantheon of explaining environmental behavior. As models became more complicated, so did identifying which variables were truly important. By combining the old but still relevant Hines model (Hines et al., 1987) with the newer model by Kollmus & Agyeman (2002), a selection could be made of all explanatory variables of influence on energy efficient product consumption behavior. After identification, these variables were operationalized. Socio-demographic variables, source of much debate in behavioral debate, were first identified. After literature comparison scales for attitude, motivation, knowledge/skill in using action strategies, personal responsibility, perception of consequences, relatedness to nature, and knowledge were either adopted or adapted. Measurement scales for variables identified as important but lacking in literature were created for self-efficacy and external factors.

The second sub-question, which consists of the data gathering aspect of this research, aims to describe the sample participants as they relate to the dependent and explanatory variables. Before actual data collection started using the variables from the first sub-question, the questionnaire was presented to a test panel to rid the survey of any unwanted problems relating to for example understandability and grammar. Next, 218 questionnaires were collected in three locations (hardware stores). Sample data shows that the average hardware store customer is slightly above neutral towards purchasing energy efficient versions of products. Lighting products and household appliances are more often bought energy efficiently while showerheads and electronics less so. The sample group consisted for two thirds of male participants, with an age spread prioritizing the youngest and oldest age groups, and household incomes of €20.000 and €30.000 (16.5%), €30.000 – €40.000 (15.6%), €40.000 - €50.000 (15.6%) and €10.000 - €20.000 (15.1%). Additionally, most participants were married or in a relationship (59%) rather than single, owned a house (58%) rather than being a tenant, belonged to a family of on average 2.2, and for nearly three fourths were educated on college level or higher. All in all the sampled participants scored slightly higher than neutral for nearly all variables. Attitude perception was relatively spread out across the items in favor of environmental concern as items such as dominance over nature and anthropocentric concern scored low and enjoyment of nature and ecocentric concern scored high. Both altruistic and biospheric motivation scored significantly higher than egoistic motivation, and self-efficacy scored slightly above neutral with some large inter-scale deviations where encouragement and free time were not considered to be strong barriers to energy efficient product consumption but unsure benefits or quality were. Participants perceived their knowledge and skill in action strategies as relatively positive, especially relating to ecomanagement and consumer/economic action. Personal responsibility, perception of consequences and relatedness to nature all scored higher than neutral, and social-cultural influence factors were perceived as being less of a barrier than institutional barriers, which in turn were less influential than external factors such as information, feedback and habits. Lastly, participants perceived their environmental knowledge as slightly above neutral, which is close to the slightly above neutral average of the objective knowledge test.

Next, the sample data was exposed to correlation and regression analysis to answer the third sub-question, which aims to identify relations between the explanatory variables and the behavior of energy efficient

consumption. By doing so, it is tested whether the assumption that the variables relating to pro-environmental behavior are interchangeable with energy efficient purchasing behavior (as no case specific explanatory variables are available). Of the involved variables only three showed no sign of correlation with the dependent variable at all (personal responsibility, perception of consequences and external factors), while others did but only marginally (some attitude items and objective knowledge). Of the socio-demographic variables age, marital status and housing also correlated strongly with the dependent variable. To test how these socio-demographic variables influenced the other correlations they were used as control variables in the next correlation analysis, which limited the significant correlations between the explanatory variables and the dependent variable to attitude, self-efficacy, political action (knowledge and skill in action strategy), relatedness to nature and knowledge (subjective and objective). Next, regression analysis was carried out, and shows three significant predictors. According to the regression model, the self-efficacy sub-group relating to worth, the attitude item personal conservation, and age prove to be strong predictors of energy efficient consumption behavior. Worth related self-efficacy is by far the strongest predictor, but especially personal conservation contributes substantially as well.

After answering all three sub-questions the main question can be resolved, which was formulated as 'to what extent can explanatory variables be identified which influence the behavior of energy efficient product consumption?'. The findings of this research point towards strong correlation and medium regression between the identified explanatory variables and the behavior of energy efficient product consumption. This research is proof that the more specific behavior of energy efficient product consumption is, to an extent, influenced by the identified explanatory variables, which find substantial overlap with variables found to influence pro-environmental behavior. Many of the identified variables show a relation with the dependent variable. However, behavior is a complex phenomenon and several limitations can be identified that could negatively influence the above findings such as the overrepresentation of perception questions and the scales being shortened to maintain response. In the next chapter the limitations of this study are thoroughly analyzed, and improvements, based on these limitations and built up experiences, for the applied method are supplied. Lastly, contributions of this research to theory and practice are substantiated.



## 6. Discussion

Several different subjects are up for discussion and are addressed in this section. First, all limitations perceived during this research are addressed. Second, potential improvements to the applied methods are proposed. And third, the contributions of this research related to both theory and practice are substantiated with recommendations for future research.

### 6.1 Research limitations

The current research suffers from two main limitations which could significantly influence outcomes and conclusions based upon them, yet could not be avoided in the opinion of the author. The first of these limitations is the fact that nearly all variables are measured based on the perception of participants. While self-reporting is a necessity to obtain appropriate sample size within a limited timeframe, no real behavior is observed. As was previously identified, steps were taken to increase the reliability of subjective questions (Lavrakas, 2008). Bias was prevented as effectively as possible with research relating to the environment, and questions were positively received by the test panel. While no objective counterparts are available for the employed scales, and thus making subjective measures a necessity, it should be kept in mind that the survey involved real subjective people. The second main limitation is that a broad variety of variables was included in this research. While this breadth is not a limitation per se, to form a questionnaire which would not be plagued by non-response some scales suffered from downsizing more than others. The scales for attitude, self-efficacy, knowledge of and skill in action strategies, and objective knowledge have been reduced significantly to fit within the attention span of the participant. Especially the attitude and knowledge/skill in action strategies variables suffer from this limitation as the sub-groups are measured by a single item where more were available. As an appropriate sample size was needed, and thus substantial response, a delicate balance between the number of items to include and the item variety within the different scales surfaced. As the whole idea behind this exploratory research is to identify which variables are of influence on the behavior of purchasing energy efficient products, no variables could be omitted speculatively. Both limitations addressed thus far could not be evaded without seriously comprising the quality of the research. However, they do provide new insights for future research which are evaluated in the next discussion section.

During the research process several minor limitations were also identified. All appropriate statistical analyses are carried out to obtain the needed data for the results section, but it is the authors' opinion that improvements could be made relating to for example the comparison of means and regression analysis. While most of the descriptive statistics section is adequate, means of the explanatory variables were compared with the dependent variable. While the assumptions based on these relations proved to be mostly correct, other tests which could provide additional measures were not included (e.g. the T-test to compare the means of two groups, or the ANOVA for more groups). While such statistical analyses are outside of the scope of this exploratory research, additional data could have been gathered as splitting the data into separate groups (based on energy efficient consumption patterns for example) could yield interesting results. Also, the second part of the regression analysis was cut short due to the lacking reliability of the variables used. Even though the applied measures seem to speak for themselves, more extensive analysis regarding ordinal regression or statistics in general could have gotten additional results.

### 6.2 Method improvement

The explanatory variables as they are identified to relate to pro-environmental behavior successfully relate to the behavior of energy efficient consumption as well. However, based on the research limitations and the identified connections with theory some potential improvements to the method can be recognized on three

levels.

The first level consists of the used variables and the applied scales. Many of the analyzed variables correlate significantly with the dependent variable, with the exception of three. Further research is required to identify whether this lack of correlation is due to the applied scales or the variables not relating to the dependent variable as was assumed. The scale for external factors is new and extremely basic, allowing for much needed alterations. For the variables personal responsibility and perception of consequences other scales should be identified, to test whether the underlying construct is to blame or the scales. For the other explanatory variables a careful assumption can be made that they relate to energy efficient purchasing behavior based on the research results as well as literature.

The second level of method improvement is the construction of better overall scales. Many of the variables significantly relate to the dependent variable, but no perfect reliability is present. Additionally, most scales are either copied or adapted from existing literature with different backgrounds and approaches. By creating a single scale incorporating all variables identified to be important to energy efficient purchasing behavior, better results may become available. Also, when producing a unique scale, both limitations that significantly influence this research can be dealt with. Using what was learned from existing scales and employing it for the construction of a new one provides the researcher with the freedom to combat the limiting factor of perception. By giving knowledge questions a more prominent place in the new scale alongside the currently overabundant perception questions better reliability of the scale can be assured (Lavrakas, 2008). Another benefit of creating a new scale is that the included items can be tailored specifically to the research goal, rather than limiting the number of items to keep appropriate response rates. Overlapping constructs could for example be avoided and all variables could contribute evenly to the scale rather than the setup for the current questionnaire where attitude items were severely reduced and motivation items were not. The focus should then become to more specifically measure the underlying constructs of behavior rather than the separate variables as is now the case. Especially the construct for altruism that was found to be the most important predictor in this research is divided over at least three variables (attitude, motivation and self-efficacy). Several attitude items are similar to other used scales, thus potentially measuring the same constructs.

After making sure that all variables included are appropriate, and a new scale is formed, a third and final level of improvement can be identified. This level pertains to the sample taken from the population and the way information is gathered from them and consists of two parts. First, participants should be gathered through probability sampling. While this research aimed to gather data on consumers of certain devices, which required non-probability sampling in specific locations, a more generalizable sample could be obtained from performing probability sampling. By doing so differences between socio-demographic variables in the sample and the population should become as small as possible (with a large enough sample), thus making the measure more reliably. The second part consists of the addition of focus groups to the survey research. Survey research is excellent for analyzing a set number of questions, but misses the flexibility of for example interviews. Any aspects or variables unidentified through literature research will not show up in a survey, and specific opinions about questions cannot be provided by the participant. Therefore, the last improvement to the applied method is to incorporate several focus groups. The use of the test panel in this research already provided significant insights into the way participants view the questions and variables, but no attempt was made at a sit-down with several individuals and discuss the influence variables at length. By doing so the scale formed on the previous improvement level could be tested for accuracy, and any variables or constructs that were missed could surface through group interaction.

To summarize, it is the opinion of the author that the current research method can be improved on three different levels. First, by further analysis of the explanatory variables relating to energy efficient product consumption behavior to identify potential new scales or improve those that worked poorly. Second, by

combining all identified scales and items into a new single scale which focusses on measures underlying constructs rather than potentially overlapping variables. Third, different approaches should be taken with regards to sampling by employing probability sampling and focus groups to both increase generalization of the data as well as test the integrity of the new scale.

