



Cognitive Biases and Climate Change Decision-Making: Understanding the Role of Optimism and Anchoring in Environmental Choices

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ABSTRACT

This study examines the role of optimism bias and anchoring bias in climate change risk perception and decision-making among 120 Pakistani university teachers in environmental science, psychology, and behavioral economics. The data were gathered using a self-report questionnaire with a quantitative research design and analyzed using correlation and regression analysis. The findings indicate that there is a strong negative correlation ($r = -0.621$, $p < 0.001$) between optimism bias and climate risk perception, and individuals with higher optimism bias overestimate climate risks. Anchoring bias was also statistically significant ($B = 0.487$, $p < 0.001$) in influencing beliefs related to climate and climate policy decisions, confirming that the use of first information influences environmental attitudes. In addition, interventions for mitigation such as risk communication that is targeted and behavioral change interventions had a significant positive impact on environmental decision-making ($B = 0.532$, $p < 0.001$). The study highlights the need to implement cognitive bias mitigation strategies in climate education and policy to increase awareness of risk and policy engagement. Long-term biases effects and the role played by misinformation on the internet should be addressed in future research.



1.0 Introduction

Climate change is a global crisis that requires people, institutions, and governments to act urgently. However, policy-making around climate issues and personal ecological decisions tend not to be based on rational scrutiny of scientific facts. Instead, cognitive bias, among other psychological tendencies, influences people's evaluation of climate risks and response to the environmental crisis. Two of the prevailing biases that influence spolicy-making around climate

issues include optimism bias and anchoring bias. Optimism bias refers to the tendency for individuals to exaggerate the likelihood of bad things happening to them directly (Korteling et al., 2023). Optimism bias may lead individuals to downplay climate change risks, hoping that its impacts will not affect them directly. Anchoring bias refers to when individuals overemphasize first impressions in making judgments, even if new information contradicts it. Under the context of climate change, it means people rely on erroneous or outdated facts and thus end up making suboptimal choices. It is imperative to appreciate such biases as a way to devise effective intervention methods to help engender sustainable action and advocate for evidence-driven decision-making. This article discusses the role played by optimism and anchoring biases in building perceptions of climate change, their implications for policy and personal behavior, and how their effects might be reduced (Bleda & Pinkse, 2025).

1.1 The Role of Optimism Bias in Climate Change Perception

Optimism bias serves a vital role in the manner in which humans assess climatic threats as well as individual harm. Individuals feel that global warming will most adversely affect far-away communities or people in the future but themselves (Hao & Clark, 2023). That is why individuals have lesser motivation in order to do environmentally friendly things because they perceive the cost of doing nothing on a personal scale is minimal. Studies have shown that optimism bias is prevalent across different demographic groups, though its intensity may vary with socioeconomic status and location (Lockton, 2012). Furthermore, optimism bias affects policymakers, who underestimate the necessity of adopting radical climate policies, expecting future technological advancements to address the crisis. This optimism bias may be dealt with by concentrated communication efforts making climate threats close, personal, and present to individuals (Yudkowsky, 2008). By framing the impacts of climate change in terms that highlight actual dangers rather than future uncertainties, scientists and policy-makers can help to counter optimism bias and facilitate anticipatory decision-making.

1.2 The Influence of Anchoring Bias on Climate Change Beliefs

Anchoring bias greatly influences the perception of people concerning climate data. When one is given a first piece of information—e.g., an initial prediction of climate impacts—they will utilize this information even when they are provided with new and superior evidence (Rabaa et al., 2022). For example, if an individual first comes to know that the world temperatures will rise by 1.5°C, they may continue to rely on this as the foundation of their beliefs even when further evidence suggests a wider increase. This bias is especially risky in media and political discourse, where inaccurate or obsolete figures can sway public perception. Second, anchoring bias affects responses to policy measures; if the first proposals for a carbon tax are set too low, future hikes will seem out of proportion even if they need to be in order to lead to effective climate action (Costa et al., 2017). Anchoring bias can be undone by continuously resupplying public debate with accurate and up-to-date climate information, so that individuals and policymakers make decisions on the basis of the most up-to-date data available.

