

Environmental awareness, altruism and social influence as drivers of sustainable behavior in university students

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ABSTRACT

In today's world, where decreasing our ecological footprint is synonymous with achieving a sustainable future, identifying the key drivers of sustainable behavior is essential. This study explores how sustainable behavior is individually impacted by environmental awareness, altruism and social influence, as well as the impact of environmental awareness mediated by altruism. It involves constructs from established literature to provide a new model. This model takes data from an online Qualtrics survey which was distributed to 77 university students and then analyzed through the partial least squares structural equation modeling method. The results show a significant impact of environmental awareness, with altruism as its mediator, on sustainable behavior while altruism by itself and social influence hold less influence. This provides marketers and policy makers with guidelines to improve motivational campaigns to encourage the most people to adopt more sustainable practices.

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Keywords

environmental awareness, altruism, social influence, sustainable behavior, university students

1. INTRODUCTION

As we keep exhausting the planet's resources faster than they can be restored, the crisis for care of the environment has become imperative for a sustainable future (Pla-Julían & Guevara, 2019). Climate change is a constant and growing threat to the sustainable development of society and human activities play the driving force in this decline, but they could also help mitigate it (Shen et al., 2024). The effects of climate change are due to human behavior that has been modeled by ideologies that separate humans from the environment that surrounds them; therefore, changing human behavior becomes a crucial part of implementing sustainability (Malt & Majid, 2023).

However, the best ways to produce change in people's behavior towards pro-environmental actions have been studied for over 50 years with different approaches as results. One of them being informational strategies that focus on increasing awareness of environmental issues (Abrahamse & Matthies, 2012). The problem lies in the varying results on how effective this strategy is on modifying the behavior of individuals. Some research finds education and awareness at the forefront for molding sustainable attitudes (De Carvalho et al., 2015; Cuzdriorean et al., 2020), while others find it fluctuating or even negligible (Cogut et al., 2019, Costanzo et al., 1986). It is clear environmental awareness is not enough to cause a substantial impact in the change of unsustainable behavior in people (Macdiarmid et al., 2016). Values play a very big role in influencing how humans behave towards their environment, this is known as altruism. (Nguyen et al., 2023). Consumers with a higher level of altruism are more cautious about the impact their behavior has on the environment (Panda et al., 2020) and connected with high levels of environmental awareness, could cause considerable impact on the adoption of sustainable behavior. However, the impact can be mitigated by the significance of social norms and lack of social influence on individuals (Malt & Majid, 2023). People, being social animals, have the tendency to depend on others' experiences to shape their own opinion (Saleem & Zhang, 2024). When there is incongruence between these three variables, the individual effects are diminished so it is natural to question the impact they each have on the adoption of sustainable behavior. The following research aims to develop this phenomenon and potentially suggest new findings. It takes students at university as the object of study since they are considered to be the future leaders in the mission to achieve the Sustainable Development Goals (SDGs; Saleh et al., 2022).

There are different aspects and definitions to sustainability, but the most relevant to this paper is ecological or environmental sustainability which defines it as meeting human needs without compromising the well-being of the ecosystems (Morelli, 2011). In 2012, the United Nations developed the SDGs which aim to improve the lives of populations around the world as well as to mitigate the effects of climate change by 2030. Such as SDG 13: Climate Action, SDG 14: Life Below Water and SDG 15: Life on Land (Archer & Males, 2024). Many organizations have followed this initiative with commitments to change their operations in order to help achieve these goals. That is the case of the University of Twente which has its vision as "How can we contribute to the development of a fair, sustainable and digital society between now and 2030?" (University of Twente, 2020). In the effort to be a more sustainable organization, the University has centered their education, research and innovation around environmental, social and economic sustainability, as well as implementing the Sustainability, Energy & Environment (SEE) programme to improve their performance as a sustainable organization (University of Twente, 2023). Since the research was mainly conducted at the University of Twente, the findings

are mainly aimed at the university's decision and policy makers. Additionally, the fact that universities have struggled to deviate from the traditional educational approach to sustainability, which is heavily intertwined with natural sciences and therefore not included into their curricula (Cogut et al., 2019), this research could benefit the University of Twente, and other universities, and help it achieve its sustainability goals with its students.

There is an ongoing debate among scholars surrounding the most effective approach when talking about pro-environmental behavior: a "bottom-up" or a "top-down" approach. Social norms and values belong to the "bottom-up", while environmental awareness belongs to the "top-down" (Hein, 2022). But not enough research has been done in the relationships between these variables and how they contribute to the sustainable behaviors of university students (Whitley et al., 2016). The research aims to answer the questions: **What is the impact of environmental awareness, altruism, and social influence on sustainable behavior of university students, and what is the role of altruism in the relationship between environmental awareness and sustainable behavior?** In order to achieve this, a survey was sent to university students of different studies and academic levels to inquire about their level of sustainability awareness, altruism and social impact as well as their current behavior. The primary data collected helped identify if there is a significant link between the variables as well as single out other factors that are not being considered that have a more considerable effect. Consequently, the data was analyzed using the partial least squares structural equation modeling (PLS-SEM) methodology which helped visualize the cause-effect relationship between the variables involved. Combined with previous findings and theories related to the study such as the value-belief-norm (VBN; Whitmarsh et al., 2021) and the psychological nature between the variables and pro-environmental behavior (Malt & Majid, 2023) the study further develops a more comprehensive take on the research questions that is specific to the environment in universities.