### 6.3 Contributions of this research

This research contributes substantially to both theory as well as practice. From the very start of this research it was clear that, while pro-environmental behavior has seen a fair amount of attention in scientific literature, more specific analysis of comparable behaviors is lacking. Research on energy efficient products usually relates to the more tangible aspects such as energy efficiency projects or energy labels (e.g. Anderson & Claxton, 1982; Birner & Martinot, 2005). By utilizing the main theories found on pro-environmental behavior, this research tests the applicability of the identified explanatory variables in those theories on the topic of energy efficient product consumption behavior. From the start significant gaps in knowledge are perceived as no general approach is agreed upon in literature and consensus on which scales best measure which variables is lacking. Variables identified by both Hines et al. (1987) as well as Kollmus and Agyeman (2002) were found to function for energy efficient product consumption behavior as they do for pro-environmental behavior. The assumption that attitude, self-efficacy and knowledge are of influence on behavior are substantiated by significant correlation coefficients, findings in tandem with the authors that provided the measurement scales such as Milfont & Duckitt (2010) and Frick et al. (2004). Other variables are found to be of influence as well, substantiating further that the Hines model alone cannot substantially measure energy efficient product consumption behavior. Added explanatory variables based on Kollmus & Agyeman (2002) such as motivation and relatedness to nature also provided significant correlation with the dependent variable. However it should also be noted that not all variables performed as well as was assumed in literature. Personal responsibility and perception of consequences as provided by Dietz et al. (2007) had very limited influence on the dependent variable while the external factors, which were identified by Kollmus & Agyeman (2002) as being a significant weakness of the Hines model, showed no correlation with the dependent variable either. In addition to the success at correlating several of the explanatory variables for pro-environmental behavior with the dependent variable of energy efficient product consumption behavior, a knowledge gap in literature on the topic was identified and its importance highlighted. The variables for self-efficacy and external factors were identified as important (the former in the Hines model, both by Kollmus & Agyeman), but no related scales were provided or available in literature. While not the primary aim of this paper, an attempt was done at creating scales for these variables, which resulted in moderate success. Not only did those scales return a high internal consistency value (Cronbach's alpha) rivaling existing scales, clear differentiating factors could be identified through factor analysis (especially the identified groups for the external factors strongly resembled differentiation in literature). By both analyzing which available scales had the best track record, and adding new quality scales for variables where none were available, a starting point is created for future research and can be used to identify which scales are appropriate and which are not for similar research.

Apart from contributing to theory how explanatory variables for pro-environmental behavior relate to energy efficient product consumption behavior, a large step was taken towards creating a unified method for further understanding of energy efficient product consumption. Of the seven socio-demographic variables included three show significant correlation with the DV, and of the 44 (sub)scales and items included, 22 showed significant correlation (14 after controlling for control variables). While certainly not perfect, a substantial number of explanatory variables are found to correlate with the dependent variable, most of which were expected to do so based on the findings of the descriptive statistics. Besides correlations with the dependent variable, additional correlation findings among the explanatory variables were found. Data showed that many of the variables correlated among each other (but not high enough to cause multicollinearity), which could be proof of underlying concepts yet unidentified. Additionally, several variables showed significant correlation

with the dependent variable but very limited correlation with other variables. While this cannot be substantiated within the extent of this research, this could mean that the variables for subjective knowledge on energy efficient products, system knowledge, and perceived skill in political action are based on underlying concepts different from the rest. While the new scale for external factors showed poor correlation with the dependent variable, there was no stronger or more significant correlation than present between the self-efficacy scale and the dependent variable. Self-efficacy was operationalized in this research by asking participants whether they would perform energy efficient consumption behavior when confronted with different obstacles. While it might seem obvious that being able to surmount different levels of obstacles correlates strongly with increased EEP purchasing behavior, this is by no means evident in literature. Even though several variables produced disappointing correlation coefficients, and even more variables barely influenced the regression model, linear regression analysis found the variables for worth related self-efficacy, personal conservation and age to be significant predictors for DV with an adjusted  $R^2$  of .184. When analyzing something as broad and intricate as behavior, potentially predicting a fifth of it is a substantial feat. The applied research method has great potential at becoming an important measurement tool for the behavior of energy efficient consumption. When taking into account the improvements as stated previously the quality of the research method, which is currently only of an exploratory nature, could be significantly improved.

Lastly, this research is relevant in practice. Obtaining a better understanding of how individuals decide to purchase energy efficient products is of considerable importance to the governments attempting to steer households towards sustainability, as well as industries trying to increase the market share of energy efficient products. Two variables have been found to be of importance to both parties. The constructed variable for altruism, consisting of both the self-efficacy and the personal conservation attitude, as well as the demographic variable age showed significant regression coefficients with energy efficient product consumption. In practice this means that older individuals which have an altruistic mindset are much more likely to purchase energy efficient products than young individuals with an opposite mindset. Knowing this means that governments can appropriately target their policy where it is most necessary. If stimulating purchases is the intended behavior then younger age groups should be targeted steering more towards economic benefits rather than their altruistic behavior. Industries on the other hand are encouraged to approach older altruistic age groups as these are more likely to contribute significantly to their market share. This means that marketing approaches as well as customer contact should be done through specific channels available to the older age segments within society, such as physical stores rather than internet or social media.

This research proves that the taken approach is effective and that explanatory variables have successfully been identified to influence energy efficient product consumption behavior. Significant findings could already be reported even though the research was of an explanatory nature. An important first step is taken to better understand energy efficient product consumption among households. The author hopes that others find inspiration in this work and continue to contribute to energy consumption worldwide, especially on the smallest of scales where there is still much to be gained.

## Literature

- Aarts, N. & Leeuwis, C. (2010). Participation and Power: Reflections on the Role of Government in Land Use Planning and Rural Development. *Journal of Agricultural Education and Extension*, 16(2), 131-145.
- Aarts, N. & Lokhorst, A.M. (2012). The Role of Government in Environmental Land Use Planning: Towards an Integral Perspective In: Appiah-Opoku, S. (2012) *Environmental Land Use Planning*. Rijeka, Croatia: InTech.
- Adams, S. A., Matthews, C. E., Ebbeling, C. B., Moore, C. G., Cunningham, J. E., Fulton, J., & Hebert, J. R. (2005). The effect of social desirability and social approval on self-reports of physical activity. *American journal of epidemiology*, 161(4), 389-398.
- Ajzen, I. & Cote, N.G. (2008). Attitude and the Prediction of Behavior. In W. Crano & R. Prislin (eds.), *Attitudes and Attitude Change* (pp. 289-312). Philadelphia: Psychology Press.
- Ajzen, I. (1985). *From intentions to actions: A theory of planned behavior* (pp. 11-39). Springer Berlin Heidelberg.
- Ajzen, I. (2001). Nature and operation of attitudes. *Annual review of psychology*, 52(1), 27-58.
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, 32(4), 665-683.
- Ajzen, I. (2011). The theory of planned behaviour: reactions and reflections. *Psychology & health*, 26(9), 1113-1127.
- Anderson, C. D., & Claxton, J. D. (1982). Barriers to consumer choice of energy efficient products. *Journal of Consumer Research*, 163-170.
- Anderson, D. R. (2001). The need to get the basics right in wildlife field studies. *Wildlife Society Bulletin*, 1294-1297.
- Arcury, T. A. (1990). Environmental attitude and environmental knowledge. *Human organization*, 49(4), 300-304.
- Baarda, D. B., De Goede, M. P. M., & Teunissen, J. (2005). *Basisboek kwalitatief onderzoek. Handleiding voor het opzetten en uitvoeren van kwalitatief onderzoek*. Groningen: Wolters Noordhoff.
- Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *Journal of environmental psychology*, 23(1), 21-32.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1994). Self-efficacy. In: V.S. Ramachaudran (Ed.) *Encyclopedia of human behavior* (Vol. 4, 71-81). New York: Academic Press.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, 5(307-337).
- Barber, N., Taylor, D.C. & Strick, S. (2009). Environmental knowledge and attitudes: influencing the purchase decisions of wine consumers. Int. CHRIE Conference-Refereed Track, Event 16
- Birner, S., & Martinot, E. (2005). Promoting energy-efficient products: GEF experience and lessons for market transformation in developing countries. *Energy Policy*, 33(14), 1765-1779.
- Blake, J. (1999). Overcoming the 'value-action gap' in environmental policy: tensions between national policy and local experience, *Local Environment*, 4(3), pp. 257-278.

Bogen, K. (1996). The effect of questionnaire length on response rates. A review of the literature. American Statistical Association, pp. 1020-1025.

Boyce, T. E., & Geller, E. S. (2001). Applied behavior analysis and occupational safety: The challenge of response maintenance. *Journal of Organizational Behavior Management*.

Bradley, J.C., Waliczek, T.M., Zajicek, J.M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education*, 30(3): 17-21.

Bryman, A. (2012). *Social research methods*. Oxford: Oxford University Press.

Buzzell, R. D., Gale, B. T., & Sultan, R. G. (1975). Market share-a key to profitability. *Harvard Business Review*, 53(1), 97-106.

Carifio, J. & Perla, R. J. (2007). Ten Common Misunderstandings, Misconceptions, Persistent Myths and Urban Legends about Likert Scales and Likert Response Formats and their Antidotes. *Journal of Social Sciences* 3(3), 106-116.

CBS (2013a). Internetgebruik ouderen fors toegenomen [Online]. Retrieved on 26-6-2015 from: <http://www.cbs.nl/nl-NL/menu/themas/vrije-tijd-cultuur/publicaties/artikelen/archief/2013/2013-4005-wm.htm>

CBS (2013a). <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=71822NED&D1=0&D2=a&D3=0&D4=0&D5=0-2,4,8-10&D6=0&D7=I&HDR=T,G6,G2,G5,G3&STB=G1,G4&VW=T>

CBS (2014a). Demografische kerncijfers per gemeente 2014 [online]. Retrieved on 30-7-15 from: <http://www.cbs.nl/NR/rdonlyres/68092452-2D41-416C-B5D5-C77737DBDE80/0/demografischekerncijfers2014.pdf>

CBS (2014b). Inkomensklassen; particuliere huishoudens naar diverse kenmerken [online]. Retrieved on 30-7-15 from: <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=70958ned&D1=0&D2=0-2&D3=0-7&D4=0-1,8,105&D5=I&HDR=T,G4,G3,G1&STB=G2&VW=T>

CBS (2014c). Gemiddeld inkomen van personen naar kenmerken en naar regio [online]. Retrieved on 31-7-15 from: <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=80500NED&D1=2-3&D2=I&D3=0-38&D4=0-4&D5=I&HDR=G4,T,G1,G3&STB=G2&VW=T>

CBS (2014d). Ontwikkeling bevolkingssamenstelling naar leeftijd [online]. Retrieved on 31-7-15 from: <http://www.wmm-provincie-utrecht.nl/bevolkingontwikkeling/>

Clark, C. F., Kotchen, M. J., & Moore, M. R. (2003). Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of environmental psychology*, 23(3), 237-246.

Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S. Clayton & S. Opatow (Eds.), *Identity and the Natural Environment* (pp. 45-65). Cambridge, MA : MIT PRESS.

Cook, R. D., & Weisberg, S. (1982). Residuals and influence in regression.

Cottrell, S. P. (2003). Influence of sociodemographics and environmental attitudes on general responsible environmental behavior among recreational boaters. *Environment and Behavior*, 35(3), 347-375.

CREM (2013). Stimuleren Duurzaam Consumentengedrag en de Rol van de Overheid: Overzicht van theorie en ervaringen in de praktijk [Online]. Retrieved on 3-9-2015 from

[http://www.crem.nl/files/upload/documents/downloads/file/Duurzaam\\_consumentengedrag\\_en\\_de\\_rol\\_van\\_de\\_overheid\\_mei\\_2013.pdf](http://www.crem.nl/files/upload/documents/downloads/file/Duurzaam_consumentengedrag_en_de_rol_van_de_overheid_mei_2013.pdf)

Crosbie, T., & Baker, K. (2010). Energy-efficiency interventions in housing: learning from the inhabitants. *Building research & information*, 38(1), 70-79.

Cudeck, R. (2000). Exploratory factor analysis. *Handbook of applied multivariate statistics and mathematical modeling*, 265-296.

Young, R. de, (1993). Changing behavior and making it stick. The conceptualization and management of conservation behavior. *Environment and behavior*, 25(3), 485-505.

Deci, E. L., & Ryan, R. M. (2002). Overview of self-determination theory: An organismic dialectical perspective. *Handbook of self-determination research*, 3-33.

Denzin, N. K., & Lincoln, Y. S. (1998). (Eds). *Collecting and interpreting qualitative materials*. Thousand Oaks: Sage Publication.

Dietz, T., Dan, A., & Shwom, R. (2007). Support for Climate Change Policy: Social Psychological and Social Structural Influences\*. *Rural Sociology*, 72(2), 185-214.

Dijk, T. van, Aarts, N. & De Wit, A. (2011). Frames to the Planning Game. *International Journal of Urban and Regional research*, 35(5), 969-987.

Dunlap, R. E., & Jones, R. E. (2002). Environmental concern: conceptual and measurement issues. In R. E. Dunlap, & W. Michelson (Eds.), *Handbook of environmental sociology* (pp. 482–524). Westport, CT: Greenwood Press.

Dunlap, R. E., & Jones, R. E. (2003). Environmental attitudes and values. In R. Fernandez-Ballesteros (Ed.), *Encyclopedia of psychological assessment*, Vol. 1 (pp. 364–369). London: Sage.

Dunlap, R. E., & Van Liere, K. D. (1978). The “new environmental paradigm”. *The journal of environmental education*, 9(4), 10-19.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of social issues*, 56(3), 425-442.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace

Eckes, T., & Six, B. (1994). Fakten und Fiktionen in der Einstellungs Verhaltens-Forschung: Eine meta-analyse. *Zeitschrift für Sozialpsychologie*, 25, 253–271

Edwards, M., & Gaventa, J. (2014). *Global citizen action*. Routledge.

EEA [European Environment Agency] (2010). *The European Environment State and Outlook 2010: Consumption and the environment*. Luxembourg, Publications Office of the European Union.

Egmond, C., & Bruel, R. (2007). Nothing is as practical as a good theory. *Analysis of theories and a tool for developing interventions to influence energy-related behaviour*.

Eisenberg, N. & Miller, P. (1987). The relation of empathy to prosocial and related behaviors, *Psychological Bulletin*, 101, pp. 91–119 In: Lehmann, J. (1999) *Befunde empirischer Forschung zu Umweltbildung und Umweltbewusstsein* (Opladen, Leske und Budrich).

Ellen, P.S. (1994). Do we know what we need to know? Objective and subjective knowledge effects on pro-ecological behaviors. *Journal of Business Research*, 30: 43-52.

- EUOPPP (2009). Sustainable Consumption Strategies in the European Union [Online]. Retrieved on 6-3-2015 from [http://www.euopp.net/docs/wp1d13\\_ecoinstitut\\_final.pdf](http://www.euopp.net/docs/wp1d13_ecoinstitut_final.pdf).
- European Commission (2008). The Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan [Online]. Retrieved on 6-3-2015 from [http://ec.europa.eu/environment/eussd/escp\\_en.htm](http://ec.europa.eu/environment/eussd/escp_en.htm).
- Feltz, D., Short, S., & Sullivan, P. (2008). Self efficacy in sport: Research and strategies for working with athletes, teams and coaches. *International Journal of Sports Science and Coaching*, 3(2), 293-295.
- Field, A. (2009). *Discovering statistics using SPSS*. Third edition. London: SAGE Publications Ltd.
- Fietkau, H.-J., & Kessel, H. (1981). *Umweltlernen: Veraenderungsmoeglichkeiten des Umweltbewusstseins. Modell-Erfahrungen* (Koenigstein, Hain).
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*.
- Fliegenschnee, M., & Schelakovsky, A. (1998). *Umweltpsychologie und Umweltbildung: eine Einfuehrung aus humanoekologischer Sicht*. Facultas. wuv/maudrich.
- Flom, P. (2010). How to analyze Likert type dependent variables [online]. Retrieved on 13-8-15 from <http://www.statisticalanalysisconsulting.com/how-to-analyze-likert-type-dependent-variables/>
- Frick, J., Kaiser, F.G., Wilson, M. (2004). Environmental knowledge and conservation behavior: exploring prevalence and structure in a representative sample. *Personality and Individual Differences*, 37: 1597-1613.
- Fryxell, G.E., Lo, C.W.H. (2003). The influence of environmental knowledge and values on managerial behaviours on behalf of the environment: an empirical examination of managers in China. *Journal of Business Ethics*, 46: 45-69.
- Fuhrer, U. (1995). Sozialpsychologisch fundierter Theorierahmen fur. eine Umweltbewusstseinsforschung. *Psychologische Rundschau*, 46, 93–103.
- Garland, R. (1991). The mid-point on a rating scale: Is it desirable. *Marketing bulletin*, 2(1), 66-70.
- Geller, E. S. (1989). Applied behavior analysis and social marketing: An integration to preserve the environment. *Journal of Social Issues*, 45, 17–36.
- Geller, E. S. (2002). The challenge of increasing proenvironment behavior. *Handbook of environmental psychology*, 525-540.
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference*. 11.0 update (4th ed.). Boston: Allyn & Bacon.
- Gliem, J. A., & Gliem, R. R. (2003). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education.
- Goddard, R. D., Hoy, W. K., & Hoy, A. W. (2000). Collective teacher efficacy: Its meaning, measure, and impact on student achievement. *American Educational Research Journal*, 37(2), 479-507.
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-606.
- Grob, A. (1991). *Meinung, Verhalten, Umwelt* (Bern, Peter Lang Verlag).
- Hakstian, A. R., Suedfeld, P., Ballard, E. J., & Rank, D. S. (1986). The ascription of responsibility questionnaire: Development and empirical extensions. *Journal of personality assessment*, 50(2), 229-247.



- Haron, S.A., Paim, L., & Yahaya, N. (2005). Towards sustainable consumption: an examination of environmental knowledge among Malaysians. *International Journal of Consumer Studies*, 29(5): 426-436.
- Hefler, E., & Cervinka, R. (2009). Connectedness with nature scales [Online] Retrieved on 6/10/2015 from [http://www.meduniwien.ac.at/umwelthygiene/p018\\_measures.pdf](http://www.meduniwien.ac.at/umwelthygiene/p018_measures.pdf)
- Hekkenberg, M., & Verdonk, M. (eds. 2015). Netherlands National Energy Outlook 2014 [Online]. Retrieved on 06-03-2015 from: <http://www.cbs.nl/NR/rdonlyres/461E1D72-AF11-4E66-8FA2-9F90D0A98310/0/E15005NetherlandsNationalEnergyOutlook2014.pdf>
- Héritier, A. (2002). *New Modes of Governance in Europe: Policy-Making without Legislating?* Bonn: Max Planck Project Group.
- Herzog, A. R., & Bachman, J. G. (1981). Effects of questionnaire length on response quality. *Public Opinion Quarterly*, 45(4), 549-559.
- Heuer, N. (2014). Exploring European students' meat consumption behavior: A survey based analysis of the relationships between various variables and meat consumption [Online]. Retrieved on 24/5/2015
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of environmental education*, 18(2), 1-8.
- Hodgson, G.M. (2006). 'What are institutions?', *Journal of Economic Issues* 2006 vol. 40 no.1, p. 2-4
- Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers. *Journal of Technology Education*, 9(1), 47-63.
- Hsu, S. J. (2004). The effects of an environmental education program on responsible environmental behavior and associated environmental literacy variables in Taiwanese college students. *The Journal of Environmental Education*, 35(2), 37-48.
- Hsu, S. J., & Roth, R. E. (1998). An assessment of environmental literacy and analysis of predictors of responsible environmental behaviour held by secondary teachers in the Hualien area of Taiwan. *Environmental education research*, 4(3), 229-249.
- Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The journal of environmental education*, 21(3), 8-21.
- Johnson, C. Y., Bowker, J. M., & Cordell, H. K. (2004). Ethnic variation in environmental belief and behavior an examination of the new ecological paradigm in a social psychological context. *Environment and Behavior*, 36(2), 157-186.
- Kaiser, F. G. (1996). *Environmental Attitude and Ecological Behavior*.
- Kals, E. (1996a). *Verantwortliches umweltverhalten [Responsible environmental behavior]*. Weinheim: Psychologie Verlags Union.
- Kals, E. (1996b). Are pro-environmental commitments motivated by health concerns or by perceived justice? In L. Montada & M. Lerner (Eds.), *Current societal concerns about justice* (pp. 231-258). New York: Plenum.
- Kals, E., & Montada, L. (1994). Umweltschutz und die verantwortung der bürger [Pollution control and the responsibility of the citizen]. *Zeitschrift für Sozialpsychologie*, 25, 326-337.
- Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and behavior*, 31(2), 178-202.
- Kellert, S. R. (1974). *From kinship to mastery: A study of American attitudes toward animals* (Report to the U.S. Fish and Wildlife Service). New Haven, CT: Yale University.

