Highway to Corporate Energy Efficiency: Extending the VBN Theory to Predict Leaders' Sustainability Behavior

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Abstract

One of the key challenges in addressing climate change is the corporate transformation towards sustainability, as industry and commerce account for over 40% of the primary energy consumption in Germany. Current literature highlights the pivotal role of leaders in shaping the corporate sustainability transformation in their respective companies through their individual pro-environmental behavior. However, little research has investigated the specific traits or psychological factors that define managers as effective sustainability leaders. Therefore, the present study aimed to explore and model the relationships among various individual factors influencing leaders' Organizational Citizenship Behavior for the Environment (OCBE). A quantitative online survey with 108 German managers responsible for sustainability and energy efficiency decisions was conducted. Based on Stern et al.'s (1999) Value-Belief-Norm (VBN) theory, a structural model (partial least squares, PLS-SEM) was developed, and additional individual factors were integrated to predict the psychological determinants driving managers' OCBE. The model results confirmed the VBN model's causal chain, where general eco-consciousness impacts specific beliefs about climate change, which then influences personal responsibility and activates personal norms, leading to OCBE. The inclusion of additional factors like locus of control, innovativeness, and sustainability interest significantly enhanced the model's explanatory power. Our model validates the VBN theory as a foundational framework for understanding environmental behavior within corporate leadership and confirms the significant influence of additional factors closely linked to managerial characteristics. Furthermore, the study yields recommendations for fostering Organizational Citizenship Behavior for the Environment (OCBE) within companies, specifically through strategic personnel selection and targeted leadership training.

Introduction

To combat climate change, it is not only necessary to change individual behaviors but also crucially important to undergo a corporate sustainability transformation as industry and commerce account for over 40% of primary energy consumption in Germany (Umweltbundesamt, 2024). In recent years, corporate sustainability has become an important aspect of companies' strategic orientation, to remain relevant and competitive in the future (Biswas et al., 2022). Besides various organizational factors, individual pro-environmental behaviors exhibited by employees or leaders have been identified as influential drivers of corporate sustainability (Robertson & Carleton, 2018). One very well-researched operationalization of pro-environmental behavior in the corporate context is Organizational Citizenship Behavior for the Environment (OCBE) which can be defined as pro-environmental initiatives that are not explicitly acknowledged by the formal reward system but help enhance an organization's environmental management effectiveness (Boiral, 2009). The existing body of research on OCBE has primarily examined the positive impact and mediating role of specific leadership practices on employees' citizenship behavior (e.g. Biswas et al., 2022; Saputro & Nawangsari, 2021). However, this perspective fails to acknowledge that leaders exert a direct influence on corporate sustainability by serving as decision-makers for investments in sustainability and energy efficiency and enforcing sustainable business practices (Bhattacharyya & Biswas, 2021). In addition, individual psychological factors – personal values and beliefs – should be

considered as they act as strong motivators for leaders' pro-environmental engagement (Williams & Schaefer, 2013). A study by Keil et al. (2023) showed that employees' attitudes and pro-environmental citizenship behaviors were not correlated with actual corporate sustainability, as assessed by the implementation of sustainability measures (e.g. energy management improvement) and environmental policies (e.g. fossil fuel reduction). Instead, the findings indicate that leaders have the potential to drive the corporate sustainability transformation within their organizations through their citizenship behavior. Therefore, to address the limited understanding of leaders' roles in corporate sustainability transformation and to improve the knowledge about underlying individual psychological factors, that potentially influence leaders' OCBE, this study aims to

1. investigate the individual pro-environmental behaviors of leaders as important drivers for corporate sustainability.
2. explore and model the psychological antecedents that characterize managers as sustainability leaders who contribute to corporate sustainability through their Organizational Citizenship Behavior for the Environment (OCBE).

State of the Art

The subsequent sections delineate theoretical approaches to explain sustainability behaviors in general, and more specifically, psychological predictors linked to OCBE. Hypotheses are derived for the development of the research model.

Value-Belief-Norm Theory

One theoretical approach often used to explain environmental behaviors is the Value-Belief-Norm (VBN) theory by Stern et al. (1999). In VBN theory the authors link various theories of environmentalism in a causal chain to explain different forms of pro-environmental behavior as target criteria: activism, non-activistic public-sphere behaviors, private-sphere behaviors, and behaviors in organizations. At the beginning of the causal chain are values as relatively stable, central personality traits. These values exhibit positive (biospheric and altruistic values) or negative (egoistic values) associations with subsequent beliefs regarding the interconnection between humans and the environment which were operationalized as the New Ecological Paradigm (NEP) by Dunlap et al. (2000). The next elements in the causal chain are derived from Schwartz's (1977) Norm-Activation Model which describes that pro-environmental behaviors are driven by personal norms regarding these behaviors. In VBN the NEP influences the Awareness of adverse Consequences (AC) caused by environmental conditions and climate change, which in turn impacts the Ascription of personal Responsibility (AR) to act against this threat. The AR finally activates specific Personal Norms (PN) which are hypothesized to directly affect all forms of pro-environmental behaviors (Stern, 2000; Stern et al., 1999).