The outline of this study is structured as follows. The introduction establishes the topic along with the problem that motivated the research being conducted. This is then followed by the theoretical framework that reviews the theories used and develops the research model. The methodology then explains the sample where the data was taken from, as well as the method used to distribute a Qualtrics survey through different channels. It also mentions the PLS-SEM as the method used in order to analyze the data. Furthermore, an analysis of the measurement and structural model is provided based on the results of the model. The discussion and implications then explain the meaning of the results in a theoretical and practical context. Finally, the conclusion of the study reveals opportunities for further research.

2. THEORETICAL BACKGROUND

2.1 Value-Belief-Norm Theory

The relationship between the variables and sustainable practices can be explained using the Value-Belief-Norm (VBN) Theory. VBN Theory is a psychological framework used to understand sustainable behavior which is influenced by three factors: values, beliefs and norms (Stern et al., 1999). It views it in a 'chain perspective' where personal values determine worldview beliefs which later promotes personal norms (Gkargkavouzi et al., 2019). It is based on the Moral Norm Activation Theory by S. H. Schwartz's (1972, 1977) which suggests people are more likely to take action on their behavior when they are aware of the environmental harm they could be causing (Stern et al., 1999). It develops from the general values into the beliefs about the relationship between humans and the environment that in turn,

impact specific beliefs that result in the change in behavior (Steg et al., 2005). The VBN Theory explains the causal relationship between internal and external motivation when it comes to sustainable behavior. The value refers to a concept that gives guidance to the selection of behaviors depending on their importance which results in desired attitudes. There are three types of values identified in the theory: egoistic value, altruism value and biospheric value and they all influence beliefs and norms that impact pro-environmental behavior in different ways (Chen, 2020). The belief part refers to the thoughts an individual has on the natural environment and human behavior. Finally, the norm refers to the moral obligation to show pro-environmental behavior (Choi et al., 2015). How the three are essentially linked will be further explored throughout the research.

2.2 Sustainable behavior

Sustainable behavior is said to reflect an environmentally responsible lifestyle where an individual's knowledge, admiration and insights in ecology issues are clearly seen (Yu et al., 2017). Sustainable choices differ from typical consumer decision making as it focuses on the long-term benefits of other people and the environment (White et al., 2019). The behavior can be classified into two different groups: behaviors of environmental activists and other non-activist behaviors. The latter includes the consumer behavior such as the purchase, use and disposal of goods (Francis & Sarangi, 2022). In this kind of behavior, it is also important to show actions that encompass the conservation of natural and social resources and altruistic behaviors, at the same time as meeting the needs of the current generation without endangering the needs of the generations to come (Sheoran & Kumar, 2020). It has been observed that there is a weak relationship between consumer's attitude towards sustainable practices and their actual behavior, this is known as the attitude-behavior gap (Joshi & Rahman, 2017). Individual behavior is key in the development of sustainable behavior as they hold purchasing power, as well as the possibility of influencing policies that affect more than just one person (Malt & Majid, 2023). Studying the drivers behind sustainable behavior in students is essential in battling with the environmental issues as they are considered to be the future educators and policymakers of ecological concerns (Shafiei & Maleksaeidi, 2020). Making sure they adopt the correct attitude that benefits the environment is necessary for the establishment of a clean and prosperous future.

2.3 Environmental awareness

One of the main drivers of sustainable consumption has been proven to be information (De Carvalho et al., 2015). This information can be defined as the awareness consumers have on sustainability problems as well as on their solutions (Bagaskoro & Qastharin, 2021). High levels of environmental awareness in consumers influences producers into changing their production to one that is more environmentally friendly (Zuzek, 2018). Similarly, one of the main barriers to sustainable consumer behavior was the lack of awareness of the negative impact of a product (Sheoran & Kumar, 2020). Expanding the public's level of awareness has been the main focus of psychologists to research the influence behavior towards more sustainable practices (Whitmarsh et al., 2021) and informational campaigns overshadow all other promotional techniques because of how easy it is to distribute (McKenzie-Mohr, 2012). Several studies show there is a high, positive relationship between level of awareness and the adoption of sustainable behaviors (Peiró-Signes et al., 2023, Fu et al., 2020). However, other studies show this is not always the case because of other contributing factors (Cogut et al., 2019), or the way sustainable activities are marketed as a 'product' (Costanzo et al., 1986). This makes it

safe to assume that raising awareness on sustainability is not enough to change the behavior of consumers. Other factors, such as presented in the VBN Theory, have a big impact and can sometimes interfere with the effectiveness of environmental awareness on sustainable attitudes (Macdiarmid et al., 2016). The contributing factor explored in this research is altruism. It has been proven that people who have high levels of environmental awareness are more likely to engage in altruistic behaviors and vice versa (Aruga, 2020). Along with that, altruism has been positively linked with environmental concern (Gifford & Nilsson, 2014); therefore, raising individual's environmental awareness will strengthen their altruistic values which will result in an increase in their pro-environmental behavior (Milfont & Schultz, 2016). This is why the following hypotheses is proposed:

H1: Higher levels of environmental awareness lead to higher levels of sustainable behavior.

H2: Higher levels of environmental awareness lead to higher levels of altruism which, in turn, leads to higher levels of sustainable behavior.

