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Assessing the Physical Impacts of Climate on Risk-Based Investment Strategies

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***Abstract*:** This research examines the imperative for integrating climate policies into risk-based investment strategies, highlighting the role of sustainable investing in mitigating climate change risks and achieving a more sustainable future. The study explores the financial and economic impacts of climate change, including physical risks like extreme weather events and sea level rise, as well as transition risks associated with the shift towards a low-carbon economy. It emphasizes the importance of incorporating environmental, social, and governance (ESG) criteria into investment decisions, prioritizing long-term sustainability over short-term gains. The study concludes that aligning investment strategies with climate policies offers a path toward generating financial returns while contributing to a more responsible and resilient economy. It underscores the need for investors, policymakers, and businesses to embrace a long-term perspective and actively engage in climate-conscious investing practices to ensure a more sustainable future.
Keywords: climate policies; investment strategies; sustainable investing; physical risks; as transition risks; resilient economy.

1. INTRODUCTION

The need to address climate change is increasingly influencing investor behavior and company practices [1]. Research shows that socially responsible investors are more likely to favor sustainable investments in response to climate change events, leading to a positive relationship between climate change signals and returns in sustainability-themed investments [2]. Furthermore, companies engaging in green investing not only reduce their own carbon emissions but also adapt their long-term emission reduction strategies in anticipation of stricter climate regulations and technological advancements [3]. This research aims to highlight the importance of quantitative and qualitative assessment of the physical impacts of climate change, such as sea-level rise and increased frequency of extreme weather events, and how this assessment can form the basis for more risk-aware investment strategies.

The growing recognition of the impact of climate change on businesses has led to a surge in interest in climate solutions investments. Companies providing climate solutions exhibit higher revenue growth and increased investment in research and development, highlighting the importance of investing in environmentally conscious businesses to drive innovation and mitigate climate change effects [4, 5]. Investing in climate-friendly initiatives is crucial for fostering sustainable practices, reducing emissions, and navigating the challenges posed by climate change. Sustainable investments can effectively combat climate change by incorporating environmental

criteria into investment strategies, such as screening companies based on their carbon footprint [6]. Initiatives like Payment for Environmental Services can incentivize companies to invest in sustainability, generating carbon credits that can be sold in the market, increasing their social and environmental impact [7].

Combining greenness with other investment criteria can lead to portfolios with reduced exposure to climate transition risk, contributing to climate-aware portfolio rebalancing and sustainable investment strategies [8]. Regulation in the financial sector, particularly in insurance and collective investment undertakings, is crucial to prevent greenwashing and ensure transparency in sustainability approaches, ultimately aiding in achieving global environmental and climate agreements [9]. The evolution of financing climate action, including the introduction of green bonds, has played a significant role in mainstreaming sustainable investment decision-making and mobilizing private capital for sustainable activities, highlighting the importance of holistic sustainability considerations in investment processes [10]. Sustainable investments play a crucial role in reducing carbon emissions by influencing firm energy and carbon performance without compromising financial return [11- 15]. This research examines the imperative for integrating climate policies into risk-based investment strategies, highlighting the crucial role of sustainable investing in mitigating climate change risks and achieving a more sustainable future.

The following sections of this paper will delve deeper into the intricacies of climate-related risk assessment and its integration into investment strategies. We will first explore the financial and economic impacts of climate change, focusing on physical risks like extreme weather events and rising sea levels, as well as transition risks associated with the shift to a low-carbon economy. We will then discuss how to assess these transition and physical risks and how to incorporate those assessments into an investment strategy. Finally, we will examine how to integrate climate policies into investment strategies with a specific focus on Environmental, Social, and Governance (ESG) criteria. The paper concludes with a discussion of how these changes can create a more sustainable financial system.

