

CIDÁLIA PACHECO

**PRO-ENVIRONMENTAL VALUES, BELIEFS AND NORMS:
IMPACTS ON HOUSEHOLD WATER CONSERVATION**



UNIVERSIDADE DO ALGARVE

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Declaration of Authorship

I hereby declare myself the author of this unique and unprecedented work. The authors and works reviewed in this dissertation are properly cited and included in the text and the included listing of references.

Cidália Maria Correia Pacheco

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(Signature)

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ABSTRACT

Purpose: This study aims to explore the relationship between values, beliefs, and norms and household water conservation behaviour using the Value-Belief-Norm (VBN) framework. Additionally, the research seeks to improve the current understanding of these relationships by including two more variables in the VBN model: perceived drought severity and institutional trust.

Design/methodology/approach: The study uses a quantitative research design, employing a survey to collect household data from 495 participants. Structural equation modelling (SEM) tests the hypothesized relationships among the constructs.

Findings: The results indicate that pro-environmental values and beliefs significantly influence household water conservation intention (HWCI). Specifically, biospheric and altruistic values positively affect a pro-ecological worldview impacting HWCI. Additionally, perceived drought severity is significantly related to HWCI, while institutional trust does not have a significant role.

Research limitations/implications: The study is limited by its cross-sectional design and reliance on self-reported data, which may introduce biases. Future research could benefit from longitudinal studies and objective measures of water conservation behaviour.

Practical implications: The results highlight the importance of biospheric and altruistic values in influencing pro-environmental behaviour and the relationship between perceived drought severity and water conservation intention. Policymakers can use these insights to design programs that stress collective responsibility and broader environmental benefits of water conservation, appealing to altruistic and biospheric values and educating the public about the real impact of their conservation efforts. Messaging should emphasize actionable steps individuals can take, reinforcing that their efforts can make a difference during extreme drought conditions.

Originality/value: This study extends the Value-Belief-Norm theory to household water conservation, highlighting the importance of individual factors in shaping pro-environmental intentions and behaviours.

Keywords: Household water conservation behaviour, Value-Belief-Norm theory, perceived drought severity, institutional trust, pro-environmental behaviour.

Paper type: Research paper.

RESUMO

Apesar das inúmeras reflexões realizadas sobre o tema da água, o crescimento global da população e a crescente procura, a diminuição das disponibilidades hídricas, associadas a episódios climáticos cada vez mais frequentes, contribuem para que este continue a ser um tema atual e extremamente desafiante.

A água está no centro das três dimensões fundamentais à vida humana: social, económica e ambiental. Todos os objetivos de desenvolvimento sustentável elencados pelas Nações Unidas dependem da água, sem uma gestão sustentável o impacto a nível global será devastador. Atualmente cerca de 50% da população mundial enfrenta situações de stress hídrico elevado pelo menos uma vez por ano. Este é um cenário que coloca vidas em risco através da segurança alimentar e energética.

Em Portugal, o país enfrenta uma seca meteorológica que tem um impacto direto na disponibilidade de água, especialmente no Algarve, uma região de grande importância turística, onde já foram implementadas medidas de restrição ao uso deste recurso essencial à vida.

O consumo doméstico de água representa cerca de 15% da procura global e de acordo com a Organização Mundial de Saúde, 50 a 100 litros por dia é a quantidade necessária para satisfazer as necessidades básicas de cada pessoa. Em Portugal, o consumo médio diário é de 195 litros, acima da recomendação, evidenciando que existe um desperdício considerável deste recurso.

Explorar a relação entre valores, crenças e normas e o consumo doméstico de água, utilizando o modelo completo da teoria Valor-Crença-Norma (VBN) é o objetivo deste trabalho de investigação, que procura aprofundar o entendimento dessas relações ao incorporar duas variáveis adicionais ao modelo: a perceção da gravidade da seca e a confiança nas instituições. Pretende-se, assim, contribuir para o desenvolvimento de intervenções mais eficazes que promovam práticas de consumo responsável de água no contexto doméstico, particularmente em regiões marcadas pela escassez de recursos hídricos, como o Algarve, no sul de Portugal.

A pesquisa foi realizada em Portimão, o terceiro maior concelho da região algarvia, com cerca de 60 000 habitantes. A investigação foi conduzida através de uma metodologia quantitativa, utilizando um questionário administrado online para recolher dados de 495 residentes, maiores de 18 anos, durante o mês de junho de 2024. Foi efetuada uma análise descritiva através do SPSS 24 e foi usada a técnica PLS-SEM para analisar a relação entre as variáveis através da modelagem de equações estruturais com mínimos quadrados parciais. Para este efeito foi utilizado o software SmartPLS 4.

Foram confirmadas 9 das 10 hipóteses enunciadas, H3 e H4 parcialmente. Os resultados destacam a relevância dos valores e crenças pró-ambientais na intenção de poupar água no contexto doméstico. Valores biosféricos e altruístas têm uma influência positiva na formação de uma visão do mundo pró-ecológica, que, por sua vez, se mostrou associada à intenção de poupar água. Além disso, a percepção da gravidade da seca revelou-se um fator determinante na motivação para consumir água de forma responsável, especialmente em cenários de escassez severa. Por outro lado, a confiança nas instituições não apresentou um impacto significativo neste contexto, a H10 não foi validada estatisticamente.

Os resultados desta pesquisa têm implicações práticas significativas. Destacam a importância dos valores biosféricos e altruístas na promoção de comportamentos pró-ambientais e reforçam a necessidade de estratégias de comunicação que apelem a estes valores. Adicionalmente enfatizam a relevância de sensibilizar a população sobre a gravidade da seca e os seus impactos na disponibilidade de água, particularmente em períodos críticos. Os decisores políticos podem utilizar estes *insights* para desenhar programas e campanhas educativas que promovam uma responsabilidade coletiva, apelando às ações concretas que os indivíduos podem adotar no seu dia a dia para evitar o desperdício de recursos hídricos.

As mensagens de comunicação devem, ainda, reforçar que o esforço individual tem um impacto significativo no combate à escassez de água. Isso é particularmente relevante em regiões turísticas, como o Algarve, onde a pressão sobre os recursos hídricos é exacerbada pelas atividades ligadas ao turismo sazonal, como a manutenção de piscinas, campos de golfe e grandes unidades de alojamento.

Este trabalho contribui de forma significativa para o corpo teórico relacionado com a teoria Valor-Crença-Norma, ao aplicar o seu modelo na íntegra ao estudo do comportamento do consumo doméstico de água num contexto de escassez hídrica. Paralelamente, estende a compreensão do modelo integrando duas variáveis: a percepção da gravidade da seca e a confiança nas instituições.

Confirma que uma visão do mundo pró-ecológica influencia fortemente a consciencialização sobre as consequências ambientais, corroborando a afirmação do modelo VBN de que as crenças são essenciais para compreender os impactos e impulsionar comportamentos sustentáveis.

Destaca o papel das crises ambientais na formação de normas pessoais e intenções, evidenciando que quanto maior for a percepção da gravidade da seca, maior a obrigação moral e a intenção de consumir água de forma responsável.

Em síntese, fornece diretrizes práticas para o desenvolvimento de políticas públicas e campanhas de marketing social que incentivem a adoção de comportamentos sustentáveis no uso dos recursos hídricos.

A investigação apresenta algumas limitações, nomeadamente o seu design transversal e dependência de dados autorrelatados, o que pode introduzir vieses. Futuras investigações poderão expandir o estudo a toda a região do Algarve para validar os resultados e beneficiar de estudos longitudinais, que integrem medidas objetivas relacionadas com o consumo doméstico responsável de água.

Palavras-chave: Consumo de água doméstico; Modelo Valor-Crença-Norma; Perceção da gravidade da seca; Confiança nas instituições; Comportamento pró-ambiental; Sustentabilidade hídrica.

