



## **Influence of Future Concerns on Personal Change and Personal and Institutional Engagement in the Context of Climate Change<sup>1</sup>**

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**Abstract:** This study investigates the relationship between concern for the future (FC), personal change (PC), personal engagement (PE), and institutional engagement (IE) in the context of climate change. A survey of 388 university students from the state of Santa Catarina, in the south of Brazil, was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The study reveals positive relationships between FC and PC, as well as between FC and PE, suggesting that FC can promote PC and increase PE in climate actions. However, a negative relationship between FC and IE indicates that an increase in FC may be associated with a reduced perception of governmental efforts in mitigating climate change. Furthermore, a positive association between PE and IE suggests that engaged individuals tend to recognize a greater institutional effort. This research contributes to the understanding of how individual concerns about climate change influence both personal actions and perceptions of institutional responses.

**Keywords:** Environmental Education. Climate Change. Personal Change. Institutional Engagement. Concern for the Future.

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## **Influência das Preocupações com o Futuro na Mudança Pessoal e no Engajamento Pessoal e Institucional no Contexto das Mudanças Climáticas**

**Resumo:** Este estudo investiga a relação entre a preocupação com o futuro (FC), a mudança pessoal (PC), o engajamento pessoal (PE) e o engajamento institucional (IE) no contexto das mudanças climáticas. Uma pesquisa com 388 estudantes universitários do estado de Santa Catarina, no sul do Brasil, foi analisada utilizando a Modelagem de Equações Estruturais com Mínimos Quadrados Parciais (PLS-SEM). O estudo revela relações positivas entre FC e PC, bem como entre FC e PE, sugerindo que a FC pode promover a PC e aumentar o PE em ações climáticas. No entanto, uma relação negativa entre FC e IE indica que um aumento na FC pode estar associado a uma percepção reduzida dos esforços governamentais na mitigação das mudanças climáticas. Além disso, uma associação positiva entre PE e IE sugere que indivíduos engajados tendem a reconhecer um maior esforço institucional. Esta pesquisa contribui para o entendimento de como as preocupações individuais sobre as mudanças climáticas influenciam tanto as ações pessoais quanto as percepções das respostas institucionais.

**Palavras-chave:** Educação Ambiental; Mudança Climática; Mudança Pessoal; Engajamento Institucional; Preocupação com o Futuro.

## **Influencia de las Preocupaciones Futuras en el Cambio Personal y el Compromiso Personal e Institucional en el Contexto del Cambio Climático**

**Resumen:** Este estudio investiga la relación entre la preocupación por el futuro (FC), el cambio personal (PC), el compromiso personal (PE) y el compromiso institucional (IE) en el contexto del cambio climático. Una encuesta de 388 estudiantes universitarios del estado de Santa Catarina, en el sur de Brasil, fue analizada utilizando el Modelado de Ecuaciones Estructurales con Mínimos Cuadrados Parciales (PLS-SEM). El estudio revela relaciones positivas entre FC y PC, así como entre FC y PE, sugiriendo que FC puede promover PC y aumentar PE en acciones climáticas. Sin embargo, una relación negativa entre FC y IE indica que un aumento en FC puede estar asociado con una percepción reducida de los esfuerzos gubernamentales en la mitigación del cambio climático. Además, una asociación positiva entre PE e IE sugiere que los individuos comprometidos tienden a reconocer un mayor esfuerzo institucional. Esta investigación contribuye al entendimiento de cómo las preocupaciones individuales sobre el cambio climático influyen tanto en las acciones personales como en las percepciones de las respuestas institucionales.

**Palabras clave:** Educación Ambiental; Cambio Climático; Cambio Personal; Compromiso Institucional; Preocupación por el Futuro.

## **INTRODUCTION**

Climate change has been deeply affecting the foundations of human livelihood, economics, and social organization. According to the Shukla *et al.* (2019), it is unequivocal that human action, through the emission of greenhouse gases (GHG) mainly originating from the burning of fossil fuels for energy generation and changes in land use and cover (deforestation), has warmed the climate system, resulting in generalized, rapid, and irreversible changes. Concurrently, the World Meteorological Organization (Canton, 2021) highlights that climate change and extreme events have quintupled the number of natural disasters in 50 years. From 1970 to 2019, more than 11,000 disasters have been reported, resulting in 2 million deaths and \$3.64 trillion in

damages. Chancel, Bothe and Voituriez (2023) point out that climate impacts are not equally distributed across the world: on average, low- and middle-income countries suffer greater impacts than their richer counterparts.

