https://doi.org/10................
ISSN: 2805-3346

RESEARCH ARTICLE

Climate Risk Perception and Behavioural Biases in Real Estate Investment Markets: A Systematic Review

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Received: 11 January 2026

Revised: 14 February 2026

Accepted: 10 April 2026

Published: 5 June 2026

Cite article as: Agorsor, P. D., Attakora-Amaniampong, E., & Appau, W. M. (2026). Climate Risk Perception and Behavioural Biases in Real Estate Investment Markets: A Systematic Review. *African Journal of Housing and Sustainable Development, 7*(2), pp. 3-19.

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ABSTRACT

Climate Change poses increasing physical and transitional risks to real estate markets, yet investment decisions continue to show systematic misperception of these hazards. This review synthesises recent empirical and theoretical literature on climate risk perception and behavioural biases in real estate investment markets, focusing on Ghana and comparative African economies. Following the PRISMA 2020 Protocol and based on over 2500 records identified from Scopus and Web of Science, 30 peer-reviewed studies between 2020 and 2025 were selected after screening and synthesised to address four research questions regarding how real estate investors perceive climate risk, what behavioural variables mediate their responses, whether market prices reflect these perceptions, and which theoretical lenses best explain observed behaviours. Three key findings emerged. One, climate risk perception is consistently distorted by cognitive biases, including availability heuristics, loss aversion, optimism bias, and herding. Two, climate risks are being capitalised into property prices, with flood-risk discounts of 12-18% documented in Accra and 6-15% in U.S. coastal markets. However, pricing remains reactive, incomplete and highly unequal across geographies. Three, developer adaptation is driven primarily by financial incentives and regulatory pressure rather than proactive, forward-looking risk management. Grounded in Prospect Theory (Kahneman, 1979) and the Adaptive Market Hypothesis (Lo, 2004), the review attributes these patterns to a structural market failure. The study recommends that policymakers in Ghana and comparable African economies prioritise investment in standardised, publicly accessible climate hazard data and mandatory climate risk disclosure frameworks as a foundational step towards closing the perception-reality gap in real estate climate risk pricing and fostering more resilient, climate-adaptive property markets

Keywords: Climate adaptation, Climate risk, Investor behaviour, Property markets, Real estate investment

1.0 Introduction

Climate change and financial markets are among the most significant shifts of the 21st century, with significant consequences on the value of assets, capital distribution and economic sustainability in the long run. The property market, which contributes a significant portion of the world's wealth and constitutes the largest asset class in the majority of economies, is placed at the centre of change (Christopher, 2024; Adkins et al., 2021). Two categories of climate risk increasingly affect property assets and portfolios. One, physical risks – in the form of rising sea levels, coast and inland floods, wildfires, extreme heat, and more powerful storms – directly jeopardise property values, thereby increasing operational and maintenance charges while decreasing the accessibility and affordability of insurance coverage (Catma, 2021; Dong, 2024; Kim and Brown, 2025). Two, policy changes, technological shocks, changing consumer demand patterns and regulatory frameworks to decarbonise, as well as other factors, have become sources of transition risks that pose financial risks to carbon-intensive developments and non-resilient assets (Sarker and Chen, 2025; Cho et al., 2024).

While these dynamics remain global, their effect is more felt in fast-growing urbanising sub-Saharan Africa. This study focuses mainly on Ghana, a representative case for an emerging market facing severe physical climate hazards, including coastal erosion, urban flooding and extreme heat. Ghana also operates within institutional and informational frameworks that are not adequately equipped to convert those hazards into market-wide risk pricing. Comparisons are also made with neighbouring African economies like Kenya, Nigeria, and South Africa. This further throw light on how differences in institutional development, the market and regulatory capacity influence behavioural dynamics of climate-risk perception and pricing across the continent.

The Classical Financial Theory, which is based on the Efficient Market Hypothesis propounded by Fama (1970), postulates that rational market participants efficiently process all available information before pricing assets accordingly. However, this assumption does not seem to be much supported by empirical data in the framework of climate-risk pricing in real estate markets (Contat et al., 2024; Hino & Burke, 2021; Catma, 2021; Thompson et al., 2023). In fact, the literature indicates that real estate markets are bounded by rationality, asymmetric information and heterogeneous risk perception, in addition to being highly behavioural in relation to incorporating long-term climate projections in investment decisions (Ahiadu et al., 2024; Sirmans et al., 2025). As a result, the perception, interpretation, processing and ultimate action of investors, developers, homebuyers and institutional actors regarding climate-related information has become a key determinant of market performance, portfolio performance and systemic financial stability.

The impact of the wrong perception or lack of comprehension of climate risks is far-reaching. The systematic mispricing of risk, leading to market participants unsustainably pricing climate vulnerabilities, leads to artificial demand in climatically vulnerable areas and the possibility of sudden and destabilising change in asset values following the manifestation or increased salience of risks (Hino & Burke, 2021; Thompson et al., 2023). These kinds of market corrections have cascading implications in financial systems, mortgage markets, insurance markets, municipal revenues and economic stability in general.

Following these dynamics, an interdisciplinary field has developed that is no longer content with the identification and quantification of physical climate hazards, but empirically investigates the behavioural, psychological and institutional processes through which these markets react (Botzen et al., 2025; Huang et al., 2025). This field of research is an interdisciplinary area in climate science, property finance, urban economics and behavioural economics that aims to de-jurisdictionalize the multi-layered decision-making processes of various market participants, including individual homebuyers and small-scale developers, large institutional investors and Real Estate Investment Trusts (REITs).

Despite the evolving existence of data relating to climate risk and the evidence presented of its effects on real estate values, investors and developers continue to make decisions that lead to the under-pricing of climate-related exposures. This brings about a disconnect between objective risk and subjective perception. This disconnect is not random; it is structured by properly documented cognitive and behavioural biases, e.g., loss aversion, availability heuristics, optimism bias and herding. This distorts the conversion of climate information into market prices and investment choices (Singh et al., 2023; Ahiadu et al., 2024). The effect of all this translates to structural market failure, where capital continues to go into climate-prone assets. Properties that are resilient usually remain undervalued relative to their long term-risk adjusted performance, as well as their broader financial system, which combines hidden climate-related liabilities (Hino & Burke, 2021; Cho et al., 2024).

This problem is prevalent in urbanised economies like Ghana, where institutional frameworks for climate risk disclosure are still at the developmental stage – a context where informal housing markets operate more outside regulations and adaptive capabilities are challenged by fiscal and informational limitations (Bapuuroh et al., 2025; Osei et al., 2025). It is therefore necessary to understand the behavioural mechanisms driving failure in this market and also identify conditions that can make markets include climate risk.

Recent research has documented the integration or otherwise of climate risks in real estate markets (Pelligra, 2024; Clayton et al., 2021). Empirical studies have also measured price discounts in climate-prone coastal and wildfire-prone areas, finding that the value of properties in areas with projected sea-level rise can trade at 6-7% discounts in comparison with similar but unexposed properties (Tarui et al., 2023; Hino & Burke, 2021). Other behavioural phenomena are herding, in which investors follow the lead of their peers in uncertain settings, and availability bias, wherein recent salient climate incidents have a disproportionate impact on risk perceptions and pricing (Thompson et al., 2023; Hennighausen & Suter, 2020). Moreover, the adaptation measures taken by progressive developers integrating climate-resilient design and green building technologies are also reported in the literature, usually driven by regulatory stipulations, market differentiation or expectations of future policy changes (Tran et al., 2020; Brandsma, 2024; Lu & Juan, 2022).