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LIST OF ABBREVIATIONS

AC	Awareness of Consequences
AR	Ascribed Responsibility
AV	Altruistic Values
AVE	Average Extracted Variance
BV	Biospheric Values
CMB	Common Method Bias
CR	Composite Reliability
DSP	Dominant Social Paradigm
EFA	Exploratory Factor Analysis
EV	Egoistic Values
GDPR	General Data Protection Regulation
HBM	Health Belief Model
HTMT	Heterotrait-Monotrait Ratio
HWCI	Household Water Conservation Intention
IT	Institutional Trust
NAM	Norm Activation Model
NEP	New Environmental Paradigm
NFI	Normed Fit Index
PDS	Perceived Drought Severity
PLS-SEM	Partial Least Square Structural Equation Modelling
PN	Personal Norms
SCT	Social Cognitive Theory
SEM	Structural Equation Modelling
SRMR	Standardized Root Mean Square Residual

TIB	Theory of Interpersonal Behavior
TIG	Trust In Government
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
VBN	Value Belief Norm

CHAPTER 1. INTRODUCTION

Despite the significant academic research into household water conservation in recent decades, it remains a relevant research topic. The acceleration of urbanisation, the contradiction between the increase in urban household water consumption and the water shortage caused by drought (Chen et al., 2023) has become gradually prominent among water resource challenges, being household water usage critical of total freshwater consumption as demands from urban and rural residents continue to rise (Wang and Tian, 2023).

Global climate change has led to a steady increase in the frequency of heatwaves and drought events, and the problem of water scarcity has become a pressing international concern (Chen et al., 2023). A projection by the World Resource Institute for 2040 shows that 25 countries, which house one-quarter of the global population, face extremely high water stress each year, regularly using up almost their entire available water supply (Kuzma, Bierkens, et al., 2023). Around 4 billion people, approximately 50% of the global population, live under highly water-stressed conditions for at least one month annually, endangering lives, livelihoods, food and energy security (Kuzma, Saccoccia, et al., 2023). Considering that almost all United Nations Sustainable Development Goals can be linked to water, without sustainable use, water scarcity will continue to have devastating global consequences (Karakaş, 2023). The European Environment Agency (2019) highlighted that the region faces significant strain on its environment, especially regarding water resources, and emphasised the urgent need for action to address water scarcity.

The entire mainland of Portugal also faces a meteorological drought, leading to significant challenges due to water scarcity. There has been a notable decrease in water availability, higher-than-average temperatures, and substantially lower-than-expected precipitation. The situation is particularly critical in the southern region of Portugal, the Algarve (ERSAR, 2023a), a place with 467 495 permanent residents. However, it is also a popular destination across Europe, having welcomed 5.13 million guests in 2023 (INE, 2023). This touristic pressure requires large amounts of water to maintain pools, lodging facilities, and golf courses. In 2024, the region implemented water rationing policies to address water scarcity, including deactivating public pools and suspending the watering of green spaces (Resolução Conselho Ministros, 2024). Faro, Albufeira, and Portimão, with 152 777 permanent residents, are among the region's most popular destinations in the Algarve and are currently facing these challenges (Turismo de Portugal, 2024).

Household water consumption accounts for about 15% of global freshwater demand, with notable differences between countries and regions (Chen et al., 2023). In Portugal, the average daily

water consumption per person is 195 litres (ERSAR, 2023b). However, the World Health Organization (WHO) suggests that between 50 and 100 litres of water per person per day are needed to meet basic needs (United Nations, 2023). This shows that households have a significant potential to increase water conservation.

In summary, the potential for severe water stress in the next 15 to 20 years, worsened by climate change and rising demand, is real if consumption habits and routines are not changed (Kuzma, Saccoccia, et al., 2023). Given these factors and the emphasis on self-enhancement, biospheric, and altruistic values in environmental studies, understanding the core values that influence household water conservation is essential (Chen et al., 2023). This understanding may support the development of effective interventions to address water shortage, namely, informing the development of effective social marketing strategies and public policies that promote sustainable water use. This is even more crucial in the context of a Mediterranean, mass and seasonal sun and beach tourism destination like the Algarve, in the south of Portugal (Soler et al., 2019).

To identify critical factors influencing pro-environmental behaviours, many theoretical frameworks have been proposed, such as the Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Health Belief Model (HBM), Social Cognitive Theory (SCT), Theory of Interpersonal Behaviour (TIB), Value-Belief-Norm theory (VBN) and much more (Chen et al., 2023) with TPB Ajzen's (1991) theory being extensively utilised (Wang et al., 2022; Ibrahim et al., 2022; Gansser and Reich, 2023).

The TPB is a widely accepted model for understanding individuals' environmental behaviours. It states that an individual's intention to engage in a specific behaviour is influenced by their attitude toward the behaviour, perceived control, and subjective norm within their social environment. However, it is essential to note that the model does not encompass all factors influencing behaviour (Li et al., 2018). Consumers' environmentally friendly behaviours are associated with self-actualisation, the highest level in Maslow's (1970) hierarchy of needs, achieved through activities that benefit society and meet intrinsic growth needs (Slevitch et al., 2013). Thus, studies examining pro-environmental behaviour must consider individual factors, such as values, beliefs and norms (Choi et al., 2015). Stern's (2000) VBN theory effectively addresses this by examining green behaviour, environmental elements, and individuals' pro-social motives through rational choice models. Unlike TPB, which focuses on maximizing self-interest, the VBN model (Stern, 2000) was designed to explain altruistic behaviour (Li et al., 2018). Although this theory has been widely used to study pro-environmental behaviour such as energy, food, climate change, green lodging, workplace conservation, university students'

behaviours, and water consumption (Hwang et al., 2020; Zhang et al., 2020; Al Mamun et al., 2022; Floress et al., 2022), and its high relevance in explaining environmentally responsible behaviour has been proven (Hwang et al., 2020), has rarely been applied to household water conservation in its complete form. For example, two studies on teachers' sustainable water consumption behaviour, developed by Yildirim and Semiz (2019) and Karakaş (2023), did not incorporate the new environmental paradigm (NEP) developed by Dunlap and Van Liere (1978), a widely used measure of ecological worldview and part of the VBN framework, despite being considered an important predictor of pro-environmental behaviour (Liu et al., 2018).

Therefore, to address the abovementioned calls, this study aims to investigate the relationship between values, beliefs and norms in the context of household water conservation intention (HWCI) by addressing the existing research gaps. To achieve this aim, we test a comprehensive model applying the complete value-belief-norm theory, using data from domestic households residing in the Algarve, a mature seaside tourism destination in southern Portugal, Europe. Located in the Mediterranean, the Algarve faces severe water scarcity, especially during the summer, due to dwindling water reserves and high tourism demand.

Moreover, limited focus has been on predicting water usage patterns during droughts, especially in severe drought conditions (Chen et al., 2023). Additionally, few studies have highlighted the importance of considering another crucial variable in water-scarce areas: institutional trust (Robles-Avila and Sakib, 2023; Cauberghe et al., 2021; Addo et al., 2018). To enrich the model's capacity for analysis, we will integrate the perceived severity of drought and institutional trust as variables, enabling a more comprehensive understanding of the subject.

When integrating the NEP construct into the VBN theory, the model offers a clearer understanding of the relationship between variables. Moreover, additional variables like perceived drought severity and institutional trust expand the knowledge base, presenting an integrated model for household water conservation. From a practical standpoint, the study's framework yields managerial insights by providing valuable data to assist public managers in developing effective marketing strategies and campaigns to increase users' awareness of the significance of responsible water usage in their daily lives.

The structure of this article is as follows. It starts with an introduction addressing the research problem, its relevance, novelty, objectives, and methodological insights. This is followed by the theoretical model and developing hypotheses drawn from VBN theory. Next, study methods are

introduced by describing how data was gathered and analysed. Study results are then presented and discussed. The last section concludes with theoretical contributions, study limitations, and directions for future research.

CHAPTER 2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Value-Belief-Norm (VBN) Theory

The Value-Belief-Norm theory (VBN), first presented by Stern et al. (1999), is an expanded version of the moral norm activation theory of altruism, designed by S. H. Schwartz (1972, 1977) to understand public support in various pro-environmental behaviours in public and private spheres. The model links value theory, Norm Activation Model (NAM), and the New Environmental Paradigm (NEP) in a causal chain that includes personal values, NEP, awareness of consequences (AC), and ascribed responsibility (AR) beliefs about general conditions in the environment, as well as personal norms for pro-environmental action (Stern, 2000). It is claimed that each variable in the chain is related and directly linked to the following variable (Yildirim and Semiz, 2019). According to this reasoning, personal norms are the primary basis for an individual's inclination towards pro-environmental actions. They are activated by specific beliefs that environmental conditions threaten things the individual values (AC) and that the individual can act to reduce the threat (AR). Several studies support this assertion, further reinforcing the conclusion that these norms are activated as the theory specifies (Stern, 2000).