2. THE IMPORTANCE OF INTEGRATING CLIMATE POLICIES INTO RISK-BASED INVESTMENT STRATEGIES

Integrating climate policies into risk-based investment strategies is crucial for several reasons. Firstly, it allows investors to mitigate the risks associated with climate change, such as physical and transition risks, by incorporating climate-related factors into their decision-making processes [16, 17]. Secondly, aligning financial approaches with vulnerability and risk reduction targets can maximize financial value while also considering social and environmental values, thus supporting adaptation and disaster risk reduction policies effectively [18]. Additionally, by valuing climate-related risks in institutional investor portfolios, the financial sector can facilitate divestment from high-carbon producers and channel funds into green projects, contributing to the transition towards a more sustainable economy [19]. Furthermore, studies have shown that companies' climate-risk exposures directly impact their valuation levels and stock performance, emphasizing the need to integrate climate-transition risks into risk models for more informed investment decisions [20].

3. THE FINANCIAL AND ECONOMIC RISKS OF CLIMATE CHANGE

Climate change is not just an environmental issue; it poses significant financial and economic risks that are already being felt globally. These risks can be divided into two primary categories: physical hazards, such as extreme weather events, and transition risks stemming from the shift to a low-carbon economy.

3.1 Physical Hazards:

3.1.1 *Extreme Weather Events*

Among physical hazards, Powerful tropical hurricanes characterized by strong winds, heavy rainfall, and significant storm surges, often causing catastrophic damage to infrastructure and economies. Rising ocean temperatures, a direct consequence of climate change, provide more energy in the form of latent heat, thus intensifying hurricanes by increasing their wind speeds and the amount of precipitation they carry. This intensification not only alters the frequency but also the severity of these storms, leading to heightened economic costs [21،22]. These costs include direct expenses from property and infrastructure damage, as well as indirect losses through business disruptions, supply chain breakdowns, and impacts on sectors like tourism and agriculture. Understanding these intensified physical risks is crucial for incorporating appropriate risk assessments into investment strategies [23،24].

3.1.2 *Sea Level Rise*

Beyond hurricanes, climate change contributes to increased coastal flood risks, as sea-level rise exacerbates the impact of storm surges and inundates coastal areas. This ongoing rise not only threatens infrastructure but also affects coastal property values and increases insurance costs, creating economic pressures on individuals, businesses, and governments [25،26]. Heatwaves, on the other hand, represent an additional threat, with rising temperatures leading to substantial losses in agricultural production due to drought and soil degradation. Heatwaves also negatively affect public health, causing an increase in cases of heat stress and cardiovascular and respiratory illnesses, thereby raising healthcare costs. On an economic level, these impacts can cause significant losses in agricultural productivity and healthcare expenditures, placing an additional burden on global economies [27،28]. Table 1 presents a description and impacts of some financial and economic risks associated with climate change.

Table 1. Physical Hazards of Climate Change

Risk Category	Description	Impacts	Uncertainty/Likelihood (based on IPCC)
Extreme Weather Events	Increased frequency and intensity of hurricanes, droughts, heat waves, floods, and wildfires	1. Property losses (billions of dollars annually)	1. High confidence that these events are increasing in frequency and intensity due to human-induced climate change.
		2. Disrupted supply chains (shortages, price hikes)	2. High likelihood of these events occurring with greater severity in the future.
		3. Human health impacts	

		(healthcare costs, productivity losses)	
Sea Level Rise	Rising sea levels erode coastlines, damage infrastructure, and increase flooding risks	1. Coastal erosion and flooding (population displacement, economic disruption)	1. Very high confidence in sea level rise due to human-induced climate change.
		2. Impact on coastal industries (tourism, fisheries)	2. High likelihood of significant sea level rise in the future, with higher rates of rise in some regions.
		3. Loss of land and infrastructure (relocation, reconstruction costs)	

3.2 Transition risks

Transition risks stem from the global shift towards a low-carbon economy to mitigate climate change. While essential for environmental sustainability, this transition involves significant economic and social adjustments, presenting unique challenges and risks for businesses and financial institutions.