- Kellert, S. R. (1976). Perceptions of animals in American society. *Transactions of the North American Wildlife and Natural Resources Conference*, 41, 533-545. Rauwald, Moore / POLICY SUPPORT ACROSS COUNTRIES 737
- Kellert, S. R. (1980). Public attitudes, knowledge and behaviors toward wildlife and natural habitats. *Transactions of the North American Wildlife and Natural Resources Conference*, 45, 111-124
- Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis*, 28(1), 113-126.
- Kidder, Louise H. (1981). *Research Methods in Social Relations*, 4th edition. New York: Holt, Rinehart and Winston.
- King, M. F., & Bruner, G. C. (2000). Social desirability bias: A neglected aspect of validity testing. *Psychology and Marketing*, 17(2), 79-103.
- Kooiman, J. (1993). *Modern Governance: New Government-Society Interactions*. London: Sage.
- Kotrlik, J. W. K. J. W., & Higgins, C. C. H. C. C. (2001). Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information technology, learning, and performance journal*, 19(1), 43.
- Krosnick, J. A., & Presser, S. (2010). Question and questionnaire design. *Handbook of survey research*, 2, 263-314.
- Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. Sage Publications.
- Lee, C. C. (2006). The causality relationship between energy consumption and GDP in G-11 countries revisited. *Energy Policy*, 34(9), 1086-1093.
- Lehman, P. K., & Geller, E. S. (2005). Behavior analysis and environmental protection: Accomplishments and potential for more. *Behavior and social issues*, 13(1), 13-32.
- Li, W., Wright, P. M., Rukavina, P. B., & Pickering, M. (2008). Measuring students' perceptions of personal and social responsibility and the relationship to intrinsic motivation in urban physical education. *Journal of Teaching in Physical Education*, 27(2), 167.
- Lindenberg, S., & Steg, L. (2007). Normative, gain and hedonic goal frames guiding environmental behavior. *Journal of Social issues*, 63(1), 117-137.
- Lindenberg, S., & Steg, L. (2007). Normative, gain and hedonic goal frames guiding environmental behavior. *Journal of Social issues*, 63(1), 117-137.
- Luchs, M. G., Naylor, R. W., Irwin, J. R., & Raghunathan, R. (2010). The sustainability liability: Potential negative effects of ethicality on product preference. *Journal of Marketing*, 74(5), 18-31.
- Maloney, M. P., & Ward, M. P. (1973). Ecology: Let's hear from the people: An objective scale for the measurement of ecological attitudes and knowledge. *American psychologist*, 28(7), 583.
- Maloney, M. P., Ward, M. P., & Braucht, G. N. (1975). A revised scale for the measurement of ecological attitudes and knowledge. *American psychologist*, 30(7), 787.
- Manikandan, S. (2011). Measures of central tendency: Median and mode. *Journal of Pharmacology and Pharmacotherapeutics*, 2(3), 214.
- Martens, S., & Spaargaren, G. (2005). The politics of sustainable consumption: the case of the Netherlands. *Sustainability: Science, Practice, & Policy*, 1(1), 29-42.

- Martin, B., & Simintiras, A.C., 1995. The impact of green product lines on the environment: does what they know affect how they feel? *Mark. Intell. & Plan.* 13(4), 16–23.
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of environmental psychology*, 24(4), 503-515.
- Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). *The limits to growth*. New York, 102.
- Meinhold, J. L., & Malkus, A. J. (2005). Adolescent Environmental Behaviors Can Knowledge, Attitudes, and Self-Efficacy Make a Difference?. *Environment and Behavior*, 37(4), 511-532.
- Metcalfe, G. E., & Hassett, K. A. (1999). Measuring the energy savings from home improvement investments: evidence from monthly billing data. *Review of economics and statistics*, 81(3), 516-528.
- Milfont, T. L., & Duckitt, J. (2004). The structure of environmental attitudes: A first-and second-order confirmatory factor analysis. *Journal of Environmental Psychology*, 24(3), 289-303.
- Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, 30(1), 80-94.
- Milfont, T. L., Duckitt, J., & Cameron, L. D. (2006). A cross-cultural study of environmental motive concerns and their implications for proenvironmental behavior. *Environment and Behavior*, 38(6), 745-767.
- Ministries of Economic and Internal Affairs (2013). *Derde Nationale Energie Efficiëntie Actie Plan voor Nederland*.
- Ministry of Foreign Affairs (2003). *Sustainable Action: Sustainable Development Programme* [Online]. Retrieved on 29-2-2015 from <http://www.un.org/esa/sustdev/natlinfo/nsds/summary.pdf>.
- Moisander, J. (1998) *Motivation for Ecologically Oriented Consumer Behavior*, Workshop Proceedings, March. The European Science Foundation (ESF) TERM (Tackling Environmental Resource Management Phase II 1998–2000).
- Moisander, J. (2007). Motivational complexity of green consumerism. *International journal of consumer studies*, 31(4), 404-409.
- Morrone, M., Mancl, K., Carr, K. (2001). Development of a metric to test group differences in ecological knowledge as one component of environmental literacy. *The Journal of Environmental Education*, 32(4): 33-42.
- Nau, R. (2015). *Statistical forecasting: notes on regression and time series analysis* [online]. Retrieved on 30-7-15 from <http://people.duke.edu/~rnau/411home.htm>
- NCRM (2011). Ordinal regression [online]. Retrieved on 13-8-15 from <http://www.restore.ac.uk/srme/www/fac/soc/wie/research-new/srme/modules/mod5/>
- Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating nearby nature affective forecasting errors obscure the happy path to sustainability. *Psychological science*, 22(9), 1101-1106.
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2008). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior*.
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies*, 12(2), 303-322.
- Norwegian Ministry of the Environment (1994). *Oslo Roundtable on Sustainable Production and Consumption* [Online. Retrieved on 2-24-15 from <http://www.iisd.ca/consume/oslo000.html>]

- OECD (2002). *Towards Sustainable Household Consumption: Trends and Policies in OECD countries*. OECD Publications Service.
- Office for National Statistics (2003). *Ethnic group statistics: A guide for the collection and classification of ethnicity data*.
- Østerås, N., Gulbrandsen, P., Garratt, A., Benth, J. Š., Dahl, F. A., Natvig, B., & Brage, S. (2008). A randomised comparison of a four-and a five-point scale version of the Norwegian Function Assessment Scale. *Health and quality of life outcomes*, 6(1), 14.
- Pallant, J. (2005). *SPSS survival manual*. McGraw-Hill Education (UK).
- Parag, Y., Hamilton, J., White, V. & Hogan, B. (2013) Network Approach for Local and Community Governance of Energy: The case of Oxfordshire. *Energy Policy*, 62, 1064-1077.
- Pelletier, L. G. (2002). A motivational analysis of self-determination for pro-environmental behaviors. In E. L. Deci&R.M. Ryan (Eds.), *Handbook of self-determination research* (pp. 205-232). Rochester, NY: University of Rochester Press.
- Pelsmacker, P. De, Driesen, L., & Rayp, G. (2005). Do consumers care about ethics? Willingness to pay for fair-trade coffee. *Journal of consumer affairs*, 39(2), 363-385.
- Peterson, D., Rhoads, A., & Vaught, B. C. (2001). Ethical beliefs of business professionals: A study of gender, age and external factors. *Journal of Business Ethics*, 31(3), 225-232.
- Peyton, R. B., & Hungerford, H. R. (1977). *An assessment of teachers' abilities to identify, teach, and implement environmental action skills*.
- Phaises, E. J. (1957) Expectancy changes in skill and chance situations. *Journal of Abnormal and Social Psychology* 54, 339-342
- Pirlogea, C. & Cicea, C. (2012) Econometric perspective of the energy consumption and economic growth relation in European Union. *Renewable and Sustainable Energy Reviews*, 16(8), 5718-5726.
- Prislin & Crano (2008) Attitudes and Attitude Change. In W. Crano & R. Prislin (eds.), *Attitudes and Attitude Change* (pp. 3-18). Philadelphia: Psychology Press.
- Rauwald, K. S., & Moore, C. F. (2002). Environmental attitudes as predictors of policy support across three countries. *Environment and behavior*, 34(6), 709-739.
- Revilla, M. A., Saris, W. E., & Krosnick, J. A. (2013). Choosing the number of categories in agree–disagree scales. *Sociological Methods & Research*, 0049124113509605.
- Rhodes, R.A.W. (1996) The New Governance: Governing Without Government. *Political Studies*, 44(4), 652-667.
- Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological monographs: General and applied*, 80(1), 1.
- Rotter, J. B. (1990). Internal versus external control of reinforcement: A case history of a variable. *American psychologist*, 45(4), 489.
- Sadik, F. & Sadik, S. (2014) A Study on Environmental Knowledge and Attitudes of Teacher Candidates. *Procedia – Social and Behavioral Sciences*, 116, 2379-2385.

- Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., and Kerr, J. (2006). "An Ecological Approach to Creating More Physically Active Communities." *Annual Review of Public Health*, 27, 297–322.
- Sallis, J. F., Owen, N., & Fisher, E. B. (2008). Ecological models of health behavior. *Health behavior and health education: Theory, research, and practice*, 4, 465-486.
- Sauro, J. & Lewis J.R. (2011) "When Designing Usability Questionnaires, Does It Hurt to Be Positive?." in *Proceedings of the Conference in Human Factors in Computing Systems (CHI 2011)* Vancouver, BC, Canada.
- Schahn, J. (1993). Die Kluftrwischen Eruntellung und Verhalten beim individuellen Umweltschutz. In J. Schahn, T. Griesinger (Eds.), *Psychologie fur dem Umweltschutz*. (pp. 29–49). Weinheim: . Psychologie Verlags Union
- Schmuck, P. (2003, August). Biospheric, altruistic, egoistic environmental concern and environmental behavior. Paper presented at the 5th Biannual Meeting of the Division of Environmental Psychology of the German Psychological Association, Eindhoven, Netherlands.
- Schultz, P. W. (2000). Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues*, 56, 391-406.
- Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, 21, 327-339.
- Schultz, P. W. (2002). Environmental attitudes and behaviors across cultures. In W. J. Lonner, D. L. Dinnel, S. A. Hayes, & D. N. Sattler (Eds.), *Online readings in psychology and culture* (Unit 8, Chapter 4). Retrieved May 17, 2005, from <http://www.ac.wvu.edu/~culture/Schultz.htm>
- Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franek, M. (2005). Values and their relationship to environmental concern and conservation behavior. *Journal of Cross-Cultural Psychology*, 36, 457-475
- Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of environmental psychology*, 24(1), 31-42.
- Schwartz, S. H. (1968). Words, deeds and the perception of consequences and responsibility in action situations. *Journal of Personality and Social Psychology*, 10(3), 232.
- Schwartz, S. H. (1973). Normative explanations of helping behavior: A critique, proposal, and empirical test. *Journal of Experimental Social Psychology*, 9(4), 349-364.
- Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, 10, 221-279.
- Schwartz, S.H. (1977) Normative influences on altruism, in: L. BERKOWITZ (Ed.) *Advances in Experimental Social Psychology*, Vol. 10 (New York, Academic Press).
- Schwarz, N. (1999). Self-reports: how the questions shape the answers. *American psychologist*, 54(2), 93.
- Schwarz, N. (2008) Attitude measurement. In W. Crano & R. Prislin (eds.), *Attitudes and attitude change* (pp. 41-60). Philadelphia: Psychology Press.
- Schwarz, N., & Sudman, S. (Eds.) (1996) *Answering questions: Methodology for determining cognitive and communicative processes in survey research*. San Francisco: Jossey-Bass.
- Seber, G. A., & Lee, A. J. (2012). *Linear regression analysis* (Vol. 936). John Wiley & Sons.