2.1.1 Values

Values have been conceptualized as guiding principles that are significant to an individual's life (Robles-Avila and Sakib, 2023). According to Schwartz's well-known definition, personal values are "the criteria that people use to select and justify actions and to evaluate people (including the self) and events" (Schwartz, 1992, p.1). These criteria are broad, transcend specific situations, and serve as a guide for appropriate behaviour. Schwartz identified ten higher-order "universal values" situated along two bipolar axes (self-transcendence vs. self-enhancement and openness to change vs. conservation), which were tested in various cross-cultural studies. Empirical evidence suggests that both self-transcendence (connected to altruistic and biospheric values) and self-enhancement (underlying a more egoistic view) values are related to pro-environmental behaviours in a positive (for the former) or negative (for the latter) manner (Steg et al., 2005).

Based on motivational theories, promoting self-sustaining behaviour through internalising values and changing how one interprets one's actions shows potential, as generating new associations for water that align with individuals' norms can instigate a self-imposed moral obligation towards pro-environmental conduct (Cauberghe et al., 2021). Values have been shown to influence

individuals' engagement in pro-environmental action by mediating norms, general beliefs, and intentions, fostering a mindset that views environmental protection as vital for both present and future life on Earth (Al Mamun, Hayat, Masud, et al., 2022), across the food, energy, and water domains (Fornara et al., 2016; Floress et al., 2022).

Several studies have explored which values are related to the types of benefits consumers search for that impact pro-environmental behaviour. Following Schwartz's (1992) work on classifying human values, Stern et al. (2000) suggested three value orientations as drivers of pro-environmental behaviours that are related to the ecological worldview: egoistic values (EV), in which case people try to maximize individual outcomes, biospheric values (BV), reflecting concern with nonhuman species or the biosphere, and social-altruistic values (AV), reflecting concern for the welfare of other human beings. Accordingly, the polarity of the values that drive an individual is vital to understanding moral obligation in dilemmas of the individual or collective welfare (Cauberghe et al., 2021).

Previous studies have confirmed that a person's attitudes towards the environment are primarily influenced by their biospheric values (Choi et al., 2015). This ecocentric system involves individuals seeing themselves as part of the global ecological system, directly connected to the environment (De Groot and Steg, 2008). Those who hold biospheric values have been found to exhibit pro-environmental behaviour based on their assessment of the costs and benefits to the ecosystem and biosphere as a whole (Choi et al., 2015).

Research indicates that the association between values and pro-environmental behaviour may not consistently adhere to the traditional value-belief-norm framework. In certain studies, values have been observed to impact other variables further down the causal chain directly (De Groot and Steg, 2008).

Following the VBN theory, which posits that an individual's eco-friendly intention and behaviour are influenced by pro-environmental personal norms, activated through a causal chain that progresses from stable and general values (such as egoistic, biospheric, and altruistic) to specific beliefs concerning the relationship between humans and the environment (ecological worldview) (Stern, 2000), the following hypotheses are proposed:

H1: A positive relationship exists between biospheric values (BV) and ecological worldview (NEP).

H2: A positive relationship exists between altruistic values (AV) and ecological worldview (NEP).

H3: A negative relationship exists between egoistic values (EV) and ecological worldview (NEP).

2.1.2 Beliefs

In environmental psychology literature, beliefs are often viewed as a person's worldview, representing their beliefs about the relationship between people and the natural world (Schultz et al., 2005). Those have been identified as potential predictors of conservation behaviour, a system of attitudes and beliefs that determine behaviour toward the environment and must be used as referential frameworks (Victor Corral-Verdugo et al., 2003).

Before the 1960s and 1970s, the prevailing worldview was the dominant social paradigm (DSP), embodying a more utilitarian outlook, characterised by principles of individualism, continuous growth and progress, a strong belief in science and technology, and an emphasis on free market economics (Wolters, 2014). On the opposite side of an anthropocentric view (i.e. DSP), the NEP, devised by Dunlap and Van Liere (1978) represents a worldview more aligned with preservationist attitudes such as concern for environmental protection, a belief that nature has the right to exist regardless of human benefit, and a generally biocentric orientation (Dunlap, 2008).

Previous studies have indicated that individuals who support the DSP generally show lower levels of environmental concern (Wolters, 2014). Conversely, those who identify with the NEP tend to exhibit a pro-ecological orientation, leading to pro-environmental beliefs and attitudes across a broad spectrum of issues (Gansser and Reich, 2023). Research has shown that people more committed to environmentalism are more likely to engage in water conservation efforts. Additionally, people who are more confident about potential ecological outcomes are more willing to participate in conservation behaviours to address environmental problems (Wolters, 2014).

The use of the NEP is still a topic of ongoing debate (Gansser and Reich, 2023). According to Dunlap and Van Liere (1978), initially, the focus was on three dimensions: beliefs about humanity's ability to disturb the balance of nature, the existence of limits to growth for human societies and humanity's right to dominate the rest of nature. These dimensions were measured using 12 items with good internal consistency. While its validity has been reinforced, no consensus exists on whether the NEP scale should be measured as a single or multidimensional construct (Gansser and Reich, 2023). Studies that have factor-analysed the initial items include research where all items load on one single factor and studies that find two, three, or even four

dimensions (Dunlap et al., 2000). Initially composed of 12 items, the instrument was revised due to changes in human activities and lifestyles incorporating 15 items (Kiatkawsin and Han, 2017). Six were taken from the initial NEP, four were slightly modified, and five were newly added. These 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). The present research will use the revised NEP scale from Dunlap et al. (2000) comprising 15 items. Although the principal component analysis showed four subscales, it is stated that treating the 15 items as a single scale is appropriate, as they all load heavily on the first unrotated factor (Gansser and Reich, 2023).

VBN theory considers three constructs of beliefs: NEP, AC and AR. NEP is predicted by the three types of values already mentioned (i.e. egoistic, biospheric and social-altruistic values); and then thought to influence specific beliefs about the consequences of environmental behaviour (AC), which refers to a belief that ecological well-being can enhance or threaten other people, other species and the biosphere (Stern, 2000). AC precedes the third and last construct of beliefs, the ascription of responsibility (AR), the belief that human actions can prevent or escalate potential negative consequences of these problems and for taking corrective actions (Steg et al., 2005; Stern, 2000). Having the previous reasoning in mind, the following is theorised:

H4: A positive relationship exists between ecological worldview (NEP) and awareness of consequences (AC) beliefs.

H5: A positive relationship exists between awareness of consequences (AC) and ascribed responsibility (AR) beliefs.

H6: A positive relationship exists between ascribed responsibility (AR) beliefs and personal norms (PN).

2.1.3 Norms

The following construct, personal norms, also known as moral obligation, relates to the code of conduct that regulates an individual's behaviour. It denotes how an individual's conduct aligns with social norms and may be influenced by moral identification and emotions (Fauzi et al., 2024). Identified as a strong motivator for encouraging pro-environmental behaviours (Steg et al., 2005; Stern et al., 1999), norms are firmly anchored within the Norm Activation Model

(NAM) (Schwartz's, 1992) involving an individual's beliefs and actions regarding right or wrong (Trautwein et al., 2023). Research shows that people are more likely to feel a moral obligation to engage in environmentally friendly actions when they understand the impact and significance of their behaviours (AC and AR) (Cauberghe et al., 2021; De Groot and Steg, 2008), which means people will perform specific actions as they have feelings of moral obligation (Li et al., 2018). According to NAM, personal norms exert a strong, positive influence on pro-environmental behaviour, and this has been confirmed within VBN theory in several studies (Li et al., 2018; Zhang et al., 2020; Trautwein et al., 2023; Kim et al., 2023; Fauzi et al., 2024). Hence, the following is posited:

H7: A positive relationship exists between personal norms (PN) and household water conservation intention (HWCI).

2.2 Extended VBN Theory

Researchers have tested either the whole or partial models of the VBN theory to date. However, few attempts have been made to extend the VBN model by considering additional predictors to capture a more significant variance in explaining pro-environmental behaviour (Choi et al., 2015). This study incorporates institutional trust and perceived drought severity to better predict pro-environmental behaviour in household water conservation in a water scarcity context.