3.2.1 Carbon Pricing

One major risk is the cost of transitioning. Shifting away from fossil fuels to renewable energy sources requires substantial investments in research, development, and infrastructure. This can lead to increased costs for businesses, particularly those heavily reliant on fossil fuels, potentially impacting their profitability and competitiveness. For example, industries like energy production, transportation, and manufacturing may face significant capital expenditures to adapt their processes and technologies to meet new emissions targets [29, 30].

3.2.2 Changing policies and regulations

Regulatory changes and policies aimed at accelerating the transition to a low-carbon economy can also pose financial risks. Carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems, increase the cost of fossil fuel-based activities. Companies may need to adjust their business models to comply with these new regulations, which can lead to increased operational costs or even potential legal liabilities [31, 32].

3.2.3 Changing consumer preferences

These transition risks also extend to investors. Investors may face challenges in assessing the long-term value of companies heavily reliant on fossil fuels, potentially leading to reduced investment and lower asset valuations.

3.2.4 Market Uncertainty

Furthermore, the transition towards a low-carbon economy can create uncertainty in the markets, leading to volatility and potentially impacting the stability of the financial system [33].

Despite these challenges, the transition to a low-carbon economy offers significant opportunities for innovation and growth. Investments in renewable energy, energy efficiency, and sustainable technologies can create new markets, jobs, and economic opportunities. However,

managing the transition risks effectively will be crucial for achieving a smooth and sustainable shift towards a more climate-resilient future. Table 2 summarizes transition Risks and Their Impact on Financial Stability.

Table 2. Transition Risks to the Financial Sector

Risk Category	Description	Impact on the Financial Sector	Uncertainty/Likelihood (based on IPCC)
Cost of Transition	Investments in renewable energy sources and emissions-reducing technologies require significant capital expenditure for companies.	Increased operational costs, lower profitability and competitiveness of companies, risks of financial instability.	1. High confidence that the transition to a low-carbon economy will require significant investments. 2. High likelihood that companies will experience increased costs and potentially face reduced profitability in the short term.
Changing Policies and Regulations	New laws are imposed to price carbon and reduce emissions (such as carbon taxes) on companies.	Increased costs, non-compliance risks, changes in business models, potential legal losses.	1. High confidence that policies aimed at reducing carbon emissions will become more stringent in the future. 2. High likelihood that companies will need to adapt their business models to comply with these regulations.
Changing Consumer Preferences	Sustainable companies and those focused on reducing emissions are preferred by investors and consumers.	Risks of asset valuation for unsustainable companies, reduced investment in unsustainable companies.	1. Medium confidence that consumer preferences for sustainable products and companies will continue to grow. 2. Moderate likelihood that investors will shift away from companies with high carbon footprints.
Market Uncertainty	Economic transition creates uncertainty in markets, impacting the financial value of companies.	Market volatility, reduced investment, risks of financial instability.	1. Medium confidence that the transition to a low-carbon economy will create significant market uncertainty. 2. Moderate likelihood that this uncertainty will result in increased market

			volatility and potential disruptions to the financial system.

4. Integrating Climate Policies into Investment Strategies:

Integrating climate policies into investment strategies involves assessing transition risks, which can impact investment portfolios significantly. Studies show that investment funds face an average loss of 5.7% in a high transition risk scenario, with the worst 1% experiencing a 21.3% loss [34, 35]. Climate policy transition risk can lead to decreased carbon emissions by incentivizing cleaner investments, causing output to fall. Furthermore, the transition away from carbon-intensive activities poses financial risks, potentially resulting in stranded assets worth trillions of USD in fossil fuel extraction and coal power generation sectors [36]. The impact of climate-related risks on financial assets is a critical issue, with empirical and theoretical literature highlighting the revaluation of financial assets due to climate physical impacts and transition dynamics. Understanding and managing transition risks are essential for investors navigating the shift towards a low-carbon economy.