- SER [Social Economic Council] (2013). *Energieakkoord voor duurzame groei*. 2D3D, Den Haag; Huisdrukkerij SER.
- Sia, A. (1985). An investigation of selected predictors of overt responsible environmental behavior. (Doctoral Dissertation, Southern Illinois University at Car- 31 Tom Marcinkowski An Issue and Action Instruction Program bondale, 1984). *Dissertation Abstracts International*, 46(3).
- Sivek, D. (1989). An analysis of selected predictors of environmental behavior of three conservation organizations. (Doctoral dissertation, Southern Illinois University at Carbondale, 1988). *Dissertation Abstracts International*, 49(11).
- Six, B. (1992). Neuere Entwicklungen und Trends in der EinstellungsVerhaltens-Forschung. In E. H. Witte (Ed.), *Einstellung und Verhalten. Beitrage des 7. Hamburger Symposiums zur Methodologie der Sozialpsychologie* (pp. 13–33). Braunschweig: Braunschweiger Studien zur Erziehungs und Sozialarbeitswissenschaft.
- Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. Acton, MA: Copley.
- Sonigo, P., Bain, J., Kong, M.A., Fedrigo, D., Withana, S., Watkins, E., Scholl, G., Rubik, F., Vanner, R. & Dresner, S. (2012). Final report on policies to encourage sustainable consumption [Online]. Retrieved on 3-9-2015 from [http://ec.europa.eu/environment/archives/eusds/pdf/report\\_22082012.pdf](http://ec.europa.eu/environment/archives/eusds/pdf/report_22082012.pdf).
- Spada, H. (1990). Umweltbewusstsein: Einstellung und Verhalten. In L. C. Kruse, F. Graumann, & E. D. Lantermann (Eds.), *Okologische . Psychologie* (pp. 623–631). Munchen: Psychologie Verlags Union
- Stern, P. C. (1999). Information, incentives, and proenvironmental consumer behavior. *Journal of Consumer Policy*, 22, 461–478
- Stern, P. C., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, 50, 65-84
- Stevens, J. P. (2012). *Applied multivariate statistics for the social sciences*. Routledge.
- Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: a look at green consumer behavior in the new millennium. *Journal of consumer marketing*, 16(6), 558-575.
- Taberero, C., & Hernández, B. (2011). Self-efficacy and intrinsic motivation guiding environmental behavior. *Environment and Behavior*, 43(5), 658-675.
- Taberero, C., & Hernández, B. (2012). A Motivational Model for Environmentally Responsible Behavior. *The Spanish Journal of Psychology*, 15(2), 648-658.
- Tajfel, H. (2010). *Social identity and intergroup relations*. Cambridge University Press.
- Tanner, C., & Wölfing Kast, S. (2003). Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology & Marketing*, 20(10), 883-902.
- Taylor-Powell, E. (1998). Questionnaire Design: Asking questions with a purpose. *University of Wisconsin Extension*.
- Tourangeau, R. (1984). Cognitive sciences and survey methods. In T. Jabine, M. Straf, J. Tanur, & R. Tourangeau (Eds.), *Cognitive Aspects of Survey Methodology: Building a Bridge Between Disciplines*, pp. 73-100. Washington, DC: National Academy Press.
- Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and teacher education*, 17(7), 783-805.
- Tzeng, G. H., Chiang, C. H., & Li, C. W. (2007). Evaluating intertwined effects in e-learning programs: A novel hybrid MCDM model based on factor analysis and DEMATEL. *Expert systems with Applications*, 32(4), 1028-1044.

- UNEP (2005). United Nations Environment Programme 2005. Published: UN Environment Programme, p. 15.
- United Nations (1972). Report of the United Nations Conference on the Human Environment. United Nations Publication.
- United Nations (1992). United Nations Conference on Environment & Development in Rio de Janeiro. Agenda 21. United Nations Publication.
- United Nations (2002). World Summit on Sustainable Development [Online]. Retrieved on 6-3-2015 from <http://www.un-documents.net/jburgdec.htm>.
- United Nations (2015). Sustainable Consumption and Production [Online]. Retrieved on 6-3-2015 from <https://sustainabledevelopment.un.org/topics/sustainableconsumptionandproduction>.
- Vermeir, I., & Verbeke, W. (2006). Sustainable food consumption: Exploring the consumer “attitude–behavioral intention” gap. *Journal of Agricultural and Environmental Ethics*, 19(2), 169-194.
- Vermeir, I., & Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecological Economics*, 64(3), 542-553.
- Verschuren, P., Doorewaard, H., & Mellion, M. J. (2010). *Designing a research project* (Vol. 2). Eleven International Publishing.
- Vicente-Molina, M.A., Fernández-Sáinz, A., Izagirre-Olaizola, J. (2013). Environmental knowledge and other variables affecting pro-environmental behaviour: comparison of university students from emerging and advanced countries. *Journal of Cleaner Production*, 61: 130-138.
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the motivation toward the environment scale. *Environment and Behavior*, 35(4), 486-505.
- VROM [Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer] (1998). *The Third Dutch National Environmental Policy Plan*. The Hague: VROM
- Watson, D.L., Newton, M., & Kim, M. (2003). Recognition of values-based constructs in a summer physical activity program. *Urban Review*, 35, 217–232
- Weigel, R. H. (1983). Environmental attitudes and the prediction of behavior. In N. R. Feimer, & E. S. Geller (Eds.), *Environmental Psychology* (pp. 257–287). New York: Praeger
- Weigel, R., & Weigel, J. (1978). Environmental concern the development of a measure. *Environment and behavior*, 10(1), 3-15
- Welsch, H., & Kühling, J. (2009). Determinants of pro-environmental consumption: The role of reference groups and routine behavior. *Ecological Economics*, 69(1), 166-176.
- Williams, S. & Doane, D. (2001). Ethical Purchasing Index 2001. The Co-operative Bank.
- Willis, G. B. (2004). *Cognitive interviewing: A tool for improving questionnaire design*. Sage Publications.
- World Commission on Environment and Development. (1987). *Our common future*. Oxford: Oxford University Press.
- Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2010). Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable development*, 18(1), 20-31.

## Appendices

### Appendix A: Environmental Attitude Inventory (EAI)

#### Scale 01. Enjoyment of nature

01. I am NOT the kind of person who loves spending time in wild, untamed wilderness areas. (R)
02. I really like going on trips into the countryside, for example to forests or fields.\* ,y
03. I find it very boring being out in wilderness areas. (R)\*
04. Sometimes when I am unhappy, I find comfort in nature.
05. Being out in nature is a great stress reducer for me.\*
06. I would rather spend my weekend in the city than in wilderness areas. (R)
07. I enjoy spending time in natural settings just for the sake of being out in nature.
08. I have a sense of well-being in the silence of nature.\*
09. I find it more interesting in a shopping mall than out in the forest looking at trees and birds. (R)\*
10. I think spending time in nature is boring. (R)\* ,y

#### Scale 02. Support for interventionist conservation policies

01. Industry should be required to use recycled materials even when this costs more than making the same products from new raw materials.
02. Governments should control the rate at which raw materials are used to ensure that they last as long as possible.\* ,y
03. Controls should be placed on industry to protect the environment from pollution, even if it means things will cost more.\*
04. People in developed societies are going to have to adopt a more conserving life-style in the future.\*
05. The government should give generous financial support to research related to the development of alternative energy sources, such as solar energy.
06. I don't think people in developed societies are going to have to adopt a more conserving life-style in the future. (R)\*
07. Industries should be able to use raw materials rather than recycled ones if this leads to lower prices and costs, even if it means the raw materials will eventually be used up. (R)\*
08. It is wrong for governments to try and compel business and industry to put conservation before producing goods in the most efficient and cost effective manner. (R)
09. I am completely opposed to measures that would force industry to use recycled materials if this would make products more expensive. (R)
10. I am opposed to governments controlling and regulating the way raw materials are used in order to try and make them last longer. (R)\* ,y

#### Scale 03. Environmental movement activism

01. If I ever get extra income I will donate some money to an environmental organization.
02. I would like to join and actively participate in an environmentalist group.\* ,y
03. I don't think I would help to raise funds for environmental protection. (R)\*
04. I would NOT get involved in an environmentalist organization. (R)\* ,y
05. Environmental protection costs a lot of money. I am prepared to help out in a fund-raising effort.\*
06. I would not want to donate money to support an environmentalist cause. (R)\*
07. I would NOT go out of my way to help recycling campaigns. (R)
08. I often try to persuade others that the environment is important.
09. I would like to support an environmental organization.\*
10. I would never try to persuade others that environmental protection is important. (R)

#### Scale 04. Conservation motivated by anthropocentric concern

01. One of the best things about recycling is that it saves money.
02. The worst thing about the loss of the rain forest is that it will restrict the development of new medicines.
03. One of the most important reasons to keep lakes and rivers clean is so that people have a place to enjoy water sports.\* ,y
04. Nature is important because of what it can contribute to the pleasure and welfare of humans.\*
05. The thing that concerns me most about deforestation is that there will not be enough lumber for future generations.\*
06. We should protect the environment for the well-being of plants and animals rather than for the welfare of humans. (R)
07. Human happiness and human reproduction are less important than a healthy planet. (R)
08. Conservation is important even if it lowers peoples' standard of living. (R)\*
09. We need to keep rivers and lakes clean in order to protect the environment, and NOT as places for people to enjoy water sports. (R)\* ,y
10. We should protect the environment even if it means peoples' welfare will suffer. (R)\*