2.4 Altruism

Altruism is the concern for the well-being of others (Anders et al., 2023) and this can be separated into two parts: social altruism and ecological altruism (Nguyen et al., 2023). In this research, the focus will be on ecological altruism which looks for the welfare of non-human factors such as the environment. Fundamental characteristics of altruistic behavior is the showing of unconditional kindness and self-sacrifice, expecting nothing in return (Da Costa et al., 2021). This translates into consumer behavior in the form of concern for the ecological benefits of their behavior, purchase decisions (Peiró-Signes et al., 2023) as well as brand loyalty and standards (Panda et al., 2020). Altruistic values in consumers are reflected on their behavior as they tend to have a more positive relationship with environmental responsibility (Da Costa et al., 2021). One example is the relationship with resource conservation. Resource conservation practices result in their future availability for individuals and others which is more appreciated in people with high levels of altruism than in people with egoistic values (Corral-Verdugo et al., 2011). It is important to highlight that a state of altruism can only be reached when self-affirmation factors have been satisfied, which is rarer in young people considering they are still in early stages of independence (Naderi & Van Steenburg, 2018). Studies show the positive relationship (Steg et al., 2012, Panda et al., 2020), while others highlight other factors that are to be considered in the relationship such as the relationship with environmental awareness (Da Costa et al., 2021). This is how the following hypothesis was made:

H3: Higher levels of altruism lead to higher levels of sustainable behavior.

2.5 Social Influence

The levels of awareness could be high and so could the levels of altruism, but a considerable barrier in the adoption of sustainable behavior is social disapproval (Perry et al., 2021). Individuals are more likely to reject information or act in contrast to their values if it goes against the social norms they have been following. Malt & Majid (2023) exemplify this situation with the culture of lawn care. A full, green and blossoming lawn is deemed as the norm to be accepted into a neighborhood, however the upkeep of this comes with attitudes that are highly detrimental to the environment such as: pesticides and the waste of water. It will be harder for them to change certain behaviors that are being implemented by everyone around them. However, this could also

act as a driver of sustainable attitudes. Since it is known that people tend to imitate each other (Wei et al., 2023), encouragement to embrace sustainable attitudes becomes easier in groups. Studies show that consumers are more likely to view sustainable products and practices as normative when a significant amount of the people around them endorse them (Otterbring & Folwarczny, 2024). This, in turn, creates pressure for others to show these practices which is known as social influence (Wei et al., 2023). Once these behaviors are adopted by the majority, it could be considered as social norms, which are harder to reject, especially in a smaller community (Perry et al., 2021) like the University of Twente. This is how the following hypothesis was made:

H4: Compared to environmental awareness, higher levels of social influence lead to higher levels of sustainable behavior.

3. METHODOLOGY

This section will present the methodology used to present the findings. The design for this study is quantitative research as it takes a range of numeric data in order to show a relationship between the variables (Coghlan & Brydon-Miller, 2014) which in this case are sustainable behavior, environmental awareness, altruism and social influence. The research consists of sending a survey to students enrolled (primarily) in the University of Twente, but all students enrolled in universities are included in order to get to know their levels on these variables and be able to identify a relationship between them.

3.1 Sample and measurement

A total of 85 students were reached through the survey that was mostly distributed online. The main social media channels to reach people were WhatsApp and Instagram. The sampling method used was “snowball sampling” which involves collecting information from individuals and asking them to refer to others to participate in the study (Handcock & Gile, 2011). There are disadvantages to this method such as selection bias due to the lack of random sampling as well as the dependency on prior knowledge of individuals which may not always be available to researchers. These drawbacks are contrasted by its advantages including being economical, efficient and effective at producing in-depth results. (Atkinson & Flint, 2001). In order to respect the

privacy of the participants, at the start of the survey they were assured they were in complete anonymity and had every right to participate or leave the survey at any point. Out of the 85 respondents, 77 filled out the survey in its completion, with at least 17 out of the 20 questions being answered, the ones that were not completed were removed from the study. The only personal questions asked were about the participants’ age, nationality and if they were a university student studying at the University of Twente, a university student studying in a different university, or not a university student at all. (Table A.1; Table A.2). The survey questions (Table A.3) were taken from existing literature that represent the four components in the most effective and accurate manner.

For the sustainable behavior construct, the survey questions were based on the literature by Kilbourne & Pickett (2008) which tested its questions on a sample of 303 respondents. Consequently, the construct of environmental awareness was measured with the questions in the literature by Blok et al., (2015) that were tested on 411 PhD students as well as full professors. The items measuring the construct of altruism were taken from the literature by Joffe-Nelson et al. (2024) which tested on 389 respondents. Finally, the items to measure Social Influence were taken from the research by Stibe & Cugelman (2019). The constructs of sustainable behavior, environmental awareness and social influence follow a five-point Likert scale (1 = completely disagree, 5 = completely agree) while the construct of altruism uses a different five-point Likert scale (1 = unimportant, 5 = very important) in order to assess participants’ habits on each of the constructs in the most accurate manner.