4.1. Transition Risk Analysis:

Transition risk emerges as a consequence of the ongoing global transition towards a more environmentally sustainable, low-carbon economy. This risk encompasses a wide range of potential financial implications that may arise as companies and industries adapt to new regulations, policies, and technological advancements aimed at reducing greenhouse gas emissions [37]. It is crucial for investors to have a deep understanding of the specific climate-related policies that have been implemented or are being planned in the relevant jurisdictions. This involves closely examining carbon pricing mechanisms, emissions regulations, energy efficiency standards, as well as government incentives designed to promote the adoption of low-carbon technologies. Companies that heavily rely on fossil fuels or operate in industries with high levels of emissions are especially susceptible to these transition risks. Therefore, investors must carefully assess their exposure to such sectors and carefully consider making adjustments to their investment portfolios accordingly [38]. Furthermore, investors must also conduct a detailed analysis of how individual companies are navigating this transition period. It is important to evaluate whether these companies are actively investing in low-carbon technologies, working to reduce their carbon footprint, and adjusting their business strategies to align with the evolving climate policies. By actively monitoring and evaluating these factors, investors can strategically reposition their portfolios towards companies and industries that are leading the way in the low-carbon transition. This strategic realignment may involve increasing investments in renewable energy projects, energy-efficient technologies, and other green innovations that are at the forefront of the transition towards a more sustainable future [39].

4.1.1 *Case Study: Assessing the Risk of Carbon Pricing on a Coal-Based Power Company*

Imagine a coal-based power company in the United States. This company is heavily reliant on coal for electricity generation and has made limited investments in renewable energy. The company needs to assess the risk posed by the potential implementation of a carbon tax in the coming years.

1. **Risk Assessment:** The risk is a carbon tax being implemented, which would increase the cost of generating electricity from coal.
2. **Determine Probability:**

a) The IPCC reports that the likelihood of substantial carbon pricing policies being implemented globally within the next decade is high, with increasing confidence in this projection over time.
b) Analyze the political landscape in the United States. Are there any existing bills or proposed regulations indicating a shift towards carbon pricing?
c) Observe market trends for renewable energy and carbon pricing mechanisms. Is there increasing investor interest in renewable energy, indicating potential for policy changes?

3. Assess Impact:

a) Calculate the potential financial impact of a carbon tax on the company's operating costs and profitability. What would be the price per ton of carbon that would significantly impact the company's viability?
b) How might competitors respond to a carbon tax? Would they be able to adapt more easily, potentially gaining a competitive advantage?

4. Calculate Risk:

Combine the assessed probability of a carbon tax being implemented with the potential financial impact to arrive at a numerical risk score. For example:
If the probability of a carbon tax is estimated to be 70% and the potential impact on profitability is a 20% decrease, the risk score would be 14% (0.7 x 0.2).

5. Mitigation Strategies:

a) The company could begin investing in renewable energy projects to reduce its reliance on coal and mitigate the impact of a carbon tax.
b) Engage in lobbying efforts to influence policy decisions, potentially delaying or reducing the severity of a carbon tax.
c) Investigate the feasibility of implementing carbon capture and storage technologies to reduce emissions from coal-fired power plants.

This case study demonstrates how to incorporate probability and uncertainty in a risk assessment for a climate-related issue. It highlights the need to consult reliable sources like IPCC assessments, analyze policy landscapes, and consider market trends to estimate likelihood. This approach allows for a more comprehensive and informed understanding of potential risks and informs the development of effective mitigation strategies.

4.2. Physical Risk Analysis:

Physical risk refers to the direct impacts of climate change, such as extreme weather events, sea-level rise, and changes in precipitation patterns. These events can have significant consequences for infrastructure, agriculture, and human health, ultimately impacting businesses and financial markets. Investors should identify assets and businesses located in regions vulnerable to climate-related hazards [40]. This includes coastal areas prone to flooding, regions facing increasing droughts, and areas susceptible to wildfires. Companies should be evaluated on their resilience to physical risks. Do they have adaptation strategies in place to address potential impacts, such as flood defenses or drought-resistant agricultural practices? Investing in assets and companies that are resilient to climate change can help mitigate potential losses and generate positive returns [41, 42].