Since its development, VBN theory has been adapted in various studies to successfully predict all kinds of pro-environmental behaviors such as the acceptance of energy policies (Steg et al., 2005) or improvements in household energy efficiency (Fornara et al., 2016). However, most research has concentrated on behaviors in the non-activistic public-sphere or private-sphere with only a few studies addressing behaviors within organizations including behaviors of leaders. An overview by Ciocirlan et al. (2020) shows that studies applying the VBN in organizational contexts mainly have focused on employee behaviors and archived inconsistent results. Further, the authors themselves applied the full VBN model to predict employees' conserving behaviors (e.g. by reducing energy use, and recycling). Although most causal relationships of the VBN chain were verified, and personal norms strongly affected the measured conserving behaviors, higher ecological values (NEP) did not exhibit a relationship with an increased awareness of consequences (AC) (Ciocirlan et al., 2020). In another VBN-based study, Bhattacharyya & Biswas (2021) predicted future managers' intent to behave pro-environmentally, which was associated with their environmental values, attitudes, and subjective norms. Moreover, positive environmental attitudes were also directly related to subjective norms. As a limitation, the sample consisted of MBA students as potential future managers. In contrast to this study, Papagiannakis and Lioukas (2018) used a sample with data from managers and tested – instead of the causal VBN chain – the direct influences of AC, AR, and managers' self-efficacy on environmental management initiatives. All factors emerged as significant antecedents, thereby affirming the importance of leader characteristics in promoting corporate sustainability.

To the best of our knowledge, no prior study has examined the causal chain rooted in the VBN theory to elucidate OCBE within a leadership sample. Thus, we propose the following hypotheses referring to the VBN theory:

H1 Value-Belief-Norm Theory

H1a Eco-consciousness is positively related to the awareness of consequences.

H1b The awareness of consequences is positively related to the ascription of responsibility.

H1c The ascription of responsibility is positively related to personal norms.

H1d Personal norms are positively related to OCBE.

As can be further seen in the methodology chapter, we choose to operationalize beliefs about the human-environment connection not with the NEP scale, as Ciocirlan et al. (2020) found no association with AC in a comparable organizational context. Instead, we employed eco-consciousness as an attitudinal factor consisting of affective, cognitive, and behavioral dimensions (as described in the methodology section).

Psychological Predictors of Pro-environmental Behavior

Although different behaviors are conceptualized as target criteria at the end of the VBN chain, Stern (2000) underscores the importance of recognizing that distinct environmentally friendly behaviors are driven by different causal factors, emphasizing the necessity to theorize each specific target behavior separately. Therefore, we explore individual psychological factors as additional predictors of pro-environmental behaviors, specifically focusing on OCBE, drawing upon theoretical frameworks and empirical evidence to augment the VBN model.

One salient factor influencing pro-environmental behaviors is Locus of Control (LoC), a concept reflecting whether individuals perceive their experiences as shaped by their own actions (internal LoC) or external forces and thus independent from their own beliefs and actions (external LoC) (Fielding & Head, 2012). In a study by Chiang et al. (2019), an internal LoC was a significant mediator in facilitating pro-environmental behavior. Concerning the VBN model, we assume that individuals with an internal LoC are more likely to acknowledge the (adverse) consequences of their behavior. Thus, we hypothesize:

H2 Locus of control is positively related to the ascription of responsibility.

In contrast to the VBN theory, numerous studies have described a direct effect of psychological and attitudinal factors on pro-environmental behaviors, rather than acting through personal norms. First, several studies suggest a direct positive correlation between environmental attitudes and employee green behavior (Norton et al., 2014). Particularly, Zientara and Zamojska (2018) found that individuals' environmental values were positively related to OCBE. Secondly, OCBE was positively related to innovative behavior, more specifically intrapreneurship, given that both behaviors require an extra, (mostly) voluntary effort (Neessen et al., 2021). Lastly, increasing environmental awareness of employees as well as leaders has been identified as one important measure to increase their willingness for pro-environmental actions and responsibility-taking (Candrianto et al., 2023; Cao & Chen, 2019). However, there is no standardized definition of environmental or sustainability awareness, which makes it difficult to derive implications for increasing it. While some studies stress knowledge about environmentalism as one important constituent (e.g. Candrianto et al., 2023; Fielding & Head, 2012), Cao & Chen (2019) operationalize it as evaluating the importance of factors that support environmentalism. In this study context, we define sustainability awareness as one's informed (knowledge) and affective (interest) consciousness about measures and behaviors facilitating environmentalism in the corporate context as well as the extent to which one assesses those as important to conquer climate change. Based on the evaluated literature on psychological, attitude-related predictors of pro-environmental behaviors, we propose the following hypotheses:

H3 Direct psychological predictors of OCBE

H3a Eco-consciousness is directly, positively related to OCBE.

H3b Innovativeness is directly, positively related to OCBE.

H3c Sustainability awareness is directly, positively related to OCBE.

Methodology

In the following chapter, we outline the operationalization of relevant factors and the survey structure, describe the obtained sample, and elaborate on the selection of structural equation modelling (partial least squares) as our methodology. The chapter concludes by presenting the proposed research model.