3.2 Method

In order to analyze the data, the PLS-SEM method was used. PLS-SEM is a causal-predictive method for structural equation modeling used for prediction in estimating statistical models to offer explanations (Hair et al., 2019). The reasons why studies generally prefer to use PLS-SEM is the small sample size, the non-normal data, high model complexity and the predictive study focus (Magno et al., 2022). Therefore, due to the objective of this research, PLS-SEM was the most useful as it analyzes the model in order to predict and explain outcomes from the sample (Hair & Alamer, 2022). It is also important to note that because of the

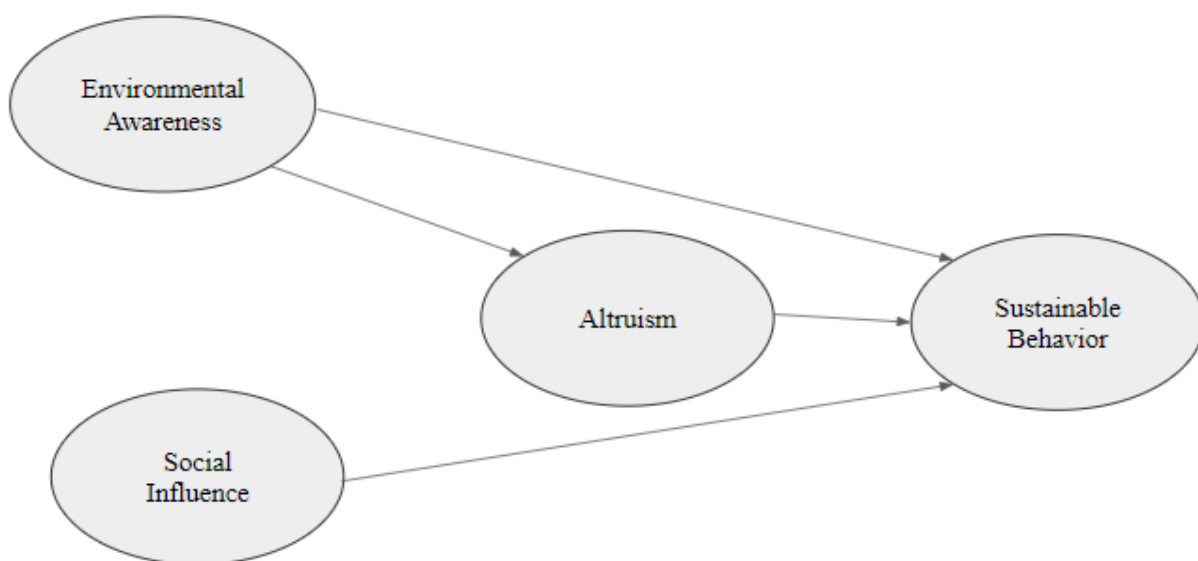


Figure 1: Theoretical model.
Source: Own illustration.

small sample size, this method gives the most satisfactory results as it offers flexibility while examining models (Mondal et al., 2024). Additionally, the method has been used in other research that involves sustainable consumption behavior and has had successful results (Morais et al., 2024). The use of the software SmartPLS 4 was necessary for the assessment of the model (Ringle et al., 2024). Features included in the software such as bootstrapping (Hair et al., 2019) as well as the PLS-SEM Algorithm (Ringle et al., 2024) were required to report the results of the model.

4. ANALYSIS

4.1 Assessment of the measurement models

For the assessment of the models, the literature by Hair et al. (2019) is used as a guideline. Before conducting the analysis, it is important to establish that this model is a reflective measurement model. This is due to the causal relationship between the constructs and the latent variable in the model. Additionally, the visual representation of the model, shown in Figure 1, also represents this reasoning as the arrows point away from the construct to the indicators (Hair et al., 2020). Therefore, the appropriate process to follow to examine this model can be divided into four steps, the first one involving examining the indicator loadings where results above 0.708 are ideal. When this is the case, the loadings can confirm item reliability (Hair et al., 2019). In the case of this research's model, the loadings are above 0.708 and the few that do not, have loadings that are sufficient enough in order to be included (Table A.4).

The second step has as an objective the assessment of internal consistency reliability. Values for composite reliability between 0.60 and 0.90 are desirable since higher values reflect higher levels of reliability; however, values above 0.95 could indicate redundancy in the items. (Hair et al., 2019). The results in this area are satisfactory as they appear to be in a range of 0.794 to 0.864 (Table A.5) Similarly, the ρ_A follows the same standards (Sarstedt et al., 2017) and comparable results (Table A.5). The exception is the construct of Social Influence that has a ρ_A value of 1.101, which shows redundancy and could mean the items are measuring the same aspect of the model (Hair & Alamer, 2022). Additionally, Cronbach's alpha follows the same rule of measuring reliability, but is considered to be less accurate than

composite reliability (Hair et al., 2020). The results of this study lay satisfactory between the threshold, except for the construct Social Influence, but due to its low level of accuracy, it is not concerning. Similarly, to further prove the reliability, the confidence intervals should be between the lower threshold (the lower end of the 95 percent confidence interval is higher than 0.70) and the upper threshold (the higher end of the 95 percent confidence interval is lower than 0.95; Hair et al., 2019). As seen on Table A.6, only the values for environmental awareness with altruism and environmental awareness with sustainable behavior lie between the threshold which means these are the only significant constructs.

The third step of the assessment involves the convergent validity of the construct's measures, which is the degree to which the construct converges to explain the variance of the items (Hair et al., 2019). The resulting values for the average variance extended (AVE) are 0.50 or higher (Table A.6) which suggests good convergent validity.

Finally, the fourth step assesses discriminant validity which measures how different the constructs are to each other (Hair et al., 2019). If a value below 0.85 Heterotrait-monotrait ratio (HTMT) can be established, then the constructs are adequately distinct from each other (Henseler et al., 2014). The loadings reflect sufficient discriminant validity between the constructs, as they each have results lower than 0.85 (Table A.7).

