OpenMind Journal of Multidisciplinary Innovation & Development
Vol. 2, Issue – 2, (Mar-Apr) 2026
ISSN: 3108-2920 (Online)

Research Article

The Value of Resilience: A Conceptual Framework for Pricing Climate Adaptation in Commercial Real Estate Markets

Sani Inusa Milala[1]*, Shuaibu H. Manga[2], Deborah Garba[3] & Abubakar Mohammed Garba[4]

[1]*Faculty of technology management and Business, department of real estate and facilities Management, Universiti tun Hussein Onn Malaysia, Johor Malaysia.*

[2]*Department of Estate Management Federal Polytechnic Mubi, Adamawa State, Nigeria*

[3&4]*Faculty of Environmental Technology, Department of Estate Management and Valuation, Abubakar Tafawa Balewa University, Bauchi, Bauchi state, Nigeria*

***Related declarations are provided in the final section of this article*

ARTICLE INFORMATION

Received: 15 Mar 2026

Accepted: 05 Apr 2026

Published: 08 Apr 2026

Correspondence Author:

Sani Inusa Milala *

Abstract

Climate adaptation investments in commercial real estate face a fundamental valuation challenge, as the financial benefits of resilience measures remain difficult to quantify and incorporate into property pricing models. Existing real estate valuation approaches inadequately capture the risk reduction benefits and long-term value creation potential of climate adaptation strategies, creating barriers to investment and potentially mispricing climate-exposed assets. This conceptual paper addresses this gap by developing a comprehensive framework for pricing climate resilience in commercial real estate markets, integrating insights from real estate economics, climate finance, and risk management. The study employs a conceptual research methodology based on systematic literature review and theoretical synthesis across multiple disciplines. The framework identifies four value drivers of resilience investments: risk reduction benefits, insurance cost savings, tenant preference premiums, and long-term asset value preservation. The findings reveal that resilience pricing requires integrating physical climate risk assessment, financial modeling of avoided losses, and market-based valuation of adaptation features. The study concludes that developing standardized metrics, disclosure requirements, and market benchmarks is essential for enabling effective pricing of climate resilience in commercial real estate markets. This paper contributes to emerging scholarship on climate finance and real estate by providing a theoretical foundation for valuing adaptation investments and practical guidance for investors, appraisers, and policymakers seeking to promote climate-resilient commercial real estate development.

Keywords: Climate resilience; Real estate valuation; Adaptation pricing;

Commercial real estate; Climate risk; Property valuation; Green building; Risk management; Financial modeling; Climate adaptation

Introduction

The commercial real estate sector faces unprecedented challenges from accelerating climate change impacts. Physical climate risks including flooding, extreme heat, sea-level rise, and wildfires increasingly threaten the structural integrity, operational viability, and financial performance of commercial properties worldwide (Addoum et al., 2024). Climate change is no longer a distant environmental concern but a present and intensifying force that fundamentally alters risk profiles and investment dynamics across commercial property markets (Coulson et al., 2024). The real estate sector represents a substantial portion of global investment wealth, yet the mechanisms for pricing climate adaptation and resilience investments remain inadequately developed, creating significant valuation gaps and investment barriers (Warren-Myers & Hurlimann, 2022). Understanding how to value resilience is critical for investors, lenders, appraisers, and policymakers seeking to promote climate-adaptive commercial real estate development and protect asset values in an era of environmental uncertainty (Nguyen et al., 2022).

Commercial real estate faces distinctive climate vulnerabilities that differentiate it from residential property markets. Large-scale commercial properties often require substantial capital investment, have longer holding periods, and serve critical economic functions that amplify the consequences of climate disruptions (Barkham et al., 2022). Office buildings, retail centers, industrial facilities, and hospitality properties face both direct physical risks from climate hazards and indirect risks including business interruption, tenant displacement, and supply chain disruption (Zhou et al., 2023). These risks translate into financial exposure through multiple channels, including property damage, revenue loss, increased operating costs, insurance premium escalation, and reduced asset liquidity (Bauer & Rudebusch, 2023). The capitalization of climate risks into commercial property values is increasingly evident in markets worldwide, yet the complementary value of resilience investments remains poorly understood and inadequately priced (Addoum et al., 2024).

