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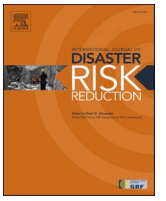

Motivations for investing in flood risk environments: An agreement analysis between property investors and estate agents

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ABSTRACT

Landed property often exhibits scarcity and strong demand, especially in the most sought-after places. Therefore, real estate investors may be attracted to locations such as flood-risk areas that may pose a substantial threat to human life and property. Furthermore, some environments may not have experienced floods in the past but are nonetheless susceptible to future occurrences. Flood occurrences are progressively more frequent because of several natural and anthropogenic factors, including urban sprawl. Nevertheless, construction projects and real estate investments in flood-prone areas persist globally. The objective of this study is to examine and comprehend the process by which perceptions of flood risk are shaped and how they, together with other variables, might impact investment choices in Lagos, Nigeria. The selection of the study locations (Ibeju-Lekki and Ikorodu) was based on their well-documented flood risk features, the hydrological estimates made by the Nigerian meteorological agency, and their high population density. An inquiry was conducted by administering questionnaires to property investors and estate agents within the study location. The findings highlight a clear stratification of motivations for real estate investment in flood-risk areas, with some factors emerging as the most significant drivers of decision-making. Results also suggest that investors place high importance on key considerations, potentially related to economic incentives or market opportunities, while other factors are perceived as less critical or more subjective. Understanding these motivations can help policymakers and real estate professionals better address concerns and develop strategies that balance risk and reward in these challenging environments.

1. Introduction

One of the qualities that make landed property, that is land, in its undeveloped and developed state, desirable as an investment, is its scarcity. The resulting high demand often leads people to invest in risky locations such as flood zones. Flood plains are among those hotspots where flooding, precipitated by natural and anthropogenic factors, poses significant risks to life and property. Floods are becoming increasingly common due to several causes, including rapid urbanisation and unwieldy urban expansion [1,2], as well as continuous developments in many flood-prone areas [3,4]. Floods could have a detrimental impact on human well-being. These

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include fatalities, economic losses, disruption to ecosystems and historical and cultural sites, and worsening existing health problems.

Climate change has raised concerns about flooding. Flooding is one of the most widespread disasters, causing severe consequences in low-income countries [5,6], including disruptions to property investments. The problem of flooding has become more severe due to a changing climate and increased urbanisation, an escalation of urban flooding occurrences and its aftereffects are ever more dire [7]. The consequences for society can be catastrophic. Increasing losses from flooding are partly due to decisions to undertake development in flood-prone areas. In some areas that are not flood-designated, flooding may still occur due to human activities, including the expansion of construction to accommodate urban growth [8]. This is reflected by the view that a substantial path dependency exists in development such that once structures and infrastructure are in place, it is very difficult to abandon areas [9]. Disaster related to a weather, climate or water hazard occurred every day on average over the past 50 years, killing 115 people and causing US$202million in losses daily [10,11]. The World Meteorological Organization report (1970–2019) found that more than 11,000 disasters were attributed to weather, climate, and water extremes, resulting in just over 2 million deaths and US$3.64trillion in losses. While disasters have become increasingly common globally, floods impact more people worldwide than any other disaster, and the economic, social, and environmental impacts are getting worse [12].

As the climate crisis intensifies, there is no question that the intensity and frequency of extreme weather often resulting in disasters is increasing [13]. The real estate sector is vulnerable to flood risk. The industry is increasingly having to address the causes of climate change through an evolving range of requirements, including environmental and sustainability strategies, regulatory controls on CO_2 emissions, and the greening of property investment portfolios and developments. The damage to residential property depends on the property characteristics and severity of the flood event [14]. Many real estate investors and associated players may not be aware that the increase in the occurrence of floods and their magnitude could pose a rising, compelling, and immediate threat to property values [15]. The property market is complex and volatile, potentially affected by unpredictable risk events which could lead to market volatility. This may affect property prices and the value of real estate investment. A high initial capital requirement is a distinguishing feature of property investment because of the need to set aside funds for potential benefits [16]. Since the expected benefits will be received over time, real estate investment is characterised by risk, the management of which is an uphill task for investors. Therefore, an astute investor would not commit himself without having adequate information. Risk is inherent in the decisions people make, as there is a degree of uncertainty associated with all decision outcomes [17]. Since individuals exercise free will, it is logical to assume that risk perceptions will vary and will likely affect the investment decision-making process [18].