2.2.1 Perceived Drought Severity

Many previous studies have shown that public awareness of risks can either increase or decrease support for preventive measures and lead to changes in behaviour. Additionally, people's experiences and memories of water scarcity caused by drought can shape and deepen their perception of risk (Tang et al., 2013). Risk perception involves individuals' subjective judgment about the characteristics and severity of a particular risk (Chen et al., 2023).

Corral-Verdugo (2002) investigated the effect of limited availability of water. His findings revealed that water scarcity is one of the most essential situational factors affecting water conservation efforts (Victor Corral-Verdugo et al., 2003). Perceived drought severity, as defined in Dascher et al. (2014), refers to how individuals perceive the drought in their state as more severe than droughts of previous years in other states and countries. This measure was also utilised by Kang et al. (2017) in their study on sustainable water consumption among Hispanic

consumers. They intended to determine if the focus on water alone would allow the variable to predict Hispanics' sustainable water consumption, but they found that some water beliefs (perceived drought severity) were not significantly related to sustainable water consumption, suggesting that future research should investigate how beliefs about drought impact consumer feelings of control, particularly regarding whether the severity of the drought is stated in absolute terms or comparison to other regions (Kang et al., 2017). Chen et al. (2023) also examined urban household water consumption behaviour during drought conditions and found a significant correlation between drought risk perception, social norms, and water reduction behaviour during drought. Additionally, they discovered that the extended theory of planned behaviour was more effective in analysing water use intentions and behaviours after adding the drought risk perception variable; the predictive explanatory power of structural equation modelling (SEM) for reducing water use increased from 44% to 50%.

As water scarcity due to drought falls within the scope of risk perception (Chen et al., 2023), and this situation is also prevalent in Portugal, particularly in the drought-stricken Algarve region is expected that adding perceived drought severity in the VBN model will enhance its focus and improve the predictive power of household water conservation intention under drought conditions. Therefore, it is hypothesized that:

H8: A positive relationship exists between perceived drought severity (PDS) and personal norms (PN).

H9: A positive relationship exists between perceived drought severity (PDS) and household water conservation intention (HWCI).

2.2.2 Institutional Trust

Corral-Verdugo et al. (2002) identified institutional trust as a significant factor in residential water consumption, although its full impact has not been extensively explored. Institutional trust is the belief that public officials will competently fulfil their duties, significantly shaping consumer activism behaviours. This trust is cultivated through ongoing social and institutional relationships, which can reduce social friction and foster cooperation, particularly when collective action is required (Robles-Avila and Sakib, 2023). Unlike generalised trust, which pertains to anonymous others, institutional trust reflects explicit confidence in government agencies responsible for managing public resources. Such trust is crucial for public resource management, as it influences support for natural resource policies, participation in conservation

programs, and compliance with regulations while minimising the need for authorities to justify their decisions repeatedly (Schroeder et al., 2021).

Jorgensen et al. (2009) suggested that individuals might use a lack of trust in others to justify higher water consumption. However, when there is trust in water authorities' efforts to secure sufficient water supplies, people are more inclined to conserve water, mainly when they believe that these authorities and the government are effectively managing water resources (Jorgensen et al., 2009; Wolters, 2014; Addo et al., 2018). Consumers in developed countries with greater trust in their government officials are more likely to engage in consumer activism, believing their actions will have a meaningful impact (Addo et al., 2018).

In a study on the improper disposal of harmful products, Robles-Avila and Sakib (2023) found that trust in government (TIG) moderates the relationship between awareness of consequences and consumer activism intention, but only for the US sample. TIG negatively influences this relationship in emerging markets, as consumers generally hold negative opinions about their government officials and are less likely to engage in pro-environmental behaviours.

Joffe-Nelson et al. (2024) emphasized the importance of understanding how the relationship between values and behaviour might vary depending on contextual factors like trust in regulatory institutions. Their study suggests that management agencies with higher levels of trust can better predict whether constituents will engage in environmentally beneficial behaviours based on their deeply held values. Consequently, this study incorporates institutional trust into the Value-Belief-Norm (VBN) theory to assess the impact of trust in the water management company Águas do Algarve on household water conservation intention, hypothesizing that:

H10: A positive relationship exists between institutional trust (IT) and household water conservation intention (HWCI).

Informed by the literature review, the proposed theoretical model (Figure 1), which includes ten research hypotheses, extends the VBN theory by incorporating perceived drought severity and institutional trust.

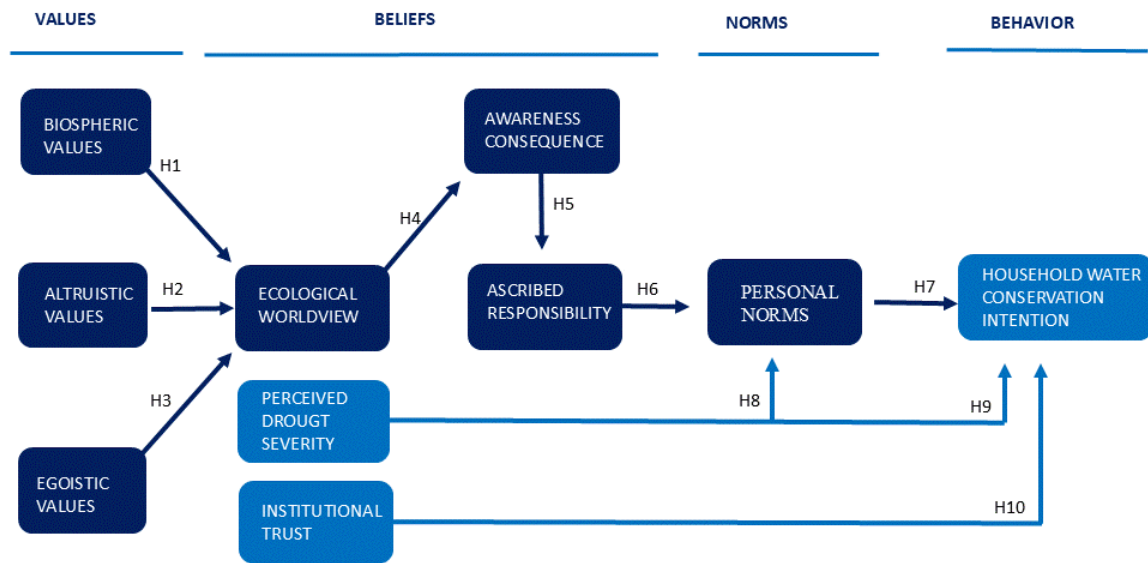


Figure 1- Conceptual Framework Model based on VBN Theory

Source - Self-constructed

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research Setting

This research focused on residents of Portimão, one of the most popular tourism destinations in the Algarve, the southmost region in Portugal, facing water shortage. As a coastal city, it has historically been a hub for shipbuilding, sardine fishing, and fish processing. However, today it is renowned for its tourism, maritime activities, and cultural heritage, including the acclaimed Portimão Museum. With a population of approximately 60,000 (PORDATA, 2023), Portimão serves as a regional hub for fishing, tourism, and commerce. Its picturesque harbour, historical sites, and lively cultural scene make it a dynamic place to visit and live. The city's warm Mediterranean climate and beautiful coastline contribute to its reputation as one of the Algarve's most sought-after destinations.

According to the data provided by the 'Water and Waste Portimão Municipal Company', referring to the 2023 period, during the summer months, particularly in July and August, water consumption peaks at 742,390 and 749,815 cubic hectometers, respectively. This situation is driven by the influx of tourists visiting the destination, reflecting the additional pressure on water resources. In contrast, the winter months, such as January and February, show significantly lower consumption rates, with figures of 333,604 and 341,732 cubic hectometers, corresponding to the off-peak tourist season. This difference highlights the importance of effective water resource management, especially in a city that relies heavily on its cultural legacy while depending on tourism and maritime activities. The Mediterranean climate and stunning coastline of Portimão not only draw in visitors but also present challenges to sustainable water consumption, requiring ongoing attention to balance the needs of the local population and tourists.