Although progress has been made, the literature is still divided into various disciplines, geographies and topics of interest. There are still critical gaps, specifically in relation to markets in the Global South, given its context of constrained adaptive capacity, informal housing and institutional structures of climate risk disclosure and management, which are still in their infancy or outright non-existent (Hussainzad & Gou, 2024; Bapuuroh et al., 2025). Research in the context of developing countries is sparse, including in Ghana, a country with acute risks due to coastal erosion, urban flooding and extreme heat. Clearly, the rapidly urbanising country is also highly vulnerable (Adu-Gyamfi et al., 2020; Damte et al., 2023; Osei et al., 2025). Similarly, studies have given disproportionate attention to residential markets in North America and Europe, with little attention paid to commercial real estate, industrial buildings or the dynamics of emerging markets.

This systematic review seeks to fill these gaps by offering a thorough, methodical synthesis of recent empirical and theoretical research on how climate risk perception and behavioural biases influence real estate investment decisions and market outcomes. The review explores the impact of climate risk perceptions on actual real estate investment behaviour in varied geographic settings, asset types and types of investors. This review aims to answer four research questions that are interrelated by synthesising the latest findings:

RQ1: What is the perception of real estate investors and developers about climate risk?

RQ2: What behavioural or psychological variables mediate their responses?

RQ3: To what extent do climate risk perceptions translate into observable pricing, timing and location adjustments in real estate markets, and what factors explain the variation in these market responses across different geographic and institutional contexts?

RQ4: What are the most appropriate theoretical lenses to explain patterns of behaviour?

These research questions enable this review to make three main contributions to the literature. They integrate different bodies of recent research, including climate science, real estate finance, behavioural economics and urban planning, into a unified thematic narrative that explains the complicated interactions between information on climate risk, investor psychology and market results. Moreover, it directly connects behavioural finance theory, especially Prospect Theory and the Adaptive Market Hypothesis, to climate-risk and real estate finance literature, providing a robust theoretical basis of non-rational market reactions to climate risks. It equally suggests an integrative conceptual framework of climate-risk-informed investor decision-making, mapping causal relationships between risk stimuli and cognitive processing and behavioural biases to the market reactions and adaptation mechanisms. Besides, focusing on unexplored areas like Ghana and other developing contexts, the review reveals serious gaps in geography, methodology and theme and therefore provides region-specific information that is globally relevant. Also provided in the review are evidence-based recommendations to investors, developers, policymakers and researchers to encourage more resilient, efficient and climate-adaptive real estate markets.

This study is undergirded by two theories that collectively offer a powerful perspective through which real estate market actors consider, interpret and react to risk information based on climatic conditions. The first one is the Prospect Theory, which was developed by Kahneman (1979). This theory does not assume the neoclassical view of rationality. It rather shows that people make choices based on reference points and that, in the context of uncertainty, all decisions are systematically biased. This means that they are more sensitive to losses than to similar gains. Prospect Theory, when applied to climate risk in real estate markets, has a variety of implications in explaining a variety of market anomalies: the excessive price discounting that occurs in the aftermath of salient disaster events, the failure of investors to take action in the face of probabilistic future risks, and the asymmetric returns to assets when faced with climate policy uncertainty.

The second theoretical framework is the Adaptive Market Hypothesis (AMH), which was proposed by Andrew Lo (2004). This theory reconciles the Efficient Market Hypothesis (EMH) with behavioural finance by applying evolutionary principles: competition, adaptation, and natural selection to financial markets.

The AMH considers the financial markets to be complex adaptive systems where investors keep learning and updating their heuristics to suit changing environmental conditions, competitive forces and informational regimes. Instead of assuming rationality in a static form or listing particular cognitive biases, the AMH describes how the price of climate risk changes over time: why markets initially do not adequately factor in new climate information and steadily upgrade their risk and price pricing as disclosure systems mature, institutional practices change and extreme events become increasingly common.

Collectively, these two frameworks are adequately suited to this review since they cover both the cross-sectional behavioural distortions of climate-risk pricing and the longitudinal mechanism through which markets adjust to climatic information over time (AMH). Their combination use is particularly suitable in emerging market settings like in Ghana, where the cognitive limitations of individual players and the institutional immaturity of the risk disclosure regime are interacting to influence the market.

2.0 Methodology

This study adopts a systematic literature review methodology, which follows the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). The objective of the review is to identify, screen and synthesise all relevant peer-reviewed research that integrates investor behaviour and climate risk in real estate markets published within a specific time frame.

2.1 Search Strategy and Sources of Data

Identification of relevant literature for the review was done via a comprehensive search of academic databases on the Internet. The databases guarantee reproducibility and limit destruction from non-peer-reviewed sources (El Bied et al., 2024; Contat et al., 2024). The search was made using Scopus and Web of Science, which provides coverage of peer-reviewed journals in environmental science, finance, economics and urban studies. Scopus and Web of Science were selected as the databases for the search because of their wide recognition as the gold standard for systematic reviews within the social science and built environment disciplines. These two databases offer advanced Boolean Search functionality, full citation indexing and reproducible search protocols that are consistent with PRISMA 2020 requirements (Page et al., 2021)

This search was made on 14 November 2025, using a well-curated Boolean query of words in order to capture the full extent of the research questions. The search terms included three core conceptual components, viz: Climate-related terms – "Climate change", "flood", "wildfire", "heat", "coastal"; Real estate investment terms – "real estate", "property", "housing", "invest", "developer", "REIT; and Behavioural and market-response terms –

"perception", "market behaviour", "pricing" and "adaptation".

2.2 Inclusion and Exclusion Criteria

The screening was done following a predefined set of criteria to ensure the final set of literature that was used for the study was adequately targeted. Only articles published online between January 1, 2020 and October 31, 2025 were considered. This time frame was chosen to capture the most recent trend of research following increased focus on climate finance. Besides, only peer-reviewed journal articles were considered, with conference abstracts, theses, working papers, industry reports and book chapters excluded. This was done to maintain the standards of academic robustness and rigour.

Again, the review was limited to articles published in English. The subject matter had to be an empirical or theoretical analysis of investor or developer behaviour, perception or decision making that is related to climate or environmental risk within the real estate, housing or property finance context. Accordingly, the researchers excluded studies that were not real estate-focused or were purely climate science papers without a link to real estate market behaviour or were simply climate policy papers lacking the real estate investor or developer component.

2.3 Screening and Selection Process

The screening process adhered to the four-step PRISMA workflow as shown in the flow diagram (Figure 1). An initial search of major databases yielded a large number of records (over 2,500 records) based on protocols outlined in the literature (El Bied et al., 2024; Contat et al., 2024). However, after the removal of duplicates, the titles and abstracts of the remaining different records were screened against the inclusion and exclusion criteria. Full texts of potentially relevant articles were then retrieved and assessed for final eligibility. This process resulted in a final selection of 30 core studies relating to the aim of the review.

2.4 Data Extraction and Synthesis

A well-detailed extraction form was used to gather key information from each included study. The extracted data comprised the following: metadata – author(s), year, journal and study location; study characteristics – market type (institutions or retail), risk type (flooding, heat stress) and methodology (hedonic pricing, survey or case study); key contents – principal empirical findings, behavioural constructs analysis, inferred behavioural implications and documented policy or adaptation responses.

The synthesis strategy was also conducted in three different ways. First, a thematic synthesis was made to arrange the evidence into three pre-defined macro themes: risk perception, market response and adaptation strategies. Second, a conceptual mapping exercise was conducted to develop an integrative behavioural model that connects the key stages of investor decision-making. Third, a gap analysis was performed to identify under-researched regions, data limitations and ignored theoretical areas for future research.