Despite the damaging role of flooding, Oyetunji et al. [19] reported that people do not consider its risk when making property investment decisions. This view is held because of the growing number of property investments in flood zones. This could mean that some investors knowingly invest in environments that are prone to flooding whilst others appear not to be aware of the risk or have limited or no access to flood information of the place, they intend to invest in. Some investors may become aware of flood risk only after experiencing flooding for the first time. They, therefore, tend to overlook the related risks within their investment decision-making. Decisions regarding property investment require the consideration of criteria relevant to the occurrence of changes in natural and urban environments. Thus, people's perceptions of flood risk involve various actions, views, and opinions when endangered by the possible occurrence of flooding.

The art and science involved in determining property values have evolved from changing externalities. Some of these externalities include climate change (environmental), economic and social aspects [20]. The focus of this paper is on the environmental externality, which is flooding. This is occasioned by worldwide housing development on flood plains in an era of climate change and its unfavourable environmental impacts. This could be the reason why floods occur more frequently and severely because of climate change [21]. Human activity, as evidenced by rapid and uncontrolled development, contributes to the manifestation of floods [22]. The social and economic responses to floods could neither mitigate nor adapt to the challenge of flooding [23,24]. Increased urbanisation, persistent rise in excess water, and fluctuations in weather conditions due to climate change have made flooding a global topic.

The real estate investment process is influenced by several variables, resulting in a dynamic, complicated, and challenging decision-making process. Several factors might impact the choice to invest in real estate. The factors according to Kamali et al. [25] may be categorized into environmental, neighbourhood, accessibility (location), and property (structural) components. Maleki and Zain [26] on their own part established a correlation between housing costs, environmental amenities, and property design (structural). Sean and Hong [27] in Malaysia categorized the elements that may impact property investment decisions into neighbourhood, financial (economic), structural, and locational variables. Wong et al. [28] disclosed that the value attributes used in investment decision-making could be determined by the property physical characteristics (such as its structure, size, and design) and the neighbourhood characteristics (such as proximity to schools, malls, parks, markets, and crime rate). This present study investigates how property investors knowledge and experience of flooding could shape their decisions in flood-prone locations with a comparative assessment of their investment decision with that of real estate professionals which in this study are referred to as estate agents.

The effect of flooding on property values is a complex phenomenon, hence, the need to contribute to existing information and knowledge about this global phenomenon. Flood-prone environments are widely recognized as high-risk areas due to the significant environmental and financial threats they pose. With the increasing impacts of climate change and the frequency of extreme weather events, these areas are more vulnerable, which can result in increased property damage, financial loss, and rising maintenance costs [29]. Despite these risks, property investors continue to invest in such regions, driven by motivations that, in many cases, appear to outweigh the perceived threats [19]. Understanding these motivations is crucial for assessing market behaviour, risk perception, and adaptive strategies within the real estate sector. Property investors and estate agents play a pivotal role in shaping investment decisions, influencing housing supply, pricing, and resilience in flood-prone areas. While flood risk is often seen as a deterrent, some economic, policy-driven, or speculative factors may still attract investment in these vulnerable environments. This paper seeks to explore and analyse the critical factors that motivate investment in flood-prone areas, in the bid to unravel why these areas remain

attractive. This study examined characteristics that have been demonstrated to influence property investment decisions in general and evaluated whether they may also incentivise investment decisions and contribute to investing in locations susceptible to flood risk. The central scientific problem this paper addresses is: "What motivates property investors to invest in flood-prone areas, despite the risks associated with these locations? This is crucial in understanding the complex decision-making processes that guide investments in such risky environments. To answer this question, the thesis of this paper is that property investors are motivated by a combination of factors, including the potential for high financial returns, and confidence in flood risk mitigation measures. These elements, together, reduce the perceived risks associated with such investments, allowing investors to view flood-prone areas as viable opportunities for profit. This study provides the framework for analysing the underlying motivations and explains how these factors influence investment behaviour. An assessment of their opinion is then compared to that of the estate agents to unravel how well their needs are understood by these stakeholders during the investment process. In order to achieve this, two administrative local government areas (LGA's) in Lagos state, Nigeria were selected as a representative study location. These LGA's are Ikorodu and Ibeju-Lekki and are selected due to the prevalence of flooding menace associated with these environments over the years. Studies and information are limited on investment potential particularly in flood-prone areas of Lagos state. This gap requires utmost attention considering the increasing menace of floods, climate change, persistent demand for land, and the need to embrace sustainable development.

2. Research methodology

2.1. Study location

The research was conducted in Lagos, the former Federal Capital of Nigeria. The state is Nigeria's principal hub for commerce, one of Africa's rapidly developing major capital with the potential to become the most economically prosperous state in the country [30]. The advantage of Lagos state can be credited to its status as hosting over 50 % of Nigeria's commercial activities [31,32], including businesses, manufacturers, financial institutions, and small and medium enterprises. According to the United Nations [33], Lagos is the most populous urban region in West Africa, mostly because of its high population density and rapid population growth rate. The state is situated in the South-Western region of Nigeria, between latitudes 6°02′N to 6°04′N and longitudes 20°45′E to 40°20′E. Officially, Lagos State has 20 local government areas (LGA), however, the state government carved out Local Council Development Areas (LCDA) from these LGA which makes the state to have 57 LCDAs. These LCDAs serve as the administrative divisions within the state, providing local governance and services to the residents. Fig. 1 depicts the geographical map of the research area.