4.2 Assessment of the structural models

In order to develop the assessment of the structural models, the guidelines provided by Hair et al. (2019, 2020) and Schmueeli et al. (2019) are followed. The assessment will follow several steps to analyze the degree in which the constructs impact each other (Becker et al., 2012).

The first step in order to analyze the relationships is looking at multicollinearity through the VIF values (Hair et al., 2020). No clear and alarming collinearity issues are present, since all the values shown (Table A.6) are lower than 3 (Hair et al., 2019).

Consequently, the path coefficients need to be examined in order to confirm or deny the validity of the hypotheses. The closer the path coefficient values are to 1, the stronger the impact is in the prediction of the constructs, the opposite goes for path coefficient

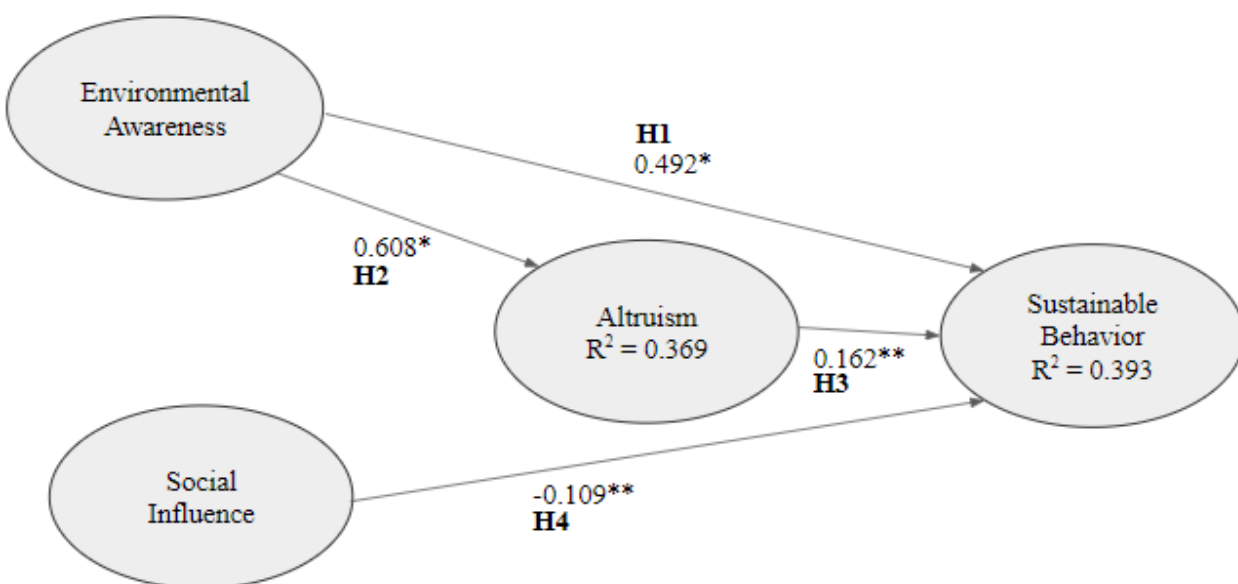


Figure 2: Theoretical model and results.
Source: SmartPLS 4; own illustration.

values closer to 0 (Hair et al., 2020). There are various levels of strength between the constructs ranging from -0.109 to 0.608 (Table A.6). The value of -0.109 means there is a weak relationship between social influence and sustainable behavior, but with a negative impact. In other words, the higher the negative social influence, the lower the habits of sustainable behavior; however, this effect is rather weak. On the other hand, the strongest relationship is between environmental awareness and altruism. The second strongest relationship is between environmental awareness and sustainable behavior with a path coefficient of 0.492, but since it is closer to the absolute value of 0, it can be said environmental awareness is a weak predictor for sustainable behavior. Finally, there is a weak relationship between altruism and sustainable behavior (Figure 2), but the relationship there is between environmental awareness and altruism should also be considered.

In order to conduct the mediation analysis, two main steps were followed: determining the significance of indirect effects and the type of mediation (Carrión et al., 2017). There is a significant indirect effect which means there is mediation present (Table A.6)

The following step measures the variance in order to quantify the model's explanatory power; higher values correspond to higher explanatory power (Hair et al., 2019). Environmental awareness explains altruism in a weak to moderate amount (Figure 2), while all constructs have the same weak to moderate explanatory power on sustainable behavior (Figure 2).

Moreover, the metric $Q^2_{predict}$ involves prediction aspects as well as explanatory power in the key endogenous constructs in order to assess the model's predictive accuracy (Hair et al., 2019). The values obtained from this research show a meaningful predictive relevance (Table A.8) as they are larger than zero. With further usage of the $PLS_{predict}$ procedure, the values of the

root mean squared error obtained through PLS-SEM ($RMSE_{PLS}$) were compared to the RMSE of the linear model (LM) benchmark (Table A.8). All $RMSE_{PLS}$ values, except for one, are lower to the $RMSE_{LM}$ values which means the model predicts the key endogenous constructs of altruism and sustainable behavior sufficiently well (Shmueli et al., 2019).

The assessments confirm a satisfactory reliability and validity of the model, which creates a solid foundation for further analysis and interpretation of related research knowledge.

