Influence of the New Ecological Paradigm (NEP) and environmental concerns on pro-environmental behavioral intention based on the Theory of Planned Behavior (TPB)

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ABSTRACT

Humanity is in a situation in which climate change has a significant impact on all countries of the world. Countermeasures can mainly be taken through changes in people's behavior or through technical innovations (von Borgstede et al., 2013). This study aims to investigate the connection between attitude toward sustainable behavior in relation to the environment and climate and the intention to change the behavior regarding nature and environmental protection. Using a structural equation model with Lavaan (0.6–9) (Rossel, 2012) and a sample of 14,233 personal face-to-face interviews in Germany, this study analyzes the importance of the new ecological paradigm (NEP) and environmental concerns (EC) as factors influencing attitudes toward sustainable behavior in the context of the theory of planned behavior (TPB). It also measures attitude on intention to change the behavior regarding nature and environmental protection in the four areas of consumption, energy, food, and mobility. Egoistic environmental concerns and pessimistic view (based on NEP) were found to play the greatest impact on attitude toward sustainable behavior. The results show that the egoistic view has the strongest influence on attitudes toward sustainable behavior related to the environment and climate. Accordingly, behavior change can only be effective if the behavior change measures lead to personal consequences. The influence of attitude toward sustainable behavior on intention to change behavior has the largest effect on the areas of consumption and energy.

1. Introduction

Due to climate change, humanity is currently heading for a climate catastrophe, which will have a significant and tangible impact on all countries of the world. These changes do not only affect nature and its ecosystems, but above all have a significant impact on people's lives and living conditions. This has brought about a change in consumer lifestyles (Cherian and Jacob, 2012) with regard to consumer preferences toward

environment-friendly consumption and behavior (Akenji, 2012). Following Kim and Hall (2019) there is a scientific consensus that it is necessary to take active measures to, at least, mitigate climate change, including waste reduction (Ackerman, 2000; Vorobeva et al., 2022), dietary changes (C. Chen et al., 2019; Korkala et al., 2014), energy and resource conservation (Han and Schaefer, 2012; Kabisch et al., 2016; Kubat and Gürhan-Canli, 2016; von Borgstede et al., 2013), and a fundamentally low-carbon lifestyle (Zeng et al., 2022). Basically, two

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categories of interventions can be distinguished as countermeasures to climate catastrophe: Changes in human behavior or technical innovations. This awareness has also already reached society (Kim and Hall, 2019), and is also reflected in the study by von Borgstede et al. (2013). The investigation shows that from 2005 to 2010 the opinion from people shifted. In 2005 people were convinced, that the development of new technologies to mitigate global warming is most important. Whereas the results in 2010 showed that the majority believes that lifestyle changes are more important than development of new technologies (von Borgstede et al., 2013, p. 187). People are aware of the costs and benefits of their behavior for the ecosystem or biosphere (Lai and Cheng, 2016; T. T. M. Nguyen et al., 2019). Costs and benefits must always be seen as a trade-off in this respect. That is, an environmentally friendly change in behavior with benefits for the environment is usually also always associated with personal restrictions and thus with costs. According to Diekmann and Preisendörfer (2003) the costs or sacrifices that come with a change in behavior can be divided into low and high cost behavior. For example, it is argued that for most there is a large cost difference (in terms of behavioral sacrifice) between using public transport and using a private car, while the majority perceive the cost difference between filling up the dishwasher completely or turning off lights in rooms where no one is present to be much smaller (von Borgstede et al., 2013, p. 183). In order to investigate the factors behind the change in behavior, the theory of planned behavior (TPB) (Ajzen, 1991) is a suitable approach. The TPB is concerned with human behavior and is already widely accepted in the field of environmental behavior research whereby sustainable and environmentally conscious behavior are examined. Numerous studies examine different individual areas of life regarding environmentally conscious behavior using TPB. Based on the current state of research, the areas of life considered in the existing studies can be categorized as follows: consumption, energy, food, and mobility. An important factor here is the individual attitude towards sustainable behavior, which according to the TPB is substantially responsible for the behavior. Therefore, it is important to examine the factors that drive attitudes toward sustainable behavior. Two well-established research approaches to measure these drivers are the new ecological paradigm (NEP) (Dunlap et al., 2000) and environmental concerns (EC) (Schultz, 2001; Stern and Dietz, 1994).

Currently, as can be seen from the overview of the state of research in the areas of consumption, energy, food, and mobility shown in Tables 1–4, only individual areas of life are considered per study. Thus, there is a lack of studies that look at multiple areas of life simultaneously. One quality criterion of theoretical models in research is the generalizability of the results. Therefore, it is necessary to investigate all areas of life simultaneously in one study. Another research gap is the unreliable measurement of EC and NEP in the literature. Both constructs are used in current behavioral research on sustainability and environmental protection, along with the TPB. However, there is disagreement as to whether the concepts of EC and NEP should be measured as a unidimensional factor measurement or multidimensional factor measurement. In addition, the terminology and content of the two theoretical concepts are not clearly defined in literature and do not have clear boundaries. In some cases, they are even used synonymously (Fransson and Gärling, 1999). However, in initial research on these two concepts, clear terminologies and differences can be derived. EC deal with the respective consequences of environmental problems for the individual people themselves (egoistic), their fellow human beings (altruistic) as well as for plants and animals (ecological) (Schultz, 2001; Schultz et al., 2005; Stern and Dietz, 1994). Whereas NEP is more of a holistic ecological worldview with five assumed facets: limits to growth, anti-anthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an ecocrisis (Dunlap et al., 2000, p. 428).

This study focuses on investigating the impact of NEP and EC on attitude toward sustainable behavior theoretically and empirically. On the one hand, both concepts are considered in the study because of their clearly differing terminologies and content. In addition, it will be examined whether the concepts are one-dimensional or multidimensional in their structure. Furthermore, four areas of life are explored to enable the measurement of the intention to change behavior regarding nature and environmental protection in a general setting. The influence of NEP and EC on attitudes against sustainable behavior is theoretically derived through extensive literature research and empirically tested with a large database using structural equation modeling. The dimensionality of the constructs NEP and EC are examined by extracting the linear correlations of the observed variables using PCA prior to structural equation analysis. It is expected that the results will show in which areas people find it particularly easy to change their sustainable behavior and where willingness to change needs to be encouraged more. In addition, the strength of influence of the different variables influencing attitudes toward sustainable behavior should provide information to explain the causes of the intention to change behavior. In the following chapter, the theoretical background is explained. The original components of the TPB (perceived behavior control, subjective norm, attitude, and behavioral intention) are explained and applied to the context of sustainable behavior. Then, the relevance of the TPB for the topic of sustainable behavior and its fundamentals are explained and the application in the four areas of consumption, energy, food, and mobility. The current state of research in the four areas of life is examined and tabulated (Tables 1–4). Hypotheses 1 to 4 of the TBP basic model are then theoretically derived. Subsequently, the TPB is expanded to include other necessary factors influencing attitude toward sustainable behavior. For this purpose, the theoretical considerations and the current state of research regarding EC (egoistic environmental concerns, social altruistic concerns, biospheric concerns) and NEP are presented, and the hypotheses 5 to 8 are derived from them. Next, the research methodology is presented, including data collection and sampling, as well as measure development. Subsequently, the research model is calculated with covariance-based structural equation modeling (CB-SEM), including hypothesis tests. Finally, the results are discussed. This discussion includes the procedure in the research process, the summary of the results, the contribution to theory and practice, and the identification of aspects that remained open and starting points for further research. The novelty of the study includes three aspects. First, in view of their significantly differing terminologies and content, both concepts EC and NEP are considered in the study. In measuring EC and NEP, it will be clarified whether each is a unidimensional factor or multidimensional factor. For a generalization of the results, a total of four areas of life will be examined with regard to the intention to change the behavior regarding nature and environmental protection. For a better overview, Fig. 1 shows the further process.
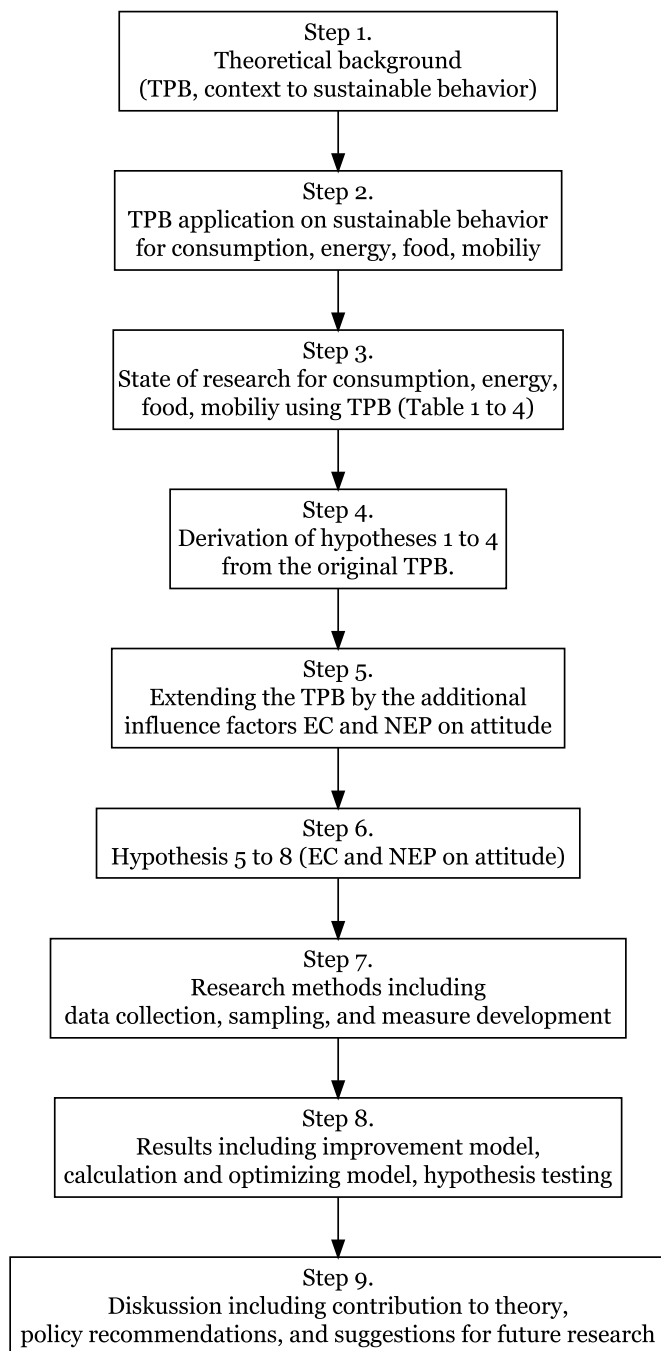
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│            Step 1.                   │
│       Theoretical background         │
│ (TPB, context to sustainable behavior)│
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│            Step 2.                   │
│   TPB application on sustainable behavior │
│  for consumption, energy, food, mobiliy │
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│            Step 3.                   │
│  State of research for consumption, energy, │
│  food, mobiliy using TPB (Table 1 to 4) │
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│            Step 4.                   │
│   Derivation of hypotheses 1 to 4    │
│      from the original TPB.          │
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│            Step 5.                   │
│     Extending the TPB by the additional │
│  influence factors EC and NEP on attitude │
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│            Step 6.                   │
│   Hypothesis 5 to 8 (EC and NEP on attitude) │
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│            Step 7.                   │
│      Research methods including      │
│ data collection, sampling, and measure development │
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│            Step 8.                   │
│   Results including improvement model, │
│ calculation and optimizing model, hypothesis testing │
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│            Step 9.                   │
│  Diskussion including contribution to theory, │
│ policy recommendations, and suggestions for future research │
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Fig. 1. Flowchart of the process.

2. Theoretical background and hypothesis development

Recent publications are concerned with different kinds of environmental behavior, such as the reduction of meat consumption as pro-environmental behavior (Çoker and van der Linden, 2020; Dupont et al., 2022), environmentally sustainable food purchase and consumption (Weber et al., 2020; Wongsaichia et al., 2022), and cultural influences on pro-environmental consumer behavior (Chwialkowska et al., 2020).