In July 2021, severe flooding affected Lagos state, Nigeria, submerging vehicles and residential properties while significantly disrupting daily activities across the metropolis. Lagos is characterized by its low-lying, flat topography, with many areas situated at or below sea level. The city's average elevation is approximately 1.5 m above sea level [34], and it is experiencing a subsidence rate of up

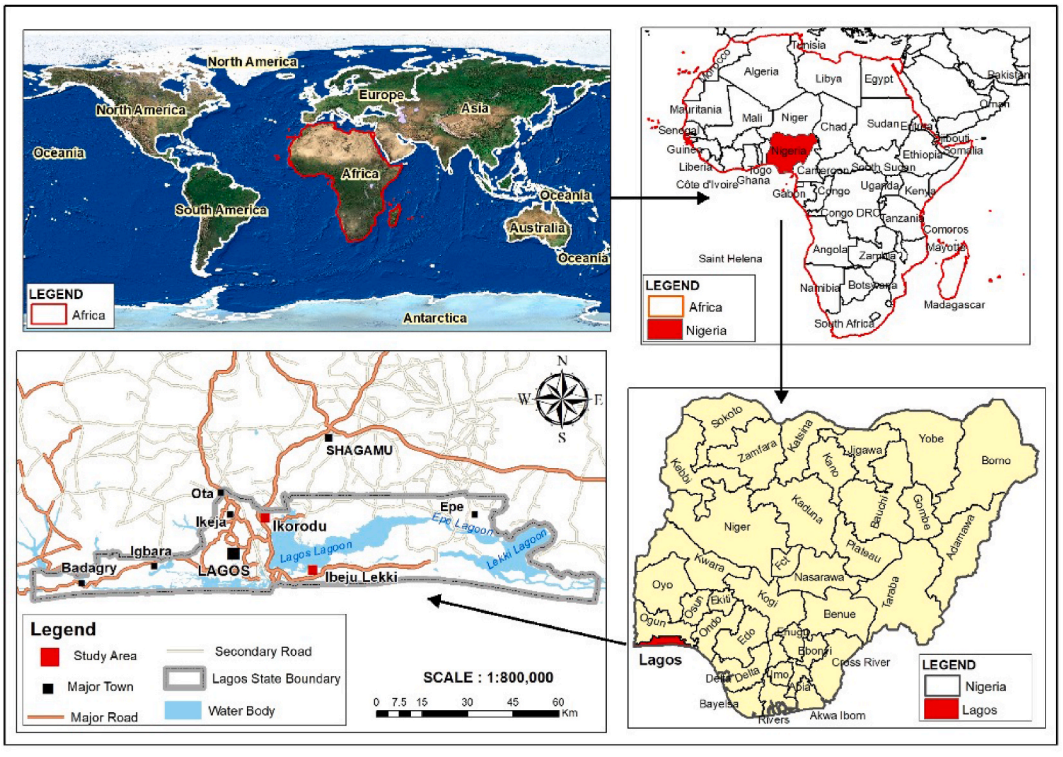

Fig. 1. Map showing the study locations (Ibeju Lekki & Ikorodu).

to 87 mm per year [35]. This rapid subsidence exacerbates coastal encroachment, further increasing the city's vulnerability to flooding. The interplay between low elevation, land subsidence, and inadequate drainage infrastructure, exacerbated by waste accumulation in drainage systems, contributes to frequent and severe flooding events. These conditions cause water to accumulate rapidly following heavy rainfall or storms, as the city's drainage capacity is insufficient to manage excess runoff effectively [36]. While media images of the flood in 2021 captured widespread attention, the city has been experiencing increasingly severe and recurrent flooding, particularly during its two annual rainy seasons, with the April to July rains being the most intense [35].

A narrow boundary separates regions susceptible to floods and those that are not [18]. This is because an area may experience flooding overnight, even if it is not officially classified as a flood plain. Cities in developing nations are more susceptible to the effects of flooding [37]. In 2010, flooding was reported in several neighbourhoods in Lagos, including Ajegunle, Agiliti, Ikorodu, Ikoyi, Ipaja-Ayobo, Mile 12, and Victoria Island [38]. Etuonovbe [39] bemoans that the frequent flooding of Lagos state during the rainy season is responsible for significant property damage and loss of life. Flooding in Lagos is heightened by factors such as canal blockages, inadequate drainage, heavy rainfall, and urban encroachment [40]; [41]. Additional contributors include climate change, soil moisture, and the discharge from nearby dams [42].