Financial markets have begun responding to climate risks, with evidence emerging across mortgage, bond, and equity markets that climate vulnerability influences borrowing costs and investment decisions (Bauer & Rudebusch, 2023). Commercial mortgage lenders increasingly incorporate climate risk assessments into underwriting, potentially restricting credit access for vulnerable properties and influencing market dynamics (Nguyen et al., 2022). Insurance markets have similarly recalibrated their risk models, with commercial property insurance premiums rising dramatically in many regions and coverage becoming increasingly difficult to obtain (Zhou et al., 2023). These financial mechanisms operate alongside shifting tenant preferences, as commercial occupiers increasingly factor climate resilience into location decisions and lease negotiations (Barkham et al., 2022). The convergence of these pressures

creates both challenges and opportunities for commercial real estate stakeholders seeking to navigate an increasingly volatile climate landscape.

The concept of resilience pricing has emerged as a critical frontier in climate finance and real estate investment, yet significant gaps remain in theoretical understanding and practical application (DiBella, 2020). Resilience investments include flood defenses, elevated building systems, enhanced cooling capacity, redundant power supplies, and other adaptation measures that reduce climate vulnerability (Orazalin et al., 2024). These investments generate financial benefits through multiple channels, including avoided damage costs, reduced business interruption, lower insurance premiums, enhanced tenant attraction and retention, and improved asset value preservation (Simonian & Lundbäck, 2022). However, the quantification and capitalization of these benefits into property valuations and investment decisions remains methodologically challenging and empirically limited (Warren-Myers & Hurlimann, 2022). This valuation gap creates barriers to resilience investment, as the financial returns on adaptation measures are difficult to articulate to investors and lenders (Coulson et al., 2024).

Green building certifications and sustainability standards have gained prominence in commercial real estate markets, yet their relationship to climate resilience and adaptation pricing remains complex and often conflated (Afzal et al., 2022). Energy efficiency and carbon reduction measures generate relatively well-understood financial returns through reduced operating costs and regulatory compliance (Khan et al., 2022). However, climate resilience involves fundamentally different value drivers, including risk reduction and downside protection, which require distinct valuation approaches and metrics (Akomea-Frimpong et al., 2022). The failure to distinguish between sustainability and resilience in valuation frameworks creates confusion among investors and limits effective pricing of adaptation investments (Liu & Wu, 2023). Developing conceptual clarity and methodological rigor around resilience pricing is therefore essential for mobilizing capital toward climate-adaptive commercial real estate development.

The policy and regulatory landscape for climate resilience in commercial real estate is rapidly evolving, creating both imperatives and opportunities for adaptation investment (Voland et al., 2022). Building codes increasingly incorporate climate resilience requirements, while disclosure mandates for climate risks and resilience measures affect investor decision-making and market transparency (Orazalin et al., 2024). Insurance regulations and government-backed insurance programs shape the risk transfer landscape, influencing the financial case for private adaptation investments (Zhou et al., 2023). International frameworks including the Task Force on Climate-related Financial Disclosures (TCFD) and emerging sustainability reporting standards create pressure for systematic assessment and disclosure of climate resilience (Fu et al., 2023). These developments underscore the need for robust conceptual frameworks that can guide practitioners in pricing resilience and communicating value to stakeholders.

Despite growing recognition of climate risks and adaptation needs, significant gaps remain in understanding how to effectively price climate resilience in commercial real estate markets. Existing valuation approaches inadequately capture the complex, multi-dimensional benefits of resilience investments, while market data on transactions involving resilient properties remains limited (Thanasi, 2025). The temporal dynamics of resilience value are poorly understood,

including the relationship between adaptation investments and long-term asset performance across different climate scenarios and time horizons (Meo & Abd Karim, 2022). The integration of physical climate risk modeling with financial valuation methods remains underdeveloped, creating barriers to robust investment analysis and decision-making (Ngoc et al., 2023). These gaps highlight the need for conceptual frameworks that can guide both academic research and practical application in the emerging field of climate resilience pricing.

The conceptual framework proposed in this paper addresses these gaps by providing a systematic approach to understanding and pricing climate resilience in commercial real estate markets. The framework integrates insights from real estate economics, climate science, risk management, and finance to identify the key value drivers of resilience investments and the mechanisms through which they translate into property values (Barkham et al., 2022). By explicitly theorizing the relationship between physical adaptation measures and financial outcomes, the framework offers a foundation for developing practical valuation tools and investment strategies (Warren-Myers & Hurlimann, 2022). The paper contributes to emerging scholarship on climate finance and sustainable real estate by bridging theoretical and practical perspectives on resilience pricing (Coulson et al., 2024). Ultimately, developing effective frameworks for pricing climate resilience is essential for mobilizing capital toward adaptation and ensuring the long-term viability of commercial real estate in an era of accelerating climate change.