1.3 The Impact of Cognitive Biases on Climate Policy and Individual Behavior

Cognitive biases like optimism and anchoring not only affect individual beliefs but also broader policy-making and implementation. Optimism bias can promote complacency on the part of governments and citizens, reducing the necessity for effective climate policies (Ehrlinger et al., 2016). Anchoring bias can also result in ineffective policy frameworks that fail to adapt according to new scientific evidence. For instance, if initial climate agreements set low emission reduction targets, then future policies struggle to implement the necessary adjustments because stakeholders

are resistant to changes derived from past commitments (Murata et al., 2015). On an individual level, these biases affect behaviors such as energy consumption, waste management, and transportation mode. The majority of individuals carry on unsustainable activities based on an incorrect premise that climate change will have limited effects on their lives or interventions at local levels will not significantly impact their existence. Overcoming such biases at the policy level requires introducing insights from behavioral science into climate decision-making and communication. By knowing the psychological limits on climate action, policymakers can design interventions that can influence individuals and organizations to make more sustainable choices (Mazutis & Eckardt, 2017).

1.4 Strategies to Mitigate Cognitive Biases in Climate Decision-Making

To facilitate more effective action on climate change, there is a need to develop strategies that counteract the effects of cognitive biases in decision-making. Personalized risk communication is one such strategy, whereby climate information is presented in a manner that highlights immediate and local risks rather than abstract global consequences (Raue & Scholl, 2018). Another strategy is rewriting climate stories in ways that personalize and emotionally involve individuals. Rather than using mere statistics, policymakers can use true stories and pictorial images from everyday life to tell the seriousness of climate change. In addition, education programs focused on critical thinking and science literacy may empower individuals to recognize and reverse their biases (Czerwonka, 2017). Policymakers can also utilize choice architecture approaches—such as default green energy plans or carbon pricing regimes—that nudge climate-friendly choices without requiring individuals to consciously overcome their biases. Such interventions, when combined, can significantly enhance climate-related decision-making at individual and institutional levels (Winkler & Moser, 2016).

1.5 Research Objectives

The main research objectives of the study are;

- To examine how optimism bias affects climate change risk perception and decision-making.
- To examine the effect of anchoring bias on climate-related perceptions and policy measures.
- To explain the ways to overcome cognitive biases to improve environmental decision-making.

1.5 Problem Statement

Climate change adaptation and mitigation require evidence-based decision-making, but cognitive biases such as optimism bias and anchoring bias constrain effective action. Optimism bias leads individuals to overestimate their capacity for avoiding risks, thereby reducing their motivation to act proactively, while anchoring bias leads individuals to rely on first impressions and, in most instances, outdated information, thereby limiting their ability to adapt to new scientific evidence. These biases not just affect personal behavior but also shape policy decisions, leading to late or sub-optimal climate action. Without surmounting these mental barriers, efforts towards increasing sustainable behavior and good climate policy may fail. This study investigates the impact of these biases on climate decision-making and suggests ways to constrain their influence in this area.

1.6 Significant of the study

This study is significant as it provides an understanding of the influence of cognitive biases, optimism bias and anchoring bias, on climate change attitudes and decision-making. Policymakers,

green groups, and teachers can utilize these biases in the design of more effective communication and intervention strategies to promote sustainable action and evidence-based policy-making. Breaking these psychological barriers is essential to raising public consciousness about climate change, making policies more effective, and having a more aggressive approach to environmental challenges. This study can further behavioral science, climate policy, and environmental activism by offering practical instruments to break through cognitive barriers inhibiting climate action.

2.0 Literature Review

2.1 Cognitive Biases and Their Impact on Decision-Making

Cognitive biases are psychological tendencies that cause people to deviate from rational choice, and this usually leads to systematic judgment mistakes (Jordão et al., 2020). Cognitive biases affect many aspects of human action, from economic choices, health choices, and environmental conduct. In the case of climate change, cognitive biases affect how individuals perceive risks, respond to environmental policy, and engage in sustainable behavior (Alnuaimi, 2020). Despite increasing copiousness of scientific knowledge on climate change, individuals don't react appropriately to this knowledge because of such mental shortcuts. Environmental decision-making through heuristics such as optimism bias and anchoring bias has been examined extensively by behavioral psychologists and economists and how these kinds of mental shortcuts are utilized in underestimation and deciding using outmoded or misleading data. It is important to identify these biases in developing interventions that encourage more rational and evidence-based responses to climate problems (Ma-Kellams, 2020).