In response, policymakers from over 140 countries, representing 90% of global greenhouse gas emissions, have adopted or announced long-term commitments and goals toward climate neutrality targets by mid-century (Wallach, 2021). A large-scale survey across 20 countries conducted by Dechezleprêtre *et al.* (2022) reveals that at least three-quarters of respondents in each country agree that “climate change is an important problem” and that their country “should take measures to fight it.” However, this consensus often does not directly translate into agreement on which climate policies to support.

Understanding public support for climate policies is crucial for several reasons. Generally, the public opinion of youth and students is a key driver of policy change in democratic countries. The individual and public risk perception related to the possible consequences of climate change is of paramount importance (Brügger *et al.*, 2015; Loy; Spence, 2020; Spence *et al.*, 2011). Risk perception not only plays a vital role in shaping climate policy but is also central in generating support for adaptation and mitigation initiatives (Lujala; Lein; Rød, 2015). Moreover, the lack of broad public support is a major barrier to adopting low-carbon economy solutions (Geels, 2013). Additionally, understanding public attitudes helps anticipate responses in later stages of the policy cycle, contributing to the design and implementation of effective policies (Drews; van den Bergh, 2016; Fairbrother, 2022).

The current study is driven by the interest in deepening the understanding of how Brazilian students perceive and react to climate change. It considers the relationship between their concerns about the future consequences of these changes and their respective personal and institutional responses. The study addresses how this perception affects their decisions and opinions, including the evaluation of the effectiveness of climate policies and their political preferences. The research objective is to investigate the relationship between concern for the future (FC), personal change (PC), personal engagement (PE), and institutional engagement (IE) in the context of climate change. In this way, it aims to provide an understanding of how these dimensions are interconnected and how they influence the attitudes of students.

We conducted a survey of 388 Brazilian students from various income levels and social and economic contexts. For data analysis, we used partial least squares structural equation modeling (PLS-SEM). The study is justified by the importance of the topic for literature, policymakers, and the community in general, focusing on students' and youth's perception of climate change concerns (Bostrom *et al.*, 2012; Han; Ahn, 2020; Lee *et al.*, 2020), especially for national literature, given the scarcity of research in this area.

## **THEORETICAL REFERENCE AND HYPOTHESES**

### **The Role of Future Concern in Personal Change and Engagement with Climate Issues**

Concern about global warming and climate change is a fundamental element for willingness to change behavior and support climate policies (Drews; van den Bergh, 2016; Fairbrother, 2022; Loy; Spence, 2020). However, a relevant step in transitioning to pro-environmental behavior is public engagement with global warming and climate change issues.

Regarding engagement and adherence to pro-environmental policies, experience with global warming (Akerlof *et al.*, 2013; Brügger *et al.*, 2015; Lujala; Lein; Rød, 2015), extreme weather events (Konisky; Hughes; Kaylor, 2016), political preference (Ballew *et al.*, 2019; Czarnek; Kossowska; Szwed, 2021), and personal values (Corner; Markowitz; Pidgeon, 2014; Reser; Bradley, 2020; Swim; Geiger, 2021) are significant. Personal values, in particular, show significant differences in levels of climate change engagement across social groups defined by their political ideology or cultural worldviews (Corner; Markowitz; Pidgeon, 2014; Swim; Geiger, 2021). Additionally, research provides evidence of an association between real and self-reported weather anomalies and a belief in, or concern about, climate change. Perceptions of having experienced climate change predict localized climate change-related risk perceptions, as well as a belief in, and concern about, climate change (Akerlof *et al.*, 2013; Li; Liu, 2022).

Shi, Visschers and Siegrist (2015) conducted a survey in Switzerland and found that cultural worldviews and climate-related knowledge were significantly related to people's concern about climate change. González-Hernández, Aguirre-Gamboa and

Meijles (2022) indicated that Mexican households' respondents are concerned about climate change or the environment, and that perceptions, alongside sociodemographic characteristics, influence a household's mitigation efforts.

Shi *et al.* (2016) showed that knowledge about the causes of climate change was highly correlated with higher levels of concern about climate change in Canada, China, Germany, Switzerland, the UK, and the US. Zaval *et al.* (2014) indicated that US households perceived temperature deviation on belief in and concern for global climate change persisted, whether the phenomenon was described as climate change or global warming. Myers *et al.* (2013) show that American adults have low levels of engagement against climate change and that personally experienced global warming is far more likely to engage with the issue than people who say they have not.