Survey Structure and Variables

A quantitative online study was conducted using Qualtrics software (Version June 2023; © 2023 Qualtrics, Provo, UT) to investigate leaders' sustainability behavior and their psychological factors as potential influencing variables. The research presented here is part of a larger study conducted within the framework of an interdisciplinary research project (ENRI – decision factors for sustainable re-investments in companies). All factors were operationalized based on validated constructs from the literature and measured on fully verbalized six-point Likert scales (1 = strongly disagree, 6 = totally agree). Negatively polarized items were reversed and

recoded during data preparation so that a high characteristic value corresponded to a high numerical value on the Likert scale. The questionnaire with all items was administered in German; the example items listed below were translated into English.

At the beginning of the survey, an introduction on the relevance of sustainability and specifically energy efficiency within the corporate context was given, followed by the survey of **sociodemographic data** (age, gender, education, and federal state of workplace). Next, respondents evaluated their **eco-consciousness** (eight items by Geiger & Holzhauer, 2020; e.g. "We need to find ways to live well independently of economic growth"), **innovativeness** (five items, by Klöckner & Nayum, 2017); e.g. "I enjoy trying new ideas"), and **locus of control** (five items by Kovaleva et al., 2014 and Fielding & Head, 2012; e.g. "I am only one person, I can't make a difference to the environment"). The **awareness of consequences** (four items, e.g. "Global warming is a problem for society"), **ascription of responsibility** (six items, e.g. "I feel jointly responsible for the exhaustion of energy sources"), and **personal norm** (six items, e.g. "I feel morally obliged to use green instead of regular electricity") items all referred to environmental problems related to energy use and were derived from Steg et al. (2005). Then, leaders' sustainability behavior was measured with the **Organizational Citizenship Behaviour for the Environment (OCBE)** scale (nine items by Boiral & Paillé, 2012; e.g. "I voluntarily carry out environmental actions and initiatives in my daily work activities"). We operationalized **sustainability awareness** with three self-conceived items measuring sustainability interest, perceived knowledge, and assessment of climate effectiveness (e.g. "I am interested in how sustainability can be improved in my company"). Lastly, the participants were asked to answer questions about their **position demographics** (job area, job position, and work experience in years) and **key data of their company** (business sector, company size in number of employees, annual revenue). To ensure comprehensibility and acceptability, the questionnaire was pretested and evaluated by the ethics committee of RWTH Aachen University as ethically unobjectionable (application number: 2023_06_FB7_RWTH Aachen).

Sample

In this study, we targeted respondents responsible for decisions regarding sustainability and energy efficiency investments in their respective companies. To reach this highly specific target group, potential respondents were screened and paid for their participation by a market research institute. To ensure that respondents were decision-makers for sustainability investments, we applied the following screening criteria: budget responsibility, participation in or accountability for sustainability decisions, sustainability as the main field of work or as a part of it, and structural sustainability integration within the company. The study was conducted between the end of June and the middle of August 2023 in Germany. We discarded incomplete and implausible data sets as well as speeders to enhance data quality. Our final sample consisted of $n = 108$ participants of which 61% were male ($n = 66$) and 39% ($n = 42$) female. The majority of respondents were 36-45 years old ($n = 37.34\%$) or 46-55 years old ($n = 32.30\%$). Educational attainment was generally high with 84% ($n = 91$) holding a high educational level, 12% maintaining medium ($n = 13$), and 4% ($n = 4$) low educational qualifications according to the International Standard Classification of Education (ISCED). Nearly one-third of the respondents held roles in business management or leadership ($n = 35$, 32%), while 14% ($n = 15$) were specifically employed in sustainability management. With 46% ($n = 50$) most of the respondents held 2-5 years of work experience in their current position. Further insights into sustainability leaders' and investment decision-makers' psychological characteristics are given in the results as part of the descriptive analysis.

Statistical Analysis

For this research, a Structural Equation Modelling (SEM) approach was chosen to analyze the psychological determinants of leaders' organizational citizenship behavior for the environment. SEM offers the possibility of mapping complex cause-effect relationships with multiple (latent) variables, which can function both as dependent and independent variables, in a linear equation system. By combining several statistical methods, structural equation analysis aims at quantifying causal relations by estimating path coefficients between the considered variables as well as measurement errors (Weiber & Sarstedt, 2021). However, it should be noted that associations found in SEM cannot be derived directly as causal relationships. Instead, strong theoretical support based on the researchers' insights from prior studies, scientific understanding, the research design, and logical reasoning is necessary to identify causal relationships (Bollen & Pearl, 2013). In this study, we conducted a Partial Least Squares (PLS) SEM using SmartPLS software (Version 4.0.9.6). PLS-SEM is a variance-based method that is widely applied in the social sciences due to several advantages: PLS-SEM attains high levels of statistical power with relatively small sample sizes, does not rely on distributional assumptions, and is suitable for complex models with many variables and structural paths. Additionally, it is specifically recommended for research exploring the theoretical extensions of existing models, as intended here (Hair et al., 2022). Finally, we tested the statistical significance of our PLS-SEM results with bootstrapping using 5.000 subsamples.