3.2 Data Collection Instrument

A questionnaire was created to test the hypotheses derived from the literature review. It was initially developed in English and then independently translated into Portuguese, by two bilingual experts. Two academics in the Marketing field also validated the data collection instrument, including the translated version. A pre-test involving 10 participants was carried out to ensure clarity. Minor adjustments were made to enhance comprehensibility based on received feedback (e.g. exhaustion of water sources). Once finalized, the content was deployed on the online platform.

Questions were designed to measure values, beliefs and norms influencing household water conservation intention, using multiple-item constructs established and validated from the literature.

Participants' **values** were assessed using a short version of Schwartz's (1992) universal values scale of 12 items, of which four reflected egoistic values (authority, wealth, social power and influence), four altruistic values (social justice, equality, a world at peace and helpful) and four biospheric values (preventing pollution, protecting the environment, respecting the earth and unity with nature), adapted from Stern, Dietz, and Guagnano (1998), and used by Steg et al. (2005). Subjects were asked to rate the importance of these 12 values as a guiding principle in their lives on a five-point scale, ranging from 1 'not important' to 5 'very important'.

To assess the **New Environmental Paradigm (NEP)**, the scale was sourced from Gansser and Reich (2023) and adapted from Dunlap et al. (2000) and Dunlap and Van Liere (1978), with responses ranging from 'Strongly Disagree' (1) to 'Strongly Agree' (5). Measures for **Awareness of Consequences (AC)**, **Ascription of Responsibility (AR)**, and **Personal Norms (PN)** were adapted from Steg et al. (2005) and followed a 5-point scale from 'Strongly Disagree' (1) to 'Strongly Agree' (5).

The **Perceived Drought Severity (PDS)** scale was adapted from Dascher et al. (2014), as referenced in Kang et al. (2017), and used a response scale ranging from 'Much Worse' (1) to 'Much Better' (5). **Perceptions of Institutional Trust (IT)** were sourced from Lowe et al. (2015), with responses ranging from 'Strongly Disagree' (1) to 'Strongly Agree' (5).

Finally, **Household Water Conservation Intentions (HWCI)** were measured with 3 items, using a scale adapted from Lowe et al. (2015) and Kang et al. (2017). For the item 'I plan to use less water in my household over the next 12 months', respondents indicated their agreement using a 5-point scale from 'Strongly Disagree' (1) to 'Strongly Agree' (5), and for the remaining items, a scale from 'Very Unlikely' (1) to 'Very Likely' (5) was used.

The questionnaire can be found in Appendix 1.

3.3 Sampling and Data Collection

The study aims to investigate household water conservation intention, so permanent residents aged over 18 were considered potential participants. The 'Water and Waste Portimão Municipal

Company' provided access to a database of clients (29,226 contacts) who receive payment invoices online, which will be used as a sampling base.

Based on the database size, a confidence level of 95%, and a margin of error of 5%, the minimum sample size was determined to be 380 individuals. The study used the same data collection method as previous research on pro-environmental behaviour (Trautwein et al., 2023). This included convenience sampling and an online survey tool (www.google.com/forms/about). The survey was distributed via email to reach a wide range of participants. Data processing practices followed the General Data Protection Regulation (GDPR). In line with ethical recommendations, participants provided informed consent electronically, indicating their full understanding of their rights and the confidentiality of their responses. In June 2024, a total of 612 questionnaires were collected, with 117 excluded because the respondents did not live in Portimão. This left 495 valid questionnaires for data analysis, accounting for 80.9% of the total collected sample, but surpassing the required minimum sample size.

3.4 Data Analysis

First, a descriptive analysis was carried out using SPSS 24 to assess the socio-demographic profile of the sample and their responses to the items measuring the constructs of the proposed model. Subsequently, the partial least squares structural equation modelling (PLS-SEM) technique was employed to estimate the conceptual model using SmartPLS 4 (Ringle et al., 2024). This approach was chosen because it is suitable for theory development and exploratory research using complex models, especially when the data do not follow a normal distribution, as in this study (tests of normality: $p=0.00$) (Hair et al., 2018).

For PLS-SEM data analysis, a two-stage evaluative process is recommended. The first stage involves measuring the model to test the reliability and validity of the study constructs (Hair et al., 2014). To assess the fit of the measurement model, individual and composite reliability (CR) of the model and convergent and discriminant validity were evaluated. The individual reliability was determined by examining the factor loadings of individual items (Hair et al., 2019), which should be higher than 0.708 (and statistically significant) to indicate more shared variance between each item and the construct than error variance (Carmines and Zeller, 1979). The CR coefficient and Cronbach's Alpha were examined to assess the construct's composite reliability (CR), with values above 0.7 indicating good internal consistency and reliability (Nunnally, 1978).

Moreover, to ensure convergent validity, Average Extracted Variance (AVE) higher than 0,5 were expected (Hair et al., 2016, 2019).

Then, the Fornell and Larcker (1981) criterion and the Heterotrait-Monotrait Ratio (HTMT) criterion were used when assessing discriminant validity to ensure that constructs are distinct. The Fornell and Larcker criterion compares the square root of each Average Variance Extracted (AVE) value with the correlations between the construct in question and the other proposed constructs. The HTMT criterion compares the mean item correlations across groups with the mean correlations for the items measuring the same construct. According to this criterion, each HTMT value should not exceed 0.85 and be significantly different from 1 (Henseler et al., 2015).

In the second stage, the structural model was evaluated using R^2 and Q^2 values to assess the exploratory and predictive capabilities of the proposed model. The research hypotheses were then tested by examining the signals and significance of the corresponding path estimates.

CHAPTER 4: RESULTS

4.1 Sample Characteristics

The demographic profile of the sample used is summarised in Table 4.1. The sample shows a slight skew towards males (51.3%) and older age groups, with the majority of respondents (74%) falling into the up to 45 age category. Most respondents have at least a bachelor's degree (66.3%), are employed (64.6%), and have a monthly family net income between €850 and €1500 (30.9%) or more than €2000 (37%). This indicates higher earnings in Portugal, considering that the medium average Portuguese income is around €1600, according to the *Instituto Nacional de Estatística* (2024). Therefore, it can be said that the participants come from middle-income families.

Variables (<i>n</i> =495)	N	Percentage (%)
Gender		
Female	241	48.7
Male	254	51.3
Other	0	0
Age		
<18	2	1
18-24	6	1
25-34	31	6
35-44	91	18
45-54	170	34
> 55	195	40
Education		
Up to high school	13	2.6
High school	154	31.1
University	328	66.3
Occupation		
Employee	320	64.6
Retired	114	23.0
Unemployed	9	1.8
Entrepreneur	43	8.7
Student	6	1.2
Domestic	3	.6
Family net income		
Less than 850€	27	5.5
850€-1500€	153	30.9
1501€-2000€	132	26.7
More than 2000€	183	37.0

Table 4. 1 - Background of the Sample Characteristics

Source - Self-constructed

4.2 Testing Common Method Bias

The model estimation involved analysing potential common method bias (CMB) to identify any undue consistency in respondents' answers, given that all items were measured on the same 1-to-5 scale (Podsakoff et al., 2012). To assess this, Harman's (1976) single-factor test was initially applied. An Exploratory Factor Analysis (EFA) was conducted, loading all items onto a single common factor. The test revealed that the total variance explained by this factor was 20.42%, well below the 50% threshold, indicating no significant CMB was present.

4.3 Measurement Assessment

In Table 4.2, the results of the measurement model are presented. To maintain the reliability and convergent validity of the construct (Hair et al., 2011, 2019), twelve items that measured egoistic values, environmental worldview, awareness of consequences, ascription of responsibility, and personal norms were removed from the initial set of 54 items as their factor loadings were lower than 0.6.

Overall, the global means of the items in each construct reveal clear trends regarding environmental awareness. Biospheric and altruistic values show relatively high averages (4.72 and 4.59, respectively), reflecting a strong concern for the environment and the well-being of others. In contrast, egoistic values have a lower average (3.32), indicating less emphasis on personal interests. The level of consciousness of adverse consequences when not acting pro-socially, the sense of obligation to take pro-environmental actions and intention related with water usage are strongly endorsed, with averages above 4.0. Regarding the feelings of responsibility for the negative consequences of not acting pro-socially, measured by ascribed responsibility, the mean of 3.59 indicates a moderate level of agreement. This suggests that, while participants acknowledge some level of shared responsibility for environmental problems, such as water consumption and global warming, their sense of personal accountability is not as strong as in other constructs like biospheric values, which had higher averages. The mean value of 1.80 for Perceived Drought Severity, where lower values indicate a greater perception of drought severity, shows that respondents perceive the drought as very serious, suggesting that the severity of the drought conditions in the Algarve is recognized. On the other hand, the mean value of institutional trust (2.89), suggests uncertainty about water management in the region.