Concerning the relationship between personal belief and climate change engagement, Lujala, Lein, and Rød (2015) show that in Norway, adult respondents demonstrate a strong relationship between reporting a higher level of belief that climate change is human-induced and listing climate change as a major challenge. Also, the authors point out that the respondents who are willing to pay more for green energy and are aware of passive houses are more likely to report climate change as a major challenge. Similarly, Ojala (2012) finds that young Swedish students have a significant correlation between pro-environmental behavior and altruism, social influence, and personal values. According to the author, the more constructive hope, altruistic values, and so on the young people possess, the more likely it is that they will behave pro-environmentally. In the same way, based on an Australian initiative, Wiseman, Williamson and Fritze (2010) show the importance of carefully planned and implemented community engagement as essential components in effective climate mitigation and adaptation strategies.

The literature suggests that concern about the future implies more personal engagement in climate change topics. In this context, the following hypotheses are formulated:

H1a. Concern for the Future (FC) is associated with Personal Change (PC).

H1b. Concern for the Future (FC) is associated with Personal Engagement (PE).

## **Change, Concern, and Engagement: Relations with the Perception of Institutional Engagement**

The engagement of people in climate change issues and the perception of governmental institutions' engagement in environmental policies are critical for the effectiveness of climate change mitigation policies. An insufficient understanding of how public attitudes towards climate policies are intertwined with the perception of institutional involvement has been an obstacle. This includes understanding the types of people who are more or less favorable to public actions to mitigate climate change and how public messages and the design of institutions and policies influence the perception of governmental engagement.

Various aspects of the climate change phenomenon, such as beliefs, concerns, knowledge, psychological factors, and demographics, are strong determinants of public opinion about taxes and laws related to climate change and, by extension, the perception of institutional engagement (Bergquist *et al.*, 2022; Corner; Markowitz; Pidgeon, 2014; Fairbrother, 2022). The lack of broad public support and a positive perception of institutional engagement are barriers to implementing effective climate policies (Drews; van den Bergh, 2016; Fairbrother, 2022).

Previous research has shown that differences among people, such as in risk perception and political identities, explain support for climate change policies and the perception of institutional engagement (Ballew *et al.*, 2020; Swim; Geiger, 2021). In a comparative context among countries, citizens' concern about climate change is associated with lower GHG emissions and a greater perception of proactive governmental engagement (Tjernström; Tietenberg, 2008). Additionally, the lack of broad public support and trust in institutions has been identified as a major barrier to transitioning to a low-carbon economy (Geels, 2013). Understanding public attitudes and how they relate to the perception of governmental institutions' engagement is crucial to anticipating public responses in later stages of the policy cycle, contributing to the design and implementation of effective policies (Drews; van den Bergh, 2016).

Fairbrother, Sevia and Kulin (2019) showed that nations whose populations are more favorable to higher taxes on fossil fuels are not necessarily those more aware and concerned about climate change, but rather those with the highest levels of political trust. Zhang, Abbas and Iqbal (2021) found that carbon taxation is an effective emission

reduction policy but unpopular, and little is known about why people oppose it. They show that the main driving factors for attitudes towards carbon taxes are trust in the government, education, and perceptions of taxation's impact on individuals and businesses.

Based on a survey with Swiss citizens, Baranzini and Carattini (2017) indicate that individuals are more concerned about the environmental effects of the tax and climate policies. Martinho, Balaia, and Pires (2017) show that Portuguese citizens agree with the tax but view it as extra revenue for the state. Sonnenschein and Smedby (2019) indicate that policy consistency regarding the tax base and its revenue use may increase public acceptability of willingness to pay (WTP) for climate change mitigation.

Considering specific policies related to transportation and electricity consumption, Wicki, Fesenfeld and Bernauer (2019) argue that the main obstacle to making the transportation sector more ecologically sustainable is political feasibility. Vuichard, Stauch and Dällenbach (2019) indicates that a local resource tax that benefits the entire community is favored over individual financial participation models.