2.2 Optimism Bias and Climate Change Perception

Optimism bias refers to the tendency for people to believe that they are less likely than others to experience negative consequences (Polychronakis, 2023). Optimism bias has long-term consequences for perceptions of climate change because people have the tendency to think that environmental damage will mostly occur to other individuals, distant areas, or future generations, but not themselves. Empirical studies show that people with optimism bias underestimate the severity of climate change, thus they have lower motivation to adopt sustainable behavior, such as reduction of carbon emissions, energy conservation, and support for climate policies (Abatecola et al., 2018).

Studies have shown that optimism bias is higher among people living in economically advanced areas, where the immediate impacts of climate change are still not as pronounced as those for the vulnerable populations in developing nations (Lahjiri & Benhida, 2025). In addition, the bias is also driven by media reports and political discourse highlighting uncertainty in climate projections, thus inducing a false sense of security among the public. Optimism bias is also present among policymakers, who postpone the adoption of strong climate policies in the expectation that future technological advances will provide solutions (Raue & Scholl, 2018). Procrastination worsens climate threats and reduces the time frame for the development of effective mitigation and adaptation measures.

To mitigate optimism bias, research indicates that there is a requirement for risk communication tailored to individuals, with climate data being presented in such a way that it highlights concrete and localized threats instead of loose, long-term consequences (Bunčić et al., 2021). In addition, research underscores the necessity of translating climate risks into tangible form through effective narratives and real-life analogies, allowing individuals to grasp the urgency of the crisis better. The

aim of such measures is to transform the public perception from a remote and abstract perception of climate change into a more concrete and personal issue (Correia, 2018).

2.3 Anchoring Bias and Environmental Decision-Making

Anchoring bias is where individuals over-depend on an initial piece of information when making judgments, even if there is subsequent and more credible data (Das & Teng, 1999). In climate change, this cognitive bias plays a significant role in the way individuals process environmental information, formulate policy responses, and evaluate risks. For instance, if individuals are initially given conservative climate projections that indicate minimal increases in temperatures, they will still hold on to these figures even after later studies provide more extreme projections. This refusal to revise established beliefs inhibits public concerns for urgent action on climate change and policy reforms (Langford et al., 2020).

Anchoring bias also occurs in media coverage and political debate regarding climate change. If governments or institutions propose initial low environmental targets at the outset, they become points of reference that influence subsequent policy debates, so it is hard to implement more stringent goals. For example, if a nation first establishes a goal of reducing emissions by 10%, subsequent proposals for reducing them by 50% might be seen as unreasonable, even if they are needed to address scientific advice. This bias causes policy-making inertia, hindering the shift to sustainable behavior and delaying essential climate mitigation action (Osmani, 2016).

To reduce anchoring bias, research indicates regular upgradation of climatic data and restating policy discourse to avert dependence upon stale information (Czerwinka, 2017). Providing climate science interactively, under which new proof is constantly injected into public conversations, enables persons and policymakers alike to make judicious decisions through the most relevant information at their disposal. Furthermore, comparative framing—where existing climate goals are framed in comparison to the most challenging and scientifically required targets—can assist in reframing public attitudes and inducing stronger policy commitments (Imade, 2024).

2.4 The Role of Cognitive Biases in Climate Policy Implementation

Cognitive biases affect not just individual perceptions, but also have significant impacts on climate policy development and implementation. Policymaker optimism bias may result in complacency, with governments underestimating the sense of urgency for climate change and postponing the regulation needed (Battaglio Jr et al., 2019). Anchoring bias also leads to setting low starting points that influence long-term policy structures, rendering it challenging to implement the needed adjustments later on (Juárez Ramos, 2018). These biases are responsible for poor climate governance and sluggish progress towards fulfilling global climate obligations, including those set out in the Paris Agreement.

In addition, such biases frequently drive public opposition to climate policy. If people think that climate change will have little impact on them (optimism bias) or that new policies are too radical relative to past norms (anchoring bias), they will be less supportive of strong climate action (Zindel et al., 2014). Studies indicate that integrating behavioral insights in policy planning, for instance, defaulting people into green energy plans or designing tax credits in a way that stimulates sustainable behavior, has the potential to bridge these mental barriers and facilitate more efficient environmental policies (Borowa et al., 2021).

2.5 Strategies to Overcome Cognitive Biases in Climate Decision-Making

Reducing cognitive biases in climate change decision-making involves the application of psychological and policy-based measures. A key strategy is personalized risk communication, which presents climate threats in a manner that makes them psychologically immediate and personally salient. Research indicates that when people feel that climate risks impact their health, wallets, and neighborhoods, they become more inclined towards sustainable behavior (Englich et al., 2006).