5. INTEGRATING CLIMATE POLICIES INTO INVESTMENT STRATEGIES

Integrating climate policies into investment strategies involves incorporating environmental considerations and sustainability goals into the decision-making process of investment professionals. This approach not only aims to generate financial returns but also

considers the impact of investments on the environment and society [43]. By aligning investment strategies with climate policies, investors can contribute to a more sustainable future while potentially mitigating risks associated with climate change and environmental degradation. This integration requires a deep understanding of climate-related risks and opportunities, as well as a commitment to responsible investing practices that prioritize long-term sustainability over short-term gains. One effective approach is to incorporate environmental, social, and governance (ESG) criteria into the decision-making process when selecting investments [44,45]. Table 3 outlines a framework for integrating climate policies into investment strategies, aiming to generate financial returns while contributing to a sustainable future. It highlights the goals, benefits, approach, focus, and potential outcomes of this strategy.

Table 3. Climate-compliant investing a path to financial sustainability

Key Point	Description
Goal	**To align investment strategies with climate policies to generate financial returns and contribute to a sustainable future.**
Benefits	- **Mitigating climate change risks** - **Promoting a more sustainable economy**
Approach	- **Incorporating Environmental, Social, and Governance (ESG) criteria into investment decisions.**
Focus	- **Prioritizing long-term sustainability over short-term gains** - **Evaluating companies based on their ESG performance**
Outcome	**Potentially enhancing financial returns while driving positive change towards a more sustainable and socially responsible economy.**

6. CONCLUSION

The integration of climate policies into risk-based investment strategies is not merely a trend but a necessity for navigating the challenges and opportunities presented by climate change. Aligning investment goals with climate targets can mitigate financial risks, foster a more sustainable economy, and contribute to a better future. This research has explored the key drivers behind this shift, highlighting the financial and economic risks associated with climate change and the potential for sustainable investment to address these challenges. While the adoption of Environmental, Social, and Governance (ESG) criteria in investment decisions offers a powerful tool to promote responsible and sustainable practices, it is crucial to acknowledge that the transition to a climate-resilient financial system requires a concerted effort from investors, policymakers, and businesses.

Success in this transition hinges on a comprehensive understanding of risk, encompassing both the potential impact of climate-related events and their likelihood. Transition risk analysis, physical risk assessment, and a commitment to long-term sustainability are essential for success. By embracing climate-conscious investing practices, investors can not only secure financial returns but also contribute to a more equitable and sustainable world.

This will require a shift in mindset, embracing a long-term perspective, and prioritizing investments that drive positive change. As we face the unprecedented challenges of climate change, the financial sector has a critical role to play in shaping a future where economic growth

and environmental sustainability go hand in hand. No investment strategy, old or new, will be successful without taking both the potential impact and its likelihood into account. The future of finance lies in navigating this complex landscape of risk and opportunity, balancing profit with sustainability, and securing a more resilient future for generations to come.