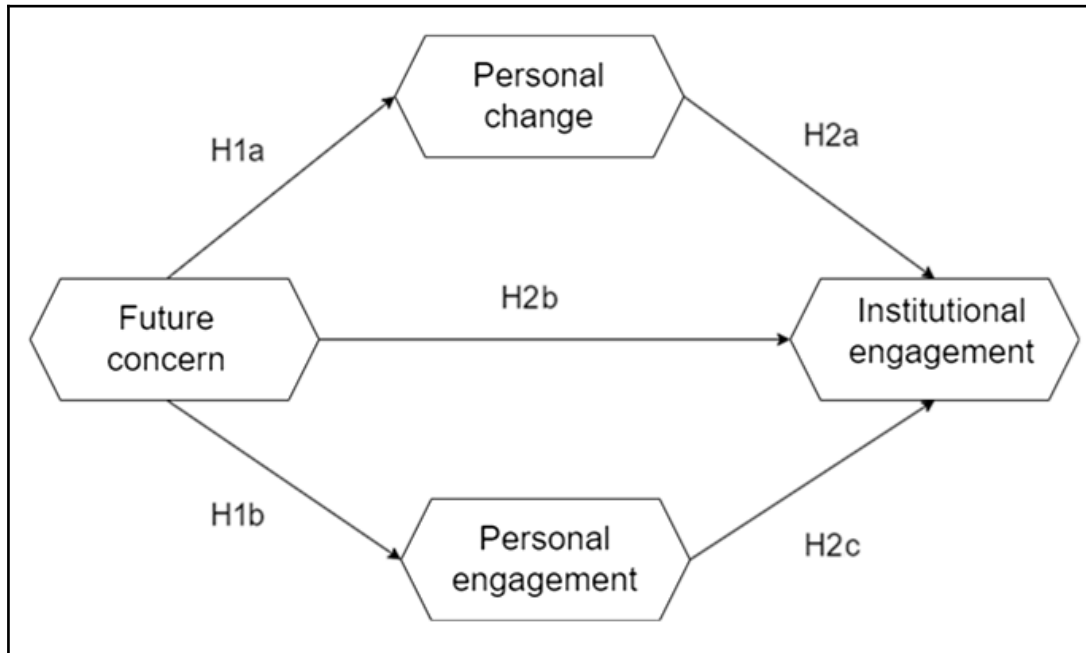
Douenne and Fabre (2020) show that greater knowledge among French citizens is clearly associated with higher concern for climate change and greater support for climate policies. Mildenberger *et al.* (2022) indicate that insufficient information about the climate change tax substantially affects policy support among Canadian and Swiss citizens. Hammerle, Best and Crosby (2021) demonstrated that for Australian citizens, carbon taxes can be a low-cost approach to reducing carbon dioxide emissions but are often constrained by public acceptability. Comparing citizens from Sweden, Norway, New Zealand, and Australia using online surveys, Haring, Jagers and Matti (2019) specifically point towards the highly politicized nature of climate policy instruments and their sensitivity to public support as explanatory factors for cross-national differences. Similarly, Uyduranoglu and Ozturk (2020) point out that Turkish citizens' concerns about global air pollution and climate change make the public more supportive of carbon taxation, and the perception that carbon taxation is an effective policy for decreasing the use of energy and addressing climate change increases public support for the policy.

Based on the above discussion, this study declares the following research hypotheses:

- H2a. Personal Change (PC) is associated with the perception of institutional engagement (IE).
- H2b. Concern for the Future (FC) is associated with the perception of institutional engagement (IE).
- H2c. People's Engagement (PE) is associated with the perception of institutional engagement (IE).

Thus, the research design describing the hypotheses is presented in Figure 1.

Figure 1: Design of the Research and Hypotheses



Source: Authors, 2023.

## METHODOLOGICAL PROCEDURES

### Sample and Data Collection

For this study, data were collected from 388 students at a university in the state of Santa Catarina, in the south of Brazil. The profile variables are available in Table 1.



Table 1: Profile of the interviewees

Profile Variable	Profile Description
Gender	Female (54.96%), Male (45.04%)
Parental Education Level	Basic education completed (16.75%), Primary education completed (14.72%), Secondary education completed (32.23%), Higher education completed (25.89%), Prefer not to say (10.41%)
Age Group	Up to 18 years (11.70%), 19 to 22 years (39.19%), 23 to 26 years (25.95%), Over 26 years (23.16%)
Residence Location	Rural area in small town (20.15%), Urban area in medium town (44.90%), Urban area in small town (25.51%), Rural area in medium town (9.44%)
Family Income	Over 20 Minimum Wages (3.30%), From 11 a 20 (6.60%), From 4 to 10 Minimum Wages (32.99%), From 2 to 4 Minimum Wages (36.55%), Up to 2 Minimum Wages (12.44%), Prefer not to say (8.12%)

Source: Authors, 2023.