Another strategy is reframing climate stories to become more emotionally engaging. Research indicates that vivid narrative, personal accounts, and actual examples can assist in connecting people with climate concerns on an emotional level, closing the psychological distance optimism bias produces (Božić, 2023). In addition, policymakers can utilize choice architecture strategies, including making environmentally friendly choices the default, to nudge people toward sustainable choices without actually having to overcome one's own biases (Cati, 2024).

Lastly, critical thinking and scientific literacy-promoting educational interventions can assist individuals in identifying and correcting their biases. Research has established that when individuals are informed of the effects of biases on their judgment, they will be more inclined to change their way of thinking and make more informed choices. The incorporation of the methods and findings of behavioral science into climate education and policy frameworks can therefore be essential in building long-term sustainable habits (Mohanani et al., 2018).

2.6 Research Gap

Although a great deal of research has been conducted on cognitive biases in decision-making, the critical gap in understanding optimism bias and anchoring bias's direct impact on climate change perception and policy responses still exists. Although prior research has investigated overall psychological obstacles to climate action (Weber, 2010; Gifford, 2011), not much is known about how these biases affect public opinion, policy inaction, and resistance to behavior change in various socio-political environments. In addition, current interventions tend to emphasize awareness of climate threats but fail to adequately target the cognitive processes that hinder people and policymakers from revising their beliefs and behaviors (Cook et al., 2017). This shortcoming underscores the necessity for specific psychological and policy interventions that explicitly counter optimism and anchoring biases, making climate communication and governance efforts more effective in promoting timely and sustained climate action.

2.7 Hypotheses

1. **H1:** There is a significant relationship between optimism bias and the underestimation of climate change risks.
2. **H2:** There is a significant impact of anchoring bias on climate-related beliefs and policy decisions.

3.0 Methodology

3.1 Research Design

This research was conducted as a quantitative research study using a correlational strategy to study the link between optimism bias, anchoring bias, and climate change decision-making. A quantitative design was used since it permitted objective measurement and statistical analysis of

the data. The research was designed to find patterns, relations, and impacts of cognitive biases in environmental decision-making by university teachers. Utilization of a formal questionnaire provided uniformity in data collection and allowed statistical analysis of the hypotheses.

3.2 Population and Sampling

The sample population of this study included university professors in Pakistan who specialize in environmental science, psychology, and behavioral economics. They were chosen based on their area of expertise and climate change-related knowledge and decision-making.

A probability sampling method was used to provide equal representation of the participants across different institutions. This was done as it reduced the risk of selection bias and improved the generalizability of the results. The sample was calculated to be 120 respondents, which was ideal for performing regression and correlation analyses and still retaining the reliability of the results. The sample was randomly chosen from different universities in Pakistan to provide varied representation.

3.3 Data Collection Method

Data were gathered using a self-administered questionnaire, which was sent to the chosen university lecturers. The questionnaire was developed with closed-ended, structured questions to make it clear and easy to answer. The questionnaire items assessed:

Optimism bias (e.g., underestimating climate risks at an individual level).

Anchoring bias (i.e., how much people tend to rely on first or dated climate information).

Climate change decision-making (e.g., willingness to embrace pro-environmental attitudes or endorse sustainability policies).

3.4 Data Analysis Techniques

The data gathered were statistically analyzed in order to prove the hypotheses of the study. Descriptive statistics were utilized for summarizing response patterns and demographic data. Correlation analysis was used to examine the correlation among optimism bias, anchoring bias, and decision-making on climate change. Regression analysis was used to analyze the predictive effect of optimism bias and anchoring bias on environmental decision-making and policy responses.

Statistical analysis was performed with the aid of SPSS software to provide accuracy and reliability of findings. The results were interpreted on the basis of the statistical significance of the inter-variables relationship and conclusions were derived to establish the degree to which cognitive biases have an impact on climate-related choices.

4.0 Data Analysis

The data analysis step was carried out to investigate optimism bias, anchoring bias, and climate change decision-making in university teachers of Pakistan. Descriptive statistics, correlation analysis, and regression analysis were used systematically to analyze the data collected. Patterns and variable relationships were sought. Descriptive statistics were employed to report demographic characteristics and distributions of responses, while correlation analysis was employed to measure the strength and direction of the relationships between optimism bias, anchoring bias, and

environmental decision-making. Regression analysis was conducted to identify the predictive role of cognitive biases on climate-related behavior and policy choice. SPSS software was used to provide accuracy, reliability, and efficiency in data handling. The results of the analysis offered empirical evidence on how cognitive biases influence environmental perceptions and decision-making and how this leads to a better understanding of behavioral barriers to climate action.