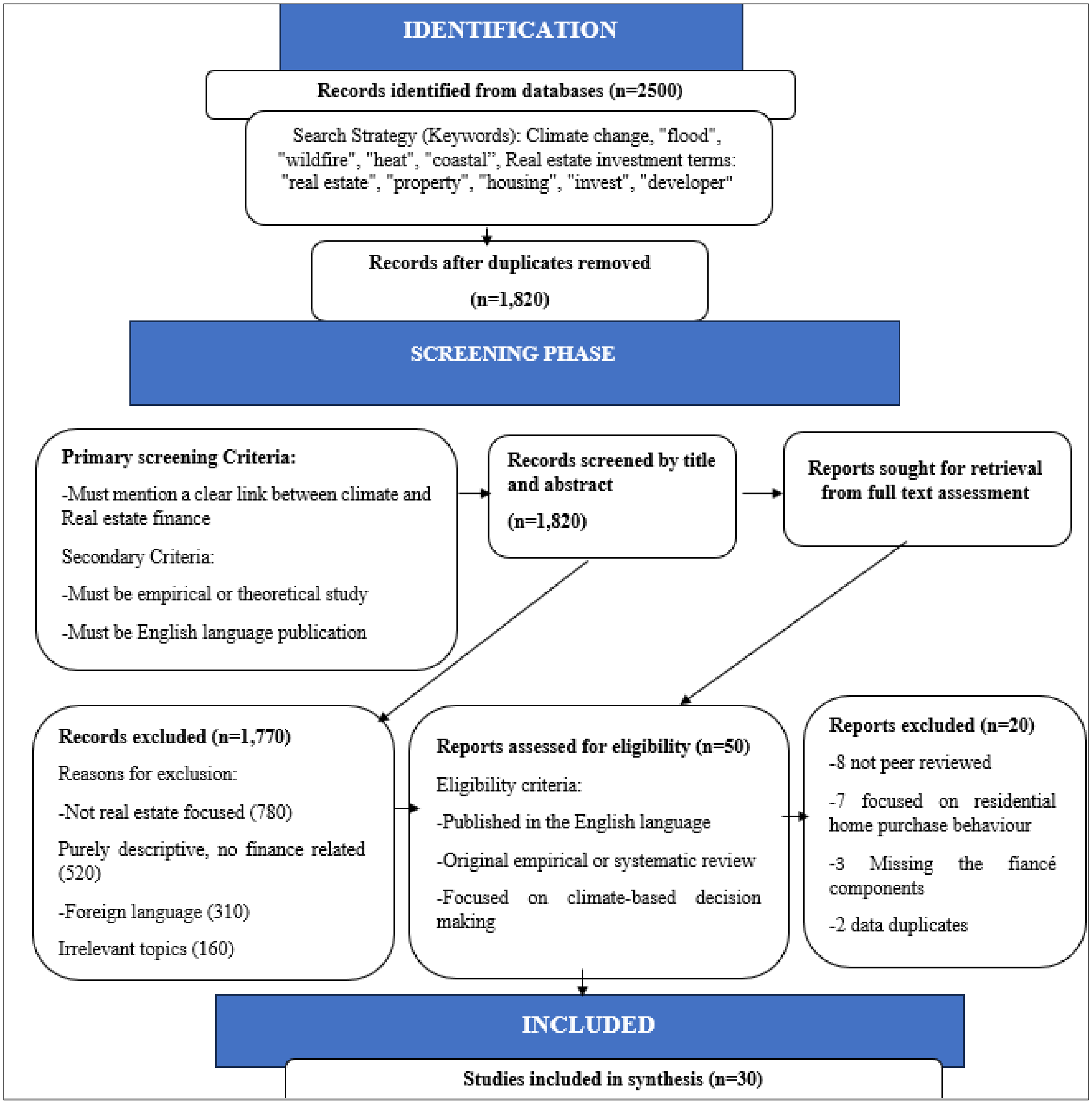

Figure 1: PRISMA 2020 Flow Diagram for Study Selection

3.0 Results

3.1 Characteristics of Included Studies

The 30 studies that were included in this review were combined from various geographic contexts, climatic risks and research methodologies. The greater part of the research was conducted in the United States, focusing on coastal markets and wildfire-prone regions. However, there has been a noticeable rise in studies covering emerging markets in Asia, Latin America and Africa, with most of them coming from Ghana.

With reference to the literature, Ghana emerges as the most represented African country from the selected year range on which the review was based. These studies examine flood risk pricing in Accra (Adu-Gyamfi & Nyarko, 2021), climate risk perceptions among commercial real estate stakeholders (Bapuuroh et al., 2025), corporate investment behaviour under physical risk exposure in sub-Saharan Africa (Arian & Naeem, 2025), as well as private sector climate adaptation literature (Osei et al., 2025). The Ghanaian studies provide the empirical basis for situating the review within an African context, even though comparable studies from Kenya, Nigeria and South Africa are scarce in the literature with respect to the selected year period for the review.

In terms of methodology, hedonic pricing models were noted to be the dominant approach for quantifying the impact of climate risk on property values (Catma, 2021). These methods have been significantly supported with survey-based methods to directly probe the risk perceptions and behavioural intentions (Tran et al., 2020; Bapuroh et al., 2025). These methods are supplemented with qualitative case studies and semi-structured interviews that provide deep insights into developer and investor decision-making (Candel & Törnå, 2022; Brandsma et al., 2024). Table 1 shows the summary of a representative sample of studies that were included, highlighting their key characteristics and findings according to the data extraction framework. Figure 2 also shows the distribution of the included studies based on the year of publication.

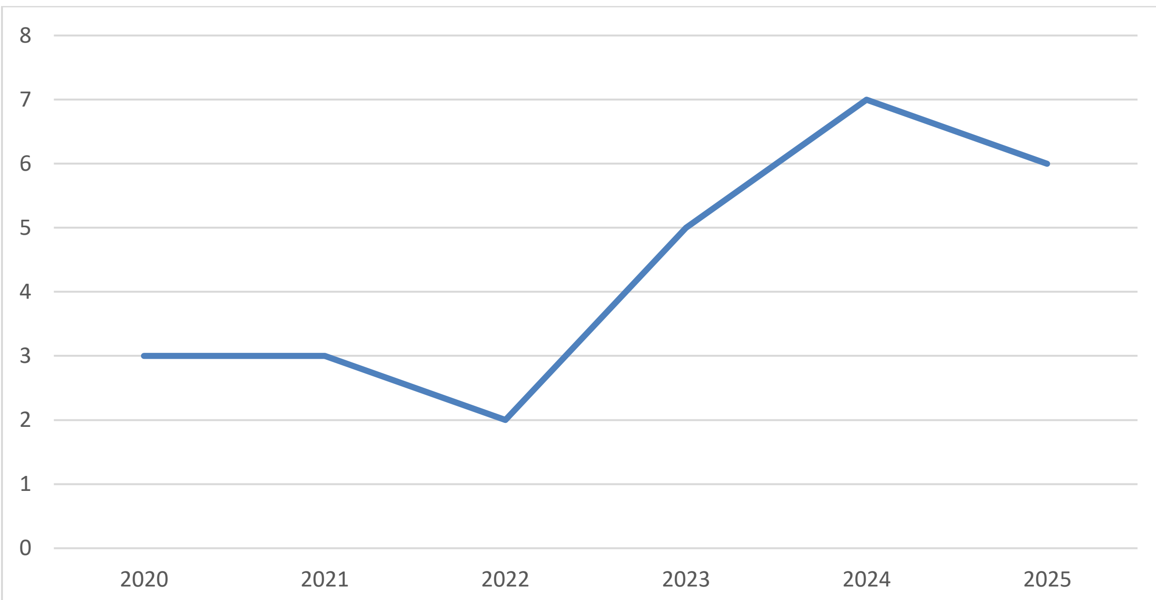

Figure 2: Distribution of the Included Studies based on Publication Year
Source: Author's construct, 2025

Table 1: Summary of a representative sample of studies that were included

Author(s), Year	Country/Region	Data & Methods	Key Findings on Behaviour & Perception	Behavioural Constructs	Policy Implications
Bapuuroh et al. (2025)	Ghana (Emerging Market)	20 semi-structured interviews with developers, investors, agents, officials. Qualitative content analysis.	Stakeholders recognize heat-related risks but rate them lower than traditional market risks. Perception drives selective adoption of energy-efficient cooling retrofits.	Risk Perception, Bounded Rationality	Need for awareness campaigns and financial incentives to overcome cost barriers for broader adaptation.
Thompson (2023)	12 Emerging Markets & U.S.	1.8M residential sales; Hedonic difference-in-differences with hazard maps & climate-salience index.	A 1-SD rise in perceived physical risk lowers prices by 3–7% in emerging markets. Post-disaster price overshooting observed. Developers accelerate sales pre-disaster.	Availability Bias, Salience, Adaptive Expectations	Price signals are emerging, but behavioural biases create volatility. Disclosure can help stabilize markets.