Scale 05. Confidence in science and technology

01. Most environmental problems can be solved by applying more and better technology.
02. Science and technology will eventually solve our problems with pollution, overpopulation, and diminishing resources.\* 03. Science and technology do as much environmental harm as good. (R)
04. Modern science will NOT be able to solve our environmental problems. (R)\*,y
05. We cannot keep counting on science and technology to solve our environmental problems. (R)\*
06. Humans will eventually learn how to solve all environmental problems.\*
07. The belief that advances in science and technology can solve our environmental problems is completely wrong and misguided. (R)\*
08. Humans will eventually learn enough about how nature works to be able to control it.
09. Science and technology cannot solve the grave threats to our environment. (R)
10. Modern science will solve our environmental problems.\*,y

Scale 06. Environmental threat

01. If things continue on their present course, we will soon experience a major ecological catastrophe.\*
02. The earth is like a spaceship with very limited room and resources.
03. The balance of nature is very delicate and easily upset.
04. When humans interfere with nature it often produces disastrous consequences.\*
05. Humans are severely abusing the environment.\*,y
06. The idea that we will experience a major ecological catastrophe if things continue on their present course is misguided nonsense. (R)
07. I cannot see any real environmental problems being created by rapid economic growth. It only creates benefits. (R)
08. The idea that the balance of nature is terribly delicate and easily upset is much too pessimistic. (R)\*
09. I do not believe that the environment has been severely abused by humans. (R)\*,y
10. People who say that the unrelenting exploitation of nature has driven us to the brink of ecological collapse are wrong. (R)\*

Scale 07. Altering nature

01. Grass and weeds growing between paving stones may be untidy but are natural and should be left alone. (R)
02. The idea that natural areas should be maintained exactly as they are is silly, wasteful, and wrong.
03. I'd prefer a garden that is wild and natural to a well groomed and ordered one. (R)\*,y
04. Human beings should not tamper with nature even when nature is uncomfortable and inconvenient for us. (R)\*
05. Turning new unused land over to cultivation and agricultural development should be stopped. (R)\*
06. I'd much prefer a garden that is well groomed and ordered to a wild and natural one.\*,y
07. When nature is uncomfortable and inconvenient for humans we have every right to change and remake it to suit ourselves.\*
08. Turning new unused land over to cultivation and agricultural development is positive and should be supported.
09. Grass and weeds growing between pavement stones really looks untidy.\*
10. I oppose any removal of wilderness areas no matter how economically beneficial their development may be. (R)

Scale 08. Personal conservation behaviour

01. I could not be bothered to save water or other natural resources.(R)\*
02. I make sure that during the winter the heating system in my room is not switched on too high.
03. In my daily life I'm just not interested in trying to conserve water and/or power. (R)\*
04. Whenever possible, I take a short shower in order to conserve water.
05. I always switch the light off when I don't need it on any more.\*
06. I drive whenever it suits me, even if it does pollute the atmosphere. (R)
07. In my daily life I try to find ways to conserve water or power.\*
08. I am NOT the kind of person who makes efforts to conserve natural resources. (R)\*,y
09. Whenever possible, I try to save natural resources.\*,y
10. Even if public transportation was more efficient than it is, I would prefer to drive my car. (R)

Scale 09. Human dominance over nature

01. Humans were meant to rule over the rest of nature.\*
02. Human beings were created or evolved to dominate the rest of nature.\*,y
03. Plants and animals have as much right as humans to exist. (R)\*
04. Plants and animals exist primarily to be used by humans.\*
05. Humans are as much a part of the ecosystem as other animals. (R)
06. Humans are no more important in nature than other living things. (R)
07. Nature exists primarily for human use.
08. Nature in all its forms and manifestations should be controlled by humans.
09. I DO NOT believe humans were created or evolved to dominate the rest of nature.(R)\*,y
10. Humans are no more important than any other species. (R)\*

Scale 10. Human utilization of nature

01. It is all right for humans to use nature as a resource for economic purposes.
02. Protecting peoples' jobs is more important than protecting the environment.\* ,y
03. Humans do NOT have the right to damage the environment just to get greater economic growth. (R)\*
04. People have been giving far too little attention to how human progress has been damaging the environment. (R)
05. Protecting the environment is more important than protecting economic growth. (R)\*
06. We should no longer use nature as a resource for economic purposes. (R)
07. Protecting the environment is more important than protecting peoples' jobs. (R)\* ,y
08. In order to protect the environment, we need economic growth.
09. The question of the environment is secondary to economic growth.\*
10. The benefits of modern consumer products are more important than the pollution that results from their production and use.\*

Scale 11. Ecocentric concern

01. The idea that nature is valuable for its own sake is naïve and wrong. (R)\*
02. It makes me sad to see natural environments destroyed.
03. Nature is valuable for its own sake.\*
04. One of the worst things about overpopulation is that many natural areas are getting destroyed.
05. I do not believe protecting the environment is an important issue. (R)\*
06. Despite our special abilities humans are still subject to the laws of nature.\*
07. It makes me sad to see forests cleared for agriculture.\* ,y
08. It does NOT make me sad to see natural environments destroyed. (R)\* ,y
09. I do not believe nature is valuable for its own sake. (R)
10. I don't get upset at the idea of forests being cleared for agriculture. (R)

Scale 12. Support for population growth policies

01. We should strive for the goal of "zero population growth".
02. The idea that we should control the population growth is wrong. (R)
03. Families should be encouraged to limit themselves to two children or less.\* ,y
04. A married couple should have as many children as they wish, as long as they can adequately provide for them. (R)\* ,y
05. Our government should educate people concerning the importance of having two children or less.\*
06. We should never put limits on the number of children a couple can have. (R)\*
07. People who say overpopulation is a problem are completely incorrect. (R)
08. The world would be better off if the population stopped growing.
09. We would be better off if we dramatically reduced the number of people on the Earth.\*
10. The government has no right to require married couples to limit the number of children they can have. (R)\*

Legend:

R = reversed coded items.

\* = The 72 balanced items selected for the short version of the EAI.

y = The 24 balanced items selected for the brief version of the EAI.

Source: Milfont & Duckitt, 2004

## Appendix B: Final Questionnaire

### Survey on energy efficient product consumption behavior

The aim of this survey is to find the driving forces that cause pro-environmental behavior related to energy efficient products. The survey takes about 8-10 minutes, will be completely confidential, and will help us learn more about sustainable consumption.

#### First we would like some personal information:

##### My age is:

- Younger than 18
- 18 - 29
- 30 – 39
- 40 – 49
- 50 – 59
- 60 – 69
- 70 or older

##### My gender is:

- Male
- Female

##### The yearly income of my household is:

- Less than €10,000
- €10,000 - €20,000
- €20,000 - €30,000
- €30,000 - €40,000
- €40,000 - €50,000
- €50,000 - €60,000
- €60,000 - €70,000
- €70,000 - €80,000
- €80,000 - €90,000
- More than €90,000

##### My marital status is:

- Single
- Married or in a partnership

##### My housing status is:

- House owner
- Rented house/apartment

##### The size of my household is:

- 1 person
- 2 persons
- 3 persons
- 4 persons
- 5 or more persons

##### My level of education is:

- High school or lower
- MBO
- HBO
- WO or higher

What have you purchased in the past 10 years? Mark the first column if you have not bought any lighting, showerheads, or electronics.

Action	Didn't buy non-efficient product either	Never	Rarely	Some times	Often	Always
Energy efficient lighting or lamps						
Energy- and water efficient showerheads						
'Witgoed' based on a high energy label (A or higher). E.g. washing machines, fridges, dishwashers or dryers.						
'Bruingood' based on a high energy label (A or higher). E.g. electronics such as computer screens or tv's.						

**Do you agree or disagree with the following statements?**

<b>Statement</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
I think spending time in nature is boring.*					
Governments should control the use of raw materials to ensure that they last as long as possible.					
I would like to join and actively participate in an environmentalist group.					
We need to keep rivers and lakes clean in order to protect the environment, and NOT as places for people to enjoy water sports.					
Modern science will NOT be able to solve our environmental problems.					
Humans are severely abusing the environment.					
I'd much prefer a garden that is well groomed and ordered to a wild and natural one.					
I am the kind of person who makes an effort to conserve natural resources.					
Human beings were NOT created or evolved to dominate the rest of nature.					
Protecting peoples' jobs is more important than protecting the environment.					
It does NOT make me sad to see natural environments destroyed.					
A married couple should have as many children as they wish, as long as they can adequately provide for them (in a population growth and environmental context).					

**I worry about environmental problems because of the consequences for:**

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
Myself					
My lifestyle					
My future					
My health					
Humanity					
My children					
The community					
Future generations					
Trees and plants					
Land animals					
Marine life					
Birds					

Please state if you would still purchase energy efficient products in the following situations:

	Wouldn't buy	Probably wouldn't buy	Maybe buy	Probably would buy	Would still buy
When I have less money to spend than I planned					
When I have less free time than I thought					
When I put less effort into making energy efficient choices					
When I don't think I have enough knowledge about the products					
When I am not encouraged to make energy efficient choices by friends and family					
When I am not encouraged to make energy efficient choices by store employees					
If I think selecting energy efficient products is inconvenient					
When I have to change my lifestyle to use energy efficient products (e.g. different lighting)					
When I am not sure about the benefits of energy efficient products					
When I am not sure about the quality of energy efficient products					

It is clear to me what the effects of the following activities are on the environment:

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Recycling of waste and old products.					
Avoid buying products that damage animals and their habitats.					
Encourage others to engage in responsible environmental behavior.					
Voting for a pro-environment political party.					
Reporting pollution violations to authorities.					

Please state if you think you can contribute to the following activities yourself:

Statement	Definitely not	Probably not	Maybe	Probably	Definitely
I can contribute to recycling.					
I can contribute to avoiding the purchase of animal damaging products.					
I can contribute to encouraging others.					
I can contribute to voting for a pro-environmental political party.					
I can contribute to reporting pollution violations to authorities.					

**Do you agree or disagree with the following statements?**

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I worry that the next generation will feel we didn't do enough to prevent climate change.					
We have a responsibility to future generations to deal with climate change.					
There is no urgent need to take measures to prevent climate change today.					
Even if only some species are threatened by climate change, we should act to protect them.					
It's too costly for the Netherlands to reduce use of fossil fuels.					

**Because of the degeneration of the environment:**

Health in the Netherlands will decrease.					
Health in the world will decrease.					
Standard of living in the Netherlands will decrease.					
Standard of living in the world will decrease.					
The number of animal species in the Netherlands will decrease.					
The number of animal species in the world will decrease.					