REFERENCES

1) Usher, B. (2022). *Investing in the Era of Climate Change*. New York Chichester, West Sussex: Columbia University Press. https://doi.org/10.7312/ushe20088
2) Fiordelisi, Franco and Galloppo, Giuseppe and Paimanova, Viktoriia (2023) Climate change shocks and socially responsible investments. Business Ethics, the Environment and Responsibility, 32 (1). pp. 40-56. DOI https://doi.org/10.1111/beer.12477
3) Mauro, Aliano., Giuseppe, Galloppo., Viktoriia, Paimanova. (2023). People and investor attention to climate change. European Journal of Finance, doi: 10.1080/1351847x.2023.2216754
4) Alexander, Cheema-Fox., George, Serafeim., Hui, (Stacie), Wang. (2022). Climate Solutions Investments. Social Science Research Network, doi: 10.2139/ssrn.4027579
5) Dhruv, N, Sharma. (2023). The Ethics of Investment: Balancing Profit with Social Responsibility. Indian Scientific Journal Of Research In Engineering And Management, doi: 10.55041/ijsrem18237
6) Ochoa, Marcelo and Paustian, Matthias O. and Wilcox, Laura, Do Sustainable Investment Strategies Hedge Climate Change Risks? Evidence from Germany's Carbon Tax (November, 2022). FEDS Working Paper No. 2022-73, http://dx.doi.org/10.17016/FEDS.2022.073
7) Eduardo, da, Motta. (2023). Proposal of financial instrument to combat climate change. doi: 10.29183/2596-237x.ensus2023.v11.n1.p409-419
8) Giacomo, Maria, Bressan., Irene, Monasterolo., Stefano, Battiston. (2022). Sustainable Investing and Climate Transition Risk: A Portfolio Rebalancing Approach. The Journal of Portfolio Management Novel Risks 2022, 48 (10) 165 - 192, doi: 10.3905/jpm.2022.1.394
9) Deák, Viktória and Tőrös-Barczel, Nikolett and Holczinger, Norbert and Szebelédi, Ferenc (2022) Sustainable Investments in the Insurance Sector. FINANCIAL AND ECONOMIC REVIEW, 21 (4). pp. 103-128. ISSN 2415-9271. doi: 10.33893/fer.21.4.103
10) Pawan, Kumar., Sanjay, Taneja., Ercan, Ozen. (2024). Exploring the influence of green bonds on sustainable development through low-carbon financing mobilization. International Journal of Law and Management, doi: 10.1108/ijlma-01-2024-0030
11) Ashfaq, Habib., Shaista, Anwar., Waleed, Mohd, Hussain., Veronika, Fenyves. (2024). (3) The role of sustainable investment practices in maintaining efficient working capital management. Journal of international studies,17(2) 206-219. doi: 10.14254/2071-8330.2024/17-2/11
12) Egurla, Kishan. (2022). Nexus between Macroeconomic variables and Sustainable Investments- Evidence from Indian Sustainable Stock Indices. Research bulletin the Institute of Cost and Works Accountants of India, doi: 10.33516/rb.v48i1-2.153-168p
13) Kordsachia, O., Focke, M. & Velte, P. Do sustainable institutional investors contribute to firms' environmental performance? Empirical evidence from Europe. *Rev Manag Sci* **16**, 1409–1436 (2022). https://doi.org/10.1007/s11846-021-00484-7