The surveyed sample reflects a particular set of socioeconomic and demographic conditions. In Brazil, the Brazilian Institute of Geography and Statistics (IBGE) uses family income as an objective criterion to define social class, categorizing people into five classes based on their family income. Thus, the study participants are classified into Class A (3.30%), B (6.60%), C (32.99%), D (36.55%), and E (12.44%).

### Measurement of Constructs

The instrument used (Appendix) consists of 16 statements, in a version translated into Portuguese. It employed a seven-point Likert scale for responses. Future Concern (FC) is a construct based on Brügger *et al.* (2015) and Corner, Markowitz and Pidgeon (2014), measured with a four-item scale. Personal Engagement (PE) was developed based on Fairbrother (2022), Loy and Spence (2020), and Poortinga *et al.* (2011), measured with three items. The Personal Change (PC) construct was developed based on Loy and Spence (2020), Lujala, Lein, and Rød (2015), and Spence *et al.* (2011), and is measured with five items. The Institutional Engagement (IE) construct was developed based on Fairbrother (2022), Loy and Spence (2020), and Poortinga *et al.* (2011), measured with four items.

### Common Method Variance Bias

The issue of common method variance (CMV) occurs when data are collected from the same respondent, potentially causing inflated correlations among variables due to similar measurement errors. To address concerns about CMV, we followed the

guidelines of Podsakoff *et al.* (2003), including voluntary participation in the research, ensuring anonymity, using validated scales, and pre-testing the questionnaire. Harman's single factor test showed that the variance of the principal factor was 23.48%, below 50%, suggesting that common variance bias did not significantly influence the outcome.

### **Data Analysis Method**

For data analysis, structural equation modeling with partial least squares (PLS-SEM) was used, incorporating a linear regression estimation technique based on variable decomposition and the covariance matrix. This technique is grounded in the study of a system of linear relationships between latent variables, resolved one at a time. It aims to estimate the variance of the endogenous constructs and their respective manifest variables, at a significance level of 0.05. PLS is particularly useful in this study, as the technique tests hypotheses with minimal data requirements and is robust for small samples. For data analysis, we performed validation tests and model adequacy using the "semPLS" package in R.

## **ANALYSIS AND DISCUSSION OF RESULTS**

### **Assessment of Measurement and Structural Models**

The correlation values of the latent variables are reported in Table 2. In this study, the highest correlation result was between PC (personal change) and FC (future concern), being 0.720, while the lowest correlation was found between IE (personal engagement) and PC, which was -0.049. Following Hair Jr. *et al.* (2017), the results indicate that the correlation of the latent variables is acceptable to proceed, as no value is above 0.800.

Table 2: Skewness, Kurtosis, and Correlation Values of Latent Variables

Latent Variables	Data Distributions		Correlation			
	Kurtosis	Skewness	FC	PC	PE	IE
Future Concern (FC)	-0,479	-0,498	1,000			
Personal Change (PC)	-0,193	-0,498	0,720	1,000		
Personal Engagement (PE)	-0,607	-0,129	0,423	0,378	1,000	
Institutional Engagement (IE)	-0,284	0,174	-0,089	-0,049	0,139	1,000

Source: Authors, 2023.

The distribution of the latent variables' data was measured using the skewness and kurtosis indicators. This study reported that the skewness values varied from -0.428 to 0.174 and kurtosis from -0.607 to -0.193. According to Hair Jr. (2011), if the extracted values for skewness are between -2 and 2, and kurtosis between -7 and 7, the data are considered normal. Thus, there was no problem of collinearity in the data based on these results.

#### **Measurement Model Assessment:**

To assess the validity and reliability of the instrument, this study employed a measurement model analysis in PLS-SEM using the algorithm technique, following the methodology outlined by Hair Jr. (2011) (see Table 3).

Table 3: Outer Loadings, Cronbach's Alpha, Composite Reliability, and AVE

Latent Variables	Items	Outer loadings	Cronbach's alpha	Composite reliability	AVE
Future Concern (FC)	FC_1	0.788	0.809	0.874	0.636
	FC_2	0.754			
	FC_3	0.797			
	FC_4	0.847			
Personal Change (PC)	PC_1	0.652	0.737	0.836	0.507
	PC_2	0.656			
	PC_3	0.715			
	PC_4	0.722			
	PC_5	0.803			
Personal Engagement (PE)	PE_1	0.780	0.691	0.827	0.615
	PE_2	0.844			
	PE_3	0.725			
Institutional Engagement (IE)	IE_1	0.683	0.721	0.824	0.543
	IE_2	0.856			
	IE_3	0.740			
	IE_4	0.639			

Source: Authors, 2023.