In the overview of the state of research regarding pro-environmental and sustainable behavior (Tables 1–4), it can be seen that all of these studies use the Theory of Planned Behavior (TPB) (Ajzen, 1991). The TPB originally focuses on human behavior in general across situations. Later it was applied to more specific subjects such as food consumption (Ajzen, 2015) and the choice of leisure (Ajzen and Driver, 1992). These applications show that the TPB is a well-established theory to predict behavior by intention. The TBP uses the confirmatory view, which can be assigned to critical rationalism. It can be seen as a basic behavioral model that can be extended in a goal-oriented way depending on the subject. This approach is particularly characterized by the planned behavior of the persons, which is to be uncovered here in the investigation. A moral or ethical view could possibly lead to different results with regard to sustainable environmentally conscious and climate-friendly behavior. The TPB (Ajzen, 1991) is based on the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975b). Its focus lies on the intention to perform a given behavior, stating that the stronger the intention to perform a behavior, the higher the probability that it will actually be performed. Intention summarizes the motivating factors that influence behavior. The motivating factors indicate how great the willingness of a person is to make an effort for certain behavior. However, this theory supposes that a behavior is performed consciously and willingly, namely that a person can decide to perform a behavior or not. However, behavior also depends, at least to a certain degree, on non-motivational factors like opportunities and resources, e.g., money and skills (Ajzen, 1991, p. 182). Therefore, the TPB is extended by perceived behavior control as a non-motivational influence on behavior (Ajzen, 1991). It is stated that motivation (intentions) and ability (behavioral control) can contribute significantly to the prediction of behavior, depending on the subject of interest (Ajzen, 1991). In the literature on the TPB, behavioral intention is shown to be a significant predictor of use behavior (Sheppard et al., 1988b, p. 336; Taylor and Todd, 1995, p. 165; Venkatesh et al., 2003, p. 456). This is not always the case with behavioral control (investigated by Venkatesh et al. (2003) as facilitating conditions, pp. 453 & 454), depending on the context of the study. Intention, on the other hand, always exhibits positively significant correlations with actual use behavior. The study aims to investigate the intention to change behavior. Since intention refers to future behavior, this excludes measurement for actual behavior. For this reason, the object of study is not actual use behavior but the intention to use in terms of intention to change behavior.

Although the intention may not always result in behavior, many studies show that intention represents a valid predictor for behavior concerned with different subjects of behaviors (Ajzen, 2005; Ajzen and Fishbein, 1980; Armitage and Conner, 2001; Sheppard et al., 1988). Sustainable behavior can apply to numerous areas of life. In order to analyze the intention to change the behavior regarding nature and environmental protection as a target variable for different areas of life, it is convenient to examine those areas, namely consumption, energy, food, and mobility. Since behavioral intention plays a central role in TPB, the influencing factors of TPB (Ajzen, 1991), attitude toward sustainable behavior, subjective norm, and perceived behavioral control on intention to change the behavior regarding nature and environmental protection are examined in the following. In a second step, the influence of subjective norm, EC, and NEP on attitude toward sustainable behavior is investigated.

2.1. TBP within the framework of intention to change the behavior regarding nature and environmental protection

The TPB defines attitude as one out of three factors directly influencing intention to behave. Attitude refers to the extent to which a person evaluates the investigated behavior as favorable or unfavorable (Ajzen, 1991). According to the expectancy-value model of attitudes (Fishbein and Ajzen, 1975a), attitudes develop from beliefs people have about the objects the attitude is concerned with. Beliefs are formed by associating certain attributes with the considered object. Concerning attitude toward a behavior, each belief connects the considered behavior to a certain outcome expected from this behavior. Since the attributes are already valued either positively or negatively, people "automatically and simultaneously acquire an attitude toward the behavior" (Ajzen, 1991, p. 191; Fishbein, 1963; Fishbein and Ajzen, 1975a). Thus, in terms of climate and environmentally friendly behavior, attitude is concerned with the evaluation of sustainable behavior in relation to the environment and climate. If people believe that sustainable behavior positively affects the environment and climate, they have a positive attitude toward this.

The second factor in TBP represents the subjective norm. Subjective norm is defined by Ajzen (1991) as a social factor that is concerned with the social pressure with regard to performing or not performing the behavior under consideration. In terms of climate and environmentally friendly behavior, subjective norm is concerned with opinions of people in the social environment of the respondent with regard to the sustainable behavior of the respondent. If the respondents' social environment has a positive opinion and attitude about the respondents behaving climate and environmental-friendly this positively influences and supports the respondents' mindset.

The third factor in the TBP is the perceived behavioral control. Perceived behavioral control is concerned with how easy or difficult the respondents assess the behavior under consideration based on past experience as well as anticipated difficulties and obstacles (Ajzen, 1991). Regarding climate and environmental-friendly behavior, perceived behavioral control is concerned with how easy or hard respondents perceive environmental and climate-friendly behavior for themselves. If people evaluate sustainable behavior as challenging to conduct, they are less likely to behave in an environment and climate-friendly way. However, if they perceive environmentally and climate-friendly behavior as easy to implement and integrate into their daily lives, respondents are more likely to actually behave that way. Bamberg (2003) also notes that it is important to consider perceived behavioral control in relation to environmentally related behaviors because many behaviors have difficulty in execution, thereby interfering with actual conscious and volitional intent.

The following Tables 1–4 provide an overview of the state of research in the field of climate and environmentally friendly behaviors with studies that refer to the TPB as a theoretical basis. These are based on the meta-studies by Fleșeriu et al. (2020) and X. Zhang and Dong (2020) and were supplemented by other literature. The literature search took place between November 2021 and February 2022. The keywords sustainable behavior, behavioral intention, ecological behavior, ecological concerns, NEP, TPB, nature, and environmental protection were used for the research. The content of the following EBSCO-owned databases was included as a research tool via FOM University: Business Source Premier, EconLit, APA PsycArticles, PSYNDEX, Medline, CINAHL, Engineering Source, GreenFILE as well as content from the IEEE Xplore digital

Table 1
State of research in the field of consumption.

Consumption	Influencing factors on intention			
	AT	SN	PBC	Content of intention
Author (Year)				
Gadenne et al. (2011)	x	–	–	environmental behavior* areas (green consumption, recycling and household habits).
Harland et al. (1999)	x	x	x	(1) use unbleached paper (2) reduce meat consumption
		n.s. (5)	n.s. (2)	(3) use other transport forms than car
				(4) use energy-saving light bulbs
				(5) turn off faucet while brushing teeth - Netherlands
Lavuri (2022)	x	x	x	purchase green goods
		n.s.		
Mohd Suki (2016)	–	x	–	purchase of green products
M. T. T. Nguyen et al. (2019)	x	x	x	purchase with regard to green apparel products in Vietnam
Qin and Song (2022)	x	x	x	purchase green products
Sreen et al. (2018)	x	x	x	purchase green products

Notes. AT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control. n.s. = not significant. Ind = indirect effect. - = not measured. *In each case, the outcome variable was behavioral intention, except in Gadenne et al. (2011).

Table 2
State of research in the field of energy.

Energy	Influencing factors on intention			
	AT	SN	PBC	Content of Intention
Author (Year)				
Ali et al. (2019)	x	n.s.	x	purchase energy-saving household products
Bamberg (2003)	x	x	x	use the offered brochure about green electricity products
Bhutto et al. (2020)	x	x	x	purchase energy-efficient appliances- Pakistan
Daiyabu et al. (2022)	x	x	x	invest in renewable energy
			n.s.	
Hossain et al. (2022)	x	x	x	purchase energy-efficient appliances
Li et al. (2018)	x	x	x	willingness to pay for green housing
Liao et al. (2020)	x			energy-saving
Ong et al. (2022)	x	x	x	switch to Bataan power plant (nuclear power)
Tan et al. (2017)	x	n.s.	x	energy-efficient household appliances

Notes. AT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control. n.s. = not significant. Ind = indirect effect. - = not measured.

Table 3
State of research in the field of food.

Food	Influencing factors on intention			
	AT	SN	PBC	Content of Intention
Author (Year)				
Asif et al. (2018)	x	x	x n.s. (1&2)	purchase organic food -(1) Pakistan, (2) Turkey, (3) Iran
Bagher et al. (2018)	x	x	x	purchase organic food - Iran
Canova et al. (2020)	x	x	x	(1) purchase of organic food (2) purchase of fresh organic fruit and vegetables - Italy
Dupont et al. (2022)	x (ind.)	x	x	consume cultured meat burger
M.-F. Chen (2007)	x	x	x	purchase organic food - Taiwan
Fleșeriu et al. (2020)	x	x	x	buy organic food - Romania
Irianto (2015)	x	x	–	purchase organic food - Indonesia
Laureti and Benedetti (2018)	x	x	x	purchasing behavior* toward organic food products - Italy
Maichum et al. (2016)	x	x	x	purchase green products - Thailand
Paul et al. (2016)	x	n.s.	x	purchase green products - India
Singh and Verma (2017)	x	x	–	purchase organic food - India
Tarkiainen and Sundqvist (2005)	x	x (ind.)	–	buy organic food - Finland
Thøgersen and Zhou (2012)	x	–	x	intention to buy organic vegetables- China
Tuan and Vinh (2016)	x	x	x	purchase organic food - Vietnam
X. Wang et al. (2019)	x	x	x n.s. (2)	purchase organic food -(1)Tanzania, (2)Kenya
Weber et al. (2020)	x	x	x	eat sustainable - Germany
Wongsaichia et al. (2022)	x	x	x	purchase green food
Yadav and Pathak (2016)	x	n.s.	x	purchase organic food - India

Notes. AT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control. n.s. = not significant. Ind = indirect effect. - = not measured. *In each case, the outcome variable was behavioral intention, except in Laureti and Benedetti (2018).

Table 4
State of research in the field of mobility.

Mobility	Influencing factors on intention			
	AT	SN	PBC	Content of Intention
Author (Year)				
Ambak et al. (2016)	x	–	–	usage of electric cars as a greener alternative to fuel- powered vehicles among commuters - Malaysia
Acheampong and Siiba (2020)	n.s.	–	–	usage of car-sharing services - Ghana
Bamberg et al. (2003)	x	x	x	usage of bus with prepaid bus ticket among college students
S.-Y. Chen (2016)	–	x	x n.s. (2)	reuse of public bike system (1) users and (2) non-user
C.-F. Chen and Chao (2011)	x	x	x	switch to public transit
Donald et al. (2014)	x (ind.)	x (ind.)	x (ind.)	usage of (1) car or (2) public transportation to commute to work
Dudenhöffer (2013)	–	x	–	use plug-in electric vehicles
Fazel (2014)	n.s. (ind.)	x (ind.)	–	use electromobility
Haustein and Jensen (2018)	x	x	x	usage of or buying a battery-electric car
Hsiao and Yang (2010)	x	x	x	choose high speed rail while participating in long-distance travel among domestic students touristic travelers
Jamšek and Culiberg (2020)	–	x	–	loyalty of bike-sharing system
Liu et al. (2020)	–	x	–	usage of autonomous electric vehicles
Moons and De Pelsmacker (2012)	x	x	x	usage of electric car -Belgium
Moons and De Pelsmacker (2015)	x	x	n.s.	usage of electric car -Belgium
Oliver and Lee (2010)	–	x	–	purchase a hybrid car – (1) USA, (2) Korea
Qin and Song (2022)	x	x	x	green transportation behavior
Schmalfuβ et al. (2017)	–	x	x	purchase a battery electric vehicle - Germany

Notes. AT = Attitude; SN = Subjective Norm; PBC = Perceived Behavioral Control. n.s. = not significant. Ind = indirect effect. - = not measured.

Library, the ACM Digital Library and SpringerLink. Only studies with TPB related to sustainability were considered as selection criteria.

Topics for the measurement of sustainable behavior in everyday life among consumers were taken from a working paper by Hempel et al. (2019). The items generated from this were examined in a study by Gansser and Reich (2021) with regard to their structure. As a result, four areas of life could be identified. Consequently, the state of research was also divided into these four areas with the studies on TPB in connection with sustainability.

2.2. Hypotheses development

Based on the theoretical background and the overview of the study results from Tables 1–4, the hypotheses are derived below. For this

purpose, the current state of research is analyzed separately for the four areas of life.

2.2.1. Attitude

Attitude refers to "the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question" (Ajzen, 1991, p. 188). It is stated by Ajzen (1991) that "the more favorable the attitude with respect to a behavior, the stronger should be an individual's intention to perform the behavior under consideration" (Ajzen, 1991, p. 188). In relation to behavior in nature and environmental protection, attitude is concerned with the individual's attitude in relation to sustainable behavior in relation to the environment and climate of himself. If the respondent has a positive attitude toward sustainable behavior, this positively influences and supports the

respondent's intention to change the behavior regarding nature and environmental protection.