5. DISCUSSION AND IMPLICATIONS

5.1 Theoretical implications

A moderate positive relationship between environmental awareness and sustainable behavior was proven in the research. The simple implication is that the more knowledge people have on their environmental impact, the more accordingly they will act. Such implies that H1 can be confirmed as high levels of environmental awareness do lead to higher levels of sustainable behavior. The VBN Theory also aids in confirming this as it suggests that being aware of the consequences of their actions will strengthen individuals' personal norms to act sustainably. This involves the idea that knowledge gives people, and customers in business situations, power over their sustainable decisions (García-Salirrosas et al., 2024). It acts in support of the increase of educational programs and campaigns in order to inform people about their personal impact on the environment so they can adjust or promote their habits. This has been proven by a study that shows that environmental education fosters encouraging attitudes towards sustainable practices (Begum et al., 2021).

The research found that the strongest relationship is between the constructs of environmental awareness and sustainable behavior, mediated by altruism. What this implicates is that higher levels of environmental awareness support altruistic behavior in a

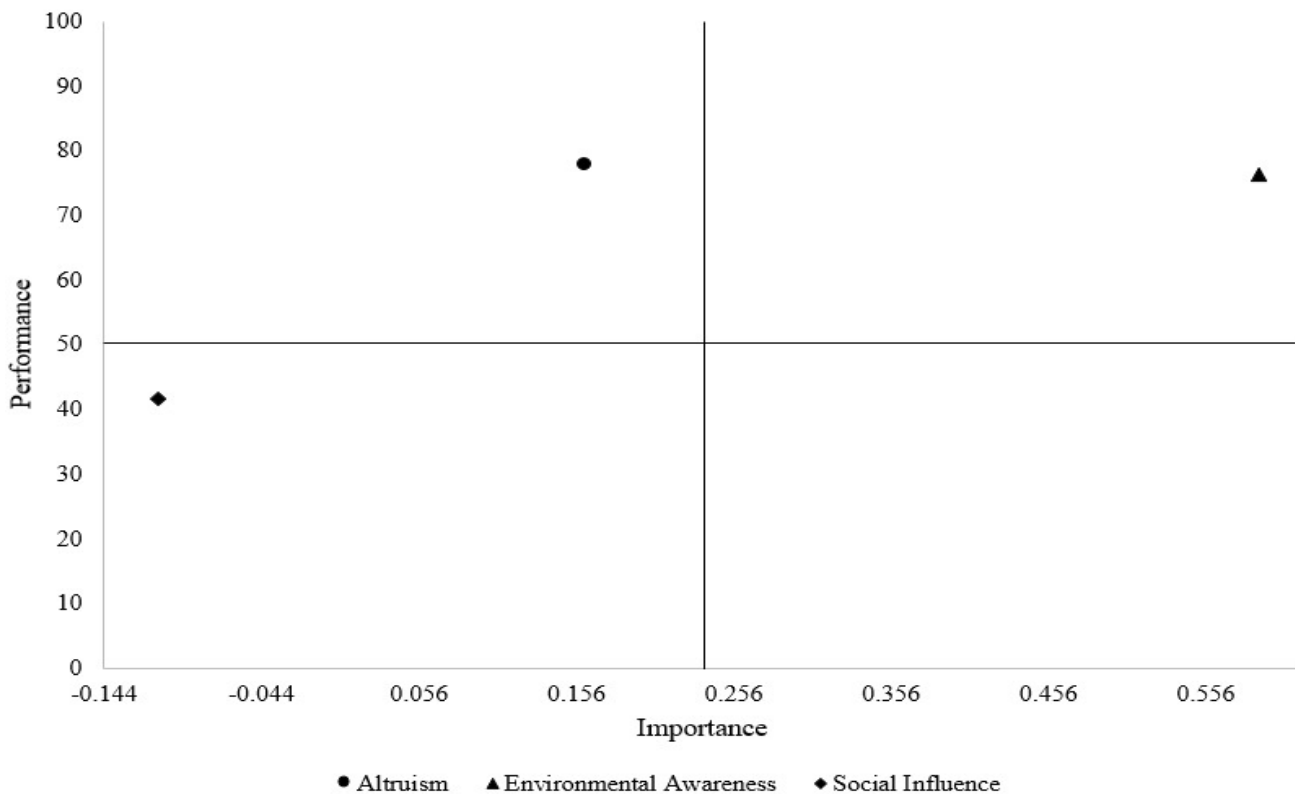


Figure 3: Importance Performance Map Analysis.

Source: SmartPLS4; own illustration.

significant amount, which in turn impact their sustainable behavior. This is enough evidence to confirm H2. It is also consistent with the VBN Theory where altruistic values are activated by environmental awareness, which translates into action. Research has shown that knowledge regarding environmental conditions inspires concern about climate issues (Zeng et al., 2023). This has substantial effects when the communication of this knowledge involves emotional responses (Sheppard, 2005). This could potentially suggest that through the development of people's environmental awareness and the issues surrounding the topic, their altruistic attitudes will rise accordingly and so will their (purchasing) behavior.

A weak, but positive relationship between altruism and sustainable behavior was also exposed. This means that there is a positive correlation between altruistic attitudes and sustainable behavior. With this in mind, H3 can be confirmed to a certain extent, as the causal relationship is not particularly strong. A distinct reasoning for this, that has been previously studied, is that altruistic individuals are more likely to make sustainable choices with their purchasing power (Li & Lin, 2023) due to the concern for the environment's wellbeing. This is also reinforced through the VBN Theory where altruistic values motivate individuals to show sustainable behavior due to there being a moral obligation. As for the weak effect, it indicates the influence of other factors, such as social interest or other demographic factors (Aruga, 2020) that might have a more considerable effect and should be further investigated.