Adu-Gyamfi & Nyarko (2021)	Ghana (Emerging Market)	Hedonic analysis of property values in Accra.	Houses in flood-prone areas sell at a 12–18% discount, particularly after recent flood events.	Risk Aversion, Availability Heuristic	Strengthen land-use planning and flood-risk mapping to guide development away from hazardous zones.
Singh (2023)	Global (Lit. Review)	Systematic literature review.	Identifies loss aversion, herding and availability bias as dominant factors in climate-exposed real estate decisions.	Loss Aversion, Herding, Availability Bias, Framing	Calls for models integrating bounded rationality with new climate-risk disclosure regimes.
Cho et al. (2024)	U.S. (REITs)	Analysis of Climate Policy Uncertainty (CPU) index and REIT returns.	CPU shocks increase downside volatility in property returns, consistent with investors overweighting extreme negative scenarios.	Loss Aversion, Risk Perception	Stable, long-term climate policy is crucial to reduce market volatility and encourage long-term investment.
Catma (2021)	U.S. (Hilton Head Island)	Hedonic analysis of 3,800 waterfront sales.	Properties in high-risk flood zones show a -15.6% discount; those near eroding beaches show a -26% implicit loss.	Risk Aversion	Highlights the severe, localized financial impact of coastal hazards, necessitating proactive coastal management.
Arian et al. (2025)	Ghana & Sub-Saharan Africa	Analysis of listed firms' investment behaviour.	Finds that higher physical-risk exposure is correlated with lower real estate investment intensity by corporations.	Risk Aversion, Capital Allocation	Corporate investors are beginning to screen for physical risks, potentially redirecting capital away from vulnerable regions.
Tran et al. (2020)	Vietnam (Emerging Market)	SEM-PLS survey analysis of 326 developers.	Perceived financial return and regulatory pressure are the strongest predictors of developers' adoption of Green Building Technologies (GBTs).	Bounded Rationality, Incentive-Seeking	Financial incentives and clear, stringent building codes are effective tools to promote developer-led adaptation.
Brandsma et al. (2024)	Netherlands	Multiple-case study of 12 development schemes; stakeholder interviews.	Developers adopt climate-responsive designs (e.g., flood-adaptive floors) when municipal approvals are tied to climate-risk metrics.	Regulatory Compliance, Collaborative Behaviour	Early collaboration between developers and planners is critical for mainstreaming adaptation features into new projects.

4.0 Thematic Synthesis and Discussion

The synthesised findings from studies that were included in the review are organised into three macro-themes that directly address the research questions: (1) Risk Perception and Behavioural Drivers, (2) Market Responses and Price Adjustments and (3) Adaptation Strategies and Developer Behaviour.

4.1 Theme 1: Risk Perception and Behavioural Drivers (RQ1 and RQ2)

The literature identified from 2020 to 2025 indicates that while the rate of awareness of climatic risks continues to grow among stakeholders in the real estate sector, its translation into decision-making is complex and influenced by a range of psychological and behavioural factors.

There has been a consistent finding that a gap exists between objective, scientifically modelled risk and the subjective risk perception of participants in the market. For instance, in Ghana, stakeholders in the real estate sector acknowledge heat-related risks but rank them as less important than traditional market risks such as financing and land tenure. This indicates a perception hierarchy where immediate financial concerns dominate long-term environmental risks. This reflects rationality, as decision makers usually simplify complex problems to focus on a limited set of salient factors.

The literature also strongly backs the influence of several key behavioural biases, suggesting a move beyond the assumption of pure rationality. Furthermore, the perceptions of investors and responses in the market are heavily influenced by the salience of recent events. Thompson et al. (2023) found that price discounts for climate risks are larger and sometimes go overboard immediately following a natural disaster, a phenomenon known as "salience-induced myopia". Similarly, in Ghana, flood risk discounts of 12-18% are most common after major flood events (Thompson et al., 2023). This suggests that risk is not priced continuously but in discrete steps, indicating reactive steps that are usually triggered by salient information.

Investors also appear to be more sensitive to potential losses from climate impacts than to equivalent gains from resilience, a finding consistent with Prospect Theory. The work on climate Policy Uncertainty (CPU) shows that investors unequally reprice real estate assets in response to negative policy news, which increases the negative aspect of volatility with respect to REIT returns (Sarkar & Chen, 2025). This implies that the threat of a climate-related loss has a more significant effect on valuation than the promise of a green premium.

Also, in the presence of uncertainty and information asymmetry, investors usually resort to copying the actions of others. This “social proof” or herding is particularly visible in markets with weak or non-standardised climate-risk disclosure (Ahiadu et al., 2024). Singh et al. (2023) found that media-driven climate narratives can trigger synchronised price movements as investors seek corroborating information, amplifying cycles in climate-exposed regions. Herding has also been noted as a driver in the adoption of green-labelled commercial properties, where certification acts as a simplifying heuristic for complex ESG considerations (Singh et al., 2023).

Despite the growing evidence of risk, some studies imply a persistent optimism bias, where investors in high-risk areas believe their specific property will be spared. This is indirectly visible in the finding that a significant volume of homes in the flood zones of the US remain over-valued relative to their expected annual losses. This also suggests many buyers are either not privy to this or are discounting the risk (Hino & Burke, 2021). Investors may also seek information that confirms their initial decision to buy in a preferred but risky location. This confirms a typical example of confirmation bias (Singh et al., 2023).

The behavioural patterns, which have been identified in the literature, are reflected in more specific and contextual ways in the Ghanaian real estate market, where structural limitations reinforce the biases observed throughout developed country contexts. Basing their conclusions on a qualitative analysis of real estate stakeholders in Ghana. Bapuuroh et al. (2025) showed that developers, investors and property agents in Ghana appear to have accepted the reality of climate-related hazards such as heat stress and flooding, although they constantly rate these hazards as secondary to urgent financial and transactional issues such as land tenure insecurity, access to credit and affordability for clients. This is an acute case of a bounded rationality effect because, under the impact of multi-horizon risks, actors in the Ghanaian market resort to settling for heuristics that are rooted in the most urgent short-term needs, and are systematic, as long-term climate concerns are postponed in many ways (Bapuuroh et al., 2025; Ahiadu et al., 2024).

The availability heuristic is also quite pronounced in the Ghanaian environment. A hedonic price study of residential properties in Accra by Adu-Gyamfi et al. (2020) has revealed that the largest discounts of flood-related risks are observed in the direct aftermath of the large floods. This indicates that the cognitive activation of risk is associated with vivid and recent experience rather than probabilistic climate forecasts. This dynamic risk pricing behaviour, in which the perception peaks immediately after the disaster and decays with the recollection, reflects the availability bias while indicating the lack of internalised, prospective risk consideration between Ghanaian buyers and developers.