Consumption - M. T. T. Nguyen et al. (2019) examine factors that drive young Vietnamese consumers' purchase intention with regard to green apparel products. Attitude showed significant impact on green apparel purchase intention. Harland et al. (1999) investigate five environmental relevant behaviors (use unbleached paper, reduce meat consumption, use other transport form than car, use energy-saving light bulbs, turn off faucet while brushing teeth). It shows that attitude has a significant impact on intention in all five areas studied. Gadenne et al. (2011) investigate antecedents on environmental behaviors. The results show that environmental behavior attitude is significantly influencing the three examined environmental behavior areas (green consumption, recycling and household habits). The study by Sreen et al. (2018) is concerned with green purchase intention. Attitude towards green products reveals as significant influence factor. The recent study by Lavuri (2022) investigates millennials' purchasing intentions toward eco-sustainable products in India as an emerging market. Attitude showed as significant influence factor on the intention. Another study from the year 2022 by Qin and Song (2022) shows that attitude significantly influences Chinese consumers' sustainable consumption behavior.

Energy - In the study by Bamberg (2003) attitude showed the strongest significant direct influence on intention in the total sample with regard to a brochure about green electricity products. Ali et al. (2019) are examining consumers' intention to purchase energy-saving household products. Attitude showed significant impact on the purchase intention. The study by Liao et al. (2020) investigates the energy-saving intention. It shows that environmental attitude has a significant influence. Bhutto et al. (2020) are concerned with consumers' intentions in Pakistan to purchase energy-efficient appliances. Attitude shows significant influence on purchase intention. Li et al. (2018) examine the willingness to pay for green housing. The use of green buildings is perceived as an important approach of improving the living environment, reduce energy consumption of building, and solve energy problems. Here, individual attitude shows as significant influencing factor. The study by Tan et al. (2017) is investigating factors that influence consumers' purchase intention for energy-efficient household appliances. Attitude shows significant influence. Hossain et al. (2022) examine consumers' purchase intention for energy-efficient household appliances. The results show that attitude significantly influences the purchase intention. The investigation conducted by Daiyabu et al. (2022) examines the conventional energy stakeholders' investment intention into renewable energy in Nigeria. It shows that attitude has a significant impact on the intention to invest. The study by Ong et al. (2022) is concerned with nuclear power in terms of a renewable energy sources. The switching intention to this energy source is investigated in the Philippines. The results show that attitude is a significant influencing factor.

Food - Weber et al. (2020) investigated attitude towards sustainable nutrition. Thereby, attitude also revealed as the most important factor influencing the examined intention to eat sustainable. Canova et al. (2020) conducted two studies. The first with regard to the purchase of organic food and the second one with regard to the purchase of fresh organic fruit and vegetables. For both studies attitude revealed to be the most important predictor of intention. The study by Fleşeriu et al. (2020) also revealed attitude as the most important predictor for the examined buying intention for organic food. In the investigation by Laureti and Benedetti (2018) on Italian purchasing behavior of organic food production, attitude showed as a relevant influence factor. Tarkiainen and Sundqvist (2005) investigated Finnish consumers' intention to buy organic food. Here, attitude showed the strongest influence on the buying intention. The intention to purchase organic food in Taiwan was examined by M.-F. Chen (2007). The result shows that attitude contributes significantly to the determination of the purchase intention. The study by Thøgersen and Zhou (2012) on Chinese consumers' willingness

to adopt sustainable lifestyle elements as organic food showed attitude as a strong influencing factor on the intention to buy organic food. The investigation by Irianto (2015) considers the intention to purchase organic food in Indonesia. Here attitude showed a significant influence on the intention to purchase organic food. Yadav and Pathak (2016) examined consumer's intention to purchase organic food in the context of India as a developing nation. It shows that attitude is positively determining the purchase intention of organic food. Tuan and Vinh (2016) show that consumer attitude towards organic food has significant impact on consumers' purchase intention in the organic food market in Vietnam. Singh and Verma (2017) study factors influencing the actual organic food buying behavior in India. They find that attitude towards organic food shows significant impact on the purchase intention. Bagher et al. (2018) investigate factors affecting the intention to purchase organic food products among Iranian consumers. Attitude towards organic food production revealed as a significant influencing factor on the intention to purchase organic food products. The comparative study by Asif et al. (2018) examines influencing factors on the purchase intention of organic food in Pakistan, Turkey, and Iran. It showed that for Pakistan attitude represents the most important predictor for the purchase intention of organic food. For Turkey and Iran attitude is the second most important influencing factor. X. Wang et al. (2019) also compares two countries: Tanzania and Kenya with regard to factors that influence the purchase intention concerning organic food. Here, personal attitude showed as the most important influencing factor and as least important in Tanzania. Paul et al. (2016) are concerned with Indian consumers' green product purchase intention. Attitude showed the highest influence. Maichum et al. (2016) investigated consumers' purchase intention towards green products in developing countries on the example of Thailand. Attitude showed the highest impact on purchase intention. Dupont et al. (2022) examine the acceptance of cultured meat in Germany. The results show that general attitudes towards cultured meat indirectly and the specific attitudes towards a cultured meat burger more in detail directly, both significantly influence the intention to consume cultured meat burger. The study by Wongsaichia et al. (2022) is concerned with green eating behaviors in Thailand. The results show that attitude has a significant effect on the purchase intention of green food for green and non-green consumers.

Mobility - In the investigation by Moons and De Pelsmacker (2012) on the intention to use an electric car attitude towards the electric car reveals as the strongest predictor of usage intention. They conducted a further study Moons and De Pelsmacker (2015) with the aim to predict the usage intention of electric cars. Here, attitude also showed significant influence. According to Ambak et al. (2016) in Malaysia public transportation does not meet the generals needs of commuter. Thus, they aim to identify the factors that impact drivers' intention to use electric cars as a greener alternative to fuel-powered vehicles among commuters. The results reveal that attitude shows strong significant impact on the behavioral intention. The study by Acheampong and Siiba (2020) is concerned with car-sharing among young adults in Ghana. The results show that neither environmental attitude nor technology attitude have significant effect on the examined intention to use car-sharing services. Haustein and Jensen (2018) examine factors of battery electric car adaption. They distinguish between symbolic (higher status, openness for new ideas & technologies, environmental and social values) and affective (enhanced driving experience by higher acceleration, smoothness, low noise) attitude. Both showed significant impact on the intention to use or buy a battery electric car. Hsiao and Yang (2010) investigate domestic students touristic travelers' willingness to take Taiwan's high-speed rail instead of using private cars. Attitude showed the strongest significant influence on the intention to choose high speed rail while participating in long-distance travel. Bamberg et al. (2003) are concerned with the effect of the introduction of a prepaid bus ticket on the bus use among college students. It shows that attitude with respect to bus use has significant influence on the intention to take the bus. The study by Donald et al. (2014) is interested in the most important factors

impacting whether participants drive or use public transportation to commute to work. The results showed that attitude is a significant indirect predictor (via intention/via habit) for both car and public transport behavior. C.-F. Chen and Chao (2011) examine the switching intentions toward public transit. For the whole sample attitude showed significant impact. The investigation by Qin and Song (2022) studies green transportation behavior. Attitude reveals as a significant influencing factor.

These studies explaining the influence of attitudes towards sustainable behavior on intention to change the behavior regarding nature and environmental protection lead to propose the following hypothesis:

H1. A higher attitude toward sustainable behavior in relation to the environment and climate leads to an increase in the intention to change the behavior regarding nature and environmental protection.

2.2.2. Subjective norm

Subjective norms is defined by Ajzen (1991) as a social factors that is concerned with the social pressure with regard to perform or not to perform the behavior under consideration.

In relation to behavior in nature and environmental protection, the subjective norm is concerned with opinions of the social environment of the respondents in relation to the sustainable behavior of the respondents. If the respondents' social environment has a positive opinion and attitude about the respondents' behavior with regard to nature and environmental protection, this positively influences and supports the respondents mind set.

Consumption - M. T. T. Nguyen et al. (2019) examine factors that drive young Vietnamese consumers' purchase intention with regard to green apparel products. Subjective norm showed significant impact on green apparel purchase intention. Harland et al. (1999) investigate five environmental relevant behaviors (use unbleached paper, reduce meat consumption, use other transport form than car, use energy-saving light bulbs, turn off faucet while brushing teeth). It emerges that the subjective norm has a significant influence on intention in the four areas studied (not significant for: turn off faucet while brushing teeth) and only stayed significant after adding personal norm for the area: use other transport form than car. The study by Mohd Suki (2016) is concerned with consumer environmental concerns as expressed through the purchase of green products. It shows that social value has the highest impact and is therefore the most dominant factor with regard to purchase green products. The study by Sreen et al. (2018) is concerned with green purchase intention. Subjective norm regarding green products reveals as significant influence factor. The recent study by Lavuri (2022) investigates millennials' purchasing intentions toward eco-sustainable products in India as an emerging market. Here subjective norm did not show as significant influence factor on the purchase intention. The investigation by Qin and Song (2022) shows that subjective norm significantly influences Chinese consumers' sustainable consumption behavior.

Energy - Ali et al. (2019) are examining consumers' intention to purchase energy-saving household products. Subjective norm does not show significant impact on the purchase intention. Bhutto et al. (2020) are concerned with consumers' intentions in Pakistan to purchase energy-efficient appliances. Subjective norm shows significant influence on purchase intention. Li et al. (2018) examine the willingness to pay for green housing. The use of green buildings is perceived as an important approach of improving the living environment, reduce energy consumption of building, and solve energy problems. Here, group pressure shows as significant influencing factor. The study by Tan et al. (2017) is investigating factors that influence consumers' purchase intention for energy-efficient household appliances. Subjective norm does not show significant influence. In the study by Bamberg (2003) subjective norm showed the second strongest direct significant influence on intention to use the offered brochure about 'green' electricity products in the total sample. Hossain et al. (2022) examine consumers' purchase intention

for energy-efficient household appliances. The results show that subjective norm significantly influences the purchase intention.

The investigation conducted by Daiyabu et al. (2022) examines the conventional energy stakeholders' investment intention into renewable energy in Nigeria. It shows that subjective norm has a significant impact on the intention to invest. The study by Ong et al. (2022) is concerned with nuclear power in terms of a renewable energy sources. The switching intention to this energy source is investigated in Philippines. The results show that subjective norm is a significant influencing factor.

Food - The investigation by Laureti and Benedetti (2018) on Italian purchasing behavior of organic food production revealed subjective norm as a relevant influence factor. M.-F. Chen (2007) examined consumers' intention to purchase organic food in Taiwan whereby subjective norm contributes significantly to the purchase intention. The investigation by Irianto (2015) considered the intention to purchase organic food in Indonesia. Here subjective norm showed a significant influence on the intention to purchase organic food. Yadav and Pathak (2016) examined consumer's intention to purchase organic food in the context of India as a developing nation. In their investigation subjective norm failed to show significant influence on the purchase intention of organic food. Tuan and Vinh (2016) show that subjective norm has significant impact on consumers' purchase intention in the organic food market in Vietnam. Singh and Verma (2017) study factors influencing on actual organic food buying behavior in India. They find that subjective norm shows significant impact on attitude towards organic food. Bagher et al. (2018) investigate factors affecting the intention to purchase organic food products among Iranian consumers. Subjective norm revealed as a significant influencing factor on the intention to purchase organic food products. The comparative study by Asif et al. (2018) examined influencing factors on the purchase intention of organic food in Pakistan, Turkey, and Iran. It showed that for Turkey subjective norm represents the most important predictor for the purchase intention of organic food. For Pakistan and Iran subjective norm revealed as second most important factor. The comparison of Tanzania and Kenya by X. Wang et al. (2019) shows subjective norm as second most important factor (from the model part of the theory of planned behavior) in Kenya with regard to organic food purchase intention. In Tanzania subjective norm represents the most important influencing factor. Paul et al. (2016) are concerned with Indian consumers' green product purchase intention. Subjective norm showed no significant influence on the purchase intention. Maichum et al. (2016) investigated consumers' purchase intention towards green products in developing countries on the example of Thailand. Subjective norm showed the lowest impact on purchase intention. For the first study conducted by Canova et al. (2020) subjective norm showed the lowest influence with regard to the purchase of organic food. In the second study subjective norm showed as the second highest influence on the intention to purchase of fresh organic fruit and vegetables. In the study by Fleşeriu et al. (2020) subjective norm also revealed as the second most important predictor for the examined buying intention for organic food. Weber et al. (2020) investigated intention to eat sustainable. Here, subjective norm revealed as the least important factor. Dupont et al. (2022) examine the acceptance of cultured meat in Germany. The results show that subjective norm towards a cultured meat burger significantly influences the intention to consume cultured meat burger. The study by Wongsaichia et al. (2022) is concerned with green eating behaviors in Thailand. The results show that subjective norm has a significant effect on the purchase intention of green food for green and non-green consumers.