Research Model

To predict leaders' sustainability behavior measured as their Organizational Citizenship Behavior for the Environment (OCBE), we extended the model with environmental personal beliefs and norms derived from Stern's VBN Theory with additional individual psychological attitudinal predictors. The integrated variables and proposed pathways can be seen in Figure 1. Our specific hypotheses are listed in the "State of the art" chapter.
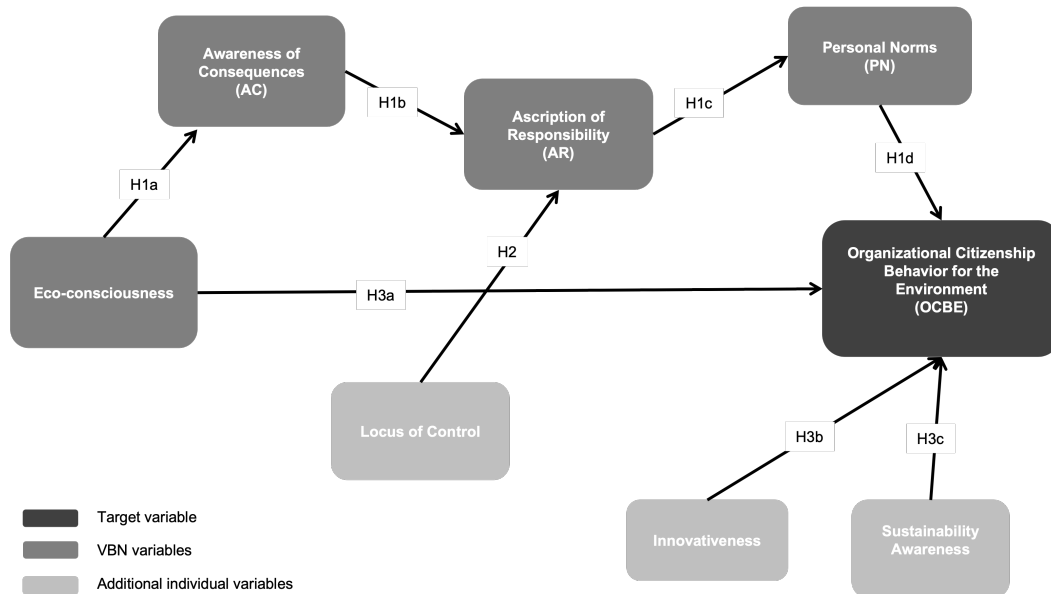

Figure 1. Research model and hypotheses for analyzing leaders' sustainability behavior

Results

At the beginning of this chapter, we evaluated the measurement quality of the proposed model. Then, we analyzed the model constituents descriptively to give an overview of leaders' characteristics and finally tested our hypotheses by calculating the model paths and explained variances.

Quality Assessment of the Measurement Model

First, we assessed the validity and reliability of the construct measures as well as the quality by following the recommended steps by Hair et al. (2019). As a first step, we evaluated the measurement model's indicator reliability and excluded items with loadings below 0.4. Next, items with a contribution below 0.6 were removed to increase composite reliability or AVE. In the final model, the majority of items showed loadings above the recommended level of 0.7, all items exceeded an acceptable threshold of 0.6. Convergent validity, which indicates whether a construct's items converge and reflect the same underlying construct, was tested by analyzing the Average Variance Extracted (AVE) values which varied between 0.524-0.843 and thus, exceeded the recommended minimum of 0.5. To ensure that the model constructs are sufficiently distinct, we considered two different criteria of discriminant validity: The Fornell-Larcker-Criterion (FLC) was larger than any squared correlation of each variable with another latent construct; the Heterotrait-Monotrait Ratio (HTMT) values for all pairs of constructs lay between 0.228-0.885 and thus below the recommended threshold of 0.9 for conceptually similar constructs as in this case e.g. eco-consciousness and the ecocentric constructs from the VBN model. Lastly, the internal consistency reliability was evaluated. All construct measurement scales demonstrated a good internal consistency with Cronbach's alpha (CRA) values above 0.8 (all measures can be seen in Table 1). The only exception was the innovativeness scale with a CRA = .564. Because CRA is influenced by the number of items in a scale and tends to underestimate internal consistency, composite reliability (CR) was measured as well. All CR scores exceeded the recommended minimum of 0.7 so that innovativeness was regarded as sufficiently internally consistent. As a result of modifications in the quality assessment, it was found that both Locus of Control (LoC) and sustainability awareness were not collectively reflected by their according items. Consequently, both constructs were condensed into single-item constructs. These single-item constructs were then relabelled as "ecocentric LoC" and "sustainability interest" to more precisely align with the specific aspects being measured by the individual items. In contrast to covariance-based SEMs, single-item constructs are not problematic in PLS-SEM regarding identification and convergence (Garson, 2016). Summarising this, the

measurement model demonstrated an adequate quality concerning indicator reliability, convergent validity, discriminant validity, and internal consistency reliability.