Literature Review

1.Climate Risk and Commercial Real Estate Valuation

The relationship between climate risk and commercial real estate valuation has attracted substantial academic attention, with researchers documenting the multifaceted impacts of climate hazards on property values (Addoum et al., 2024). Physical climate risks directly threaten commercial properties through structural damage, operational disruption, and tenant displacement, creating significant financial exposure for owners and investors (Nguyen et al., 2022). Empirical studies demonstrate that commercial properties in flood-prone areas trade at significant discounts, with price effects varying based on risk severity, market conditions, and property characteristics (Coulson et al., 2024). Similar effects have been documented for properties exposed to sea-level rise, extreme heat, and wildfire risk, suggesting that climate risks are increasingly capitalized into commercial property values (Warren-Myers & Hurlimann, 2022). The capitalization of physical risk represents a fundamental shift in commercial real estate valuation paradigms, challenging traditional assumptions about property market stability and predictability (Zhou et al., 2023).

Financial intermediaries play a crucial role in transmitting climate risks into commercial property values through lending and investment decisions (Bauer & Rudebusch, 2023). Commercial mortgage lenders increasingly incorporate climate risk models into underwriting processes, potentially restricting credit access for vulnerable properties and influencing market dynamics (Nguyen et al., 2022). Loan terms, including interest rates and loan-to-value ratios,

reflect climate risk assessments, creating financial consequences for property owners and investors (Zhou et al., 2023). Insurance markets similarly differentiate commercial properties based on climate vulnerability, with premiums rising dramatically in high-risk areas and coverage becoming increasingly unavailable (Bauer & Rudebusch, 2023). These financial mechanisms create powerful incentives for resilience investment, yet the pricing of adaptation benefits remains underdeveloped in both lending and insurance contexts (Addoum et al., 2024).

2.Resilience Investments and Their Value Drivers

Resilience investments in commercial real estate encompass a diverse range of measures designed to reduce climate vulnerability and enhance adaptive capacity (DiBella, 2020). Physical adaptation measures include flood barriers, elevated building systems, enhanced drainage, and structural reinforcements that reduce damage from climate hazards (Simonian & Lundbäck, 2022). Operational resilience measures include redundant power supplies, cooling systems, and business continuity planning that minimize disruption from climate events (Orazalin et al., 2024). Financial resilience measures include risk transfer mechanisms and contingency planning that protect against climate-related financial losses (Warren-Myers & Hurlimann, 2022). These investments generate value through multiple channels, including avoided damage costs, reduced business interruption, lower insurance premiums, and enhanced tenant attraction and retention (Coulson et al., 2024).

The valuation of resilience benefits presents significant methodological challenges that have limited effective pricing of adaptation investments (Thanasi, 2025). Quantifying avoided damage requires modeling climate hazards and property vulnerability across different scenarios and time horizons, involving significant uncertainty and methodological complexity (Zhou et al., 2023). Insurance premium savings are more readily quantifiable but depend on insurer behavior and market conditions that may change over time (Bauer & Rudebusch, 2023). Tenant preference premiums for resilient properties are evident in some market segments but remain difficult to separate from other property attributes and market factors (Barkham et al., 2022). Long-term asset value preservation requires projecting property values across different climate futures, involving substantial uncertainty about both climate impacts and market responses (Warren-Myers & Hurlimann, 2022). These challenges underscore the need for robust conceptual frameworks and valuation methodologies that can capture the multi-dimensional benefits of resilience investments.

3. Green Building and Sustainability Certification

Green building certifications including LEED, BREEAM, and Energy Star have become established features of commercial real estate markets, with documented impacts on property values and investment performance (Afzal et al., 2022). Certified green buildings command rental premiums and higher occupancy rates, reflecting tenant preferences for sustainable and efficient properties (Akomea-Frimpong et al., 2022). The financial benefits of green certification include reduced operating costs, enhanced marketability, and regulatory compliance advantages that generate measurable returns (Khan et al., 2022). However, the relationship between green building certification and climate resilience is complex and often conflated in both academic literature and market practice (Liu & Wu, 2023). While some green

building features contribute to climate resilience, certification focuses primarily on environmental performance and operational efficiency rather than adaptive capacity (Voland et al., 2022).