Mobility - In the investigation by Moons and De Pelsmacker (2012) in Belgium on the intention to use an electric car subjective norm shows significant influence on usage intention. They conducted a further study (Moons and De Pelsmacker, 2015) with the aim to predict the usage intention of electric cars. Here, they distinguished between subjective norm peers and subjective norms media whereby both showed significant influence. The study by Dudenhöffer (2013) aims to investigate the acceptance of electric vehicles. It is argued that subjective norm has a

positive effect on the intention to use plug-in electric vehicles because it is stated that especially car usage is often related to social status, and social comparison. The results show a significant positive influence of social norm on the behavior intention after the consumers conducted test drives with the electric vehicles. Oliver and Lee (2010) examined consumers' intention to purchase a hybrid car perceived as a high involvement, environmentally friendly product. Here, social influence also showed a positive significant influence on the intention to purchase a hybrid car in the two countries under investigation (USA and Korea). Fazel (2014) studied the acceptance of electromobility. Here an indirect effect of subjective norm on behavior intention showed mediated by perceived usefulness. The study by Jamšek and Culiberg (2020) is concerned with bike-sharing systems. Sustainable subjective norms showed significant positive impact on the loyalty of bike-sharing. Liu et al. (2020) examine the adoption of robo-taxis as shared autonomous electric vehicles. It is pointed out that with regard to sustainability they have the potential to reduce traffic congestions and fuel consumption as well leading to a reduction of parking issues. Parking demand can for example be reduced by the possibility empty cruising vehicles and the reduction of needed vehicles by shared rides (W. Zhang et al., 2015). Ride sharing refers to a type of transportation in which individual passengers, who have analogous travel routes and identical schedules, drive the same car for example to work or school, or for travelling and share transportation costs, such as fuel costs, parking fees, and tolls (Y. Wang et al., 2020).

The results of Liu et al. (2020) show that social influence has a strong significant impact on the investigated behavior intention with regard to the usage of autonomous electric vehicles. Haustein and Jensen (2018) examine factors of battery electric car adaption. It showed that subjective norm is a significant influencing factor in the users intention to buy or use a battery electric car. Hsiao and Yang (2010) investigate domestic students touristic travelers' willingness to take Taiwan's high speed rail instead of using private cars. Subjective norm showed significant influence on the intention to choose high speed rail while participating in long-distance travel. Bamberg et al. (2003) are concerned with the effect of the introduction of a prepaid bus ticket on the bus use among college students. It shows that subjective norm with respect to bus use has significant influence on the intention to take the bus. The study by Donald et al. (2014) is interested in the most important factors impacting on whether participants drive or use public transportation to commute to work. The results showed that subjective norm is a significant indirect predictor (via intention/via habit) for both car and public transport behavior. Schmalfuβ et al. (2017) state that battery electric vehicle can contribute to the realization if more sustainable mobility systems. It shows that subjective norm has significant impact on the examined willingness to purchase a battery electric vehicle. S.-Y. Chen (2016) are examining the green loyalty to a public bike system. Subjective norm shows significant influence for both public biker users and non-user. C.-F. Chen and Chao (2011) examine the switching intentions toward public transit. For the whole sample subjective norm showed significant impact. The investigation by Qin and Song (2022) studies green transportation behavior. Subjective norm reveals as a significant influencing factor.

These studies explaining the influence of subjective norm on intention to change the behavior regarding nature and environmental protection lead to propose the following hypothesis:

H2. A higher subjective norm leads to an increase in the intention to change the behavior regarding nature and environmental protection.

2.2.3. Perceived behavior control

Perceived behavioral control is concerned with how easy or difficult the respondent assesses the behavior under consideration based on past experience as well as anticipated difficulties and obstacles (Ajzen, 1991). With regard to climate and environmental friendly behavior perceived behavioral control is concerned with how easy or hard a

respondents perceives to protect nature and the environment for himself. When people perceive sustainable behavior as difficult to implement, they are less likely to engage in nature and environmental advocacy. However, if they perceive an environment and climate friendly behavior as simple to implement and easy to integrate into their daily lives, respondents are more likely to actually behave this way.

Consumption - M. T. T. Nguyen et al. (2019) examine factors that drive young Vietnamese consumers' purchase intention with regard to green apparel products. Perceived behavior control of public bikes shows significant impact on green apparel purchase intention. Harland et al. (1999) investigate five environmental relevant behaviors (use unbleached paper, reduce meat consumption, use other transport form than car, use energy-saving light bulbs, turn off faucet while brushing teeth). It shows that behavioral control (independent of considering personal norm or not in the model) showed significant impact on intention on four areas under investigation (not significant for: reduce meat consumption). The study by Sreen et al. (2018) is concerned with green purchase intention. Perceived behavior control with regard to green products reveals as significant influence factor. The recent study by Lavuri (2022) investigates millennials' purchasing intentions toward eco-sustainable products in India as an emerging market. Perceived behavioral control did not show as significant influence factor on the purchase intention. The investigation by Qin and Song (2022) shows that perceived behavioral control significantly influences Chinese consumers' sustainable consumption behavior.

Energy - Ali et al. (2019) are examining consumers' intention to purchase energy-saving household products. Perceived behavior control shows significant impact on the purchase intention. Bhutto et al. (2020) are concerned with consumers' intentions in Pakistan to purchase energy-efficient appliances. Perceived behavior control shows significant influence on purchase intention. Li et al. (2018) examine the willingness to pay for green housing. The use of green buildings is perceived as an important approach of improving the living environment, reduce energy consumption of building, and solve energy problems. Here, perceived behavior control shows as significant influencing factor. The study by Tan et al. (2017) is investigating factors that influence consumers' purchase intention for energy-efficient household appliances. Perceived behavior control shows the strongest significant influence. In the study by Bamberg (2003) for highly environmentally concerned people perceived behavior control showed the highest influence on the intention to use the offered brochure about 'green' electricity products. For low environmentally concerned people perceived behavior control showed as the lowest influencing factor. Hossain et al. (2022) examine consumers' purchase intention for energy-efficient household appliances. The results show that perceived behavioral control significantly influences the purchase intention.

The investigation conducted by Daiyabu et al. (2022) examines the conventional energy stakeholders' investment intention into renewable energy in Nigeria. It shows that perceived behavioral control has a significant impact on the intention to invest. The study by Ong et al. (2022) is concerned with nuclear power in terms of a renewable energy sources. The switching intention to this energy source is investigated in Philippines. The results show that perceived behavioral control is a significant influencing factor.

Food - Bamberg (2003) also states that in terms of environmentally related behaviors it is important to consider perceived behavioral control since many behaviors experience difficulties in execution. Since this hinders the actual conscious and willful intention. In the study by Bamberg (2003) perceived behavioral control showed the least strongest direct significant influence on intention in the total sample. The investigation by Laureti and Benedetti (2018) on Italian purchasing behavior of organic food production revealed perceived behavioral control as a relevant influence factor. In the study by M.-F. Chen (2007) on the intention to purchase organic food in Taiwan perceived behavioral control showed a significant influence. The study by Thøgersen and Zhou (2012) on Chinese consumers' on the willingness to adopt

sustainable lifestyle elements as organic food revealed perceived behavioral control as a significant influence on the intention to buy organic vegetables. Yadav and Pathak (2016) examined consumer's intention to purchase organic food in the context of India as a developing nation. In their investigation perceived behavioral control emerged as the strongest influence on the purchase intention of organic food. Tuan and Vinh (2016) showed that perceived behavioral control has significant impact on consumers' purchase intention in the organic food market in Vietnam. Bagher et al. (2018) investigate factors affecting the intention to purchase organic food products among Iranian consumers. Perceived behavioral control revealed as a significant influencing factor on the intention to purchase organic food products. The comparative study by Asif et al. (2018) examined influencing factors on the purchase intention of organic food in Pakistan, Turkey, and Iran. It showed that only for Turkey perceived behavioral control is a significant influencing factors. In the comparison of Tanzania and Kenya by X. Wang et al. (2019) perceived behavioral control showed no significant influence in Kenya but as most important in Tanzania on intention. Paul et al. (2016) are concerned with Indian consumers' green product purchase intention. Here, perceived behavioral control showed significant influence on intention. Maichum et al. (2016) investigated consumers' purchase intention towards green products in developing countries on the example of Thailand. Perceived behavioral control showed the second highest impact on purchase intention. For the first study conducted by Canova et al. (2020) perceived behavioral control showed the second highest influence with regard to the purchase of organic food. In the second study perceived behavioral control showed as the lowest influence on the intention to purchase of fresh organic fruit and vegetables. This applies for the study by Fleșeriu et al. (2020), too. Here, perceived behavioral control also revealed as the least important predictor for the examined buying intention for organic food. Weber et al. (2020) investigated intention to eat sustainable. Here, perceived behavioral control revealed as the second most important factor but only little higher than subjective norm. Dupont et al. (2022) examine the acceptance of cultured meat in Germany. The results show that perceived behavioral control towards a cultured meat burger significantly influences the intention to consume cultured meat burger. The study by Wongsaichia et al. (2022) is concerned with green eating behaviors in Thailand. The results show that perceived behavioral control has a significant effect on the purchase intention of green food for green and non-green consumers.

Mobility - In the investigation by Moons and De Pelsmacker (2012) based on an explorative qualitative study ten-items are developed. Not all items show a uniform significant influence on the intention to use an electric car. They conducted a further study (Moons and De Pelsmacker, 2015) with the aim to predict the usage intention of electric cars. Here, they used the decomposed theory of planned behavior where perceived behavior control is decomposed into perceived personal ability and external source constraints and facilitators. Perceived personal ability, that is concerned with the belief of consumers on their ability to use electric cars showed no significant influence. Regarding the examined external constraints (time, money) and facilitators (charging facilities, car maintenance) only the single item construct concerned with having enough budget to afford an electric car showed as a significant influence factor. Haustein and Jensen (2018) examine factors of battery electric car adaptation. It showed that perceived behavior control is a significant influencing factor in the users intention to buy or use a battery electric car. Hsiao and Yang (2010) investigate domestic students touristic travelers' willingness to take Taiwan's high-speed rail instead of using private cars. Perceived behavioral control showed significant influence on the intention to choose high speed rail while participating in long-distance travel. Bamberg et al. (2003) are concerned with the effect of the introduction of a prepaid bus ticket on the bus use among college students. It shows that the perception of behavioral control with respect to bus use has significant influence on the intention to take the bus. The study by Donald et al. (2014) is interested in the most important factors

Table 5
State of research in the field of environmental concerns as a unidimensional factor.

Environmental concerns	Influencing factor on attitude	
	EC	Content of Attitude
Author (Year)		
Asif et al. (2018)	x (ind) n.s. (1&2)	the purchase intention* of organic food - (1) Pakistan, (2) Turkey, (3) Iran
Bagher et al. (2018)	x	toward organic food production - Iran
Irianto (2015)	x	toward the purchase organic food - Indonesia
Laureti and Benedetti (2018)	x (ind.)	purchasing behavior* of organic food products - Italy
Lavuri (2022)	x	toward purchase green goods
Leclercq-Machado et al. (2022)	x	toward products that seek to preserve the environment
Liao et al. (2020)	x	toward energy-saving intention - China
Maichum et al. (2016)	x	toward purchase intention toward green products - Thailand
Paul et al. (2016)	x	toward green product purchase intention - India
Sadiq et al. (2022)	x	towards environment
Tan et al. (2017)	n.s.	toward purchase intention for energy–efficient household appliances - Malaysia
Tuan and Vinh (2016)	x	toward the organic food market - Vietnam
Wongsaichia et al. (2022)	x	toward purchase green food
Yadav and Pathak (2016)	x	toward buying of organic food - India

Notes. EC = Environmental Concerns. n.s. = not significant. Ind = indirect effect. - = not measured. *In each case, the outcome variable was attitude, except in Laureti and Benedetti (2018) and Asif et al. (2018).

impacting on whether participants drive or use public transportation to commute to work. The results showed that perceived behavior control is a significant indirect predictor (via intention/via habit) for both car and public transport behavior. Schmalfuβ et al. (2017) state that battery electric vehicle can contribute to the realization if more sustainable mobility systems. It shows that perceived behavior control has significant impact on the examined willingness to purchase a battery electric vehicle. S.-Y. Chen (2016) are examining the green loyalty to a public bike system. Perceived behavioral control shows significant influence for public biker users but not for non-user. C.-F. Chen and Chao (2011) examine the switching intentions toward public transit. For the whole sample perceived behavior control showed significant impact. The investigation by Qin and Song (2022) studies green transportation behavior. Perceived behavioral control reveals as a significant influencing factor.