Finally, the results revealed a weak and negative relationship between social influence and sustainable behavior. Compared to the results for environmental awareness, H4 cannot be confirmed. What this proposes is that the higher levels of social influence in a person, the lower levels of sustainable behavior they showcase. It could be interpreted that social pressures could be the reason for negative or indifferent attitudes towards sustainability. Social perception and habits displayed by those around them act as barriers for sustainable consumption (Vergura et al., 2023). Due to the weak effect, it suggests the presence of other factors influencing this negative relationship. The VBN Theory could help explain this, as there seems to lack a translation between the norms and the sustainable behavior. These aspects give way for further investigation in order to understand the obstacles for the promotion and adoption of sustainable behavior.

5.2 Practical implications

To further analyze the implications of the models, an importance-performance map analysis (IPMA) was conducted. The IPMA compares the importance and the performance of each construct (environmental awareness, altruism and social influence) on a target outcome (sustainable behavior) in order to find the ones that play a very important role in achieving the target outcome, but do not have high performance (Ringle & Sarstedt, 2016). This is so that the right amount of attention is placed on them for improvement on the outcome. The results for this analysis (Table A.9) show which of the constructs acts the most as a driver for sustainable behavior. What can be interpreted from these findings is that environmental awareness scores relatively highly in both performance (76.35) and importance (76.35), while altruism scored higher on performance (77.7), but lower on importance (0.16). Social influence scored relatively low on both aspects.

From these results, recommendations can be made in order to improve their positions on the IPMA (Figure 3). Mainly, decision and policy makers should focus on campaigns and programs that focus on spreading awareness and raising the level of environmental knowledge in the public, since environmental

awareness is the construct with higher levels of importance and performance, making it the biggest driver of sustainable behavior in this research. Moreover, these campaigns should also highlight the emotional benefits of adopting sustainable behavior since altruism has a considerable effect on the target outcome. Advertising the importance of sustainable habits on the well-being of the environment is a good way to influence the public who value altruism. Furthermore, social influence does not seem to be a relevant construct to direct special attention to when it comes to sustainable behavior in this research; therefore, limited resources should be allocated to its improvement (Tzeng & Chang, 2011). However, it is not concerning as it can be analyzed as a barrier instead of a driver factor and paired together with other factors such as culture and social awareness (Aruga, 2020). With these implications, a clearer understanding of the drivers of sustainable behavior can be achieved so the campaigns and policies achieve the most amount of effectiveness.

6. CONCLUSIONS

This research had as the principal objective to answer the research questions: **What is the impact of environmental awareness, altruism, and social influence on sustainable behavior of university students, and what is the role of altruism in the relationship between environmental awareness and sustainable behavior?** Previous research had not been conducted to study the effects these three variables had on sustainable behavior, so this research aimed to fill this gap with meaningful findings. Through the usage of the PLS-SEM methodology, environmental awareness was concluded to be a significant driver in sustainable behavior, much more influential than altruism and social influence.

The main contributions of this study rely on the evidence that environmental awareness acts as the biggest driver mediated by altruism, compared to altruism and social influence, for sustainable behavior in university students. Additionally, adding altruism as a mediator in the relationship between environmental awareness and sustainable behavior along with its own causal relationship provides new opportunities to the area of research. Furthermore, it focuses on university students as the demographic group, as 83.1% of the sample belonged to the age group 18-24 (Table A.2), which acts as an addition to the universities' knowledge of their student habits. This is so that organizations like the University of Twente (which is where a big part of the sample came from), among others, and businesses can achieve their commitment to the Sustainable Development Goals in a timely manner.

Despite the strength of the research, it is also subject to a fair share of limitations. One of them being the small sample size. This creates a generalization that is not as representative of the demographic group as a bigger sample size would be. It is also not evenly geographically dispersed, as most of the participants in the survey were from European countries and Mexico. Further research should include a larger sample size that either focuses on one geographical location or takes data from a more widespread reach. Additionally, this research uses social influence as a driver for sustainable behavior, and it resulted in having a weak causal relationship. This contributes to the need to research barriers for sustainable behavior or compare the impact of drivers and barriers alike. (Camacho-Otero et al., 2018; Raghoebar et al., 2024)

Another influential research that is encouraged by these results could be the analysis of different promotional strategies that use environmental awareness, altruism values or social influence as their selling point for customers to choose more sustainable options in the market. It has been proven that satisfying results have come from individualized marketing approaches where the

information provided is catered to the needs and barriers of distinct population clusters (Steg & Vlek, 2009). This would be beneficial for encouraging businesses to adopt more sustainable practices and offer more environmentally friendly options. Additionally, investigating how to mitigate the barriers keeping businesses from applying more ecological practices would benefit the future of the circular economy (Kazancoglu et al., 2020).

In conclusion, this research emphasizes the importance of promotional efforts to include diverse factors that influence the adoption of sustainable behavior. Increasing environmental awareness, appealing to altruistic values and understanding the role of social influence is necessary to develop strategies that encourage the public to take interest and maintain sustainable practices. This research serves as a solid foundation for future research to be explored with the aim of improving the effectiveness of standards and policies in sustainability.

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9. APPENDIX

Appendix A

Table A1: Country demographic data.