Cronbach's alpha and Composite Reliability (CR) were used to measure the reliability of the constructs (Hair Jr., 2011), while convergent validity, indicated by the Average Variance Extracted (AVE), demonstrates the shared variance among indicators of each latent variable or construct in the model (Fornell; Larcker, 1981). Both Cronbach's alpha and Composite Reliability (CR) values exhibited loadings above the threshold recommended in the literature, which is 0.70 (Hair Jr., 2011). All AVE loadings were equal to or exceeded the acceptable minimum of 0.50 (Fornell; Larcker, 1981; Hair, 2011).

The discriminant validity of the model was analyzed to confirm that the variables are distinct enough to exert their individual effects (Hair Jr. *et al.*, 2021). Following the approaches of Henseler, Ringle and Sarstedt (2015), the heterotrait-monotrait ratio (HTMT) was assessed using the procedure presented by Hair Jr. *et al.* (2021), which suggests that HTMT is the most reliable source of validity and that its values should differ from 1 (see Table 4).

Table 4: Heterotrait – monotrait ratio (HTMT)

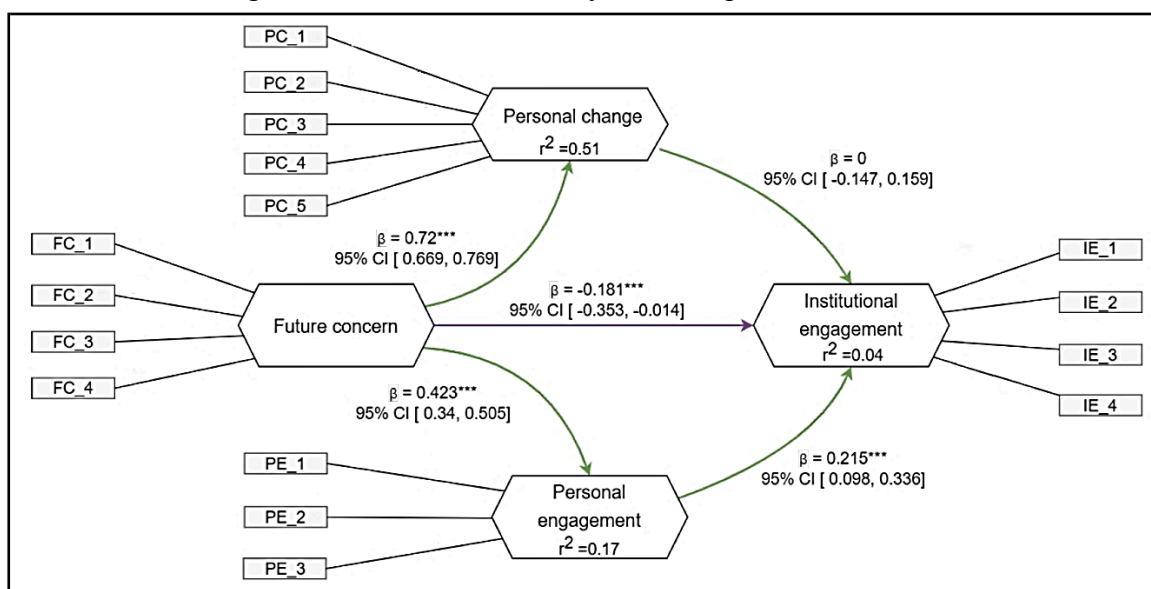
Latent Variables	FC	PC	PE
Future Concern (FC)			
Personal Change (PC)	0,931		
Personal Engagement (PE)	0,547	0,528	
Institutional Engagement (IE)	0,154	0.166	0.216

Source: Authors, 2023.

## Hypotheses and Discussion of Results

In the estimation of the structural model, the path coefficients represent the strength and direction of the relationships between the latent variables and are interpreted as standardized beta coefficients of ordinary least squares regressions (Henseler; Ringle; Sarstedt, 2015) (figure 2).

Figure 2: Measurement Analysis of Proposed Framework



Source: Authors, 2023.

To obtain the standard errors of the path coefficients, we used the bootstrap procedure with 10,000 samples. By dividing the path coefficient by the standard error obtained through bootstrap, we obtained the empirical t-values, allowing for the assessment of the significance of the corresponding path coefficient. The t-statistic values should be greater than 1.96 (Hair Jr., 2011). Additionally, the  $R^2$  values were also

determined, representing the variance in an endogenous variable explained by exogenous variables (Hair Jr., 2011).