Construct and scale items	Mean	Loading	Cronbach alpha	CR	AVE	t-value	p-value
Biospheric Values (BV)	4.72		0.91	0.93	0.78		
Preventing pollution – BIO1	4.77	0.86				32.18	0.00
Respecting the earth - BIO 2	4.77	0.90				40.63	0.00
Unity with nature – BIO 3	4.57	0.84				39.64	0.00
Protecting the environment – BIO 4	4.78	0.92				61.59	0.00
Egoistic Values (EV)	3.32		0,77	0,86	0,68		
Authority – EGO1	3.78	0.81				20.93	0.00
Social power (Controlling others) – EGO2	3.02	0.89				44.14	0.00
Influential (being influential on people and events) – EGO4	3.16	0.77				16.80	0.00
Altruistic values (AV)	4.59		0.85	0.90	0.69		
Helpfulness (I care for others who are weak and older) – Alt1	4.49	0.80				24.55	0.00
Social Justice (I like to correct injustice) – Alt2	4.49	0.81				25.79	0.00
A world at peace (I value a world free of war and conflict) – Alt3	4.73	0.87				42.53	0.00
Equality (I respect equal opportunity for all) – Alt4	4.65	0.83				25.20	0.00
Pro-Ecological Worldview (PRO-NEP)	4.42		0.73	0.83	0.56		
The balance of nature is very delicate and easily upset by human activities	4.53	0.80				37.84	0.00
Humans greatly abuse the environment	4.42	0.73				16.40	0.00
The earth has abundant natural resources if only we learn to use them	4.54	0.66				15.08	0.00
If things continue as they are, we will soon face a tremendous ecological catastrophe	4.20	0.78				26.46	0.00
Anti-Ecological Worldview (ANT-NEP)	2.45		0.69	0.81	0.52		
Humans have the right to modify the natural environment to suit their needs	2.34	0.76				26.66	0.00
The so-called “ecological crisis” facing humankind has been greatly exaggerated	2.43	0.73				18.34	0.00
The balance of nature is strong enough to cope with the impact of modern industrialised nations	2.18	0.73				19.19	0.00
Humans will eventually learn enough about how nature works to be able to control it	2.86	0.65				14.56	0.00
Awareness of Consequences (AC)	4.27		0.80	0.87	0.62		
Global warming is a problem for society	4.50	0.79				31.31	0.00
Water conservation helps reduce global warming	4.07	0.79				31.65	0.00
The exhaustion of water sources is a problem	4.58	0.81				35.41	0.00
Environmental quality will improve if we use less water	3.96	0.76				27.40	0.00
Ascription of Responsibility (AR)	3.59		0.85	0.90	0.69		
I am jointly responsible for the problems related to water consumption	3.91	0.81				33.83	0.00

Not only the government and industry are responsible for high water consumption levels, but I am too	3.81	0.81				33.40	0.00
I feel jointly responsible for the exhaustion of water sources	3.26	0.84				30.75	0.00
I feel jointly responsible for global warming	3.39	0.86				57.81	0.00
Personal Norms (PN)	4.20		0.85	0.89	0.53		
I feel personally obliged to save as much water as possible	4.35	0.76				22.98	0.00
I feel morally obliged to save water, regardless of what others do	4.48	0.78				27.93	0.00
I feel guilty when I waste water	4.12	0.70				21.11	0.00
People like me should do everything they can to save water	4.41	0.83				36.26	0.00
If I were to buy a new washing machine, I would feel morally obliged to buy an energy-efficient one	4.43	0.72				24.05	0.00
I feel obliged to bear the environment and nature in mind in my daily behaviour	4.20	0.71				22.86	0.00
I would be a better person if I saved water	3.45	0.59				16.14	0.00
Perceived Drought Severity (PDS)	1.80		0.71	0.87	0.77		
How is this drought (2023/24) compared to the previous drought(s) in the Algarve?	2.05	0.86				35.49	0.00
How are current drought conditions in the Algarve compared to other Portugal regions?	1.56	0.89				46.38	0.00
Institutional Trust (IT)	2.89		0.88	0.94	0.89		
I feel pretty optimistic that the future of the water situation in the Algarve will improve	2.91	0.95				3.37	0.00
Águas do Algarve company is managing our water resources effectively	2.87	0.94				3.46	0.00
Household Water Consumption Intention	4.26		0.75	0.86	0.67		
I plan to use less water in my household over the next 12 months	4.03	0.75				24.71	0.00
If circumstances allowed you, how likely would you be to install new water-saving appliances or fixtures?	4.40	0.87				44.29	0.00
If circumstances allowed you, how likely would you upgrade your existing appliances to more water-efficient options?	4.36	0.83				28.04	0.00

Notes: CT=construct reliability; AVE=average variance extracted $p < 0.001$

Table 4.2 - Descriptive Statistics of the Measurement Model

Source - Self-constructed

It should be noted that keeping the NEP scale as a unidimensional construct leads to insufficient individual reliability and convergent validity. Furthermore, conducting a principal component analysis to find subscales also leads to inappropriate results (namely very low explained validity).

Therefore, to ensure adequate levels of convergent validity (specifically AVEs above 0.5), the NEP items were divided into two sets: Pro-Ecological Worldview (PRO-NEP) and Anti-Ecological Worldview (ANT-NEP). As shown in Table 4.2, higher scores on the PRO-NEP items indicate strong environmental awareness, while higher scores on the ANT-NEP items indicate less environmental awareness. PRO-NEP has a high average (4.42), highlighting a critical perception of human impacts on the environment. Meanwhile, ANT-NEP shows a significantly lower mean (2.45), indicating the rejection of perspectives that soften the environmental crisis.

Generally, the constructs show good to excellent internal consistency and convergent validity. Most factor loadings exceeded 0.7 (Hair *et al.*, 2011) indicating an adequate level of individual reliability, except for the items '*The earth has abundant natural resources if only we learn to use them*' (0.660); '*Humans will eventually learn enough about how nature works to be able to control it*' (0.654); '*I would be a better person if I saved water*' (0.59). However, the analysis retained these items as their removal would not improve the measurement model.

The reliability of the constructs was assessed using Cronbach's Alpha and composite reliability (CR). The Cronbach's Alpha values for the eleven constructs range from 0.69 (ANT-NEP) to 0.91 (BV), validating the reliability of the chosen measurements (Nunnally, 1978).

Regarding CR, all indexes ranged from 0.81 to 0.94, surpassing the recommended threshold of 0.7, indicating strong construct reliability (Kline, 2005). Subsequently, each latent variable's Average Variance Extracted (AVE) was evaluated to assess convergent validity. As also demonstrated in Table 4.2, all AVEs exceeded the threshold of 0.5, as suggested by Hair *et al.* (2011). Additionally, results revealed that all items were significantly associated with the corresponding construct (all loadings reported p-values of 0.00).

To ensure that the measurement model demonstrates discriminant validity, Fornell and Larcker (1981) and the Heterotrait-Monotrait Ratio (HTMT) (Henseler *et al.*, 2015) criteria were used. Our findings indicate that all constructs fulfil both criteria (Table 4.3).