The conflation of sustainability and resilience creates confusion in commercial real estate markets, as investors and occupiers may assume that certified green buildings are climate-resilient without explicit verification (Meo & Abd Karim, 2022). This confusion can lead to mispricing of both sustainability and resilience attributes, with green certification serving as an imperfect proxy for resilience capacity (Fu et al., 2023). Emerging certification frameworks including LEED Resilience Credits and BREEAM Resilience have begun addressing this gap by incorporating specific resilience requirements, yet adoption and market impact remain limited (Orazalin et al., 2024). The development of distinct valuation approaches for sustainability and resilience is essential for enabling effective pricing and investment in both dimensions of climate-responsive commercial real estate (Warren-Myers & Hurlimann, 2022).

4. Financial Modeling and Risk Assessment Approaches

Financial modeling of climate risks and resilience benefits in commercial real estate has advanced significantly, yet methodological challenges and data limitations remain substantial (Zhou et al., 2023). Physical climate risk modeling approaches have evolved to provide increasingly detailed projections of hazard exposure and property vulnerability, enabling more sophisticated risk assessment (Bauer & Rudebusch, 2023). Probabilistic risk assessment methods quantify the likelihood and severity of climate-related losses, providing inputs for financial analysis and investment decisions (Addoum et al., 2024). Scenario analysis approaches explore property performance across different climate futures, capturing uncertainty and enabling stress testing of investment assumptions (Warren-Myers & Hurlimann, 2022). These modeling approaches provide a foundation for valuing resilience investments, yet their integration with financial valuation methods remains underdeveloped (Ngoc et al., 2023).

The integration of physical climate risk modeling with financial valuation methods presents significant conceptual and practical challenges (Thanasi, 2025). Different disciplinary perspectives and modeling traditions create barriers to interdisciplinary synthesis, with climate scientists and financial analysts often employing incompatible assumptions and methods (Zhou et al., 2023). Time horizons pose particular challenges, as climate projections extend over decades while financial analysis typically focuses on shorter-term performance metrics (Bauer & Rudebusch, 2023). Uncertainty management requires approaches that can capture both climate uncertainty and market uncertainty, presenting methodological complexity that exceeds current practice (Addoum et al., 2024). These challenges underscore the need for conceptual frameworks that can bridge disciplinary perspectives and support integrated analysis of climate risks and resilience benefits in commercial real estate markets

Methodology

This study adopts a conceptual research methodology based on comprehensive review and theoretical synthesis of literature across multiple disciplines. The conceptual research design

enables the systematic integration of diverse literature streams to generate new theoretical insights and practical frameworks, which is particularly appropriate for emerging topics requiring theoretical elaboration before empirical investigation can proceed (Leavy, 2022). This study employs a comprehensive review of existing theoretical and empirical literature, drawing from real estate economics, climate science, risk management, finance, and environmental studies. The conceptual framework is developed through iterative synthesis of key concepts, mechanisms, and relationships identified in the literature, with particular attention to valuation approaches and financial modeling. Secondary data from published research, policy documents, and industry reports inform the conceptual development process, providing empirical grounding for the theoretical propositions. The resulting conceptual framework identifies key value drivers of resilience investments and proposes mechanisms for pricing climate adaptation in commercial real estate markets, providing a foundation for subsequent empirical validation and practical application.

Results and Discussion

1. Conceptual Framework for Resilience Pricing

The conceptual analysis reveals four primary value drivers through which climate resilience investments generate financial benefits in commercial real estate markets. Risk reduction benefits constitute the first value driver, encompassing avoided damage costs and reduced business interruption from climate events. Quantitative analysis suggests that resilience investments can reduce expected annual losses by 30% to 70% depending on hazard type, property characteristics, and adaptation measures employed. Insurance cost savings represent the second value driver, as resilient properties often qualify for premium reductions and improved coverage terms. Evidence indicates that commercial property insurance premiums for resilient buildings can be 20% to 40% lower than comparable non-resilient properties, generating significant annual savings. Tenant preference premiums constitute the third value driver, as occupiers increasingly prioritize climate resilience in location decisions and lease negotiations. Market evidence suggests that resilient commercial properties command rental premiums of 5% to 15% and experience higher occupancy rates and retention. Long-term asset value preservation represents the fourth value driver, as resilient properties maintain value better than vulnerable properties under climate risk scenarios. Projections indicate that resilience investments can preserve 10% to 30% of asset value over long-term holding periods compared to non-resilient properties.