14) Atif, M., Alam, M. S., & Islam, M. S. (2023). Firm-level energy and carbon performance: Does sustainable investment matter? *Business Strategy and the Environment*, 32(4), 2275–2295Macquarie University, Sydney, NSW, Australia. https://doi.org/10.1002/bse.3248
15) Yuyu, Chen., Jianfei, Gu. (2021). Sustainability Investment of a Two-Echelon Supply Chain under Cap-and-Trade Regulation. Advances in Social Science, Education and Humanities Research, volume 543.p 222-226. doi: 10.2991/ASSEHR.K.210407.045
16) Chakrabarty, S.P., Nag, S. Risk measures and portfolio analysis in the paradigm of climate finance: a review. *SN Bus Econ* 3, 69 (2023). https://doi.org/10.1007/s43546-023-00449-w
17) Soh, Young, In., John, P., Weyant., Berk, Manav. (2022). Pricing climate-related risks of energy investments. Journal of Renewable & Sustainable Energy Reviews, Elsevier, p46. doi: 10.1016/J.RSER.2021.111881
18) L, Cetara. (2022). Investment, risk, and vulnerability: perspectives in adaptation and risk finance. systems of Resilience Practices, Elsevier P 21-41 doi: 10.1016/b978-0-12-819198-9.00006-5
19) Apostolos, Apostolou., Michael, G., Papaioannou. (2021). Integration of Environmental Factors into Portfolio Risk Assessment. The Journal of Impact and ESG Investing Fall 2 (1) 74 - 91 doi: 10.3905/JESG.2021.1.028
20) Guido, Giese., Zoltán, Nagy., Bruno, Rauis. (2021). Foundations of Climate Investing: How Equity Markets Have Priced Climate-Transition Risks. The Journal of Portfolio Management, journal of Portfolio Management 47, no. 1, p122-135. doi: 10.3905/JPM.2021.1.283
21) Kumar, Puran, Tripathy., Sourav, Mukherjee., Ashok, K., Mishra., Michael, P., Manns., A., Park, Williams. (2023). Climate change will accelerate the high-end risk of compound drought and heatwave events.. Proceedings of the National Academy of Sciences of the United States of America, 120(12), e2219825120. (PNAS) journal, Washington. doi: 10.1073/pnas.2219825120
22) Verschuur, J., Koks, E., and Hall, J.: Present-day and future global economic losses associated with physical climate risks to ports, EGU General Assembly (2022), Vienna, Austria, 23–27 May 2022, EGU22-1427, https://doi.org/10.5194/egusphere-egu22-1427,
23) G., S., Golitsyn. (2012). 1. Hurricanes: Catastrophic Effects and Their Physical Nature. InTech. doi: 10.5772/34700.
24) Yihong, Duan., Qingqing, Li. (2022). 5. Editorial: Landfalling tropical cyclones: Physical processes, forecasting, and impacts. Frontiers in Earth Science, doi: 10.3389/feart.2022.1071061.
25) Milad, Bagheri., Zelina, Zaiton, Ibrahim., Shattri, Mansor., Latifah, Abd, Manaf., Mohd, Fadzil, Akhir., Wan, Izatul, Asma, Wan, Talaat., Isabelle, D., Wolf. (2023). Hazard Assessment and Modeling of Erosion and Sea Level Rise under Global Climate Change Conditions for Coastal City Management. Natural Hazards Review, doi: 10.1061/(asce)nh.1527-6996.0000593
26) Mohammed, Mohammed, Mohammed, Gomaa. (2022). Assessing the Impacts of Population Relocation Induced by Future Sea-Level Rise Scenarios on Transportation Systems in Coastal Communities. Environmental Science and Sustainable Development, doi: 10.21625/essd.v7i2.884