	AC	AR	AV	BV	EV	IT	PN	PRO NEP	ANT NEP	PDS	HWCI
AC	0.789										
AR	0.596	0.500	0.830								
AV	0.435	0.278									
	0.372	0.241	0.828								
BV	0.388	0.210	0.628								
	0.343	0.194	0.553	0.882							
EV	0.174	0.053	0.297	0.221							
	0.130	-0.010	0.225	0.179	0.825						
IT	0.155	0.095	0.100	0.099	0.240						
	0.124	0.081	0.080	0.093	0.197	0.946					
PN	0.680	0.549	0.400	0.469	0.140	0.183					
	0.561	0.474	0.341	0.417	0.106	0.159	0.730				
PRO NEP	0.754	0.476	0.581	0.527	0.169	0.060	0.707				
	0.592	0.383	0.462	0.439	0.128	0.034	0.556	0.745			
ANT NEP	0.286	0.300	0.272	0.242	0.284	0.223	0.301	0.427			
	-0.230	-0.235	-0.220	-0.207	0.211	0.165	-0.236	-0.316	0.719		
PDS	0.347	0.285	0.219	0.119	0.103	0.083	0.344	0.377	0.295		
	-0.270	-0.219	-0.169	-0.097	-0.044	0.069	-0.268	-0.278	0.205	0.879	
HWCI	0.561	0.432	0.309	0.380	0.092	0.063	0.747	0.488	0.315	0.436	
	0.455	0.366	0.256	0.319	0.065	0.054	0.613	0.374	-0.243	-0.325	0.818

Diagonal values corresponding to the Fornell-Larcker criterion appear in bold, and HTMT values are in regular type.

Table 4.3 - Correlations among latent variables

Source: Self-constructed

4.4 Structural Model and Hypothesis Testing

The structural model was analysed before testing the research hypotheses (Table 4.4). First, the model's explanatory capacity was evaluated using the coefficient of determination (R^2) for the dependent latent constructs (Hair *et al.*, 2019). These values can be sorted by high (0,75), medium (0.50) or low (0.25) (Hair *et al.*, 2011). This model's results demonstrate a moderate explanatory power, accounting for 40% of the variance in HWCI, as indicated by an R^2 value of 0.401. As expected, the remaining dependent constructs report lower R^2 values (AC = 0.353; AR = 0.250; PN = 0.253; PRO-NEP = 0.262; ANT-NEP = 0.134). Lastly, Stone-Geisser's Q^2 values were calculated using the blindfolding procedure. As recommended by Hair *et al.* (2017) all Q^2 values for all the dependent constructs were positive (AC=0,141; AR=0.048; PN=0.106; PRO-NEP=0.234; ANT-NEP=0.114; HWCI=0.110).

Hypotheses		Path coefficients	t Statistics	Significance (<i>p-value</i>)	Results
H1	Biospheric values -> PRO-NEP	0.26	4.56	0.00	Supported
	Biospheric values -> ANT-NEP	-0.15	2.45	0.01	
H2	Altruistic Values -> PRO-NEP	0.32	4.71	0.00	Supported
	Altruistic Values -> ANT-NEP	-0.20	3.70	0.00	
H3	Egoistic Values -> PRO-NEP	0.01	0.26	0.80	Partially Supported
	Egoistic Values -> ANT-NEP	0.28	6.10	0.00	
H4	PRO-NEP -> AC	0.58	14.67	0.00	Partially Supported
	ANT-NEP -> AC	-0.05	1.24	0.22	
H5	AC -> AR	0.50	12.02	0.00	Supported
H6	AR -> PN	0.44	10.39	0.00	Supported
H7	PN-> HWCI	0.57	14.48	0.00	Supported
H8	PDS -> PN	-0.17	4.14	0.00	Supported
H9	PDS -> HWCI	-0.17	4.18	0.00	Supported
H10	IT -> WHCI	-0.03	0.70	0.49	Not supported

Table 4.4 - Result of Structural Model and Hypotheses Testing

Source: Self-constructed

Path coefficients (β) were calculated and analysed alongside t-statistics and *p-values* to test the hypotheses. The structural model's results are presented in Table 4.4. The results indicate four positive and robust relations supporting the hypotheses H1, H2 and H5 to H7. Regarding H8 and H9, the path coefficients are negative as expected given the measurement scale of PDS where lower scores mean concern about water scarcity. Therefore, H8 and H9 are also supported.

Given the division of NEP into two constructs, H3 would be supported if the relationship between EV and PRO-NEP is negative and the relationship between EV and ANT-NEP is positive, with both needing to be statistically significant. However, this expected finding only occurs in the link between EV and ANT-NEP. Thus, H3 is partially supported. The same rationale applies to H4: a positive and significant relationship was expected for the link PRO-NEP -> AC, and a negative and significant relationship was expected for the link ANT-NEP -> AC. As this latter relationship is not significant ($p = 0.22$), H4 is also partially supported. Lastly, the relationship between institutional trust (IT) and HWCI is not significant ($\beta = -0.025$, $t = 0.699$, $p = 0.485$). Thus, H10 is not supported.

These findings support that values, especially biospheric and altruistic, play a crucial role in shaping positive environmental perceptions. This, in turn, enhances environmental awareness and responsibility promoting a sense of obligation to take pro-environmental action, which is

essential for household water conservation intention. These results suggest that a higher perceived drought severity increases moral obligation and conservation intention.

CHAPTER 5. DISCUSSION AND CONCLUSIONS

5.1 Conclusions

The primary significance of this study is that, according to our knowledge, it is the first time that the VBN model, in its entire form, is applied in the context of household water conservation to explain the formation of consumer behaviour. In addition, this study investigates how people's perception of the severity of drought and their trust in institutions contribute to deepening the VBN model. The study collected 495 samples in the Algarve, a region in the south of Portugal that is currently experiencing severe drought. The data analysis revealed that nine out of ten hypotheses in the VBN model are statistically supported (H3 e H4, partially). It was also discovered that the perceived severity of the drought plays a crucial role in the connection between personal norms to take pro-environmental actions and the intention to conserve household water. Specifically, the study found that as the perceived severity of the drought increases, the sense of moral obligation and intention to conserve water rises. Regarding the influence of institutional trust, the hypothesis was not supported.

(1) Biospheric values are significantly correlated with ecological worldview to reduce household water consumption, confirming the importance of these values in shaping environmental beliefs (**H1**). This finding aligns with existing literature highlighting the role of biospheric values in fostering positive and negative environmental beliefs (Choi et al., 2015; Cauberghe et al., 2021). Furthermore, altruistic values, which accentuate concern for others, demonstrated a positive association with a pro-ecological worldview and negative association with the anti-ecological worldview. This underscores the relationship between concern for others and environmental beliefs, confirming hypothesis **H2**.

(2) Egoistic values prioritise self-interest and do not influence a pro-ecological worldview. This finding suggests that self-centred values do not lead to pro-environmental beliefs. Conversely, they are positively associated with the anti-ecological worldview, partially supporting **H3**. This is consistent with the literature review that indicates that individuals with higher egoistic values are likelier to hold negative environmental beliefs (Han, 2015).

(3) The relation between environmental concern (PRO-NEP) and awareness of consequences is the strongest in the entire model (path coefficient of 0.58, t-statistic of 14.67, and p-value of 0.00), showing that a positive ecological worldview is significantly related to a greater awareness of environmental consequences, contributing to support **H4**. Individuals with positive

environmental beliefs are more likely to be aware of the impacts of environmental issues (Cauberghe et al., 2021; De Groot and Steg, 2008). On the contrary, negative environmental concerns do not significantly affect awareness of consequences (H4 is thus only partially supported), suggesting that those with negative environmental beliefs may not be as conscious of environmental impacts.

(4) Awareness of consequences, ascribed responsibility, personal norms and household water conservation intention are strongly related. Therefore, hypotheses **H5**, **H6**, and **H7** are supported, with the last path showing the second strongest connection in the model, with a path coefficient of 0.57, a *t*-statistic of 14.48, and a *p*-value of 0.00. Evidence indicates that awareness of consequences increases consumers' moral obligation to engage in prosocial behaviours. These results demonstrate that beliefs significantly predict water conservation intention, aligning with psychological theories such as the Theory of Planned Behaviour (Fishbein and Ajzen, 1975) and the value-belief-norm model (Stern, 2000). These theories emphasize the importance of beliefs as drivers of people's environmental intentions and behaviour (Russell and Fielding, 2010; Cauberghe et al., 2021).