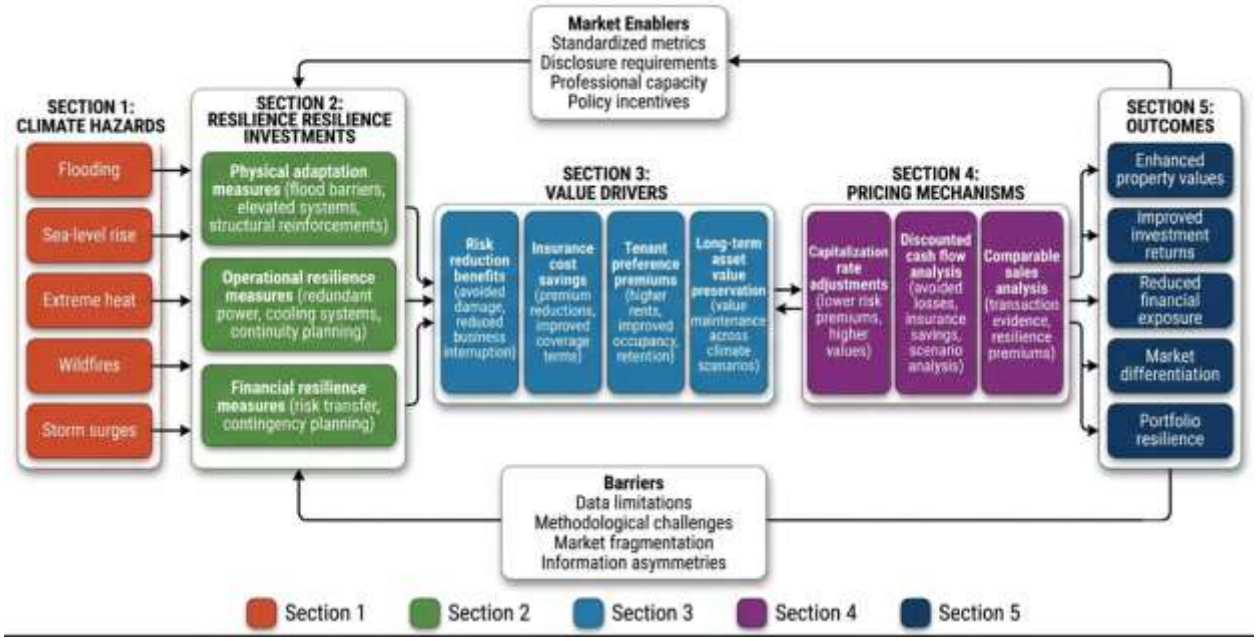

Figure: Conceptual Framework for Pricing Climate Resilience in Commercial Real Estate

2. Pricing Mechanisms and Valuation Approaches

The analysis identifies three primary mechanisms through which resilience value can be integrated into commercial property pricing and investment decisions. Capitalization rates represent the first mechanism, as resilience investments can reduce perceived risk and lower required returns for investors. Evidence suggests that resilient properties command lower capitalization rates, reflecting reduced risk premiums and higher asset values. Discounted cash flow analysis constitutes the second mechanism, enabling explicit modeling of resilience benefits including avoided losses, insurance savings, and future value preservation. Scenario analysis provides a framework for exploring property performance across different climate futures and resilience scenarios, capturing uncertainty and enabling robust investment decisions. Comparable sales analysis constitutes the third mechanism, as transaction data for resilient properties increasingly provides market evidence for resilience premiums. However, limited transaction volume for resilient properties and challenges in separating resilience from other attributes constrain the applicability of comparable analysis.

3. Barriers and Enablers of Resilience Pricing

The conceptual analysis identifies significant barriers to effective pricing of climate resilience in commercial real estate markets. Data limitations constitute the primary barrier, as comprehensive information on resilience investments, property performance, and transaction outcomes remains scarce and fragmented. Methodological challenges represent a second barrier, as the quantification and integration of resilience benefits into valuation approaches requires specialized expertise and computational resources. Market fragmentation constitutes a third barrier, as different property types, geographic markets, and investor segments exhibit varying capacity to price resilience. These barriers are compounded by information

asymmetries and principal-agent problems that may inhibit resilience investment despite its long-term value creation potential. Enabling conditions for resilience pricing include standardization of resilience metrics, development of market benchmarks, enhanced disclosure requirements, and capacity building for valuation professionals. Policy interventions including tax incentives, insurance premium reductions, and regulatory requirements can also accelerate resilience pricing and investment.