This study confirms hypothesis H1a, demonstrating that concern for the future (FC) is intrinsically linked to personal change (PC) in climate issues. This finding aligns with the research of Drews, van den Bergh (2016) and Fairbrother (2022), who highlighted the relevance of individual perception of climate change as a catalyst for pro-environmental behaviors. Furthermore, the research underscores the crucial role of public engagement and personal experience in global warming issues, as emphasized by Akerlof *et al.* (2013) and Brügger *et al.* (2015), underlining the importance of individual awareness in adopting pro-environmental policies.

Regarding hypothesis H1b, the results demonstrate a significant association between concern for the future (FC) and personal engagement (PE) in climate issues. This corroborates the studies of Lujala, Lein and Rød (2015), which show a strong relationship between the belief in human-induced climate change and recognizing it as a major challenge. Additional literature from Ojala (2012) and Wiseman, Williamson and Fritze (2010) supports this finding, suggesting that constructive personal values, such as hope and altruism, are crucial in driving pro-environmental behavior. These findings reinforce the understanding that concern for the future not only influences personal environmental choices but also fosters greater engagement with sustainable climate policies and practices.

The hypothesis H2a “Personal Change (PC) is associated with Institutional Engagement (IE)” was rejected, indicating that individual actions related to personal change are not significantly linked to the perception of institutional engagement. This suggests that while people may change their behaviors due to concerns about the future (FC), these changes are not necessarily motivated by the perception that governmental institutions are effectively engaged in mitigating climate change. This finding is consistent with the studies of Baranzini and Carattini (2017), which show that concern for the environmental effects of policies can be a driver for personal change, regardless of the perception of institutional engagement. Additionally, Martinho, Balaia and Pires (2017) highlight that support for climate policies, such as carbon taxation, does not necessarily reflect a positive perception of governmental engagement but can be motivated by other reasons, such as direct environmental concerns.

For hypothesis H2b, the results indicate a significant and negative association between Concern for the Future (FC) and institutional engagement (IE). This implies that the greater people's concern for the future, the lower their perception of the engagement of governmental institutions. This result suggests a possible discrepancy between people's concern for the future and their assessment of the ability of governmental institutions to effectively address the challenges of climate change. This could be correlated with the findings of Douenne and Fabre (2020), where greater knowledge about climate change does not necessarily translate into a positive perception of governmental engagement. Furthermore, the study by Haring, Jagers and Matti (2019) on the politicized nature of climate policy instruments might contribute to this perception, where political actions can be seen as insufficient or inadequate in the face of individuals' real concerns.

The hypothesis H2c was proven to be significant and positive, indicating that People's Engagement (PE) is indeed associated with institutional engagement (IE). This suggests that individuals who are personally engaged in climate issues tend to perceive a greater engagement on the part of governmental institutions. This finding is in line with the work of Fairbrother, Sevä and Kulin (2019), which shows a correlation between high levels of political trust and support for climate policies. This might indicate that those who are personally engaged also have a greater inclination to trust and positively perceive the role of institutions. Moreover, the results from Uyduranoglu and Ozturk (2020), highlighting the link between environmental concerns and support for carbon taxation, suggest that greater personal engagement could lead to a more favorable perception of institutional actions.

## **CONCLUSION**

Upon confirming hypothesis H1a, a positive relationship between concern for the future (FC) and personal change (PC) was identified. This link suggests that concern about the future implications of climate change acts as a motivator for altering personal behaviors, aligning with literature that emphasizes individual perception of climate change as a driving factor for pro-environmental behaviors. With the rejection of hypothesis H2a, positing an association between personal change (PC) and institutional engagement (IE), it is observed that individual concerns, although they may incite

behavioral changes, are not necessarily linked to the perception of engagement of governmental institutions in combating climate change.

The relationship between concern for the future (FC) and personal engagement (PE), corroborated by hypothesis H1b, indicates that concern about future issues stimulates greater personal engagement in climate actions. This relationship suggests a transfer of individual concern to concrete actions, relating to the relevance of personal perception in adopting sustainable environmental policies and practices. Following this, hypothesis H2c, which explores the relationship between personal engagement (PE) and institutional engagement (IE), is supported, indicating that individuals personally engaged in climate issues tend to perceive greater engagement on the part of institutions.