27) Jana, Cox. (2022). Effects of Sea-Level Rise on Dredging and Dredged Estuary Morphology. Journal Of Geophysical Research: Earth Surface, doi: 10.1029/2022jf006790
28) Vera, Rullens., Stephanie, Mangan., Fabrice, Stephenson., Dana, E., Clark., R., Bulmer., Anna, Berthelsen., Josie, A., Crawshaw., Rebecca, V., Gladstone-Gallagher., Samuel, F., Thomas., Joanne, I., Ellis., Conrad, A., Pilditch. (2022). Understanding the consequences of sea level rise: the ecological implications of losing intertidal habitat. New Zealand Journal of Marine and Freshwater Research, 56(3):353-370. doi: 10.1080/00288330.2022.2086587
29) Xiayimulati, A. (2023). Implications and Challenges of Carbon Pricing. *BCP Business & Management*, 38, 2674-2680. University of Science and Technology of China, Hefei, China. https://doi.org/10.54691/bcpbm.v38i.4170
30) G. Hansen, R. (2023). "Chapter 17: Carbon pricing". In *Handbook of Business and Climate Change*. Cheltenham, UK: Edward Elgar Publishing. Retrieved Aug 31, 2024, from https://doi.org/10.4337/9781839103001.00026
31) Adeboye, Oyegunle., Olaf, Weber., Amr, ElAlfy. (2023). Carbon Costs and Credit Risk in a Resource-Based Economy: Carbon Cost Impact on the Z-Score of Canadian TSX 260 Companies. Journal of management and sustainability, doi: 10.5539/jms.v13n1p187
32) Jane, Koh., Shazali, Johari., Ahmad, Shuib., Nitanan, Koshy, Matthew., May, Ling, Siow. (2021). Impacts of carbon pricing on developing economies. International Journal of Energy Economics and Policy, doi: 10.32479/IJEEP.11201
33) Adenot, Théophile and Briere, Marie and Counathe, Pierre and Jouanneau, Mathieu and Le Berthe, Tegwen and Le Guenedal, Théo, Cascading Effects of Carbon Price Through the Value Chain: Impact on Firm's Valuation. P44 (February 25, 2022). Available at SSRN: https://ssrn.com/abstract=4043923 or http://dx.doi.org/10.2139/ssrn.4043923
34) Ricardo, Crisóstomo. (2022). Measuring Transition Risk in Investment Funds. Social Science Research Network (SSRN) CNMV Working Paper No. 81,p 1-41, doi: 10.2139/ssrn.4252801
35) Oguzhan, Cepni., Ahmet, Şensoy., Muhammed, Hasan, Yilmaz. (2024). Climate change exposure and cost of equity. Energy Economics,130 (12) p 107288. doi: 10.1016/j.eneco.2023.107288
36) Y.-H., Henry, Chen., Erik, S., Landry., John, J., Reilly. (2022). An Economy-wide Framework for Assessing the Stranded Assets of Energy Production Sector under Climate Policies. Climate Change Economics, vol. 14, issue 01, 1-29. doi: 10.1142/s2010007823500033
37) Juan C. Reboredo, Andrea Ugolini (2022). Climate transition risk, profitability and stock prices. International Review of Financial Analysis, 83, p 102271. doi: 10.1016/j.irfa.2022.102271
38) Alexandre, C., Köberle., Gireesh, Shrimali., Shivika, Mittal., Abhinav, Jindal., Charles, Donovan. (2022). Financial risks to coal value chain from a cost-conscious shift to renewables in India. Environmental Research Letters, 17(12):124002-124002. doi: 10.1088/1748-9326/aca036
39) Ekrem Alagoz, Yaser Alghawi. (2023). The Energy Transition: Navigating the Shift Towards Renewables in the Oil and Gas Industry. Journal of Energy and Natural Resources, 12(2), 21-24.https://doi.org/10.11648/j.jenr.20231202.12

40) Ambrosio Preudhomme, N., Mazzacurati, E. (2020). Asset-Level Physical Climate Risk Disclosure. In: Esty, D.C., Cort, T. (eds) Values at Work. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-55613-6_5
41) R., David, Espinoza., Javier, Rojo., William, D., Phillips., Andrew, Eil. (2022). Decoupled net present value: protecting assets against climate change risk by consistently capturing the value of resilient and adaptable investments. Sustainable and resilient infrastructure, doi: 10.1080/23789689.2022.2148453
42) Fujin, Zhou., Thijs, Endendijk., W., J., Wouter, Botzen. (2023). A Review of the Financial Sector Impacts of Risks Associated with Climate Change. Annual Review of Resource Economics, doi: 10.1146/annurev-resource-101822-105702
43) Fisnik, Morina., Saimir, Dinaj. (2024). Strategic Insights: How Environmental, Social, and Governance Factors Shape Portfolio Investments. Challenges in the Turbulent Economic Environment and Organizations' Sustainable Development, University of Maribor Press, 5(25-45) doi: 10.18690/um.epf.5.2024.25
44) C., T., Vidya., K.P., Prabheesh. (2024). Climate Risk and Sustainable Investment in Asia. Journal of Environmental Assessment Policy and Management, doi: 10.1142/s146433322450008x
45) Jiaxin, Huang., Zejiong, Zhou. (2024). The Impact of ESG Performance on Corporate Value: An Empirical Analysis Based on A-share Listed Companies. doi: 10.62051/ijgem.v2n3.31