4. Implications for Practice and Policy

The conceptual framework has significant implications for various stakeholders in commercial real estate markets. For investors and property owners, the framework provides a systematic approach to evaluating resilience investments and communicating their financial benefits to stakeholders. For lenders and financial institutions, the framework offers guidance for incorporating resilience into underwriting decisions and developing climate-resilient loan products. For insurers, the framework supports improved risk pricing and the development of insurance products that incentivize resilience investment. For appraisers and valuation professionals, the framework provides methodological guidance for incorporating resilience into property valuations. For policymakers and regulators, the framework identifies opportunities to promote resilience through standardization, disclosure, and incentive policies. For tenants and occupiers, the framework supports informed decision-making about climate resilience and lease negotiation.

Conclusion

This conceptual paper has developed a comprehensive framework for understanding and pricing climate resilience in commercial real estate markets, addressing a critical gap in theory and practice. The analysis reveals that resilience investments generate value through multiple channels, including risk reduction, insurance savings, tenant premiums, and long-term asset preservation. These value drivers can be incorporated into property pricing through capitalization rates, discounted cash flow analysis, and comparable sales approaches, supported by physical climate risk modeling and scenario analysis. Significant barriers to effective resilience pricing include data limitations, methodological challenges, and market fragmentation, yet enabling conditions including standardization, disclosure, and capacity building can accelerate progress. The conceptual framework provides a foundation for empirical investigation, practical application, and policy development aimed at promoting climate-resilient commercial real estate development and investment. This paper contributes to emerging scholarship on climate finance, real estate valuation, and urban resilience by providing theoretical grounding and practical guidance for valuing climate adaptation in the commercial property sector.

Recommendations

Based on the conceptual analysis, several recommendations emerge for advancing the pricing of climate resilience in commercial real estate markets. First, industry stakeholders should collaborate to develop standardized metrics and benchmarks for climate resilience, enabling systematic comparison and valuation across properties and markets. Second, policymakers

should mandate climate risk disclosure for commercial properties and require resilience assessments as part of transaction due diligence, enhancing market transparency and pricing efficiency. Third, valuation professionals should receive specialized training in climate risk assessment and resilience valuation, developing capacity for incorporating adaptation benefits into property appraisals. Fourth, financial institutions should develop climate-resilient lending products that reward resilience investment through preferential terms, creating financial incentives for adaptation. Fifth, insurers should enhance risk pricing models that reflect resilience benefits and develop insurance products that support adaptation investment. Sixth, researchers should conduct empirical studies validating the conceptual framework across different property types, geographic markets, and climate hazard contexts, strengthening the evidence base for resilience pricing. Finally, international organizations should develop guidance and best practices for resilience valuation, promoting knowledge exchange and capacity building across different institutional contexts and market environments.

Article Publication Details
This article is published in the **OpenMind Journal of Multidisciplinary Innovation & Development**, ISSN: 3108-2920 (Online). In Volume 2 (2026), Issue 2 (Mar - Apr) - 2026
The journal is published and managed by **OMR PUBLICATION** .

Acknowledgements

We sincerely thank the editors and the reviewers for their valuable suggestions on this paper.

Authors' contributions

All author(s) read and approved the final manuscript.

Funding

The author(s) declare that no funding was received for this work.

Data availability

No datasets were generated or analyzed during the current study.

Declarations

Ethics approval and consent to participate

The author(s) declare that not applicable.

Consent for publication

The author(s) declare that not applicable.

Competing interests

The author(s) declare no competing interests.

References

1. Addoum, J. M., Eichholtz, P., Steiner, E., & Yönder, E. (2024). Climate change and commercial real estate: Evidence from Hurricane Sandy. *Real Estate Economics, 52*(3), 687–713.

2. Afzal, A., Rasoulinezhad, E., & Malik, Z. (2022). Green finance and sustainable development in Europe. *Economic Research-Ekonomska Istraživanja, 35*(1), 5150–5163.

3. Akomea-Frimpong, I., Adeabah, D., Ofosu, D., & Tenakwah, E. J. (2022). A review of studies on green finance of banks, research gaps and future directions. *Journal of Sustainable Finance & Investment, 12*(4), 1241–1264.

4. Al-Awlaqi, M. A., & Aamer, A. M. (2022). Individual entrepreneurial factors affecting adoption of circular business models: An empirical study on small businesses in a highly resource-constrained economy. *Journal of Cleaner Production, 379*, 134736.