These studies explaining the influence of perceived behavior control on intention to change the behavior regarding nature and environmental protection lead to propose the following hypothesis:

H3. A higher perceived behavioral control leads to an increase in the intention to change the behavior regarding nature and environmental protection.

In addition to the influences due to the basic model of the TPB, the study of Tarkiainen and Sundqvist (2005) investigated Finnish consumers' intention to buy organic food. Here, subjective norm showed a significant influence on attitude toward buying organic food products. The investigation by Irianto (2015) considered the intention to purchase organic food in Indonesia. Here subjective norm showed a significant influence on the attitude toward the purchase of organic food. Paul et al. (2016) are concerned with Indian consumers' green product purchase intention. Subjective norm showed significant influence on attitude. Gadenne et al. (2011) investigate antecedents on environmental

behaviors. The results show that social influence is significantly influencing environmental behavior attitudes. The study by Sreen et al. (2018) is concerned with green purchase intention. Subjective norm regarding green products reveals as a significant influence factor on the attitude toward green products. This leads to the following hypothesis:

H4. A higher subjective norm leads to an increase in the attitude toward sustainable behavior in relation to the environment and climate.

2.3. Extending the TPB by the additional influence factors EC and NEP on attitude

As shown in the preceding part, the TPB represents a widely used model for environmentally friendly thinking and behavior. However, Gifford and Nilsson (2014) criticize that this model does not comprise the high variety of relevant social and personal factors that also play an important role concerning pro-environmental behavior. Following this conclusion, it is necessary to extend the basic model in the context of the investigation by EC (Schultz, 2001; Schultz et al., 2005; Weber et al., 2020) as further influencing factors as well as the NEP (Dunlap et al., 2000). Schultz et al. (2005) note that EC can be distinguished from environmental attitudes in that EC refer to "the affect associated with environmental problems" (Schultz et al., 2005, p. 458). Brieger (2019) defines EC as an individual's awareness or understanding that the environment is worth protecting and the individual's willingness to protect the environment. Liao et al. (2020) further summarize EC as a specific attitude toward environment-related actions or issues. In addition, Schultz et al. (2005) indicate that the importance of environmental problems can be considered an important influence on environmental attitudes. Environmental attitude referred to in this investigation as attitude toward sustainable behavior in relation to the environment and climate, is explained by Schultz et al. (2005) as the "collection of beliefs, affect, and behavioral intentions that a person holds about environmentally related activities or issues" (Schultz et al., 2005, p. 458). Table 5 shows an overview of studies that examine the influence of EC on attitude toward sustainable behavior as a common factor. They are derived from a recent literature review. The literature search took place between November 2021 and February 2022. The keywords environmental concerns and influence of environmental concerns on attitude was used for the search. Exclusion criterion was if no influence on Attitude was measured in connection with environmentally friendly. The search tools included content from the following EBSCO-owned databases of the FOM University: Business Source Premier, EconLit, APA PsycArticles, PSYNDEX, Medline, CINAHL, Engineering Source, GreenFILE, and content from the IEEE Xplore digital Library, ACM Digital Library, and SpringerLink.

All of the studies found through the literature search measured EC as a one-dimensional latent factor variable with either direct or indirect influence on attitude. Each of the studies has a different operationalization for EC in terms of both content and number of items. In terms of content, the EC factor includes each time the concern for environmental pollution. However, Stern and Dietz (1994) and Schultz (2001) argue, the significance of the consequences of pollution should be at different levels that form the basis for environmental justice beliefs and can influence pro-environmental behaviors: a selfish level that reflects the personal concern of individuals (egoistic concern), an altruistic level that focuses on other people (altruistic concern), and a biospheric level that includes plant and animal life (biospheric level). Schultz (2001) argument, the significance of the consequences of pollution should be at different levels: a selfish level that reflects the personal concern of individuals (egoistic concern), an altruistic level that focuses on other people (altruistic concern), and a biospheric level that includes plant and animal life (biospheric level).

Egoistic concern - It is stated that egoistic values are concerned with the aspects of protecting the environment that affect each person. Thereby, it is assumed that if egoistic people believe that environmental

changes threaten them personally, they should be pro-environmental (Schultz et al., 2005; Stern et al., 1999; Stern and Dietz, 1994; Weber et al., 2020).

H5. Higher egoistic environmental concerns lead to an increase in the attitude toward sustainable behavior in relation to the environment and climate.

Altruistic concern - Heberlein (1972) refers to Schwartz (1968a, 1968b) when it comes to decision making. It is stated that norms will be activated if the person making a decision is aware of the consequences of the action for others and if the person itself feels personally responsible for the action and its consequences. Moreover, Schwartz (1970a) points out that the more a person is aware of the consequences of his or her decision, this leads to an increase of volunteering self-sacrificing behavior, which can be referred to as altruism. Heberlein (1972) observes that decisions controlling the behavior that affects the environment seem to fit the same model. An earlier experiment shows that people experience carrying around litter or searching for an appropriate garbage can as expenditure. This sentiment increases the harder it is to find an appropriate way to dispose the litter and the more unpleasant the individual perceives it. Therefore, it is stated that the decision to refrain from littering involves that the individual has to carry higher economic costs by sticking to an (culturally and ecofriendly) appropriate behavior, which makes it a moral decision. This is in line with the norm-activation model by Schwartz (1970b, 1977). It is stated that individual people perceive a moral responsibility in terms of a personal moral norm and behave according to this if they are aware that negative consequences for others are likely to occur. They can personally prevent or reduce these consequences by taking appropriate action. Overall, according to the norm-activation model, it is assumed that if individuals act according to social-altruistic norms, they evaluate situations or behavior regarding costs/sacrifices and benefits not only for themselves but also for groups. In this context, a group can be an ethnic group, a community, a country, or the whole world population (Stern and Dietz, 1994). Therefore, it is assumed that people act according to personal norms and are aware of the consequences of their behavior for other people, and that they are aware that they can personally prevent harmful consequences should they behave in an environmentally friendly manner.

H6. A higher social altruistic concern leads to an increase in the attitude toward sustainable behavior in relation to the environment and climate.

Biospheric concern - Stern and Dietz (1994) state that biospheric values already play an important role for many ecologists and environmentalists. They postulate that a new biospheric value orientation might emerge whereby people account for actions or behavior regarding costs/sacrifices or benefits for the ecosystem or biosphere. This is supported by Nguyen et al. (2019). They state that "nowadays, people are more concerned about the environment, and they are increasingly aware of unsustainable consumption patterns as a cause of serious environmental issues such as climate change, global warming, and disastrous pollution" (M. T. T. Nguyen et al., 2019, p. 246). In contrast to the following examined NEP (Dunlap et al., 2000), biospheric values are viewed, according to Stern and Dietz (1994), as a moral behavior similar to the altruistic value presented in the norm-activation model by Schwartz (1970b, 1977) but with regard to non-human objects like the environment. Thus, it is assumed that people act according to personal norms and are aware of the consequences of their behavior on the environment and that they can personally prevent harmful consequences if they behave in an environmentally friendly manner.

H7. Higher biospheric concerns lead to an increase in the attitude toward sustainable behavior in relation to the environment and climate.

The NEP scale (Dunlap et al., 2000) is a revised scale based on the new environmental paradigm (Dunlap and Van Liere, 1978). In contrast to biospheric concerns (as a part of EC) NEP is more concerned with
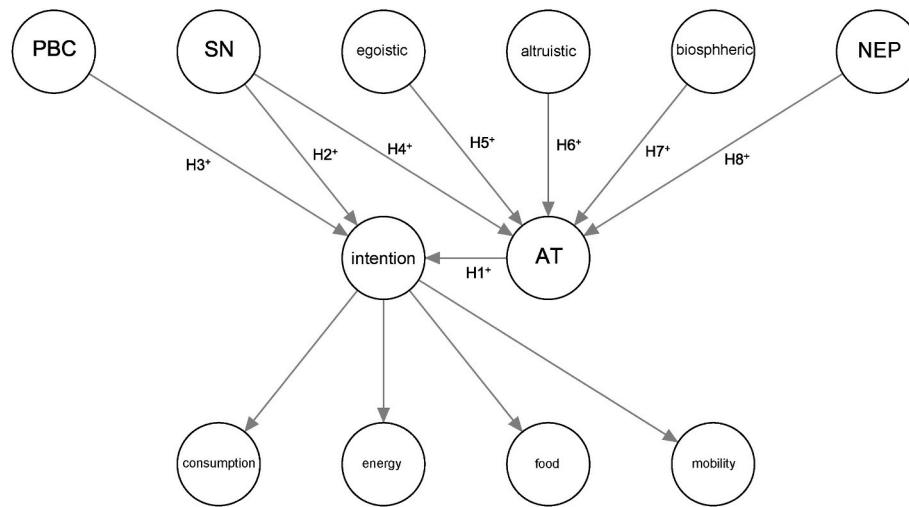
Fig. 2. Research model.

"beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature" (Dunlap et al., 2000, p. 427) and the ecological worldview. It is stated that a high score on the NEP scale reflects "pro-ecologically orientation or "seeing the world ecologically" should lead to pro-environmental beliefs and attitudes on a wide range of issues" (Dunlap et al., 2000, p. 428).

There is no consensus on how to deal with the initial NEP. Originally, Dunlap and Van Liere (1978) focus on the three dimensions: beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature measured by 12 items with good internal consistency. The content validity of these three dimensions was reinforced by the results of the unstructured in-depth interviews conducted by Kempton et al. (1995) with regard to the environmental perspective of Americans. However, there is no consensus on whether the NEP scale should be measured as a single or multidimensional construct. Dunlap et al. (2000) review studies that have factor-analyzed the initial items. It shows that there are studies where all items load on one single factor and studies that find two, three, or even four dimensions (Dunlap et al., 2000, p. 430). The revised NEP scale in Dunlap et al. (2000) consists of 15 items, six taken from the initial NEP. Four items are slightly modified and five are newly added. The items are assigned to "five hypothetical facets of an ecological worldview: the reality of limits to growth, anti-anthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an ecocrisis" (Dunlap et al., 2000, p. 432). Although their principal component analysis showed four subscales, Dunlap et al. (2000) state that treating the 15 NEP items as a single scale is appropriate, as all 15 items load heavily on the first unrotated factor. Recent studies also use a one-factor solution for NEP (Derdowski et al., 2020; Kang et al., 2012; Moons and De Pelsmacker, 2015; Schultz, 2001; Xiao et al., 2019).

H8. Higher individual endorsement of the New Ecological Paradigm (NEP) leads to an increase in the attitude toward sustainable behavior in relation to the environment and climate.

A visual representation of the research framework with the derived hypotheses is presented in Fig. 2.

3. Research methods

Based on the theoretical considerations, a basic research model was created. This must now be verified in the real world. According to (Hair et al., 2021) basically there are two different approaches: Covariance-based SEM (CB-SEM) and Variance-based SEM (Partial Least

Squares SEM or PLS-SEM). The goal of a CB-SEM is to test theories, confirm theories, or compare alternative theories. Parameter estimation of the model is performed simultaneously. Hypotheses are tested by determining how accurately a proposed theoretical model can reproduce the covariance matrix for an observed sample data set (Jöreskog and Wold, 1982). The goal in variance-based SEM (Partial Least Squares SEM or PLS-SEM) is to predict important target constructs or identify important driver constructs. The factor values are first determined successively for the measurement models and then, in a second step, used as measurement values for the latent variables in a regression analysis (Hair et al., 2012). Hypotheses are already present in the theory-based research model presented here. This study is not about predicting target constructs or finding effect relationships. For this reason, the appropriate procedure for testing the hypotheses in the research model is structural equation modeling with covariance-based estimation.