**Do you agree or disagree with the following statements?**

When I spend time in nature I feel free and easy.					
I do not feel especially at ease whenever I spend time in nature.					
I feel relaxed and have a pleasant feeling of intimacy when spending time in nature.					
When surrounded by nature I get calmer and I feel at home.					
I do not feel especially at ease whenever I spend time in nature.					
Whenever I spend time in nature I do not experience a close connection to it.					
Sometimes when I feel unhappy I find solace in nature.					
I am well informed about environmental issues.					
I am well informed about energy efficient products.					

**How often do you feel the following factors influence your energy efficient purchasing behavior?**

Factor	Never	Rarely	Sometimes	Often	Always
Family					
Friends					
Community (e.g. neighborhood or street)					
Culture (e.g. religion or nationality)					
Education (e.g. school)					
Media (e.g. news or blogs)					
Government (e.g. through laws and rules, or communicative motivation)					
Industry (e.g. producers of energy efficient products)					
Non-governmental organizations (e.g. environmental groups)					
Economic incentives (e.g. taxes on non-efficient products or tax benefits on efficient products)					

Information (e.g. energy labels or better comparison material)					
Feedback (e.g. feedback from stores or the government regarding your purchases)					
Habits (e.g. buying a product because you have always bought the product)					

Select the right answer(s) in the following questions

<p>What does the abbreviation CO<sub>2</sub> stand for?</p> <p><input type="radio"/> Carbon dioxide</p> <p><input type="radio"/> Carbon monoxide</p> <p><input type="radio"/> Greenhouse effect</p> <p>When wind energy is converted, no CO<sub>2</sub> is emitted.</p> <p><input type="radio"/> True</p> <p><input type="radio"/> False</p> <p>Solar energy is unlimitedly available (during the day).</p> <p><input type="radio"/> True</p> <p><input type="radio"/> False</p> <p>Which of the following kinds of energy is not renewable?</p> <p><input type="radio"/> Solar energy</p> <p><input type="radio"/> Nuclear power</p> <p><input type="radio"/> Wind power</p> <p>Why is CO<sub>2</sub> a problem?</p> <p><input type="radio"/> CO<sub>2</sub> damages many species of plants</p> <p><input type="radio"/> CO<sub>2</sub> contributes to global warming</p> <p><input type="radio"/> CO<sub>2</sub> is poisonous to many microorganisms</p> <p><input type="radio"/> Levels of CO<sub>2</sub> are decreasing in the atmosphere</p> <p><b>(More than one answer possible)</b> What are the protective functions of the forests? They protect against...</p> <p><input type="radio"/> ... erosion</p> <p><input type="radio"/> ... radioactive contamination of the ground</p> <p><input type="radio"/> ... inundations</p> <p><b>(More than one answer possible)</b> What are the characteristics of fossil energy (such as coal and oil)?</p> <p><input type="radio"/> They developed during the last 100 years.</p> <p><input type="radio"/> During the conversion, CO<sub>2</sub> is released.</p> <p><input type="radio"/> They are available only in limited quantities.</p> <p><input type="radio"/> It took only 10 years for large-scale industrial exploitation to exhaust them.</p>	<p><b>(More than one answer possible)</b> The energy consumption for heating can be reduced by ...</p> <p><input type="radio"/> ... keeping the room temperature constant.</p> <p><input type="radio"/> ... setting the temperature lower at night.</p> <p><input type="radio"/> ... insulating windows and doors.</p> <p>What is 'grey energy'?</p> <p><input type="radio"/> Energy that was used for the production of an appliance.</p> <p><input type="radio"/> The total amount of energy used by an appliance.</p> <p><input type="radio"/> Heat energy that is lost when appliances are used.</p> <p><b>(More than one answer possible)</b> How can ozone build-up be reduced in the summertime?</p> <p><input type="radio"/> By not using solvents.</p> <p><input type="radio"/> By not driving cars.</p> <p><input type="radio"/> By reducing the use of electricity.</p> <p>A TV or stereo needs so little energy on standby that it makes no difference to turning it off completely.</p> <p><input type="radio"/> True</p> <p><input type="radio"/> False</p> <p>Doing the laundry using the 30°C program saves 50% energy compared to the 40°C program.</p> <p><input type="radio"/> True</p> <p><input type="radio"/> False</p> <p>Water-saving showerheads consume ... of the water consumed by conventional showerheads.</p> <p><input type="radio"/> A quarter</p> <p><input type="radio"/> Half</p> <p><input type="radio"/> Three quarters</p> <p>Energy saving light bulbs consume ...% less energy than conventional light bulbs with the same illuminating power.</p> <p><input type="radio"/> 20%</p> <p><input type="radio"/> 40%</p> <p><input type="radio"/> 80%</p>
---	--

If the concentration of atmospheric CO<sub>2</sub> was doubled, the global average temperature would rise by about 5°C.

- True
- False

If all ozone-destroying emissions were eliminated right now, it would take 100 years for almost complete regeneration of the ozone layer.

- True
- False

Asparagus from California is environmentally harmful because...

- ... climatic conditions are not advantageous for growing asparagus in California.
- ... too much packaging material is used.
- ... air transport consumes excessive amounts of energy.

Energy can be saved if one takes a shower instead of a bath.

- True
- False

What type of lamp consumes the least energy for the same amount of light?

- Incandescent lamp
- Halogen lamp
- Fluorescent tube

Lowering the heating temperature at home by 1 degree means an average of ... % less energy consumption.

- 2%
- 4%
- 6%

A household needs most of the energy for...

- ... lighting.
- ... hot water.
- ... heating.



## Appendix C: Additional statistics

Table 26: Influence of gender on DV

Gender	Mean	Std. Deviation	Std. Error of Mean
Male	3.175	.9746	.0833
Female	3.341	1.1061	.1332
Total	3.230	1.0208	.0711

Table 27: Influence of age on DV

Age	Mean	Std. Deviation	Std. Error of Mean
Younger than 18	2.500	.	.
18 - 29	2.864	1.0864	.1478
30 - 39	3.106	.8474	.1323
40 - 49	3.385	.8468	.1848
50 - 59	3.342	1.0299	.1649
60 - 69	3.541	1.0290	.1648
70 or older	3.517	1.0021	.2587
Total	3.223	1.0133	.0699

Table 28: Influence of income on DV

Household income	Mean	Std. Deviation	Std. Error of Mean
Less than €10.000	2.738	1.1166	.2437
€10.000 - €20.000	2.854	.9982	.1765
€20.000 - €30.000	3.389	1.0384	.1731
€30.000 - €40.000	3.444	1.0079	.1729
€40.000 - €50.000	3.453	1.0519	.1804
€50.000 - €60.000	3.351	.8257	.2207
€60.000 - €70.000	3.548	.8469	.3201
€70.000 - €80.000	3.476	.5626	.2126
€80.000 - €90.000	3.381	.7860	.2971
More than €90.000	2.639	.9691	.3230
Total	3.228	1.0205	.0720

Table 29: Influence of marital status on DV

Marital status	Mean	Std. Deviation	Std. Error of Mean
Single	3.037	1.1169	.1241
Married or partnership	3.361	.9320	.0830
Total	3.234	1.0182	.0708

Table X: Influence of housing on DV

Table 30: Influence of housing on DV

Housing	Mean	Std. Deviation	Std. Error of Mean
House owner	3.399	.9421	.0853
Rented house/apartment	2.961	1.0499	.1126
Total	3.217	1.0094	.0698

Table 31: Influence of family size on DV

Family size	Mean	Std. Deviation	Std. Error of Mean
1 person	3.277	1.0365	.1437
2 persons	3.264	1.0554	.1050
3 persons	3.189	.9904	.1942
4 persons	2.942	.9012	.1767
5 or more persons	3.542	.4852	.1981
Total	3.226	1.0123	.0697

Table 32: Influence of education on DV

Level of education	Mean	Std. Deviation	Std. Error of Mean
Highschool or lower	3.463	1.1790	.2636
MBO	3.121	1.0161	.1532
HBO	3.332	1.0658	.1170
WO	3.097	.8717	.1098
Total	3.230	1.0134	.0699

Table 33: Composition of attitude scale

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Enjoyment of nature	6	8	14	81	109
Conservation policies	7	8	35	118	49
Environmental activism	37	80	79	18	4
Anthropocentric concern	25	59	70	44	18
Confidence in science	28	115	31	34	9
Environmental fragility	4	14	46	113	39
Altering nature	31	60	63	48	15
Personal conservation	1	18	45	112	41
Dominance over nature	53	112	38	11	3
Utilization of nature	20	81	87	24	5
Ecocentric concern	9	11	17	98	83
Population growth	13	66	70	50	19

Table 34: Influence of attitude on DV

	<b>Enjoyment of nature</b>	<b>Conservation policies</b>	<b>Environmental activism</b>	<b>Anthropocentric concern</b>	<b>Confidence in science</b>	<b>Environmental fragility</b>
Strongly disagree	3.181	3.125	3.138	3.140	3.179	3.833
Disagree	3.740	3.417	3.086	3.266	3.333	3.143
Neutral	2.970	2.833	3.351	3.229	3.322	3.276
Agree	2.954	3.168	3.264	3.335	2.854	3.212
Strongly agree	3.431	3.587	4.063	2.889	2.781	3.246
	<b>Altering nature</b>	<b>Personal conservation</b>	<b>Dominance over nature</b>	<b>Utilization of nature</b>	<b>Ecocentric concern</b>	<b>Population growth</b>
Strongly disagree	3.458	2.500	3.509	3.383	3.458	3.090
Disagree	3.000	2.171	3.148	3.303	3.477	3.176
Neutral	3.462	2.986	3.102	3.200	2.706	3.348
Agree	3.000	3.360	2.932	3.018	3.179	3.154
Strongly agree	3.339	3.589	3.375	2.950	3.331	3.219

Table 35: Composition of motivation scale

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
<b>Concern for myself</b>	7	37	66	84	14
<b>Concern for my lifestyle</b>	10	50	76	61	11
<b>Concern for my future</b>	7	20	42	120	18
<b>Concern for my health</b>	7	22	39	117	24
<b>Concern for my humanity</b>	2	4	27	123	55
<b>Concern for my children</b>	3	6	32	112	53
<b>Concern for the community</b>	2	9	35	130	34
<b>Concern for future generations</b>	3	2	18	126	61
<b>Concern for trees and plants</b>	5	4	18	135	47
<b>Concern for land animals</b>	4	2	21	138	46
<b>Concern for marine life</b>	4	2	24	134	47
<b>Concern for birds</b>	5	3	24	133	46