Table 1. Quality measurement results for PLS model factors (NOI: Number of items; AVE: Average variance extracted, CR: Composite reliability, CRA: Cronbach's alpha) and descriptive statistics (min, max, M: Mean, SD: Standard deviation) for all items in the final model.

Construct	NOI	AVE	CR	CRA	Operationalization	Factor Loadings	Min	Max	*M*	*SD*
Eco-consciousness	**4**	**.633**	**.873**	**.805**	*EC*	**-**	**1**	**6**	**4.75**	**0.88**
					It makes me angry when I see how Germany is failing to meet its climate protection targets.	.868	1	6	4.27	1.17
					It worries me when I think about the environmental conditions in which future generations will probably have to live.	.805	1	6	4.94	1.14
					More environmental protection also means better quality of life and health for everyone.	.766	1	6	5.11	0.99
					I don't see any added value in buying expensive green electricity. (recoded)	.736	1.5	6	4.67	1.16
Awareness of Consequences	**2**	**.843**	**.915**	**.815**	*AC*	**-**	**1**	**6**	**5.31**	**0.93**
					Global warming is a problem for society.	.929	1	6	5.36	0.88
					It is not certain whether the exhaustion of energy sources is a problem. (recoded)	.907	2	6	5.26	1.14
Ascription of Responsibility	**6**	**.619**	**.906**	**.874**	*AR*	**-**	**1.67**	**6**	**4.26**	**0.94**
					I am jointly responsible for the energy problems.	.851	1	6	4.04	1.20
					I feel jointly responsible for the exhaustion of energy sources.	.852	1	6	3.94	1.23
					I feel jointly responsible for global warming.	.846	1	6	4.06	1.27
					My contribution to the energy problems is negligible. (recoded)	.769	2	6	4.41	1.10
					Not only the government and industry are responsible for high energy consumption levels, but me too.	.745	1	6	4.43	1.13
					In principle, individuals at their own cannot contribute to the reduction of energy problems. (recoded)	.634	1	6	4.69	1.28
Personal Norm	**6**	**.663**	**.921**	**.897**	*PN*	**-**	**1.67**	**6**	**4.65**	**0.88**
					I feel personally obliged to save as much energy as possible.	.889	1	6	4.63	1.10
					I feel morally obliged to save energy, regardless of what others do.	.877	1	6	4.88	1.05
					I feel guilty when I waste energy.	.772	1	6	4.33	1.30
					I feel morally obliged to use green instead of regular electricity.	.768	1	6	4.15	1.31
					People like me should do everything they can to reduce energy use.	.863	1	6	4.70	0.97
					I feel obliged to bear the environment and nature in mind in my daily behaviour.	.698	3	6	5.18	0.76
Locus of Control	**1**	**-**	**-**	**-**	*Eco_LoC*	**-**	**1**	**6**	**4.68**	**1.20**
					I am only one person, I can't make a difference to the environment. (recoded)	1.00	-	-	-	-
Organizational Citizenship Behaviour for the Environment	**7**	**.578**	**.905**	**.878**	*OCBE*	**-**	**1**	**6**	**4.65**	**0.79**
					I spontaneously give my time to help my colleagues take the environment into account in everything they do at work.	.693	1	6	4.24	1.18
					I encourage my colleagues to adopt more environmentally conscious behaviour.	.801	1	6	4.97	0.92
					I encourage my colleagues to express their ideas and opinions on environmental issues.	.770	1	6	5.05	1.01
					I undertake environmental actions that contribute positively to the image of my organization.	.692	1	6	4.84	1.00
					In my work, I weigh the consequences of my actions before doing something that could affect the environment.	.798	1	6	4.52	0.98
					I voluntarily carry out environmental actions and initiatives in my daily work activities.	.776	1	6	4.35	1.21
					I make suggestions to my colleagues about ways to protect the environment more effectively, even when it is not my direct responsibility.	785	1	6	4.56	0.98

Innovativeness	3	.524	.767	.564	*Innovativeness*	-	3.67	6	4.98	0.58
					I enjoy trying new ideas.	.742	3	6	5.30	0.71
					I consider myself to be creative and original in my thinking and behavior.	.691	3	6	4.86	0.83
					I feel that I am influential towards my friends and colleagues.	.737	1	6	4.77	0.83
Sustainability Awareness	1	-	-	-	*Sus_Interest*	-	1	6	5.20	0.91
					I am interested in how sustainability can be improved in my company.	1.00	-	-	-	-

Descriptive Analysis of Leader Characteristics

Before we analyze the structural model and the relationships between its constituents, a descriptive overview of the constructs is given to gain an overview of the psychological characteristics of sustainability decision-makers. We calculated measures of central tendencies and dispersion using R Studio Version 2022.12.0+353. Leaders in the sample exhibited a very high awareness of consequences ($M = 5.31$, $SD = 0.93$) regarding climate change and depletion of energy sources as well as a high sustainability interest ($M = 5.20$, $SD = 0.91$). They perceived themselves as very innovative ($M = 4.98$, $SD = 0.58$) and showed a heightened eco-consciousness ($M = 4.98$, $SD = 0.58$). Moreover, the remaining measured attitudes were elevated as well: On average the respondents had an internal locus of cont

rol ($M = 4.68$, $SD = 1.20$), felt obligated to take pro-environmental actions due to their personal norms ($M = 4.65$, $SD = 0.88$), engaged in citizenship behavior for the environment ($M = 4.65$, $SD = 0.79$), and felt a heightened ascription of responsibility ($M = 4.26$, $SD = 0.94$) for energy problems. All construct means deviant significantly from the scale mean of 3.5, which we verified with one-sample Wilcoxon tests. Effect sizes r for all differences were large, varying between 0.627 and 0.871.