3.1. Data collection and sampling

To test our hypotheses, a new survey study was conducted using face-to-face interviews. In order to maintain a high level of data quality in the survey, the questionnaire was not sent out online. Instead, students of the FOM University were instructed to survey respondents in person using a standardized printed questionnaire. The survey took place solely on the basis of the written questionnaire. The questionnaire was only filled out by the students based on the answers of the respondents. Each question had to be read to the respondents individually. The answers were then entered into the questionnaire. Subsequently, the manually entered data were entered into an online input mask. The data entered were all stored in a database and form the data basis for the study. 1334 students surveyed 14,233 respondents nationwide in Germany from 03 to 01–2021 to 06-15-2021. The students were participants in 31 courses on scientific work. According to the curriculum of the courses, detailed interview training was conducted by the teachers. The students also received extensive accompanying material for conducting face-to-face interviews. These training activities were carried out to avoid response tendencies residing in the interviewer's personality. Each student who participated in the lecture was instructed to conduct a maximum of 12 face-to-face surveys in the survey period of more than 11 weeks. All students were previously trained in face-to-face surveys. For the quoting of the sample characteristics, a quota plan was used, with the distribution of the characteristics of gender and age group. The quota plan was drawn on the basis of the population forecast of the Federal Statistical Office in Germany (Federal Statistical Office, n.d.). The quota plan contained seven age groups with equally distributed

Table 6
Results of the principal component analysis of the four endogenous constructs.

Construct	Items	RC1	RC4	RC2	RC3
Energy	Y6.9	**.80**	.15	.12	.13
	Y6.8	**.78**	.17	.13	.11
	Y6.10	**.76**	.24	.06	.12
	Y6.7	**.74**	.27	.02	.08
Consumption	Y6.1	.13	**.78**	−.05	.05
	Y6.2	.02	**.67**	.21	.15
	Y6.3	.29	**.64**	.14	.16
	Y6.4	.28	**.55**	−.03	−.00
	Y6.6*	.30	.43	.30	.19
	Y6.5*	.24	.40	.10	.14
Food	Y6.11	.10	.11	**.84**	.16
	Y6.13	.10	.11	**.83**	.21
	Y6.12	.06	.07	**.82**	.10
Mobility	Y6.16	.13	.13	.18	**.84**
	Y6.15	.06	.08	.19	**.83**
	Y6.14	.19	.21	.11	**.74**

Notes. *Eliminated items. The verbalized items for Y6.1 through Y6.16 can be found in Appendix Table A1.

gender with the following returns: (12–17:1563 male/1605 female, 18 to 25: 476 male/493 female, 26 to 35: 792 male/852 female, 36 to 45: 989 male/973 female, 46 to 55: 922 male/927 female, 56 to 65: 1125 male/1202 female, and 66 and older: 1125 male/1122 female, 33 have not specified gender). In the literature, for CB-SEM, a sample size is considered sufficient when the sample size N is five times the number of parameters to be estimated (Bagozzi and Yi, 1988). In the present

research model, 121 parameters are to be estimated, resulting in a minimum sample size of 605. This is given by the present sample size. For the estimation of the parameters a maximum likelihood estimation was chosen.

3.2. Measure development

The research model for measuring intention to change behavior related to conservation and environmental protection is measured using multiple item constructs established and validated from the literature (Appendix). The order of the constructs in the questionnaire was: 1. NEP, 2. EC, 3. attitudes toward sustainable behavior, 4. Perceived behavioral control, 5. Subjective norm, and 6. the intention to change the behavior regarding nature and environmental protection. All constructs were selected after extensive literature research and the evaluation of the reliability and validity of the items.

The measures of all constructs from the theory of planned behavior (attitude toward sustainable behavior, subjective norm, and perceived behavioral control) were adapted from Weber et al. (2020), referring to Graf (2007) and Weber and Fiebelkorn (2019). Intention to change behavior is measured as a second-order construct using the four identified areas of life from Gansser and Reich (2021). The four domains of life were identified with over 18,000 respondents in line with current research (Tables 1–4) on planned sustainability behaviors. The study (Gansser and Reich, 2021) examined, among other things, how effective actions for environmental and climate protection are assessed and how often (frequency) these actions are implemented in everyday life. For

Table 7
Results of the principal component analysis of the six exogenous constructs.

Construct	Items	RC1	RC2	RC5	RC6	RC3	RC7	RC4	RC8
Altruistic EC	X2.11	**.84**	.11	.19	.13	−.14	.12	.023	−.01
	X2.10	**.84**	.11	.21	.11	−.16	.13	.01	.01
	X2.12	**.84**	.11	.21	.14	−.15	.14	.02	.01
	X2.9	**.83**	.12	.18	.15	−.13	.13	.03	.00
	X2.8	**.77**	.06	.14	.15	−.08	.14	.06	.08
	X2.7	**.73**	.05	.14	.22	−.09	.13	.06	.08
	X2.6	**.69**	.08	.08	.33	−.04	.14	.09	.03
	X2.5*	.60	.09	.08	.49	−.01	.11	.09	.00
	X1.7*	.35	.11	.35	.07	−.30	.10	−.00	.35
Perceived Behavioral Control	X4.3	.07	**.78**	.04	.10	.01	.12	.08	−.07
	X4.4	.10	**.75**	.09	.06	−.06	.10	.06	.07
	X4.1	.13	**.70**	.10	.09	−.09	.17	.08	.06
	X4.2	.09	**.66**	.06	.04	−.06	.05	.10	.06
	X4.5	.04	**.66**	.05	.03	.01	.00	.02	.09
	X3.5*	.05	.57	−.02	.09	.10	.19	.04	−.19
Pessimistic View (NEP)	X1.11	.10	.05	**.67**	.07	−.05	.03	.04	−.18
	X1.1*	.10	.05	**.65**	.03	.10	.03	.08	−.31
	X1.3	.15	.06	**.60**	.08	−.14	.11	.02	.15
	X1.15	.21	.04	**.59**	.15	−.22	.18	.06	.06
	X1.5	.20	.04	**.58**	.08	−.22	.14	.02	.22
	X1.13	.18	.07	**.56**	.13	−.21	.08	.03	.10
	X1.9*	.14	.07	.47	.04	−.19	.05	.03	.22
Egoistic EC	X2.2	.20	.13	.11	**.81**	−.01	.11	.08	−.03
	X2.1	.27	.13	.16	**.77**	−.09	.18	.08	.02
	X2.3	.31	.09	.12	**.77**	−.10	.13	.03	.05
	X2.4	.32	.09	.12	**.73**	−.10	.16	.04	.06
Superior View (NEP)	X1.12	−.17	−.06	−.14	−.06	**.70**	−.08	.01	−.17
	X1.8	−.08	.00	−.25	−.04	**.66**	−.10	.00	.02
	X1.14	−.04	−.01	−.02	−.03	**.65**	−.01	.01	.15
	X1.2	−.17	−.06	−.06	−.07	**.64**	−.09	.02	−.06
	X1.10	−.10	.01	−.23	−.06	**.58**	−.15	−.10	.01
	X1.4	−.01	.02	−.07	.01	**.56**	−.01	.02	.38
Attitude	X3.2	.22	.19	.15	.15	−.12	**.78**	.10	.03
	X3.3	.19	.18	.11	.13	−.10	**.76**	.05	.04
	X3.4	.27	.22	.18	.21	−.16	**.70**	.11	.03
	X3.1	.30	.22	.21	.23	−.18	**.63**	.13	.04
Subjective Norm	X5.1	.06	.14	.08	.07	−.01	.08	**.90**	.01
	X5.2	.07	.10	.07	.05	.01	.07	**.89**	.01
	X5.3	.06	.13	.05	.09	−.02	.10	**.88**	−.02
	X1.6*	.08	.03	.10	.05	.18	.07	.01	.76

Notes. *Eliminated item. The verbalized items for X1.1 through X5.3 can be found in Appendix Table A2.

Table 8

Descriptive statistics and correlations.

Variable	M	SD	α	CR	AVE	1	2	3	4	5	6	7
1. IB[a]	4.29	1.09	_a	_a	_a							
2. AT	5.59	1.14	.86	.86	.61	.42**						
3. PBC	4.83	1.08	.79	.79	.43	.29**	.42**					
4. SN	3.70	1.62	.90	.90	.75	.28**	.27**	.25**				
5. EG	5.36	1.34	.89	.89	.66	.35**	.51**	.28**	.20**			
6. AL	5.91	1.16	.94	.94	.67	.36**	.54**	.28**	.18**	.57**		
7. PV	5.34	1.09	.74	.74	.37	.31**	.45**	.23**	.17**	.38**	.49**	
8. SV	2.98	1.17	.74	.74	.36	−.17**	−.36**	−.13**	−.06**	−.25**	−.35**	−.45**

Note. * indicates p < .05. ** indicates p < .01. a indicates Second Order Construct; M = Mean; SD = standard deviation; α = Cronbachs Alpha; CR = Composite Reliability; AVE = average variances extracted; IB = Intention to change behavior; AT = Attitude toward sustainable behavior (recoded to 1 to 7); SN = Subjective Norm; PBC = Perceived Behavioral Control (recoded to 1 to 7); EG = egoistic; AL = altruistic.

this purpose, 16 items were used which were assigned to the four areas of life due to their structure and their discriminatory power (cumulative variance for effectiveness = 0.66 and frequency = 0.57, four components with eigenvalues >1, Cronbach's alpha between .71 and .86) (Gansser and Reich, 2021). The economic concerns (egoistic, altruistic, biospheric) were adopted from Weber et al. (2020), based on Schultz (2001), Schultz et al. (2005), and Stern and Dietz (1994). The NEP was adopted from Dunlap et al. (2000), based on Dunlap and Van Liere (1978).

All constructs were measured using reflective measurement models. Each set of observed variables (and their deviations and covariances) can be classified as manifestations of the underlying constructs (Bagozzi and Yi, 1988). The second-order construct, intention to change behavior, is measured by the four first-order constructs consumption, energy, food, and mobility. The items for the four dimensions of intention to change behavior from Gansser and Reich (2021) can be seen in Appendix A1. All other constructs (EC, attitude, subjective norm, perceived behavior control, NEP) with their items are shown in Appendix A2. The questionnaire contains statements with scales of agreement to the respective theoretical constructs only. Except for the constructs perceived behavior control and attitude toward sustainable behavior all items could be answered on a seven-point Likert scale, ranging from "1 = disagree at all/not important at all" to "7 = fully agree/very important". The other two constructs (perceived behavior control and attitude toward sustainable behavior) could be answered on a bipolar response scale from −3 to +3.

4. Results

4.1. Improvement of the measurement model

In order to find linear functions that explain maximal variance in the observed data under the four endogen constructs (consumption, energy, food, and mobility), a principal component analysis with varimax rotation (PCA) was performed. The KMO statistic of 0.85 demonstrates that the correlation structure in the data contains sufficient information to perform a principal component analysis. The Bartlett test is highly significant (Bartlett statistic: 79,497, df = 120, p < .001) and does not argue against the use of principal component analysis. Four principal components with an eigenvalue greater than 1 can be considered (5.18, 2.07, 1.29, 1.16). The rotated factor solution in Table 6 shows that variables X6.5 and X6.6 have a loading smaller than 0.5 and are therefore not assigned. The four main components can explain 66 percent of the total variance with eigenvalues smaller 1 (4.68, 2.06, 1.28, 1.15).