Moreover, it seems that the optimism bias and regard for the status quo are especially well established in the Ghanaian property market. Osei et al. (2025) reported that players in the private sector in Ghana are aware of the need to adapt to the climate but are nevertheless unwilling to internalise the costs of adaptation in the absence of direct policy incentives, which is indicative of a tendency to underestimate their own exposure and discount future climate scenarios that may not be consistent with the returns on current investments. Arian and Naeem (2025) also showed that the intensity of real estate investment in Ghana and other listed sub-Saharan Africa companies with high physical climate-risk exposure is already leading to reduced risk exposure by pricing risk (this is still nascent and poorly distributed, however), but is more driven by reactive capital withdrawal than by systematic and behaviourally sensitive risk management. All these results indicate that the same fundamental biases, including limited access to good quality climate hazard information, ineffective institutional structures and institutional dominance of informal market activities combine to establish a uniquely difficult context in which the central biases, e.g., limited rationality, availability heuristics, the optimism bias and herding, are all enforced in Ghana as they would be in a developed market.

4.2 Theme 2: Market Responses and Price Adjustments (RQ3)

The literature also provides strong quantitative evidence that climate risks are being capitalised into property prices, although the efficiency and uniformity of the pricing differ significantly. The most direct evidence of market response, as noted from the literature, comes from hedonic pricing studies that usually isolate the financial effects of specific climate hazards. Studies regarding the U.S. coastal markets document significant price discounts. Properties that are projected to be flooded by sea level rise sell for an average of 6.6% less, with this discount widening to 14.7% for the most vulnerable parcels (Tariu et al., 2023). For instance, in Hawai, homes exposed to a 3.2 feet sea level rise show an 8% price discount (Tariu et al., 2023). The impact of coastal erosion is more severe. One study also found an implicit value loss of 26% for properties that were close to eroding beaches (Catma, 2021).

Risks of flooding are one of the most consistently priced hazards. In the United States, it has been noted that flooded properties can lose up to 3-8% of their value in two years following an event (Hennighausen & Suter, 2020). In Accra, Ghana, it has also been noted that the discount for homes in floodplains is even higher, ranging from 12% to 18%. This reflects a lower adaptive capacity and higher risk perception in that context. However, the national market in the United States still shows a collective overvaluation of $43.8 billion for homes in flood zones. This indicates that price signals are not yet fully aligned with expected damages (Hino & Burke, 2021).

The threat of wildfire in California has been shown to cause a 2.2% price reduction in nearby neighbourhoods. This effect has also been noted to increase with proximity to the fire (Dong, 2024). Less important risks like urban heat are beginning to be priced. A study in Austin, Texas found that a one-standard-deviation increase in a home's micro-climate temperature corresponded to a 1.8-2.3% reduction in its price.

Climate risk is also influencing broader capital flow and the behaviour of financial intermediaries. For example, institutional investors are integrating third-party hazard scores into their underwriting models and, in some other cases, establishing "no-buy" zones for the highest risk assets (Sirmans et al., 2025). A survey has found that 64% of institutional investors now require audited physical risk closure. Again, markets with such mandates see lower required returns for low-risk assets (Ilhan et al., 2023). In sub-Saharan Africa, firms that are listed with high physical-risk exposure are already showing lower real estate investment intensity. This shows a potential capital retreat from vulnerable areas (Arian & Naeem, 2025). The insurance market is often a leading indicator with carriers in high-risk zones. They are either withdrawing coverage or applying steep increases of 25-40% for wildfire risk. This further creates availability and affordability crises (Boomhower et al., 2024).

4.3 Theme 3: Adaptation Strategies and Developer Behaviour

Unsurprisingly, financial considerations are evident. A survey conducted with Vietnamese developers found that perceived financial return was a driver for adopting Green Building Technologies (GBTs) (Tran et al., 2020). Chinese developers also prioritise technologies with payback periods under 10 years and government subsidies can increase adoption probability by approximately 25% (Lu & Juan, 2022). The business case is strengthening, with another study finding that resilient retrofits can offer internal rates of return (7-12%) comparable to conventional energy upgrades (Felicioni et al., 2025).

Regulation is also a powerful tool when it comes to adaptive strategies as noted in the literature. Developers in the Netherlands were found to adopt innovative features like flood-adaptive ground floors, especially when municipal design panels linked project approvals to specific climate-resilience metrics (Brandsma et al., 2024). Similarly, stringent local building codes in Southeast Asia were shown to shift developer

decisions toward deeper, more resilient retrofits (Bui et al., 2023). Again, unclear guidelines and policy uncertainty are cited by UK house-builders as major barriers to implementation (Candel & Törnå, 2022).
Moreover, proactive developers are beginning to use more sophisticated risk management tools, such as adaptive pathways and real-options analysis. They use these tools to stage investments in resilience measures like coastal retreat or flood-proofing (Siders & Pierce, 2021). Again, experience also counts. Developers with a track record of green projects show higher risk tolerance and a greater willingness to exceed minimum code requirements (Tran et al., 2020).

4.4 Ghana in Comparison with Selected African Countries

Situating Ghana within the broader African context exposes the similarities and significant differences in the perception and pricing of climate risk in the real estate markets on the continent of Africa countries. Although the literature reviewed offers the most significant basis of evidence with regard to Ghana, a comparative reading involving Nigeria, Kenya, and South Africa – the other three key real estate economies in Africa – sheds light on how much the behavioural dynamics in Ghana are context-specific or typical of regional trends.

As the biggest economy in sub-Saharan Africa, Nigeria has many of the same structural characteristics found in Ghana. Nigeria has a large, predominantly informal housing sector, poor land titling systems and undeveloped systems of disclosure of climate risks. Its urban core, Lagos, is acutely vulnerable to coast-effect flooding and sea-level rise. Similar to Ghana, the real estate market in Nigeria demonstrates a weak sign of systematic pricing of climate risk, with investors pegged on issues of short-term yield and liquidity instead of probabilistic weather forecasts (Hussainzad & Gou, 2024). However, this implies that international institutional investors using third-party climate risk scoring are already having some impact on pricing and underwriting decisions, which is still in its nascent stage in Ghana (Sirmans et al., 2025).

The case of Kenya is different in East Africa. Outside South Africa, the most developed REIT ecosystem on the continent is in Nairobi and the increased use of green building certifications like EDGE has incorporated market mechanisms that implicitly price some climate-resilience features despite a lack of explicit climate-risk disclosure. The major climate hazard profile of Kenya, which consists mainly of drought, water stress and localised flooding, significantly differs from the exposure to salient past occurrences in Ghana. However, the underlying core behavioural mechanism is similar: Risk perceptions are motivated more by salient recent events than by prospective probabilistic evaluations (Thompson et al., 2023). No doubt, South Africa is the most institutionally developed real estate market in Africa, boasting of JSE-listed REITs, obligatory environmental reporting of listed groups and a Green Star rating framework that gives the asset market distinction between those that are resilient and those that are not. The Cape Town water crisis of 2017-2018 showed with unusual clarity how fast a latent climate risk can become manifest and priced by the market, as commercial and residential property values in water-stressed precincts dropped sharply as the risk became salient, an archetypal case of availability-bias-induced repricing and subsequent market recalibration (Ilhan et al., 2023). In the case of Ghana, this South African path provides both a caution and a blueprint: Unless Ghana undertakes active investments in disclosure infrastructure, climate risk will continue to exist as a systematically underpriced risk until a crisis event will compel reactive repricing, which, in Ghana, would cost the economy possibly more than the cost of early adaptation.