Structural Model and Path to Leader's Sustainability Behavior

After confirming the satisfactory quality of the measurement model, we tested the structural model with the hypothesized paths representing relationships between the measured constructs. Due to the lack of comprehensive criteria evaluating the entire model fit in PLS-SEM, we conducted an assessment based on Hair et al.'s (2022) methodology. This involved determining the significance and importance of path coefficients, evaluating the model's explanatory and predictive power, and examining for collinearity issues.

First, multicollinearity was not an issue as the Variance Inflation Factors (VIF) of the predictor constructs ranged between 1.000- 2.747 and therefore were below the suggested threshold of 5. Secondly, the significance of path coefficients was calculated using a bootstrapping procedure with 5.000 subsamples to assess t-statistics and p-values. Significance levels for all paths can be seen in Figure 2.
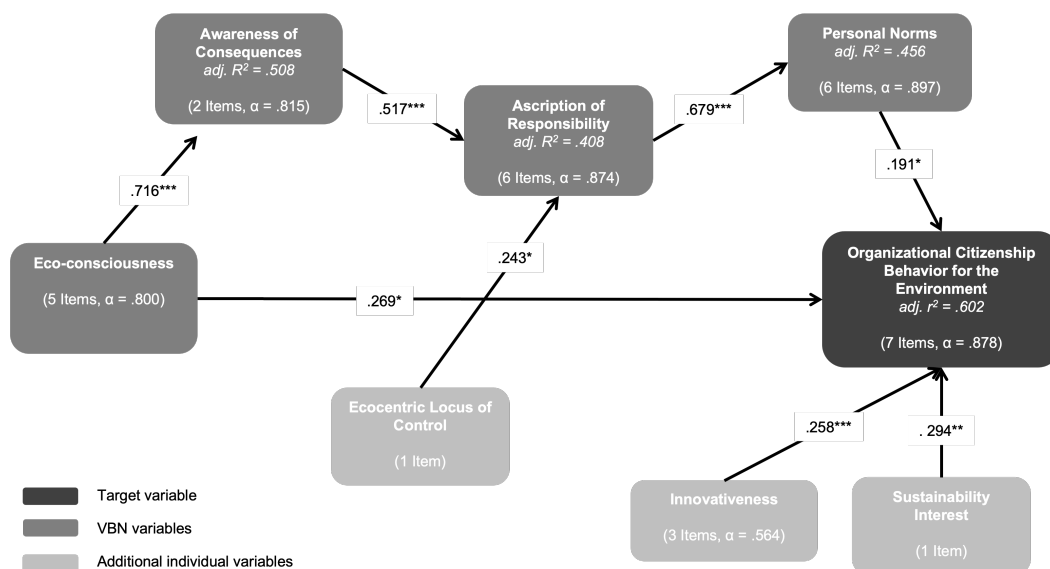

Figure 2. Structural path model to organizational citizenship behavior for the environment of leaders (* = p <.05; ** = p <.01, *** = p <.001)

In the next step, the coefficient of determination (R^2) value for all endogenous constructs was calculated, which indicates the amount of variance explained by all preceding exogenous constructs. Following the causal chain of

Stern's VBN theory in the path model, eco-consciousness was positively related to awareness of consequences (ß = .716, $p < .001$, H1a confirmed) and predicted 50.8% of its variance. Then, awareness of consequences (ß = .517, $p < .001$, H1b confirmed) accounted together with an ecocentric locus of control (ß = .243, $p < .05$, H2 partly confirmed) for 40.8% of the variance in the ascription of responsibility which in turn was positively related to personal norms (ß = .679, $p < .001$, H1c confirmed) and explained 45.6% of its variance. These findings are in accordance with Stern et al.'s (1999) VBN theory, demonstrating that a broader eco-consciousness positively affects particular sustainability and climate change beliefs. This, in turn, influences individual responsibility and triggers personal norms, subsequently driving leaders' Organizational Citizenship Behavior for the Environment (OCBE).

Together with the VBN model pathway, the direct links from eco-consciousness, innovativeness, and sustainability interest explained a considerable amount of the variance in our target variable organizational citizenship behavior for the environment (OCBE, $R^2 = .602$). When examining the path coefficients, it is evident that sustainability interest (ß = .294, $p < .01$, H3c partly confirmed) exerted the most substantial positive impact on OCBE, closely followed by the direct link from eco-consciousness (ß = .269, $p < .05$, H3a confirmed) and innovativeness (ß = .258, $p < .001$, H3b confirmed). As the end-construct of the VBN chain, personal norms (ß = .191, $p < .05$, H1d confirmed) was significantly, but only weakly positively related to OCBE as well. In summary, the analysis reveals that leaders exhibit stronger OCBE when they have a heightened interest in sustainability, demonstrate higher levels of innovativeness, and possess a stronger personal commitment to environmentally friendly actions.