Table 36: Influence of motivation on DV

Concern for:	Myself	My lifestyle	My future	My health
Strongly disagree	3.060	3.367	3.310	3.202
Disagree	3.104	3.124	3.042	2.825
Neutral	3.004	3.192	3.236	3.104
Agree	3.362	3.225	3.170	3.213
Strongly agree	3.904	3.850	3.799	3.783
Concern for:	Humanity	My children	The community	Future generations
Strongly disagree	2.500	2.889	2.125	2.750
Disagree	2.000	2.000	2.667	2.625
Neutral	2.907	3.105	2.917	2.926
Agree	3.228	3.260	3.271	3.219
Strongly agree	3.461	3.399	3.493	3.314
Concern for:	Trees and plants	Land animals	Marine life	Birds
Strongly disagree	2.500	1.938	2.313	2.050
Disagree	2.833	2.917	2.167	2.694
Neutral	3.282	3.258	3.101	3.053
Agree	3.223	3.237	3.268	3.262
Strongly agree	3.287	3.272	3.266	3.339

Table 37: Composition of self-efficacy scale

	Would not buy	Probably would not buy	Maybe buy	Probably would still buy	Would still buy
Money	11	58	72	43	30
Free time	4	31	48	63	68
Effort	7	39	61	53	52
Knowledge	5	39	77	59	32
Encouragement by friends/family	5	23	51	60	74
Encouragement by store employees	3	28	53	60	70
Inconvenience	17	57	63	39	36
Lifestyle change	14	40	73	51	35
Unsure benefits	23	59	67	42	22
Unsure quality	27	92	60	24	11

Table 38: Influence of self-efficacy on DV

	Money	Free time	Effort	Knowledge	Encouragement family/friends
Would not buy	2.750	2.875	3.214	2.350	2.950
Probably would not buy	2.738	2.964	2.821	2.982	2.902
Maybe buy	3.324	2.770	2.977	2.974	2.771
Probably would still buy	3.312	3.171	3.327	3.511	3.336
Would still buy	3.850	3.662	3.641	3.638	3.512

	Encouragement store	Inconvenience	Lifestyle change	Unsure benefits	Unsure quality
Would not buy	3.000	2.844	2.577	2.623	2.972
Probably would not buy	2.750	2.817	2.890	3.153	3.028
Maybe buy	2.918	3.200	3.193	3.254	3.322
Probably would still buy	3.253	3.425	3.367	3.423	3.663
Would still buy	3.567	3.727	3.633	3.515	3.712

Table 39: Composition of knowledge and skill in using action strategies items

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Knowledge	Ecomanagement	0	4	16	129	67
	Consumer/economic action	1	2	29	124	59
	Persuasion	3	15	48	122	28
	Political action	10	32	58	81	34
	Legal action	7	27	59	94	28
		Definitely not	Probably not	Maybe	Probably	Definitely
Skill	Ecomanagement	1	4	22	94	95
	Consumer/economic action	0	5	17	107	87
	Persuasion	2	12	46	97	59
	Political action	10	29	53	64	58
	Legal action	11	35	46	76	48

Table 40: Influence of knowledge and skill in using action strategies on DV<sup>10</sup>

Knowledge	Ecomanagement	Consumer/ economic action	Persuasion	Political action	Legal action
Strongly disagree			2.833	2.575	3.417
Disagree	3.083	2.500	3.333	3.072	3.160
Neutral	3.233	3.151	3.065	3.296	3.121
Agree	3.077	3.224	3.258	3.247	3.279
Strongly agree	3.506	3.271	3.333	3.412	3.268

<sup>10</sup> When no mean value is shown it means that the sample was too low to calculate a mean (0 or 1 available value for comparison).

Skill	Ecomanagement	Consumer/economic action	Persuasion	Political action	Legal action
<b>Definitely not</b>			3.750	3.176	2.975
<b>Probably not</b>	2.563	2.813	3.008	2.866	3.035
<b>Maybe</b>	3.202	3.322	2.968	3.124	3.124
<b>Probably</b>	3.079	2.977	3.169	3.184	3.305
<b>Definitely</b>	3.392	3.518	3.520	3.503	3.375

Table 41: Composition of personal responsibility items

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<b>PersResp 1</b>	12	47	52	83	21
<b>PersResp 2</b>	0	2	21	118	74
<b>PersResp 3</b>	18	26	39	79	51
<b>PersResp 4</b>	3	19	49	106	38
<b>PersResp 5</b>	2	17	69	82	45

Table 42: Influence of personal responsibility on DV

	Item 1	Item 2	Item 3	Item 4	Item 5
<b>Strongly disagree</b>	2.795		3.644	3.028	3.125
<b>Disagree</b>	2.911	3.000	3.480	3.125	3.482
<b>Neutral</b>	3.365	2.881	2.921	3.304	3.116
<b>Agree</b>	3.296	3.251	3.115	3.291	3.193
<b>Strongly agree</b>	3.595	3.311	3.395	3.041	3.415

Table 43: Composition of perception of consequences items

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<b>Health decrease Netherlands</b>	1	16	49	117	32
<b>Health decrease world</b>	1	8	34	133	39
<b>Standard of living decrease Netherlands</b>	3	39	81	68	24
<b>Standard of living decrease world</b>	2	23	74	84	32
<b>Decrease animal species Netherlands</b>	2	14	49	114	36
<b>Decrease animal species world</b>	1	6	37	124	47

Table 44: Influence of personal responsibility on DV

	Health decrease Netherlands	Health decrease world	Standard of living decrease Netherlands	Standard of living decrease world	Decrease animal species Netherlands	Decrease animal species world
<b>Strongly disagree</b>	4.750	4.750	3.917	4.750	3.542	
<b>Disagree</b>	3.202	3.262	3.255	3.417	2.708	3.050
<b>Neutral</b>	3.051	2.997	3.087	3.074	3.085	2.984
<b>Agree</b>	3.200	3.193	3.196	3.131	3.247	3.232
<b>Strongly agree</b>	3.583	3.517	3.684	3.674	3.555	3.461

Table 45: Composition of relatedness to nature items

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Nature1	2	2	18	119	74
Nature2	2	9	12	82	107
Nature3	8	22	77	85	23
Nature4	1	6	26	141	39
Nature5	1	8	30	95	79
Nature6	1	8	45	90	70
Nature7	8	33	84	68	22

Table 46: Influence of relatedness to nature on DV

	Nature1	Nature2	Nature3	Nature4	Nature5	Nature6	Nature7
<b>Strongly disagree</b>	2.500	3.750	2.964	4.000	2.500	2.500	3.905
<b>Disagree</b>	2.125	3.000	3.040	3.597	3.313	3.250	2.664
<b>Neutral</b>	3.074	3.188	3.246	3.000	2.771	3.050	3.106
<b>Agree</b>	3.165	3.133	3.163	3.168	3.221	3.155	3.442
<b>Strongly agree</b>	3.416	3.290	3.703	3.506	3.412	3.426	3.689

Table 47: Composition of external factors items

	Never	Rarely	Sometimes	Often	Always
<b>Family</b>	47	53	84	26	3
<b>Friends</b>	40	54	86	33	1
<b>Community</b>	54	78	64	17	1
<b>Culture</b>	72	58	55	23	6
<b>Education</b>	43	48	62	49	13
<b>Media</b>	25	30	93	62	5
<b>Government</b>	27	34	88	64	1
<b>Industry</b>	33	46	80	52	1
<b>NGO's</b>	36	46	84	44	1
<b>Economic incentives</b>	23	38	86	55	11
<b>Information</b>	19	30	78	76	11
<b>Feedback</b>	28	44	92	48	1
<b>Habits</b>	22	38	82	66	5

Table 48: Influence of external factors on DV

	Family	Friends	Community	Culture	Education
<b>Never</b>	3.183	3.075	3.211	3.171	3.183
<b>Rarely</b>	3.278	3.365	3.211	3.283	3.044
<b>Sometimes</b>	3.219	3.224	3.298	3.266	3.379
<b>Often</b>	3.237	3.174	3.059	3.138	3.135
<b>Always</b>	2.833	4.000	4.000	3.625	3.737
	Media	Government	Industry	NGO's	Economic incentives
<b>Never</b>	3.128	2.923	3.065	3.031	3.027
<b>Rarely</b>	3.090	3.294	2.874	3.076	3.169
<b>Sometimes</b>	3.307	3.324	3.410	3.401	3.311
<b>Often</b>	3.196	3.167	3.291	3.203	3.176
<b>Always</b>	3.600	4.250	3.250	2.750	3.341
	Information	Feedback	Habits		
<b>Never</b>	3.407	3.142	3.444		
<b>Rarely</b>	2.809	3.089	3.452		
<b>Sometimes</b>	3.173	3.146	3.045		
<b>Often</b>	3.338	3.531	3.216		
<b>Always</b>	3.598	5.000	3.717		

Table 49: Composition of subjective knowledge items

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<b>Environmental issues</b>	3	28	80	93	11
<b>Energy efficient products</b>	5	24	75	92	19



Table 50: Influence of subjective knowledge items on DV

	Environmental issues	Energy efficient products
Strongly disagree	2.167	2.317
Disagree	2.651	2.674
Neutral	3.297	3.129
Agree	3.403	3.408
Strongly agree	3.121	3.702

Table 51: Composition of objective knowledge items

	Wrong	Partially right	Right
Q1	51		144
Q2	67		128
Q3	86		109
Q4	13		182
Q5	24	5	166
Q6	17	75	103
Q7	34	66	95
Q8	165		30
Q9	75		120
Q10	50		145
Q11	36		159
Q12	26	64	104
Q13	97	63	34
Q14	16		178
Q15	43		151
Q16	24	68	102
Q17	25	78	91
Q18	111		83
Q19	38	92	64
Q20	65		129

Table 52: Values of quality measures for the regression model

	N	Minimum	Maximum	Mean	Std. Deviation
Cook's Distance	206	.00000	.04523	.0050435	.00770751
Standardized DFFIT	206	-.42857	.41952	.0001132	.14300745
Standardized DFBETA Intercept	206	-.22469	.30986	.0000564	.07104262
Standardized DFBETA Age	206	-.31854	.21310	-.0000193	.07201935
Standardized DFBETA Personal Conservation	206	-.19781	.33272	.0001125	.06683283
Standardized DFBETA Efficacy Worth	206	-.33321	.25111	-.0001871	.07355573

Table 53: Full regression coefficient table for model 4

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	.784	.337		2.325	.021	.119	1.448
Age	.087	.039	.144	2.230	.027	.010	.164
1 Personal conservation	.268	.080	.229	3.352	.001	.110	.425
Worth related self-efficacy	.295	.075	.262	3.918	.000	.147	.443

a. Dependent Variable: Total of all four dependent variables