(5) This study aimed to test the validity of the VBN theory and enhance the model by including perceived drought severity and institutional trust variables. The findings show that the impact of perceived drought severity on pro-environmental behaviour is evident in both **H8** (with a negative path coefficient of -0.17, *t*-statistic of 4.14, and *p*-value of 0.00), indicating that the personal norms increase as drought severity is perceived, and **H9**, also showing a negative path coefficient of -0.17, a *t*-statistic of 4.18, and a *p*-value of 0.00, supporting both hypotheses. These findings highlight that the more severe the drought is perceived, the stronger the moral obligation to conserve water and the higher the intention to engage in water-saving behaviours. This suggests that heightened awareness of drought severity motivates individuals to take greater responsibility for water conservation. This is in line with Corral-Verdugo (2002), Dasher et al. (2014) and Chen et al. (2023) findings of significant correlation between drought risk perception and water reduction behaviour during drought. This is highly relevant to policymakers and effective social marketing strategies addressing water shortages, as highlighting the severity of drought can positively influence water conservation behaviour. Emphasizing the critical nature of the drought can motivate individuals to take more proactive steps toward water conservation.

(6) With a path coefficient of -0.03, a *t*-statistic of 0.70, and a non-significant *p*-value of 0.49, **H10** was not confirmed. Trust in institutions does not significantly influence the intention to

conserve water at the household level. The results on institutional trust do not align with previous research, which indicated that people are more inclined to conserve water when they trust the authority's efforts to provide sufficient water. This is especially true when individuals believe that the water authority and government guarantee water supplies (Jorgensen et al., 2009; Wolters, 2014; Addo et al., 2018)

Based on the statistical results, this study has the following theoretical and managerial implications.

5.2 Theoretical Implications

This study offers relevant theoretical contributions, particularly regarding the application of the Value-Belief-Norm (VBN) model in the context of household water conservation. As expected, all variables were significantly linked to the following variable in the causal sequence (Stern, 2000). To our knowledge, this research is the first to apply the full VBN model to explore the formation of consumer behaviour in response to water scarcity, extending the theoretical framework by incorporating perceived drought severity and institutional trust as additional variables.

Second, the study reinforces the importance of biospheric values in shaping a pro-ecological worldview, confirming the key role of these values in driving environmental beliefs and actions. This finding aligns with the existing literature and strengthens the argument that intrinsic values related to nature are central to fostering pro-environmental behaviour.

Third, the study makes a valuable contribution by confirming that a pro-ecological worldview strongly predicts awareness of environmental consequences. This supports the theoretical claim that environmental beliefs are crucial for recognizing the impact of environmental issues and informs future research on how such awareness can be leveraged to promote sustainable behaviour.

Furthermore, the integration of perceived drought severity into the VBN model provides an important theoretical advancement. The results demonstrate that as perceived drought severity increases, so too does the sense of moral obligation and the intention to conserve water, suggesting that heightened awareness of environmental crises can directly motivate pro-environmental behaviour. This finding supports prior research, which suggested that perceived drought severity can strengthen personal norms, encouraging individuals to act. Contrary to

expectations, institutional trust did not significantly influence household water conservation intentions. This challenges earlier models that emphasized the role of trust in authorities in shaping pro-environmental behaviours. These results call for a re-examination of the relationship between institutional trust and environmental behaviour, suggesting that other factors, such as personal responsibility or perceived control, may play a more critical role in shaping individual conservation efforts.

In sum, the study expands the theoretical framework of the VBN model by showing how perceptions of environmental severity and trust in institutions interact with value-driven behaviours. These findings provide new opportunities for further theoretical exploration, particularly in understanding how situational factors such as environmental crises can affect established pathways of pro-environmental behaviour.

5.3 Managerial Implications

The findings of this study offer valuable evidence supporting the notion that cultivating biospheric and altruistic values while reducing egoistic values is essential in shaping an ecological worldview. This is crucial, as both biospheric and altruistic values have been shown to influence water conservation intention significantly. Therefore, the study underscores the necessity for targeted educational campaigns that resonate with these values. Furthermore, the study emphasizes the positive impact of perceived drought severity on conservation efforts, suggesting that heightened awareness of drought conditions increases the motivation to conserve water. Therefore, communication strategies should aim to highlight the severity of the drought in a way that empowers individuals to act, ensuring sustained engagement in water-saving practices.

5.4 Limitations and Suggestions for Future Research

As with most research studies, this one has some limitations. Data were collected in a specific geographic region (Portimão), which may affect the generalizability of the findings. In further research, the samples should be more diverse, including participants with different levels of education and income. Future research should also consider the entire Algarve context to validate the results.

Overall, the study contributes to understanding the psychological drivers of household water conservation and provides valuable insights for designing effective environmental policies and interventions.

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APPENDIX

Appendix 1 - Survey Instrument

Please rate each statement according to your way of thinking. Mark only one X per line.
1. VALUES - As a guiding principle in your life, please rate each idea.
NOT IMPORTANT (- 1) / FEW IMPORTANT (2) / NEUTRAL (3) / IMPORTANT (4) / VERY IMPORTANT (5)
Preventing pollution
Respecting the earth
Unity with nature
Protecting the environment
Authority (having authority, leadership)
Social power (Controlling others)
Wealth
Influential (being influential on people and events)
Helpfulness (I care for others who are weak and older)
Social Justice (I like to correct injustice)
A world at peace (I value a world free of war and conflict)
Equality (I respect equal opportunity for all)
2. ECOLOGICAL WORLDVIEW
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
The balance of nature is very delicate and easily upset by human activities
Humans have the right to modify the natural environment to suit their needs
Plants and animals have as much right as humans to exist
We are approaching the limit of people the Earth can support
Humans were meant to rule over the rest of nature
The so-called “ecological crisis” facing humankind has been greatly exaggerated
When humans interfere with nature, the consequences are often disastrous
Human ingenuity will ensure that we do NOT make the earth uninhabitable
Humans greatly abuse the environment
The earth has abundant natural resources if only we learn to use them.
The balance of nature is strong enough to cope with the impact of modern industrialised nations
Despite our unique abilities, humans are subject to the laws of nature
Earth is like a spaceship with minimal space and resources

Humans will eventually learn enough about how nature works to be able to control it
If things continue as they are, we will soon face a tremendous ecological catastrophe
3. AWARENESS OF CONSEQUENCES
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
Global warming is a problem for society
Water conservation helps reduce global warming
The exhaustion of water sources is a problem
Environmental quality will improve if we use less water
It is not sure whether global warming is a real problem
4. ASCRIPTION OF RESPONSIBILITY
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
I am jointly responsible for the problems related to water consumption
My contribution to problems related to water consumption is negligible
Not only the government and industry are responsible for high water consumption levels, but I am too
I feel jointly responsible for the exhaustion of water sources
In principle, individuals on their own cannot contribute to the reduction of problems related to water consumption
I feel jointly responsible for global warming
5. PERSONAL NORMS
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
I feel personally obliged to save as much water as possible
I feel morally obliged to save water, regardless of what others do
I feel guilty when I waste water
People like me should do everything they can to save water
If I were to buy a new washing machine, I would feel morally obliged to buy an energy-efficient one
I feel guilty when I buy vegetables and fruit from distant countries
I feel obliged to bear the environment and nature in mind in my daily behaviour
I would be a better person if I saved water
6. HOUSEHOLD WATER CONSERVATION INTENTION
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
I plan to use less water in my household over the next 12 months
VERY UNLIKELY (1) / LIKELY (2) / NEUTRAL (3) / LIKELY (4) / VERY LIKELY (5)

If circumstances allowed you, how likely would you be to install new water-saving appliances or fixtures?
If circumstances allowed you, how likely would you be to upgrade your existing appliances to more water-efficient options?
7. PERCEIVED DROUGHT SEVERITY
MUCH BETTER (5) / BETTER (4)/ NEUTRAL (3) / WORSE (2) / MUCH WORSE (1)
How is this drought (2023/24) compared to the previous drought(s) in the Algarve?
How are current drought conditions in the Algarve compared to other Portugal regions?
8. INSTITUTIONAL TRUST
STRONGLY DISAGREE (1) / DISAGREE (2) / NEUTRAL (3) / AGREE (4) / STRONGLY AGREE (5)
I feel optimistic that the future of the water situation in the Algarve will improve
Águas do Algarve company has done a great job assisting the community to save water
Águas do Algarve company is managing our water resources effectively

9. SOCIODEMOGRAPHICS

Gender	Female	Male	Other	City		Age	
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Education	Up to High School	High school	University	
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Monthly net family income	Less than 850 €	850 € - 1500€	1501€ - 2000€	More than 2000 €
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Occupation	Employee	Retired	Unemployed	Entrepreneur	Student	Domestic
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Thank you very much for your time and valuable participation.