Lastly, we applied the PLSpredict analysis procedure (Shmueli et al., 2016), which is a cross-validation of the model results with randomly split subgroups, to determine the model's out-of-sample predictive power. The number of folds was set to $k = 10$ and ten repetitions were calculated. Following the recommended procedure by Hair et al. (2022), the analysis was focused on our model's key target construct OCBE. The first indicator was Q^2predict values which should be larger than zero. The values for all OCBE indicators varied between 0.252-0.363 and the PLS model thus exceeded the most naïve benchmark. Further, the root mean squared error (RMSE, square root of the mean of the squared variances between predictions and actual observations) was compared with a linear regression model (LM) as the naïve benchmark. Our findings reveal that the PLS-SEM analysis yielded smaller prediction errors, specifically smaller RMSE values, compared to the LM across all OCBE indicators. Overall, the PLSpredict analysis demonstrated high predictive power of the PLS model, suggesting that the findings are generalizable to samples outside our data set.

Discussion

This study empirically investigated the role of leadership in promoting corporate sustainability with a focus on understanding the individual pro-environmental behavior of leaders and the psychological antecedents characterizing managers as sustainability leaders. Two primary goals guided our research: firstly, to examine leaders' individual pro-environmental behaviors as drivers for corporate sustainability; and secondly, to explore and model the psychological factors contributing to their Organizational Citizenship Behavior for the Environment (OCBE). Methodologically, the study employed structural equation modeling, assessing psychological constructs among leaders through a comprehensive survey. The discussion section of the paper will interpret these findings, evaluate their alignment with existing theoretical frameworks, discuss practical implications, acknowledge limitations, and propose directions for future research.

Characteristics of Sustainability Decision-Makers

In our leadership sample, the elevated levels of key constructs from the VBN theory (awareness of consequences, eco-consciousness) as well as the additional leader variables (sustainability interest, innovativeness), underscore the pivotal role these attributes play in fostering organizational sustainability. These traits can be aligned with the Environmental Leadership Model (Flannery & May, 1994), which states that leaders with strong environmental attitudes and behavioral control are more likely to drive environmentally responsible behaviors within organizations. To further explore sustainable leadership characteristics and behaviors, in-depth analyses should be conducted to assess the significance and interconnection of these traits, extending beyond the foundational concepts of the VBN theory. Our findings indicate that sustainability decision-makers, on average, demonstrated heightened OCBE, implying a positive influence on corporate sustainability practices through proactive engagement. Consequently, the research proposes an examination of the direct link from leaders' OCBE to corporate sustainability, aiming to analyze and quantify their direct impact (Keil et al., 2023).

Using VBN Theory to Predict Leaders' OCBE

We successfully applied the VBN theory to an organizational context with a leadership sample and therefore contribute to the knowledge of research on sustainable behavior in organizational contexts. Previous studies mainly focused on employee behavior (e.g. Ciocirlan et al., 2020) and said little about the attitudes and behaviors of leaders. However, in our leader sample, it was found that the VBN chain can be transferred as a robust explanatory concept. This implies that the VBN theory's applicability extends to the domain of corporate leadership, highlighting the importance of internal values and beliefs in driving environmental action within organizational contexts. As all factors were significantly positively related to the following element of the causal chain, eco-consciousness was validated as a suitable construct to replace the NEP scale and measure beliefs about human-environment relations in this underlying context. Surprisingly, Personal Norms (PN) as the final, behavior-activating element in the VBN chain were the weakest predictor of OCBE in our model. This contradicts earlier research, which emphasizes personal norms as a crucial or primary predictor of pro-environmental behavior and advocates for their promotion through strategies like social normalization, training, and communication (e.g. Ciocirlan et al., 2020; Papagiannakis & Lioukas, 2018). However, this is not directly comparable to our findings as Ciocirlan et al. analyzed an employee sample and Papagianniakis and Lioukas did not directly measure PN, but AC and AR as its activators. Further, Ruepert et al., (2016) identified inconsistent and partly weak associations between PN and the observed environmental behaviors in an employee sample as well. Due to these inconsistent research findings, it remains unclear whether personal norms in organizational contexts are less influential on managers' OCBE or if deviations are due to methodological constraints. Future studies should investigate this, exploring the reproducibility of results and potential confounding with eco-consciousness, which, beyond the VBN chain, also directly predicts OCBE.