Throughout the four markets, one trend that was consistently observed in other related literature bases synthesised in this review is that climate risk is systematically under-priced in comparison to the objective exposure to hazard, with the maturity of institutional reporting systems and the timeliness of relevant climate events being also negatively associated with the degree to which they are mispriced. Ghana is on the most vulnerable end of this spectrum both in terms of its high physical exposure and institutional capacity on the one hand and its limited adaptive investment on the other hand. However, South Africa can boast of maturation of institutions, even though behavioural biases still impede significant acceleration of market learning and risk internalisation. Such cross-country comparisons suggest that the significant gap between perception and reality in climate-risk pricing is not just a problem of individual cognitive failures but that of institutional conditions, such as failures in behaviour and policy interventions designed to enhance the information environment. Moreover, the disclosure infrastructure can decisively influence the elimination of a gap between perception and reality in climate-risk pricing (Arian & Naeem, 2025; Osei et al., 2025).

4.5 Theoretical Lenses for Explaining Behaviour (RQ4)

4.5.1 Prospect Theory

The Behavioural Finance Theory, grounded in Prospect Theory, has become the most common theoretical framework for explaining the behaviour of investors in climate-exposed real estate markets. Initially formulated by Kahneman (1979), Prospect Theory questions the rationality of the utility maximisation process by showing that people assess the results in relation to reference points and are systematically biased in making decisions under uncertainty. A number of assumptions as proposed by this theory are repeated in the literature on climate risks, and they offer strong explanatory capabilities to visible market abnormalities. Loss aversion, which is the propensity of people to attach greater importance to possible losses than to similar profits, can be observed in the context of real estate markets where investors tend to be much more sensitive to climate risks to the downside and demand a higher risk premium on vulnerable property once the risk is salient (Cho et al., 2024; Thompson et al., 2023). This is due to the availability bias, in which recent and vivid experiences have a disproportionate impact on risk assessments, which explains why property price discounts of climate risks become more acute in the immediate aftermath of a disaster and decrease over time as memories decline and new buyers, presumably less directly affected, enter the market (Hennighausen & Suter, 2020; Thompson et al., 2023).

Social proof and information cascade result in herding behaviour, which is especially intense in highly uncertain markets with asymmetric information, where investors tend to follow the actions of other investors or institutional actors instead of performing their own risk analysis (Ahiadu et al., 2024). The effects of framing are also essential because how the climate-risk information is framed (whether it focuses on physical threats or investment opportunities in resilience) is an important factor influencing investor decisions (Siders & Pierce, 2021). These behavioural principles are consistent with empirical regularities, which lie in the non-linear and inefficient response of real estate markets to the disclosures of climate risk and imply that cognitive and emotional mechanisms are systematically mediating the conversion of the objective risk information into market prices and investment choices (Sarker & Chen, 2025; Ilhan et al., 2023).

4.5.2 Adaptive Market Hypothesis (AMH) and Bounded Rationality

The Adaptive Market Hypothesis (AMH), proposed by Andrew Lo (2004), is a dynamic and evolutionary view of financial markets that complements and extends traditional behavioural finance models. In contrast to the Efficient Market Hypothesis, which assumes that rationality is static, or behavioural finance, which focuses on systematic biases, the AMH considers markets as complex adaptive systems where members are constantly learning, adapting and changing their strategies based on the changing environment, competitive forces and the availability of information. In the climate-risk pricing context of the real estate market, this framework offers useful insights into investors' behavioural changes over time as climate science becomes more accurate, disclosure regimes become more advanced and extreme weather events become more frequent and severe. The AMH assumes that investors use both rational analytical instruments and simplifying heuristics, as well as switch between them depending on the clarity of the available information, institutional pressures and experience learning (Ahiadu et al., 2024).

This viewpoint applies to the temporal dynamics of climate-risk pricing, wherein the initial under-reaction of the market to the emerging climate data shifts towards a more advanced risk assessment as institutional investors incorporate third-party climate risk rating, regulatory policies enact regulatory disclosure and academic research spreads the findings to practitioners (Contat et al., 2024; Ilhan et al., 2023).

One of the principles underlying the AMH is the concept of bounded rationality, which acknowledges the cognitive limitations, as well as the lack of time and availability of information, that overwhelm investors trying to make decisions in the face of the complexity of climate science, projections of risk on a probabilistic basis and multi-decadal time horizons. Instead of making optimum decisions, investors adopt different strategies to find solutions that are good enough to eliminate cognitive load and perceived risks (Ahiadu et al., 2024). This practice can be observed with reference to the popular use of simplified risk signals, e.g. FEMA flood maps or the recent history of disasters, instead of complex probabilistic climate projections. The AMH model is therefore an empirical and realistic perspective through which real estate markets can be observed to gradually but disproportionately adapt to climate risks.

4.6 Behavioural Model of Climate Risk in Real Estate

Based on the various studies synthesised, the researchers proposed a conceptual Behavioural Model of Climate Risk in Real Estate Investment, which is based on all the critical cognitive, emotional, institutional and market factors discovered in the literature. The model provides a sequence of causal relationships between climate-risk stimuli and observable market outcomes. Identifying several feedback loops and moderating variables, the model is based on climate-risk stimuli, which include objective hazard information – scientific forecasts of sea-level rise, flood maps, wildfire prediction models – and subjective experiential information such as recent disaster experiences, media reports and first-hand experience, among others. Individual and institutional cognitive processing mechanisms are used to filter these stimuli, and behavioural biases such as availability bias, loss aversion, optimism bias and herding are systematic ways of distorting risk perceptions compared with objective probabilities. Most importantly, the model acknowledges that the transmission and processing of risk information is moderated by information asymmetries, institutional quality and regulatory environments.

Responses are further mediated by investor characteristics, such as investment horizon, portfolio diversification, financial sophistication and previous climate experience. The model next follows the process of conversion of these biased risk perceptions into the outcome of decision-making in three areas: pricing adjustments, e.g., discounts on exposed properties and premiums on resilient assets; locational and timing strategies, e.g., capital flight out of high-risk zones and speculative entry in undervalued markets; and adaptation investments, e.g., resilience retrofits and green building adoption. Lastly, the model has feedback mechanisms in which market reactions (e.g., falling property prices, insurance retreat) in turn have a recursive effect on risk perceptions and behaviours in the future, potentially developing vicious or vicious cycles of market correction or maladaptation.