Another PCA is performed to find linear functions that explain maximal variance in the observed data under the exogen constructs (perceived behavior control, subjective norm, EC, and NEP). 14,233 respondents assessed 40 items. The KMO statistic of 0.93 demonstrates that the correlation structure in the data contains sufficient information to perform a principal component analysis. The Bartlett test is highly significant (Bartlett statistic: 295787, df = 780, p < .001) and does not argue against the use of principal component analysis. Eight principal components with an eigenvalue greater than 1 could be considered (11.11, 3.15, 2.61, 2.06, 1.68, 1.57, 1.29, 1.09). The rotated factor
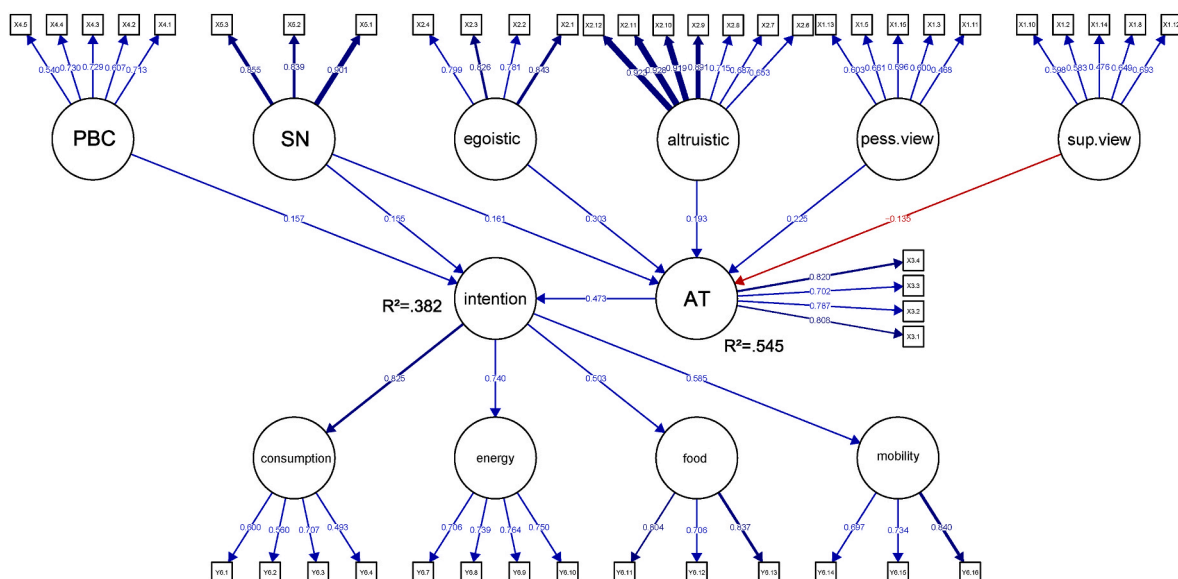

Fig. 3. Path analysis results. All loadings and path coefficients are significant (p < .001); n = 14,233.

solution in Table 7 shows that variable X2.5 has double loadings on RC1 and RC6, X1.7 and X1.9 have loadings smaller than 0.5, X3.5 has a stronger loading on R2 instead of RC7, and X1.6 has a loading on its own construct, which cannot be explained by the theory and is not represented in the model. For this reason, these five variables are not assigned and are not considered further in the rest of the analysis. The seven main components can explain 62 percent of the total variance with eigenvalues greater than 1 (0.16, 2.93, 2.41, 1.99, 1.61, 1.49, 1.26). As shown in Table 7, the items measuring NEP can be extracted into two components. This result is also found in other studies (Bechtel et al., 1999; Gooch, 1995; NOE and Hammitt, 1992; Scott and Willits, 1994).

4.2. Calculating and optimizing the CB-model

The remaining items to measure the constructs were transferred to a model measurement with lavaan (Rossel, 2012) according to the TPB and the extension in this study. Hooper et al. (2008) recommend assessing the fit of each construct and its items individually to determine if there are any items that are particularly weak. In this study, items with low multiple r2 (less than 0.20) are removed from the analysis as this is an indication of a very high level of error (Hooper et al., 2008, p. 56). Two items (X.1.1 and X.1.4) showed a smaller r2 and are excluded from further analysis.

At the measurement scale level, discriminant validity is assessed by checking that each pair of latent correlations is sufficiently below 1 so that the latent variables can be considered two distinct constructs. Likelihood ratio tests are used to compare the original base model with more constrained alternatives (Rönkkö and Cho, 2022). All chi-square statistics of the latent variables in the model, including the four dimensions of intention, are significant, indicating discriminant validity. Table 8 shows correlations, reliability and convergent validity diagnostics for all variables. All correlations between the latent constructs are less than 0.57. All survey measures achieved adequate values for Cronbach's alpha, composite reliability (CR), and average variances extracted (AVE) (Fornell and Larcker, 1981). The four first-order constructs of intention have alpha/CR/AVE values of 0.68/.69/.36 (consumption), 0.83/.83/.55 (energy), 0.82/.83/.61 (food), and 0.80/.80/.58 (mobility).

In order to assess the overall fit of the model, the measures of goodness CFI, TLI (NNFI), RMSEA, and SRMR are used. All quality criteria considered are outside the respective rejection ranges of the model used in literature. As an inferential statistical quality criterion, the SRMR is below the threshold of 0.06 at 0.05 (Hu and Bentler, 1999), the (descriptive) absolute fit index RMSE is below the threshold of 0.08 at 0.045 (Hu and Bentler, 1999), and the two incremental fit measures CFI and TLI for model comparison are both above the threshold of 0.90 at 0.915 (CFI) and 0.909 (TLI) (Homburg and Baumgartner, 1995). Podsakoff et al. (2003) and MacKenzie et al. (2011) recommend some approaches to avoid and reduce the main causes of common method bias (CMB) in advance or in the design of data collection. The questionnaire for the present study was developed in a theory-driven manner. Existing and established scales from literature were used to measure the constructs. During the interviews, the respondents' anonymity was ensured, and the concern of the respondents about their answers was reduced. The items used to measure the constructs were adapted to the research subject. Duplicate questions were avoided. The survey instrument was pretested with a representative group of respondents. After data collection, a one-factor test by Harman (1976) was used to assess the presence of a CMB in the data. This approach suggests that the common method variance is negligible. The common latent factor explained 21.6% of the variance. This is less than 50% of the variance - indicating the absence of a serious CMB (Chang et al., 2010).

4.3. Hypothesis testing

First, it should be noted that all path coefficients in the model are

significant at the 0.1 percent level. All path coefficients and all loadings on the constructs are shown in Fig. 3. Looking at the direct influencing variables on intention to change behavior, data support H1, H2, and H3 that attitude toward sustainable behavior ($\beta_1 = 0.47$), subjective norm ($\beta_2 = 0.15$), and perceived behavior control ($\beta_3 = 0.16$) have a positive influence on intention to change behavior. Next, the constructs that influence attitude toward sustainable behavior are examined in the hypothesis model to investigate which environment-related variables influence attitude. In the research model, there are three influences on attitude toward sustainable behavior: subjective norm, EC, and NEP. For subjective norm, with a path coefficient of $\beta_4 = 0.16$, hypothesis H4 can be maintained. For EC, there were originally three hypotheses (H5 to H7) for the egoistic, altruistic, and biospheric environmental concerns derived from the theory. Across all exogenous influence variables in the research model, PCA (Table 7) shows that only two components can be extracted for environmental concerns. One component includes egoistic concerns, which include the consequences of environmental problems for the individual. The other component includes all altruistic concerns for other fellow humans, animals, and plants. Egoistic concerns have the strongest influence of all exogenous variables in the model on attitude toward sustainable behavior, with a path coefficient of $\beta_5 = 0.30$ (H5). The influence of altruistic concerns about the consequences of environmental problems is significant and lower than that of egoistic concerns, with a path coefficient of $\beta_{6/7} = 0.19$ (H6/H7). Similarly, the PCA of the exogenous influence factors shows that the NEP scale, which was originally used as a one-factor solution, can be clearly divided into two components. Based on the semantic meaning of the items, the two components are defined as pessimistic view and superior view. The influence of the pessimistic view has the second strongest positive influence on attitude toward sustainable behavior (H8a) with a path coefficient of $\beta_{8a} = 0.22$. The superior view, on the other hand, has a negative influence on attitude toward sustainable behavior with an influence coefficient of $\beta_{8b} = -0.14$ (H8b).

For hypothesis testing of the model, the measurement of the second-order construct intention to change behavior, whether formative or reflective, is not crucial. In a relative comparison of the importance of first-order constructs, weights and loadings yield similar results. Similarly, the mean values show the same results in relation to each other (consumption: 4.87, energy: 4.86, food: 3.39, mobility: 4.05). In a lavaan model, it is not possible to include formative measurement constructs. For this reason, the second-order construct intention to change behavior was measured reflectively with the four areas of life consumption, energy, food, and mobility. The path coefficients given in the model are therefore interpreted as loadings. Thus, consumption has the highest charge at 0.83 and thus the highest intention to change. The second highest willingness to change is found in energy with a loading of 0.74. Lower willingness to change is found in mobility (loading: 0.59) and food (loading: 0.50). The simultaneous measurement of the four areas of life via a second-order measurement is recommended since the importance in relation to the behavioral change intention in the individual areas can be seen here.

5. Discussion

The study used a face-to-face survey with a standardized questionnaire to examine the behavioral perspective of how people behave in relation to the intention to change their behavior regarding nature and environmental protection.

Mankind is currently facing a climate crisis. This can be countered either by technical innovations or by behavioral changes. The study aims to investigate what influences people's intention to change their behavior toward sustainability. The existing research gap was the lack of studies in which both environment-related influencing variables (EC and NEP) are investigated simultaneously in one research model. Furthermore, there is disagreement in research on whether the two constructs are uni- or multidimensional factors. In addition, there are no studies on

environmental behavior that go beyond the measurement of a single area of life and thus allow a generalization of the results.

A study was conducted with 14,233 respondents in Germany to fill all three research gaps. The TPB with its original variables perceived behavior control and subjective norm was extended by EC and NEP. In addition, the intention to change behavior regarding nature and environmental protection in the four areas of life of consumption, energy, food, and mobility was surveyed simultaneously.

The results show that the construct EC has to be measured two-dimensionally and divided into egoistic EC and altruistic EC. Altruistic EC includes both the importance of the consequences for fellow humans and the importance of the consequences for plants and animals. Two-dimensionality can also be observed in the data for NEP (pessimistic view and superior view). This result, based on a very large sample, helps to further clarify the intense discussion in research on the measurement of NEP. In addition to the question of dimensionality, the study shows that both environment-related areas of influence can and must be used separately and together in an overall model (see Table 5 for the low correlations between these two concepts). A synonymous use as described in the literature is not evident in the available data. The simultaneous use of both environment-related concepts as important influencing variables is also reflected in the high coefficient of determination for attitudes toward sustainable behavior. Regarding the four areas of life examined, there are clear differences in the weighting of the intention to change the behavior regarding nature and environmental protection.

5.1. Contribution to theory

As expected from the previous studies (Tables 1–4), the extensive data set also shows that the original factors influencing intention in a TPB model perform consistently with the hypothesis. In the hypothesis model, attitude toward sustainable behavior in relation to the environment and climate has the greatest influence on intention to change the behavior regarding nature and environmental protection (H1). This finding is in accordance with the theory by Ajzen (1991) and Venkatesh et al. (2003). In terms of climate and environmentally friendly behavior, the most important influencing variable is attitude and thus the evaluation of sustainable behavior. The two other original variables from the TBP influencing intention to change behavior (subjective norm (H2) and perceived behavioral control (H3)) have similar path coefficients. These are each three times lower than the influence of attitude toward sustainable behavior on intention to change behavior and thus tend to be rather subordinate. Since attitude is the most important variable influencing intention, one of the main objectives of the study is to investigate which environment-related variables influence attitude toward sustainable behavior. In the TPB, according to Ajzen (1991), the influence of the subjective norm on attitude is not described. However, this influence is measured in some other studies (e. g. Gadenne et al., 2011; Irianto, 2015; Paul et al., 2016; Sreen et al., 2018; Tarkiainen and Sundqvist, 2005). In this study, there is also a significant positive influence on attitude toward sustainable behavior (H4). This is similarly low as on intention to change behavior. It was deduced from the theory that environmental concerns influence attitude. For this purpose, three hypotheses were formulated, divided into three areas (egoistic, altruistic, and biospheric) based on literature (Schultz, 2001; Stern and Dietz, 1994). As seen from the PCA (Table 7), the analysis of all exogenous influencing factors shows that only two components can be extracted for environmental concerns. One component includes egoistic concerns, which include the consequences of the individual's environmental problems. The other component includes all altruistic concerns about fellow humans, animals, and plants. Originally, according to Stern and Dietz (1994) and Schultz (2001), this was divided into fellow humans (altruistic) and animals and plants (biospheric). It is striking that the egoistic concerns have the strongest influence of all exogenous variables in the model (H5). The evaluation of one's own environmentally

conscious behavior depends to a large extent on how much a person believes that he or she is personally affected by it. The influence of altruistic concerns about the consequences of environmental problems is much lower than the egoistic concerns (H6/H7). Conversely, this finding fits in with the strong influence of egoistic concerns that consequences that do not affect oneself have less influence on one's attitude. Similarly, the PCA of all exogenous influence factors shows that the NEP scale, originally used as a single-factor solution, can be clearly split into two components. Following the semantic meaning of the items, the two components are defined as pessimistic view and superior view. The influence of the pessimistic view is shown to be the second strongest positive influence on attitude toward sustainable behavior (H8a). In contrast, the superior view has a negative influence on attitude toward sustainable behavior (H8b). These influences can be interpreted in such a way that people who have a pessimistic view of the overall ecological situation in the world have a more positive attitude toward sustainable behavior the more pessimistic their view of the overall ecological situation is. The more pronounced the superior view is toward the general ecological situation, the more negative is the attitude toward sustainable behavior regarding the environment and climate.