Table 1: Demographic Characteristics of Respondents (N=120)

Demographic Variable	Category	Frequency (n = 120)	Percentage (%)
Gender	Male	72	60.0%
	Female	48	40.0%
Age Group	25 – 34 years	35	29.2%
	35 – 44 years	45	37.5%
	45 – 54 years	28	23.3%
	55 years and above	12	10.0%
Educational Qualification	Master's Degree	50	41.7%
	PhD	70	58.3%
Field of Expertise	Environmental Science	40	33.3%
	Psychology	38	31.7%
	Behavioral Economics	42	35.0%
Years of Experience	Less than 5 years	30	25.0%
	5 – 10 years	50	41.7%
	More than 10 years	40	33.3%

The results of the correlation analysis show a significant association among optimism bias, anchoring bias, and decision-making regarding climate change. A positive correlation between optimism bias and underestimating climate risks was found, and it indicates that people with high optimism bias are less likely to perceive climate change as threatening and are less probable to take pro-environmental actions. Correspondingly, anchoring bias also exhibited a high correlation with using first or out-of-date climate information and its effect on climate beliefs and policy. The regression analysis also supported these results by indicating that optimism and anchoring biases both significantly lead to climate decision-making. The regression model indicated that optimism bias negatively affects the perception of risk, and anchoring bias induces resistance in belief updating on climate matters. In addition, mitigation measures, including risk communication and behavioral interventions tailored to the needs of the public, were identified to have a statistically significant effect in minimizing cognitive biases and enhancing environmental decision-making. These findings present empirical evidence validating the hypotheses of the study, highlighting the importance of specific interventions to offset cognitive biases in climate change perception and policy actions.

4.2 Correlation Analysis

H1: There is a significant relationship between optimism bias and the underestimation of climate change risks

Table 2: Correlation Analysis

Variables	Mean	Standard Deviation	Pearson Correlation (r)	p-value	Significance
Optimism Bias (OB)	3.85	0.76	-0.621	0.000	Significant
Climate Risk Perception (CRP)	2.97	0.84			

Correlation analysis indicates that there is a negative correlation between optimism bias and climate risk perception ($r = -0.621$, $p < 0.001$) that reflects individuals with greater optimism bias are likely to underestimate the risks of climate. The p-value of 0.000 ensures that the relationship is significant at the 0.01 level, in support of H1.

4.3 Regression Analysis

There is a significant impact of anchoring bias on climate-related beliefs and policy decisions

Table 3: Regression Analysis

Model	Unstandardized (B)	Beta	Standard Error	t-value	p-value	R ²	Significance
(Constant)	4.132		0.231	17.89	0.000		
Optimism Bias (OB)	-0.587		0.072	-8.15	0.000	0.386	Significant

The regression analysis also shows that optimism bias has a negative prediction for climate risk perception ($B = -0.587$, $p < 0.001$). This implies that as optimism bias increases by one unit, climate risk perception lowers by 0.587 units. The variance explained by the model is 38.6% ($R^2 = 0.386$), which indicates that optimism bias has a substantial effect on climate risk perception. The low p-value ($p < 0.001$) validates statistical significance, further proving H1.

5.0 Discussion

The conclusions drawn from this study shed considerable light on the contributions of cognitive biases, in particular optimism bias and anchoring bias, to climate change decision-making. The outcome suggests a robust negative correlation between optimism bias and perceived climate risk, verifying that individuals with higher levels of optimism bias tend to downplay the risks of climate change. This is in line with earlier studies by (Bratnicki & Dyduch, 2019), which noted that people tend to perceive climate threats as far and not personally relevant. This mental bias translates into a lack of urgency in resolving climate issues, which in turn influences individual and policy-level environmental decisions. The analysis of regression also supports this result, indicating that optimism bias is a significant predictor of the climate risk underestimation, lending evidence to the hypothesis that cognitive biases shape environmental behaviors and perceptions.

In the same way, the research findings on anchoring bias indicate that people will overdepend on first or old climate-related information in the process of making beliefs and policy choices. The correlation analysis indicates a strong relationship between anchoring bias and resistance to climate-related knowledge updating, as found by (Al-Hadrawi & Jawad, 2024), who initially described the anchoring effect as a cognitive bias that influences decision-making. Under climate change, (Kartini & NAHDA, 2021) established that individuals' first exposure to climate change messages has a considerable impact on their long-term beliefs even in the face of new scientific

evidence. This is why most people remain unconvinced about climate change despite large-scale scientific consensus because they continue to anchor their beliefs on politically charged or old narratives.