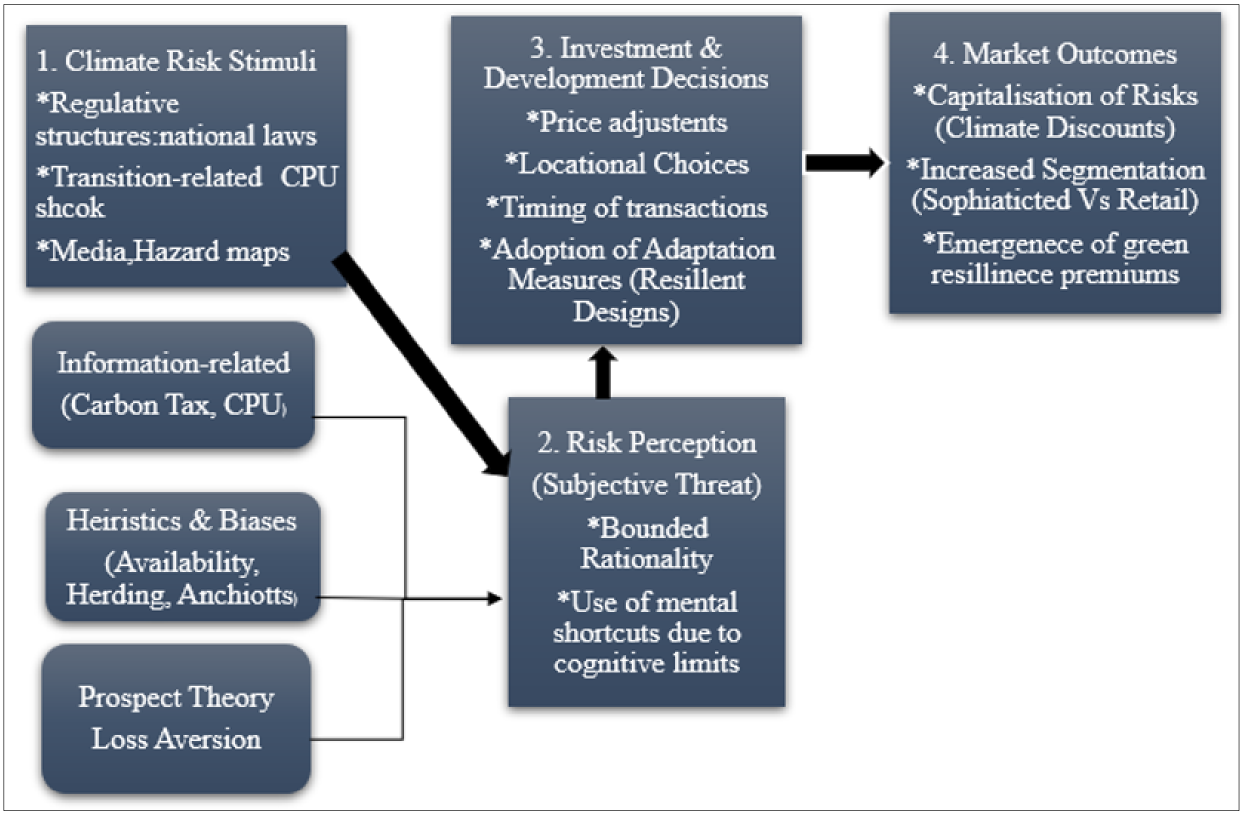

Figure 3: Behavioural model of climate risk in Real Estate
Source: Author's Construct, 2025

4.7 Gap Found and Future Research Agenda

This systematic review reveals a rapidly advancing field but also highlights several critical gaps requiring future research in the area. One of the strongest gaps identified from the literature is the overwhelming concentration of empirical research in developed countries, especially the United States. While this review identified an important and growing cluster of studies on Ghana and some other parts of West Africa, the evidence base remains small compared to the risks faced. Thus, there is an urgent need for more quantitative hedonic studies, investor surveys and developer case studies across sub-Saharan Africa to understand how climate risk is being perceived and priced in contexts of rapid urbanisation, alongside how this issue is handled in informal housing markets and lower institutional capacity. While the impact of policy uncertainty is being studied, research has yet to fully incorporate the effects of new mandatory climate-risk disclosure regimes into behavioural models. How do these standardised information shocks alter heuristics like herding?

The comparative analysis undertaken here shows that the structured cross-country research designs achieved by comparing Ghana with Nigeria, Kenya and South Africa can generate considerable scholarly and policy-oriented value. Such comparative studies could consider variations in institutional development, disclosure maturity and hazard profiles across these four markets to identify the conditions under which behavioural biases in climate-risk pricing are most pronounced and most amenable to policy intervention. A typical example is a panel hedonic pricing experiment that measures the flood-risk discounts across several climate episodes and policy cycles in Accra, Lagos, Nairobi, and Cape Town, which would provide the first rigorous set of data on whether African real estate markets can actually demonstrate the type of adaptive learning implied by the AMH – and how fast. Likewise, a relative survey of the attitudes of

institutional investors towards climate risk in these markets would allow researchers to dissociate the relative role of individual cognitive bias and the quality of institutional frameworks in creating the perception-reality gap in climate-risk pricing (Thompson et al., 2023; Arian & Naeem, 2025).
Again, most of the studies are cross-sectional or use short panels. Longitudinal research that tracks the evolution of risk perceptions and price discounts over multiple climate events and policy cycles is needed to understand whether market learning occurs and if price impacts persist or fade over time.

Moreover, research on developers often focuses on project-level economics. More work is therefore needed on portfolio-level capital allocation strategies and how large development firms manage climate risk across diverse geographic holdings. The literature also focuses heavily on a few key biases. Also remaining under-explored is the role of other constructs such as mental accounting, regret aversion and confirmation bias in real estate climate-risk decisions.

4.8 Theoretical and Practical Implications

The review shows that behavioural finance models have greater explanatory power compared to neoclassical models, which explain how climate risk is priced in real estate markets because systematic biases, including loss aversion, availability bias, herding and optimism bias, always affect price. The Prospect Theory, which is one of the theoretical frameworks used in synthesizing this review, can be used to explain the non-linear and asymmetric market responses, such as the sharp post-disaster price discounts, which dissipate with time as the salience wanes. The results also confirm the Adaptive Market Hypothesis, which states that climate-risk pricing changes over time as investors learn, disclosure regimes are enhanced and institutional risk measurement become more sophisticated. Bounded rationality explains further that the use of heuristics is an optimal reaction to complexity and uncertainty, and that effective policy should not focus on increasing the amount of data at the expense of simplified and standardised risk information. Furthermore, the review shows the necessity to generalise current behavioural theories to consider more contextual variations in different emerging markets, where institutional capacity, informal systems and local norms play an important role in climate-risk decisions.

Practically, the review guides investors, developers, financial intermediaries and policymakers on how to deal with climate risk in real estate markets. To investors, the domination of behavioural biases highlights the importance of organised, data-driven climate risk screening; it also opens up possibilities of carefully implemented contrarian strategies in markets that have suffered a temporary post-disaster mispricing. Institutional investors are advised to incorporate third-party climate risk measures, scenario analysis and diversification of hazards in the management of portfolios to enhance their long-term performance on a risk-adjusted basis. To developers, the experience demonstrates that proactive climate-resilient and green investments can act as strategic assets – to differentiate in the market, to respond to regulations and to perform well in the financial market – instead of being a burden of compliance expenses. The financial intermediaries also need to revise lending, valuation and insurance procedures to accommodate changing climate risks, while policymakers need to enhance the information infrastructure, the standardised disclosure and adaptive regulation, especially by capacity building and innovative finance instruments, not least in the vulnerable emerging markets.

5.0 Conclusion and Recommendations

This systematic review focused on recent literature, typically from 2020-2025, and ascertained that climate risk is no longer considered a theoretical, long-term issue of real estate markets but a current and increasingly priced reality. The review shows that investor and developer perceptions that are largely influenced by behavioural biases are leading to quantifiable property values, capital allocation and development practices. Nevertheless, the process is not balanced but reactive and at risk of market instability. There is still a big gap between objective risk and perceived risk, particularly in emerging markets that are not well studied, such as Ghana. These findings highlight to investors and developers the importance of transitioning to long-term and data-driven climate risk analytics by abandoning heuristic-informed decision-making. Active investment in adaptive design and green building technologies is not only a compliance cost but also a strategic investment because, in the markets, resilient assets can enjoy a resilience premium. Institutional investors are expected to aggressively seek standardised, asset-level climate risk disclosures and collaborate with researchers and public institutions to create locally hazard-relevant hazard maps, especially in data-poor markets like Ghana.

To policymakers, informational and regulatory uncertainty, which intensifies the biases in behaviour, needs to be minimised. Plausible, long-term climate adaptation, predictable building codes and investment in high-resolution, publicly available hazard information are all necessary prerequisites to rational market pricing, particularly in emerging economies like Ghana, where most of the information asymmetry is critically felt. Specific monetary support, such as subsidies, tax credits and concessional green finance, is also essential to combat the initial cost limitations that hinder the use of climate-resilient technologies today.
There should be comparative longitudinal research in the emerging markets of Africa (especially Ghana and her sub-Sharan neighbours), Southeast Asia and Latin America. A mixed approach of hedonic pricing model and qualitative interviews will be necessary to gain insights not just regarding the responses of the market to climate risk but also its causes. Further development of behavioural models is also needed to include more cognitive biases, given that the disclosure system is undergoing a revitalisation that will redefine the information environment in which investors are constrained to do business.