Hypothesis H2b revealed a negative association between concern for the future (FC) and institutional engagement (IE), suggesting that an increase in concern for the future may be associated with a diminished perception of governmental institutions' engagement in climate issues, pointing to a potential misalignment between individual concerns and the evaluation of institutional efficacy. One possible explanation is that individuals concerned about climate change may have heightened expectations of governmental actions and, consequently, perceive a greater deficit between these expectations and the perceived reality. Alternatively, this perception may be influenced by a sense of urgency not reflected in the current policies and strategies of institutions. Moreover, the negative association between FC and IE may reflect a lack of effective communication or transparency in institutional actions. Individuals with high concern for the future may not be fully aware of institutional efforts or may perceive these efforts as insufficient due to ineffective communication of policies and outcomes.

This study has limitations that should be considered. Initially, it is conducted with a sample of students in Santa Catarina, in the South of Brazil, providing a basis for extending this research to distinct contexts with the aim of verifying the applicability and extensibility of the obtained results. The methodological approach, limited to a specific geographical and temporal context, indicates the usefulness of conducting additional studies that address variations in perceptions and behaviors in diverse environments and over different periods. Thus, the implementation of longitudinal studies would allow for the analysis of changes in perceptions and actions regarding



climate change, contributing to a deeper understanding of the trends and patterns that emerge over time.

Further investigations could benefit from analyzing how cultural and socioeconomic variables influence engagement with climate issues. Evaluating the effectiveness of communication strategies and public policies, concerning institutional engagement and the promotion of climate actions at the individual level, represents another promising field of study. These efforts could contribute to an understanding of how to encourage more adaptive behaviors in response to climate changes.

This study contributes to the understanding of the dynamics between individual concerns for the future and the perception of engagement in climate actions, both at a personal and institutional level. The findings reinforce the need for integrated strategies that consider both individual motivations and institutional actions in combating climate change, providing a basis for future investigations.

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## APPENDIX

Construct	Items	Assertion	Scale Label
FC	FC_1	How do you feel about the sustainable use of natural resources?	Very unconcerned / Very concerned
	FC_2	Do you believe that in the near future (years, maybe a decade), there will be some kind of rationing or access limitation to natural resources such as water, arable land, quality air, etc.?	Very low risk / Very high risk
	FC_3	Regarding sustainable production practices, how do you feel about the origin of the products you consume (food, beverages, clothing, electronics)?	Very unconcerned / Very concerned
	FC_4	How do you feel about climate change and global warming?	Very unconcerned / Very concerned
PE	PE_1	How would you define your level of attention and time dedicated to informing yourself about natural resources and sustainability, whether through traditional media such as newspapers, radio, magazines, and television?	No attention / A lot of attention
	PE_2	On a strictly personal level, do you adopt any type of "reuse" initiative for natural resources (water) or waste separation for recycling?	No initiative / A lot of initiative
	PE_3	Have you ever observed (or gotten involved in some way) in discussions about sustainability or climate change on social media such as WhatsApp, Telegram, Facebook, Instagram, and Twitter?	Never noticed / Much noticed
PC	PC_1	Do you agree (believe) that there is anthropogenic global warming and climate change (caused by human action)?	Strongly disagree / Strongly agree
	PC_2	Would you be willing to pay an additional amount (or specific tax) to ensure that the products and services you consume have their environmental impact reduced or mitigated?	Slightly willing / Very willing
	PC_3	How willing would you be to cease using a specific product or service if you knew its origin was related to environmental impact (emission of pollutants)?	Slightly willing / Very willing
	PC_4	What is the level of relevance, for your purchase decision and/or consumption of products from a company, that is concerned with sustainable production practices?	Little relevance / Very relevant
	PC_5	On a strictly personal level, how relevant is it for a political candidate (legislative and local and state executive) to inform or agenda environmental causes in their government program?	Little relevance / Very relevant
IE	IE_1	How would you define the initiatives and actions of the companies operating in your region (or city) for the preservation of natural resources?	Very inadequate / Very adequate
	IE_2	How would you define the initiatives and actions of the government (local, state, federal) for the preservation of natural resources?	Very inadequate / Very adequate
	IE_3	How would you define the set of institutions and laws responsible for environmental protection (IBAMA, environmental police, justice)?	Very permissive / Very punitive
	IE_4	How would you define the existence or sufficiency of discussions about laws, regulations, and incentives for the sustainable management of natural resources in the discussions during the electoral process of candidates (and elected officials) from the local and state executive and legislative branches?	Very inappropriate / Very appropriate