5.2. Policy recommendations

The anthropocentric worldview of mankind has led to the fact that we live in a very bizarre world. The world population is growing faster than the earth can bear. More and more people are striving toward the prosperity of the industrial nations or want to become an industrial nation themselves. This has far-reaching consequences. More people consume more, more people need more energy, more people have to eat food, and more people demand more and more mobility. The biggest ecological disaster in the world is factory farming (digesting cattle, manure, clearing rainforests for grazing land). Despite an increasing proportion of vegetarians and vegans, meat consumption continues to rise sharply. Another major problem is the area of mobility. Also, the step goes to public or alternative transportation possibilities only slowly ahead.

Mankind has now two possibilities to solve these problems:

1. It drastically changes its behavior with regard to the impact on ecosystems.
2. It creates technical possibilities through innovations to ensure an impact without behavioral changes.

However, both options have disadvantages. For example, it is visible in the results of the study that an intention to change behavior does not fall easily in every area. This is particularly the case in the areas of food and mobility. Equally uncertain, however, are technical innovations that are not yet available or whose full consequences are not yet predictable. Technical innovations in the area of food, especially in meat consumption, could include artificially produced meat. Not only from the ethical point of view, but also from the ecological point of view, the awareness that artificially produced meat might be healthier (no high use of medication due to factory farming, no stress due to appalling farming conditions, no contaminated feed mixtures) should increase. The production of artificial meat uses much less water and energy, requires less land and produces lower CO_2 emissions. Against technical measures speaks the fact that the biggest problems of this world are that humans cannot stop manipulating the cycle of nature with their technology and thereby causing more and more damage. Also, plant-based meat substitutes are not an optimal solution to the problem because they promote monocultures and genetic modification of plants. These technical aspects were not investigated in the present study.

However, the intention to change behavior was examined. First, attitude is the most important driver of behavioral intention. That is, without an individual's inner conviction for climate- and environment-friendly behavior, the intention to change behavior with respect to

nature and environmental protection changes only slightly. This is, therefore, the most important lever for slowing down climate change in practice. Subjective norm and perceived behavioral control (the two other influencing factors from the TAM model) also show significant influences but play a rather subordinate role in the total model.

It is of little use to emphasize species extinction and climate change in the media and to portray natural events drastically. Rather, the consequences and limitations should be pointed out so that the consequences of environmental problems for the people themselves, your lifestyle, your health, and your future become visible. According to the results of the study, personal concern, which is the egoistic concern of the individual, has the greatest influence on attitudes. A subordinate influence is altruistic concern, which relates to other creatures, plants, and fellow human beings.

At the same time, awareness of fragile and easily destroyed nature, environmental abuse by humans, the possible occurrence of an imminent ecological and environmental catastrophe, catastrophic consequences due to human intervention in nature, and limited space and resources influence attitudes toward sustainable behavior. This shows that there is an awareness of the current critical situation regarding climate and environment. Strategically, it makes little sense to spread fear and panic unnecessarily, but the fact that climate change can no longer be stopped but at least slowed down should be communicated openly, realistically, and understandably.

Both the personal consequences of environmental problems and the pessimistic view of the environmental situation take place at the individual level. This means that a change in attitude and, consequently, a change in behavior with regard to nature and environmental protection can only be achieved by each individual. Therefore, it is important to make consumers understand that they can exert pressure on producers and retailers through their consumption behavior. However, this task cannot and must not be left to consumers alone. Both the states and the manufacturers have a responsibility in this regard. Sustainability must be anchored in all layers (consumers, suppliers, retailers, and manufacturers).

All statements reflecting the superior view relate more or less to technical innovations or assume that humans are superior to nature and the environment through technical innovations. The results show that a superior view reduces the attitude towards sustainable behavior. This would also reduce the intention to change behavior. Apparently, breaking climate change only by innovations does not take place sufficiently at the moment. Should innovations fail to materialize, the only remaining option is behavioral change. This can be carried out safely because it takes place on an individual level. Technological innovations represent a risk that is uncertain because the probability of occurrence is unknown. Therefore, individual behavioral change plays the most important controllable role in environmental and climate sustainability.

As explained in the results, the area of consumption has the strongest importance, followed by energy, mobility, and food. Low intention to change behavior could mean that high habit effects are prevalent in this area and that equivalent or higher value substitution or abandonment is difficult. The opposite effect is true for high intention to change behavior. The fact that the lowest willingness to change is found in the area of food could be due to the fact that habit effects have the strongest influence here. People have to deal with the topic of food several times a day. This tends not to be the case with consumption. Repairing damaged goods, buying used things, generally buying less, and buying less or higher-quality goods are all actions that have to be performed less often. In the case of food, it can be assumed that already, for example, the substitution of sausage with an equivalent meat-free alternative is a great challenge for some people. The complete renunciation seems almost impossible. People are also confronted with the issue of mobility on a daily basis, both professionally and privately. Mobility may not be as essential as food, but it is fundamentally an integral part of daily life. It is, therefore, reasonable to assume that the frequency of confrontation with this topic in daily life is only marginally better with mobility than

with food. In addition, particularly in Germany, individual mobility is very important in society, and there are no equivalent alternatives to current use for a large group of people. However, this can also be specific to the place of residence (connection to public transport, access to car-sharing, etc.). The willingness to change behavior is similarly high in the area of energy as it is for consumption. This can be attributed to the fact that reductions in water consumption, lighting, and living temperatures are directly perceptible. If effects are directly visible, they are considered easy to implement, compared to effects that are not directly visible or only occur with a time delay. In addition, lower energy costs directly benefit the customer. This results in societal, environmental effects, and individual monetary effects.

As a result, a change in behavior in these areas represents a major change, which could be perceived as unpleasant. A change in behavior is, therefore, more or less only possible through political measures and retraining. Such measures would, of course, not be a pleasant political agenda for many people. The results show that the egoistic view has the strongest influence on attitudes towards sustainable behavior in relation to the environment and climate. Thus, behavior change can only be effective if the behavior change actions lead to personal consequences. Only when people are personally affected do they reconsider their behavior and develop an awareness to change their behavior. This applies to all four areas of life examined in the study.

5.3. Suggestions for future research

In the present study, analysis of the data revealed that EC and NEP each included two components. The EC domain can be divided into egoistic concerns and altruistic concerns. NEP can be differentiated into pessimistic view and superior view. The large database of over 14,000 respondents provides some reliability in answering these research questions. Nevertheless, the respective two dimensions of EC (egoistic and altruistic) and NEP (pessimistic and superior) should be confirmed in further studies.

Another important aspect is the investigation of the areas of life in a more differentiated way. Thus, consumption can be specifically divided into further areas, e. g. clothing, technical products, leisure, etc. Regarding the influence of different areas of life on the intention to change, it would be interesting to investigate the causality of two assumptions. Based on the results of the study, it seems reasonable to assume that the frequency of confrontation in everyday life (food and mobility vs. consumption and energy) could be one reason for the different intentions to change behavior. Here, an experimental research approach could provide further insights into the reasons for behavioral changes. The same applies to habituation effects and direct visibility of effects. It could be that a large habit is more likely to discourage one's behavior from changing. At the same time, direct visibility of effects helps people to accept changes in their own behavior.

In addition, further studies should investigate to what extent people are willing to accept changes in long-standing behaviors in favor of the environment and climate and above what threshold they would find this unpleasant. Furthermore, it could be investigated whether a change with substitution products is easier than a change in behavior and what degree of conformity with the original product is considered acceptable by the consumer. For example, a switch to a completely meat-free diet entails the preparation and consumption of completely different meals, whereas meat substitutes can be used to maintain familiar diets. In addition, country-specific differences could have an influence on the willingness to change in the various areas of life. Mobility has a different status in different countries. For example, a status symbol as opposed to a pure means of transportation. Nutrition is also very strongly culturally influenced. Energy depends very much on prosperity and the degree of industrialization. Consumption intensity is reflected in prosperity.

CRediT authorship contribution statement

Oliver Alexander Gansser: Conceptualization, Methodology, Formal analysis, Investigation, Writing, Supervision.

Christina Stefanie Reich: Conceptualization, Methodology, Validation, Investigation, Writing, Visualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix

Table A1
Items for the four dimensions of intention to change behavior

Variable	Items	Measurement of intention for each area of life
Consumption		In the future, I will try more often to …
(Gansser & Reich, 2021)	Y6.1	… repair damaged things.
	Y6.2	… buy used things.
	Y6.3	… to buy less in general.
	Y6.4	… to buy less non-durable and more high-quality products with a longer lifetime.
	Y6.5	… not to fly on vacation, but rather to stay in the region.
	Y6.6	… buying clothes from fair and sustainable production (with certificate).
Energy		In the future, I will try more often to …
(Gansser & Reich, 2021)	Y6.7	… using lighting more sparingly.
	Y6.8	… Set lower temperatures when washing.
	Y6.9	… Set lower temperatures when heating.
	Y6.10	… use water more sparingly.
Food		In the future, I will try more often to …
(Gansser & Reich, 2021)	Y6.11	… to avoid the consumption of animal products (milk, cheese, eggs, etc.).
	Y6.12	… to avoid the consumption of fish.
	Y6.13	… to avoid the consumption of meat.
Mobility		In the future, I will try more often to …
(Gansser & Reich, 2021)	Y6.14	… to increase the use of bicycles or walking.
	Y6.15	… to increase the use of public transport.
	Y6.16	… Increasingly avoid the use of the car.

Table A2
Items for all exogenous constructs and attitude toward sustainable behavior

Variable	Items	Construct	Measurement items
Environmental Concern			How important are the consequences of environmental
(Schultz, 2001;Schultz et al., 2005;			problems to you personally for …
Stern & Dietz, 1994; Weber et al., 2020)	X2.1	Egoistic	yourself?
	X2.2		your lifestyle?
	X2.3		your health?
	X2.4		your future?
	X2.5	Altruistic	people in your country
	X2.6		all people
	X2.7		children
	X2.8		future generations
	X2.9	Biospheric	plants
	X2.10		creatures of the sea
	X2.11		birds
	X2.12		mammals
Attitude			To behave sustainably for me is …
(Graf, 2007;	X3.1		very undesirable - very desirable
Weber et al., 2020;	X3.2		very bad - very good
Weber & Fiebelkorn, 2019)	X3.3		very harmful - very beneficial
	X3.4		very unimportant - very important
	X3.5		very hard - very easy
Subjective Norm	X5.1		Most of the people who are important to me think that I should behave sustainably.
(Graf, 2007;	X5.2		My family thinks I should behave in a sustainable way.
Weber et al., 2020;	X5.3		My friends think I should behave in a sustainable way.
Weber & Fiebelkorn, 2019)			
Perceived Behavioral Control	X4.1		For me, behaving sustainably is in general … completely impossible - very possible.
(Graf, 2007;	X4.2		For me, behaving sustainably is financially … completely impossible - very possible.

Table A2 (*continued*)

Variable	Items	Construct	Measurement items
Weber et al., 2020;	X4.3		For me to achieve a sustainable lifestyle is … very difficult - very easy.
Weber & Fiebelkorn, 2019)	X4.4		If I wanted to, it would be easy for me to behave in a sustainable way … very unlikely - very likely
	X4.5		The decision to behave sustainably is under my complete control … not at all - completely
New Ecological Paradigm	X1.1		We are approaching the limit of the number of people the earth can support.
(Dunlap et al., 2000; Dunlap & Van Liere, 1978)	X1.2		Humans have the right to modify the natural environment to meet their needs.
	X1.3		When humans interfere with nature, the consequences are often disastrous.
	X1.4		Human ingenuity will ensure that we do NOT make the earth uninhabitable.
	X1.5		Humans greatly abuse the environment.
	X1.6		The earth has abundant natural resources if only we learn to use them.
	X1.7		Plants and animals have as much right to exist as humans.
	X1.8		The balance of nature is strong enough to cope with the impact of modern industrialized nations.
	X1.9		Despite our special abilities, humans are subject to the laws of nature.
	X1.10		The so-called "ecological crisis" of mankind is greatly exaggerated.
	X1.11		Earth is like a spaceship with very limited space and resources.
	X1.12		Humans should rule over the rest of nature.
	X1.13		The balance of nature is very delicate and can be easily disturbed.
	X1.14		Humans will eventually learn enough about how nature works to be able to control it.
	X1.15		If things continue as they are, we will soon face a great ecological catastrophe.

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