Country	N	%
Armenia	1	1.3
Austria	1	1.3
Belgium	1	1.3
Bolivia	1	1.3
China	1	1.3
Croatia	1	1.3
Cyprus	1	1.3
Egypt	1	1.3
Estonia	2	2.6
France	3	3.9
Germany	5	6.5
India	1	1.3
Italy	3	3.9
Kenya	1	1.3
Mexico	26	33.8
Mexico/ Russia	1	1.3
Netherlands	11	14.3
Norway	1	1.3
Poland	5	6.5
Romania	1	1.3
Spain	4	5.2
Turkey	2	2.6
Venezuela	1	1.3
Western Sahara	2	2.6

Source: Own tabulation based on collected data.

Table A.2: Age group demographic data.

Age Group	N	%
Under 18 years old	0	0.0
18-24 years old	64	83.1
25-34 years old	11	14.3
35-44 years old	1	1.3
45-54 years old	0	0.0
55-64 years old	0	0.0

Source: Own tabulation based on collected data.

Table A.3: Measurement items for the constructs in the theoretical model.

Construct	Measurement Item	Source
Sustainable Behavior	<p>Please indicate whether you agree/disagree with the following statements.</p> <p>SB1: I buy environmentally friendly products whenever possible</p> <p>SB2: I reduce household waste whenever possible</p> <p>SB3: I use products made from recycled material whenever possible</p> <p>SB4: I buy organic food whenever possible.</p> <p>SB5: I am a member of an environmental</p>	Kilbourne & Pickett, 2008
Environmental Awareness	<p>Please indicate whether you agree/disagree with the following statements.</p> <p>EA1: Environmental problems have consequences for my life</p> <p>EA2: I can see with my own eyes that environment is deteriorating</p> <p>EA3: Too much attention is paid to environmental problems</p> <p>EA4: A better environment starts with me</p> <p>EA5: I worry about environmental problems</p>	Blok et al., 2015
Altruism	<p>Please rate to what extent these values are a guiding principle in your life</p> <p>AL1: Protecting the environment: preserving nature</p> <p>AL2: Unity with nature: fitting into nature</p> <p>AL3: A world of beauty: beauty of nature and the arts</p> <p>AL4: Equality: equal opportunity for all</p> <p>AL5: Social justice: correcting injustice, care for others</p>	Joffe-Nelson et al., 2024
Social Influence	<p>Please indicate whether you agree/disagree with the following statements.</p> <p>SI3: I prefer to do what other people typically do</p> <p>SI4: I avoid acting in a way that is uncommon</p>	Stibe & Cugelman, 2019

Table A.4: Indicator loadings.

Construct	Items	Loadings	Confidence Intervals
Altruism	AL1	0.604	[0.329;0.767]
	AL2	0.655	[0.329;0.820]
	AL3	0.643	[0.327;0.785]
	AL4	0.849	[0.694;0.926]
	AL5	0.800	[0.617;0.887]
Environmental Awareness	EA1	0.781	[0.636;0.867]
	EA2	0.743	[0.573;0.829]
	EA3	0.660	[0.389;0.804]
	EA4	0.696	[0.510;0.821]
	EA5	0.846	[0.752;0.900]
Sustainable Behavior	SB1	0.832	[0.723;0.890]
	SB2	0.701	[0.478;0.823]
	SB3	0.888	[0.827;0.924]
	SB4	0.566	[0.283;0.734]
	SB5	0.733	[0.583;0.822]
Social Influence	SI3	0.635	[-0.541;0.930]
	SI4	0.966	[0.805;1.00]

Source: data from SmartPLS 4

Table A.5: Reliability and validity.

Construct	Cronbach's alpha	ρ_A	Composite reliability	AVE
Altruism	0.758	0.708	0.838	0.514
Environmental Awareness	0.803	0.816	0.863	0.559
Social Influence	0.585	1.101	0.794	0.668
Sustainable Behavior	0.802	0.840	0.864	0.566

Source: data from SmartPLS 4

Table A.6: Structural model results.

Construct	VIF	Path coefficient	Confidence Intervals
Altruism → Sustainable Behavior	1.590	0.162	[-0.105;0.409]
Environmental Awareness → Altruism	1.000	0.608	[0.447;0.707]
Environmental Awareness → Sustainable Behavior	1.620	0.492	[0.217;0.707]
Social Influence → Sustainable Behavior	1.024	-0.109	[-0.267;0.179]

Source: data from SmartPLS 4

Table A.7: Discriminant validity (HTMT)

Construct	HTMT	Confidence Intervals
Environmental Awareness → Altruism	0.753	[0.582;0.919]
Social Influence → Altruism	0.167	[0.143;0.584]
Social Influence → Environmental Awareness	0.203	[0.129;0.619]
Sustainable Behavior → Altruism	0.566	[0.387;0.763]
Sustainable Behavior → Environmental Awareness	0.725	[0.573;0.861]
Sustainable Behavior → Social Influence	0.236	[0.138;0.592]

Source: data from SmartPLS 4

Table A.8: PLSpredict analysis result

Construct	Q ² predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
SB1	0.237	0.877	0.676	0.935	0.694
SB2	0.123	0.830	0.645	0.876	0.681
SB3	0.301	0.995	0.823	1.049	0.849
SB4	0.098	0.998	0.804	1.068	0.875
SB5	0.141	0.957	0.719	0.960	0.719

Source: data from SmartPLS 4

Table A.9: Importance-performance map analysis (IPMA) results.

IPMA (on Sustainable Behavior)	Total effects	Performance
Altruism	0.162	77.657
Environmental Awareness	0.590	76.346
Social Influence	-0.109	41.709

Source: data from SmartPLS 4