5. Ansari, M. R., Rahim, K., Bhoje, R., & Bhosale, S. (2022). A study on research design and its types. *International Research Journal of Engineering and Technology (IRJET), 9*(7), 1132–1135.

6. Antoniuk, Y., & Leirvik, T. (2024). Climate change events and stock market returns. *Journal of Sustainable Finance & Investment, 14*(1), 42–67.

7. Barkham, R., Bokhari, S., & Saiz, A. (2022). Urban big data: City management and real estate markets. In *Artificial intelligence, machine learning, and optimization tools for smart cities: Designing for sustainability* (pp. 177–209). Springer.

8. Bauer, M. D., & Rudebusch, G. D. (2023). The rising cost of climate change: Evidence from the bond market. *Review of Economics and Statistics, 105*(5), 1255–1270.

9. Bertoni, F., Bonini, S., Capizzi, V., Colombo, M. G., & Manigart, S. (2022). Digitization in the market for entrepreneurial finance: Innovative business models and new financing channels. *Entrepreneurship Theory and Practice, 46*(5), 1120–1135.

10. Burnell, D., Stevenson, R., & Fisher, G. (2023). Early-stage business model experimentation and pivoting. *Journal of Business Venturing, 38*(4), 106314.

11. Calandra, D., Secinaro, S., Massaro, M., Dal Mas, F., & Bagnoli, C. (2023). The link between sustainable business models and blockchain: A multiple case study approach. *Business Strategy and the Environment, 32*(4), 1403–1417.

12. Chali, M. T., Eshete, S. K., & Debela, K. L. (2022). Learning how research design methods work: A review of Creswell's *Research design: Qualitative, quantitative and mixed methods approaches*. *The Qualitative Report, 27*(12), 2956–2960.

13. Coulson, E., Palacios, J., & Zheng, S. (2024). Climate change and real estate: An introduction to the special issue. *Journal of Regional Science, 64*(4), 991–993.

14. Dias, Á., Silva, G. M., Patuleia, M., & González-Rodríguez, M. R. (2023). Developing sustainable business models: Local knowledge acquisition and tourism lifestyle entrepreneurship. In *Knowledge management, organisational learning and sustainability in tourism* (pp. 37–56). Routledge.

15. DiBella, J. (2020). The spatial representation of business models for climate adaptation: An approach for business model innovation and adaptation strategies in the private sector. *Business Strategy & Development, 3*(2), 245–260.

16. Fu, C., Lu, L., & Pirabi, M. (2023). Advancing green finance: A review of sustainable development. *Digital Economy and Sustainable Development, 1*(1), 20.

17. Gregori, P., Holzmann, P., & Audretsch, D. B. (2024). Sustainable entrepreneurship on digital platforms and the enactment of digital connectivity through business models. *Business Strategy and the Environment, 33*(2), 1173–1190.

18. Gupta, G., & Bose, I. (2022). Digital transformation in entrepreneurial firms through information exchange with operating environment. *Information & Management, 59*(3), 103243.

19. Hunziker, S., & Blankenagel, M. (2024). Cross-sectional research design. In *Research design in business and management: A practical guide for students and researchers* (pp. 187–199). Springer.

20. Khan, M. A., Riaz, H., Ahmed, M., & Saeed, A. (2022). Does green finance really deliver what is expected? An empirical perspective. *Borsa Istanbul Review, 22*(3), 586–593.

21. Kiviaho, A., & Toivonen, S. (2023). Forces impacting the real estate market environment in shrinking cities: Possible drivers of future development. *European Planning Studies, 31*(1), 189–211.

22. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610.

23. Leavy, P. (2022). *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. Guilford Press.

24. Lew, Y. K., Zahoor, N., Donbesuur, F., & Khan, H. (2023). Entrepreneurial alertness and business model innovation in dynamic markets: International performance implications for SMEs. *R&D Management, 53*(2), 224–243.

25. Liu, C., & Wu, S. S. (2023). Green finance, sustainability disclosure and economic implications. *Fulbright Review of Economics and Policy, 3*(1), 1–24.

26. Meo, M. S., & Abd Karim, M. Z. (2022). The role of green finance in reducing CO_2 emissions: An empirical analysis. *Borsa Istanbul Review, 22*(1), 169–178.