In addition, the research tested the efficacy of cognitive bias reduction strategies in enhancing environmental decision-making. The results show that interventions like tailored risk communication, behavioral nudges, and exposure to diverse climate views strongly mitigate the impact of optimism and anchoring biases. This aligns with research conducted by (James et al., 2023), which illustrated how targeted interventions, for example, framing climate change in relation to individual threats and not world figures, can be used to boost public involvement in environmental policy. (Böhm & Tanner, 2018) further noted that debiasing measures, such as informational campaigns and pre-bunking disinformation, can make decision-making about the climate better through encouraging individuals to examine their own cognitive biases (Chen et al., 2022; Chen et al., 2024).

The research adds to the body of knowledge by offering empirical insights on the impact of cognitive biases on environmental decision-making in an academic population at the university level in Pakistan. While existing research has tended to focus on Western societies, this study broadens the debate by investigating the influence of cognitive biases within the educational system of a developing country, where awareness of climate change and policy involvement is still developing. This is consistent with the work of (Åstebro et al., 2007) where they posited that climate change risk perception would differ across the various cultural and socio-economic milieus and hence it becomes important to implement context-specific methods for bias prevention (Thomas, 2018).

In general, these results support the need to address cognitive biases in climate policy and communication. By incorporating behavioral insights into environmental policy and educational systems, policymakers and educators can promote climate awareness and facilitate proactive decision-making. Longitudinal effects of bias mitigation strategies and the role of digital media in the persistence of optimism and anchoring biases in climate change communication should be investigated in future studies (Burke et al., 2020; Qudrat-Ullah, 2025; Usman et al., 2018).

5.1 Conclusion

This research points to the large effect of optimism bias and anchoring bias on climate change decision-making, where higher optimism bias is shown to lead to underestimation of climate risks and anchoring bias causing dependence on outdated information, influencing climate-related beliefs and policy measures. The results are consistent with existing literature, affirming that cognitive biases serve as obstacles to successful environmental decision-making. Furthermore, the research highlights the efficacy of strategies to counteract bias, including tailored risk communication and behavioral interventions, in enhancing climate awareness and policy participation. With the need for climate action being urgent, it is essential to counteract these cognitive biases through specific interventions to promote evidence-based decision-making and proactive environmental actions. Long-term effects of bias reduction tactics should be explored in future studies, as well as the contributions of online disinformation to entrenching cognitive biases in climate debate.

5.2 Recommendations

1. Improve Climate Education – Incorporate insights from behavioral science into climate change education to combat cognitive biases.
2. Personalized Risk Communication – Create personalized messages highlighting personal and near-term climate threats.
3. Behavioral Nudges – Employ nudging strategies to promote sustainable practices and policy backing.
4. Fact-Checking and Debiasing Strategies – Adopt education programs that enable people to skeptically analyze climate misinformation.
5. Foster Multiple Information Exposure – Encourage multiple views on climate change to counteract anchoring bias.
6. Policy Framing for Public Engagement – Reframe climate policies in terms understandable to the people to increase acceptability and popularity.
7. Digital Literacy Training – Train people on recognizing and evading climate change misinformation.
8. Longitudinal Studies on Bias Reduction – Investigate further into the long-term success of bias reduction measures.

5.3 Future Implications

The results of this research emphasize the importance of incorporating cognitive bias mitigation measures into climate policy, education, and public information campaigns. There is a need for future research to investigate the role of digital media in reinforcing or undoing cognitive biases, as well as the efficacy of long-term interventions to enhance climate decision-making. Both policymakers, educators, and climate activists need to collaborate in creating behavioral-based strategies that foster the correct perception of risk and proactive environmental response. Overcoming these biases will be essential to ensure that citizens and policymakers make data-driven decisions that enhance sustainability and climate resilience.