References

Adkins, L., Cooper, M., & Konings, M. (2021). Class in the 21st century: Asset inflation and the new logic of inequality. *Environment and planning A: economy and space*, *53*(3), 548-572.

Adu-Gyamfi, B., Shaw, R., & Yan, W. (2020). Assessment of housing exposure to accelerated coastal erosion in Keta Municipality of Ghana. *International Journal of Disaster Risk Reduction*, *44*, 101450.

Ahiadu, A. A., Abidoye, R. B., & Yiu, T. W. (2024). Decision-making amid economic uncertainty: exploring the key considerations of commercial property investors. *Buildings*, *14*(10), 3315.

Arian, A., & Naeem, M. A. (2025). Climate risk and corporate investment behavior in emerging economies. *Emerging Markets Review*, *65*, 101257.

Asianoah, R., Ayitey, A. F., & Brink, B. (2025). Assessing financial and professional risks on commercial property development and investment in the Accra, Ghana Enclave. *Construction Economics and Building*, *25*(2), 215-234.

Bapuuroh, R., Dinye, R. D., & Ayimaa, R. (2025). Assessing Climatic Risks on Commercial Real Estate in Ayeduase and Kotei, Ghana: Pathways to a Sustainable Future. *International Journal of Environment and Climate Change*, *15*(3), 408-423.

Boomhower, J., Fowlie, M., Gellman, J., & Plantinga, A. (2024). *How Are Insurance Markets Adapting to Climate Change? Risk Classification and Pricing in the Market for Homeowners Insurance* (No. w32625). National Bureau of Economic Research.

Botzen, W. W., Thepaut, L. D., & Banerjee, S. (2025). Kahneman's insights for climate risks: Lessons from bounded rationality, heuristics and biases. *Environmental and Resource Economics*, *88*(10), 2663-2688.

Brandsma, S., Lenzholzer, S., Carsjens, G. J., Brown, R. D., & Tavares, S. (2024). Implementation of urban climate-responsive design strategies: an international overview. *Journal of Urban Design*, *29*(5), 598-623.

Bui, T. T., Wilkinson, S., MacGregor, C., & Domingo, N. (2023). Decision making in reducing carbon emissions for building refurbishment: Case studies of university buildings in New Zealand. *Building and Environment*, *242*, 110557.

Candel, M., & Törnå, N. (2022). Housing developers perceived barriers to implementing municipal sustainability requirements in Swedish sustainability-profiled districts. *Journal of Housing and the Built Environment*, *37*(4), 1693-1721.

Catma, S. (2021, February). The price of coastal erosion and flood risk: A hedonic pricing approach. In *Oceans*, Vol. 2(1), pp. 149-161.

Cho, C., Yang, J., & Jang, B. (2024). Climate policy uncertainty and its impact on real estate market dynamics: A sectoral and regional analysis. *PloS One*, *19*(10), e0311688.

Clayton, J., Devaney, S., Sayce, S., & Van de Wetering, J. (2021). Climate risk and real estate prices: what do we know?. *Journal of Portfolio Management*, *47*(10).

Contat, J., Hopkins, C., Mejia, L., & Suandi, M. (2024). When climate meets real estate: A survey of the literature. *Real Estate Economics*, *52*(3), 618-659.

Damte, E., Manteaw, B. O., & Wrigley-Asante, C. (2023). Urbanization, climate change and health vulnerabilities in slum communities in Ghana. *The Journal of Climate Change and Health*, *10*, 100189.

Dong, H. (2024). Climate change and real estate markets: An empirical study of the impacts of wildfires on home values in California. *Landscape and Urban Planning*, *247*, 105062.

El Bied, S., Ros McDonnell, L., de-la-Fuente-Aragón, M. V., & Ros Mcdonnell, D. (2024). A comprehensive bibliometric analysis of real estate research trends. *International Journal of Financial Studies*, *12*(3), 95.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The journal of Finance*, *25*(2), 383-417.

Felicioni, L., Klepačová, K., & Hejtmánková, B. (2025). Economic Assessment of Building Adaptation to Climate Change: A Systematic Review of Cost Evaluation Methods. *Smart Cities*, *8*(5), 156.

Hennighausen, H., & Suter, J. F. (2020). Flood risk perception in the housing market and the impact of a major flood event. *Land economics*, *96*(3), 366-383.

Hino, M., & Burke, M. (2021). The effect of information about climate risk on property values. *Proceedings of the National Academy of Sciences*, *118*(17), e2003374118.

Huang, S., Vigne, S., Yao, D., & Xu, X. (2025). Climate risk analysis: Definitions, measurements, strategies, and sectoral impacts. *Journal of Economic Surveys*, *39*(4), 1795-1822.

Hussainzad, E. A., & Gou, Z. (2024). Climate risk and vulnerability assessment in informal settlements of the global south: a critical review. *Land*, *13*(9), 1357.

Ilhan, E., Krueger, P., Sautner, Z., & Starks, L. T. (2023). Climate risk disclosure and institutional investors. *The Review of Financial Studies*, *36*(7), 2617-2650.

Kahneman, D. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica*, *47*, 278.

Kim, S. W., & Brown, R. D. (2025). Measuring the impact of the urban microclimate on housing price using the spatial hedonic pricing method: The case study of Mueller, Austin, TX. *Applied Geography*, *174*, 103483.

Lo, A. W. (2004). The adaptive markets hypothesis: Market efficiency from an evolutionary perspective. *Journal of Portfolio Management, Forthcoming*.

Lu, H., & Juan, Y. K. (2022). Optimal decision-making model for selecting residential green building technologies in China. *Frontiers in Environmental Science*, *10*, 973334.

Osei, J., Ahenkan, A. and Anuga. S. (2025). "Possibilities for Climate Change Adaptation Investments in Ghana: Exploring Private Sector Concerns and Perceptions about Policy Incentives." Business Strategy and the Environment34, no. 6: 7723–7735. https://doi.org/10.1002/bse.4365.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *bmj*, *372*.

Pelligra, A. (2023). *Evaluation of risks with a special focus on climate change related risks in real estate development* (Doctoral dissertation, Politecnico di Torino).

Sarker, P. K., & Chen, X. H. (2025). Quantile Effects of Climate Policy Uncertainty, Economic Policy Uncertainty, and Interest Rates on REIT Returns: Evidence from the United States. *Economic Notes*, *54*(2), e70012.

Siders, A. R., & Pierce, A. L. (2021). Deciding how to make climate change adaptation decisions. *Current Opinion in Environmental Sustainability*, *52*, 1-8.

Singh, A., Kumar, S., Goel, U., & Johri, A. (2023). Behavioural biases in real estate investment: a literature review and future research agenda. *Humanities and Social Sciences Communications*, *10*(1), 1-17.

Sirmans, C. S., Sirmans, G. S., Smersh, G. T., & Winkler, D. T. (2025). Perceptions of climate change and the pricing of disaster risk in commercial real estate. *The Journal of Real Estate Finance and Economics*, 1-33.

Tarui, N., Urbanski, S., Lam, Q. L., Coffman, M., & Newfield, C. (2023). Sea level rise risk interactions with coastal property values: a case study of O ʻahu, Hawai ʻi. *Climatic Change*, *176*(9), 130.

Thompson, J. J., Wilby, R. L., Hillier, J. K., Connell, R., & Saville, G. R. (2023). Climate gentrification: Valuing perceived climate risks in property prices. *Annals of the American Association of Geographers*, *113*(5), 1092-1111.

Tran, Q., Nazir, S., Nguyen, T. H., Ho, N. K., Dinh, T. H., Nguyen, V. P., ... & Kieu, T. S. (2020). Empirical examination of factors influencing the adoption of green building technologies: The perspective of construction developers in developing economies. *Sustainability*, *12*(19), 8067.