The Role of Additional Individual Factors in Predicting Leaders' OCBE

Moreover, our study contributes new insights as we found that including further explanatory factors significantly enhanced the predictive power of the model and suggests that leaders' pro-environmental behaviors are directly driven by their innovativeness, sustainability interest, and eco-consciousness. Our results align with previous findings by Neessen et al. (2021) who also linked innovative attitudes to OCBE and Akterujjaman et al., (2022) who found a positive relation between environmental attitudes and OCBE. This implies that organizations may benefit from considering these characteristics when selecting individuals for managerial roles. Alternatively, they can foster innovativeness and eco-consciousness through training programs, promoting collaborative discussions among leaders regarding sustainable and innovative ideas, or incentivizing corresponding behaviors.

As the three sustainability awareness items could not be combined into one construct, sustainability interest remained a single-item construct and was the strongest predictor for OCBE. However, it should be taken into account that single-item constructs have a lower predictive power (Hair et al., 2022). Therefore, we recommend developing a multi-item measurement tool for sustainability interests to further investigate and quantify its influence on leaders' OCBE since this has not been explored yet. The second single-item construct was ecocentric Locus of Control (LoC) as only the environmentally related LoC item has been retained in the final PLS model. Our results align with previous studies that found a relation between environmentally specific LoC and environmental behaviors (e.g. Fielding & Head, 2012) but contradict studies that have found a link between LoC in general and environmental behaviors (e.g. Williams & Schaefer, 2013). This may arise from the specificity of OCBE as a behavior, making it more prone to prediction by particular psychological variables in the same context. Therefore, future investigations into OCBE should consider employing a multi-item construct for ecocentric LoC. Alternatively, perceived behavioral control emerges as a noteworthy construct, given its thematic connection to LoC and its empirically demonstrated direct impact on OCBE in a study conducted by Akterujjaman et al. (2022).

From the literature, additional constructs can be derived, which should be investigated in future studies to further enhance the explained variance of OCBE in the model or enrich the model with additional target constructs. Di Fabio et al. (2023) stress the importance of positive and supportive relationships in companies for a healthy, sustainable, and successful work environment. They found that Positive Relational Management (PRM) was positively related to a higher-order construct combining sustainability, ethical, mindful, and servant leadership – namely human capital sustainability leadership. To expand our findings with this perspective, future studies could include PRM as an additional construct and investigate whether its three constituents, respect, caring, and connectedness, are further psychological factors that predict leaders' environmental behaviors. Another interesting factor is subjective norms, which was found to be positively related to leaders' behavioral intention to

act environmentally friendly (Bhattacharyya & Biswas, 2021) and to positively moderate the relationship between managers' environmental attitude and OCBE (Akterujjaman et al., 2022). In contrast to personal norms that represent a felt moral obligation based on one's attitudes and values, subjective norms are the perceived social expectations and pressure to align one's actions with those expectations (Bhattacharyya & Biswas, 2021).

The PLS model's results indicating sustainability interest as the strongest predictor of OCBE suggest that organizations should prioritize fostering this interest among their leaders and employees. Effective interventions could include sustainability-focused training programs, workshops, and campaigns that highlight the importance and impact of sustainable practices (e.g., Papagiannakis & Lioukas 2018). Further, it is important to focus on enhancing awareness of the consequences of their behavior, which is an important determinant in engagement in environmental behavior (Ciocirlan et al., 2020; Wynveen et al., 2015). By actively engaging employees in sustainability initiatives and providing them with opportunities to contribute to environmental goals, as well as demonstrating the effects and (positive) consequences of sustainability measures, organizations can enhance their overall environmental citizenship behavior. Additionally, aligning corporate values and goals with sustainability principles can further reinforce this interest and encourage proactive environmental actions within the workplace.

Methodological Reflection and Limitations

In this research, we applied PLS-SEM to model the psychological antecedents of sustainability decision-makers' pro-environmental behavior. This methodological approach has proven to be particularly suitable due to its applicability for small and less heterogeneous groups (Hair et al. 2022), as in our case due to the highly specific target group. Consequently, the measurement model demonstrated high reliability as well as validity, and the structural showed high explanatory as well as predictive power. Due to the quality criteria applied, the previously planned operationalization of locus of control and sustainability awareness was not tenable and resulted in the reduction into single-item constructs. As already discussed, single-item constructs have a lower predictive power which is why it is advisable to either refine the measurement of these constructs and develop multi-item factors or test other content-related constructs as replacements. To improve the reliability and external validity of our results, larger samples and international compositions are necessary to test generalizability outside of the German context.

Conclusion

Finally, our study underscores the relevance of leaders' psychological factors in promoting sustainable practices within corporations and suggests that managers' pro-environmental behavior and leadership play a pivotal role in this dynamic. By integrating traditional elements of the VBN theory with additional psychological characteristics like innovativeness and sustainability interest, our research contributes to a more comprehensive understanding of what drives pro-environmental behavior in the context of corporate leadership. Drawing from the findings of this study, we have identified implications for enhancing managers' inclination to serve as sustainability role models, thereby contributing to the corporate sustainability transformation as an integral component of climate change mitigation. We recommend the implementation of training programs, workshops, and campaigns to stimulate and bolster their interest in sustainability. Moreover, these initiatives should aim to cultivate awareness regarding the consequences of unsustainable actions and emphasize the managerial responsibility to act as sustainability role models for their employees.

Acknowledgments

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