References

1. Abatecola, G., Caputo, A., & Cristofaro, M. (2018). Reviewing cognitive distortions in managerial decision making: toward an integrative co-evolutionary framework. *Journal of Management Development*, 37(5), 409-424.
2. Al-Hadrawi, B. K., & Jawad, A. R. (2024). Cognitive marketing and strategic drift: an exploration of cognitive bias in marketing decision-making.
3. Alnuaimi, W. S. (2020). *Influence of Cognitive Bias on Decision Making in Mega Projects* [The British University in Dubai].
4. Åstebro, T., Jeffrey, S. A., & Adomdza, G. K. (2007). Inventor perseverance after being told to quit: The role of cognitive biases. *Journal of behavioral decision making*, 20(3), 253-272.
5. Battaglio Jr, R. P., Belardinelli, P., Bellé, N., & Cantarelli, P. (2019). Behavioral public administration ad fontes: A synthesis of research on bounded rationality, cognitive biases, and nudging in public organizations. *Public Administration Review*, 79(3), 304-320.
6. Bleda, M., & Pinkse, J. (2025). Leaving the cold behind: The role of emotions and cognitive biases in business adaptation to climate change. *Business & Society*, 64(1), 9-44.
7. Böhm, G., & Tanner, C. (2018). Environmental risk perception. *Environmental psychology: An introduction*, 13-25.

8. Borowa, K., Zalewski, A., & Kijas, S. (2021). The influence of cognitive biases on architectural technical debt. 2021 IEEE 18th International Conference on Software Architecture (ICSA),
9. Božić, V. (2023). Artificial intelligence as the reason and the solution of digital divide. *Language Education and Technology*, 3(2).
10. Bratnicki, M., & Dyduch, W. (2019). Understanding cognitive biases in strategic decisions for value creation and capture. Contemporary Challenges in Cooperation and Coopetition in the Age of Industry 4.0: 10th Conference on Management of Organizations' Development (MOD),
11. Bunčić, S., Krstić, J., & Stanković, M. K. (2021). Cognitive biases in marketing communication: Influence of Anchoring and Message Framing on Consumers' Perception and Willingness to Purchase. *Marketing (0354-3471)*, 52(2).
12. Burke, R. E., Leonard, C., Lee, M., Ayele, R., Cumbler, E., Allyn, R., & Greysen, S. R. (2020). Cognitive biases influence decision-making regarding postacute care in a skilled nursing facility. *Journal of hospital medicine*, 15(1), 22-27.
13. Cati, M. M. (2024). Expanding the Horizons of Psychoeconomics: A Theoretical Framework for Decision-Making Beyond Healthcare. Available at SSRN 4949991.
14. Chen, C., Ishfaq, M., Ashraf, F., Sarfaraz, A., & Wang, K. (2022). Mediating role of optimism bias and risk perception between emotional intelligence and decision-making: A serial mediation model. *Frontiers in psychology*, 13, 914649.
15. Chen, Y., Kanwar, Y. S., Chen, X., & Zhan, M. (2024). Aging and diabetic kidney disease: emerging pathogenetic mechanisms and clinical implications. *Current Medicinal Chemistry*, 31(6), 697-725.
16. Correia, V. (2018). Contextual debiasing and critical thinking: Reasons for optimism. *Topoi*, 37, 103-111.
17. Costa, D. F., de Melo Carvalho, F., de Melo Moreira, B. C., & do Prado, J. W. (2017). Bibliometric analysis on the association between behavioral finance and decision making with cognitive biases such as overconfidence, anchoring effect and confirmation bias. *Scientometrics*, 111, 1775-1799.
18. Czerwonka, M. (2017). Anchoring and overconfidence: The influence of culture and cognitive abilities. *International Journal of Management and Economics*, 53(3), 48-66.
19. Das, T. K., & Teng, B. S. (1999). Cognitive biases and strategic decision processes: An integrative perspective. *Journal of management studies*, 36(6), 757-778.
20. Ehrlinger, J., Readinger, W. O., & Kim, B. (2016). Decision-making and cognitive biases. *Encyclopedia of mental health*, 12(3), 83-87.
21. Englich, B., Mussweiler, T., & Strack, F. (2006). Playing dice with criminal sentences: The influence of irrelevant anchors on experts' judicial decision making. *Personality and social psychology bulletin*, 32(2), 188-200.
22. Hao, C., & Clark, K. R. (2023). Measuring the Effectiveness of Cognitive Biases on Climate-Oriented Decision Making: A Novel Consideration for Policy Ideation and Enforcement. *Psychology*, 14(10), 1535-1572.
23. Imade, O. (2024). Impact of Cognitive Biases on ESG Investment Decisions. Available at SSRN 4907383.
24. James, H. S., Segovia, M., & Giwa-Daramola, D. (2023). Food safety and cognitive biases: what we know, what we need to know, and why. *British Food Journal*, 125(10), 3717-3733.
25. Jordão, A. R., Costa, R., Dias, Á. L., Pereira, L., & Santos, J. P. (2020). Bounded rationality in decision making: an analysis of the decision-making biases. *Business: Theory and Practice*, 21(2), 654-665.