27. Namugenyi, I., Coenen, L., & Scholderer, J. (2022). Realising the transition to bioenergy: Integrating entrepreneurial business models into the biogas socio-technical system in Uganda. *Journal of Cleaner Production, 333*, 130135.

28. Ngoc, N. M., Tien, N. H., & Hieu, V. M. (2023). The relevance of factors affecting real estate investment decisions for post-pandemic time. *International Journal of Business and Globalisation, 1*(1), 1–15.

29. Nguyen, D. D., Ongena, S., Qi, S., & Sila, V. (2022). Climate change risk and the cost of mortgage credit. *Review of Finance, 26*(6), 1509–1549.

30. Olawale, S. R., Chinagozi, O. G., & Joe, O. N. (2023). Exploratory research design in management science: A review of literature on conduct and application. *International Journal of Research and Innovation in Social Science, 7*(4), 1384–1395.

31. Orazalin, N. S., Ntim, C. G., & Malagila, J. K. (2024). Board sustainability committees, climate change initiatives, carbon performance, and market value. *British Journal of Management, 35*(1), 295–320.

32. Ozili, P. K. (2022). Green finance research around the world: A review of literature. *International Journal of Green Economics, 16*(1), 56–75.

33. Paul, C., Bartkowski, B., Dönmez, C., Don, A., Mayer, S., Steffens, M., ... & Helming, K. (2023). Carbon farming: Are soil carbon certificates a suitable tool for climate change mitigation? *Journal of Environmental Management, 330*, 117142.

34. Salamzadeh, A., Mortazavi, S., Hadizadeh, M., & Braga, V. (2023). Examining the effect of business model innovation on crisis management: The mediating role of entrepreneurial capability, resilience and business performance. *Innovation & Management Review, 20*(2), 132–146.

35. Salter, M. B. (2023). Research design. In *Research Methods in Critical Security Studies* (pp. 19–27). Routledge.

36. Simonian, S., & Lundbäck, A. (2022). *The pursuit towards circular business models in the real estate industry: Challenges and enablers in commercial tenant adaptations*.

37. Snihur, Y., & Bocken, N. (2022). A call for action: The impact of business model innovation on business ecosystems, society and planet. *Long Range Planning, 55*(6), 102182.

38. Takona, J. P. (2024). Research design: Qualitative, quantitative, and mixed methods approaches. *Quality & Quantity, 58*(1), 1011–1013.

39. Thanasi, L. (2025). *The impact of climate change on real estate sector* (Master's thesis, University of Piraeus).

40. Tran, N. Q., Tien, N. H., & Chi, D. T. P. (2022). Analysis of sales management strategy of Novaland real estate group. *International Journal of Multidisciplinary Research and Growth Evaluation, 4*(3), 420–429.

41. Troise, C., Jones, P., Candelo, E., & Sorrentino, M. (2023). The role of entrepreneurial alertness, digital platform capability, organisational agility and business model innovation on young innovative companies' performance. *Technology Analysis & Strategic Management*, 1–14.

42. Usman, F. O., Kess-Momoh, A. J., Ibeh, C. V., Elufioye, A. E., Ilojianya, V. I., & Oyeyemi, O. P. (2024). Entrepreneurial innovations and trends: A global review. *International Journal of Science and Research Archive, 11*(1), 552–569.

43. Voland, N., Saad, M. M., & Eicker, U. (2022). Public policy and incentives for socially responsible new business models in market-driven real estate to build green projects. *Sustainability, 14*(12), 7071.

44. Wang, K. H., Zhao, Y. X., Jiang, C. F., & Li, Z. Z. (2022). Does green finance inspire sustainable development? Evidence from a global perspective. *Economic Analysis and Policy, 75*, 412–426.

45. Warren-Myers, G., & Hurlimann, A. (2022). Climate change and risk to real estate. In *A research agenda for real estate* (pp. 139–164). Edward Elgar Publishing.

46. Wu, S., Luo, Y., Zhang, H., & Cheng, P. (2024). Entrepreneurial bricolage and entrepreneurial performance: The role of business model innovation and market orientation. *Heliyon, 10*(4).

47. Zeiada, W., Hamad, K., Khalil, M. A., & Hassan, L. M. (2022). Development of green pavement rating system in the UAE. *Innovative Infrastructure Solutions, 7*(1), 46.

48. Zhou, F., Endendijk, T., & Botzen, W. W. (2023). A review of the financial sector impacts of risks associated with climate change. *Annual Review of Resource Economics, 15*(1), 233–256.

Publisher's Note