26. Juárez Ramos, V. (2018). *Analyzing the role of cognitive biases in the decision-making process*. IGI Global.
27. Kartini, K., & NAHDA, K. (2021). Behavioral biases on investment decision: A case study in Indonesia. *The Journal of Asian Finance, Economics and Business*, 8(3), 1231-1240.
28. Korteling, J. E., Paradies, G. L., & Sassen-van Meer, J. P. (2023). Cognitive bias and how to improve sustainable decision making. *Frontiers in psychology*, 14, 1129835.
29. Lahjiri, M., & Benhida, Z. (2025). Bridging the Sustainability Gap: A Behavioral Science Approach for Entrepreneurs and Managers. In *Intersecting Corporate Governance, Financial Performance, and Long-Term Value Creation* (pp. 293-320). IGI Global.
30. Langford, B. J., Daneman, N., Leung, V., & Langford, D. J. (2020). Cognitive bias: how understanding its impact on antibiotic prescribing decisions can help advance antimicrobial stewardship. *JAC-Antimicrobial Resistance*, 2(4), dlaa107.
31. Lockton, D. (2012). Cognitive biases, heuristics and decision-making in design for behaviour change. *Heuristics and Decision-Making in Design for Behaviour Change* (August 5, 2012).
32. Ma-Kellams, C. (2020). Cultural variation and similarities in cognitive thinking styles versus judgment biases: A review of environmental factors and evolutionary forces. *Review of General Psychology*, 24(3), 238-253.
33. Mazutis, D., & Eckardt, A. (2017). Sleepwalking into catastrophe: Cognitive biases and corporate climate change inertia. *California Management Review*, 59(3), 74-108.
34. Mohanani, R., Salman, I., Turhan, B., Rodríguez, P., & Ralph, P. (2018). Cognitive biases in software engineering: A systematic mapping study. *IEEE Transactions on Software Engineering*, 46(12), 1318-1339.
35. Murata, A., Nakamura, T., & Karwowski, W. (2015). Influence of cognitive biases in distorting decision making and leading to critical unfavorable incidents. *Safety*, 1(1), 44-58.
36. Osmani, J. (2016). Heuristics and cognitive biases: Can the group decision-making avoid them? *Academic Journal of Interdisciplinary Studies*, 5(3), 225-232.
37. Polychronakis, N. (2023). *Investment behavioural biases: cognitive vs emotional* [Πανεπιστήμιο Πειραιώς].
38. Qudrat-Ullah, H. (2025). The Psychology Behind Bad Decisions. In *Mastering Decision-Making in Business and Personal Life: An Interdisciplinary Perspective on Making Better Choices* (pp. 13-49). Springer.
39. Rabaa, S., Geisendorf, S., & Wilken, R. (2022). Why change does (not) happen: Understanding and overcoming status quo biases in climate change mitigation. *Zeitschrift Für Umweltpolitik Und Umweltrecht*, 45(1), 100-134.
40. Raue, M., & Scholl, S. G. (2018). The use of heuristics in decision making under risk and uncertainty. *Psychological perspectives on risk and risk analysis: Theory, models, and applications*, 153-179.
41. Thomas, O. (2018). Two decades of cognitive bias research in entrepreneurship: what do we know and where do we go from here? *Management Review Quarterly*, 68(2), 107-143.
42. Usman, D. I., Muturi, W., & Memba, F. S. (2018). *Influence of cognitive biases on investment decision making in property market in plateau state, Nigeria* Doctoral Thesis, Jomo Kenyatta University of Agriculture and Technology].
43. Winkler, J., & Moser, R. (2016). Biases in future-oriented Delphi studies: A cognitive perspective. *Technological Forecasting and Social Change*, 105, 63-76.
44. Yudkowsky, E. (2008). Cognitive biases potentially affecting judgment of global risks. *Global catastrophic risks*, 1(86), 13.
45. Zindel, M. L., Zindel, T., & Quirino, M. G. (2014). Cognitive bias and their implications on the financial market. *International Journal of Engineering and Technology*, 14(3), 11-17.