With the issue of rising climate change, Nicholls et al. [43] found that Lagos was predicted to rank fifth of the most exposed cities to climate change. This present study is focused on two flood-prone LGAs in Lagos State, Nigeria: Ikorodu and Ibeju Lekki. The selection of these areas for investigation stems from their historical flood risks, impact of previous flooding, and their status as high-risk areas as put forward by the hydrological service agency [44,45]. This means their selection is strongly justified based on their significant flood risk profiles and their contextual relevance to the research objectives of this present study. Ibeju-Lekki, located along Lagos' Atlantic coastline, is highly vulnerable to coastal flooding. This is largely due to rising sea levels and frequent storm surges, which have been exacerbated by rapid urbanisation and large-scale developments [46] such as the Lekki Free Trade Zone and the Dangote refinery. The alteration of natural drainage systems in this area has led to severe flooding during heavy rainfall [47], making it a critical zone for studying how flood risks influence property investment decisions.

Past flooding events have caused substantial property damage, raising urgent questions about the resilience of ongoing and planned developments. Ikorodu, on the other hand, is situated near Lagos Lagoon and is intersected by rivers and wetlands. The area experiences frequent inland flooding, particularly during intense rainfall and lagoon overflow. Unregulated urban expansion and inadequate drainage infrastructure have intensified the flood risks faced by residents and investors. The selection of these two areas reflects an effort to capture the diverse nature of flood risks in Lagos State, with Ibeju-Lekki representing coastal flooding challenges and Ikorodu exemplifying inland flooding scenarios. When compared to other flood-prone areas like Ajah or Victoria Island, Ibeju-Lekki and Ikorodu present a compelling case for study. Ibeju-Lekki stands out as an emerging development zone with high investor interest, despite its well-documented flood vulnerabilities. This makes it a prime location for examining how investors weigh risks against the promise of high returns in high-growth areas. Ikorodu, in contrast, represents a more established residential hub with substantial flood risks but less visibility in terms of large-scale investments. Together, these areas provide a balanced perspective on flood risk management, offering insights into both emerging and established flood-prone regions in Lagos.

The availability of data and ease of accessibility further strengthened the rationale for selecting these locations. Both areas have been the focus of previous environmental and urban studies, which facilitated access to secondary data and streamlined primary data collection efforts. Additionally, both Ibeju-Lekki and Ikorodu have been identified as critical zones for intervention in the Lagos State flood management plan, underscoring their importance to policymakers and stakeholders. The attention of both the government and the property sector to flood mitigation strategies in these areas highlights their practical significance for this research. The study sites were selected not only for their flood risk profiles but also for their economic and social relevance to property investment [32]. These locations offer a representative mix of challenges and opportunities, making them ideal for exploring the intersection of flood risk and investment behaviour. While further comparative studies in other areas would be valuable, the choice of Ibeju-Lekki and Ikorodu provides a robust foundation for understanding the complexities of flood-related investment decisions.

2.2. Target population

This research primarily focuses on residential properties in flood-prone areas due to its critical significance in the built environment. Participants in this study are important stakeholders in the built environment sector. The participants include property investors and estate agents. They both play a crucial role in the real estate market. Their strategic decisions could significantly play a role in the sustainability, resilience, and desirability of properties, particularly in areas with high-risk such as flood-prone zones. Estate agents act as intermediaries between buyers, sellers, landlords, and tenants, offering expertise in property valuation, marketing, and legal transactions [48]. In addition, they serve as advisors to property investors, providing insights into emerging markets, risks, and investment opportunities. Property investors, on the other hand, comprising individuals or entities, allocate capital to residential real estate to generate returns through rental income, capital appreciation, or both [19]. Their role is central to shaping housing availability, affordability, and sustainability. Investors depend on estate agents for property sourcing, marketing, and tenant acquisition, with both stakeholders collectively influencing market pricing, housing demand, and urban sustainability through property investment decisions.

The two stakeholders for this study represent two sides of the same market equation - one as the decision-maker with financial stakes and the other as a facilitator with market expertise. Property investors' choices directly impact market dynamics in flood-prone areas, while estate agents influence how these choices are framed and executed. Through this comparison, the study can reveal not only how risk is perceived differently but also how these perceptions influence market behaviour, property values, and the overall resilience of flood-prone real estate markets. It will also highlight the interplay between subjective and objective risk assessments.

Investors tend to approach risk from a financial standpoint, driven by data, market trends, and long-term predictions, while estate agents often operate based on more immediate market conditions, customer perceptions, and property status. The divergence in their approaches offers a valuable perspective on how flood risks are understood and managed within the real estate sector.

The opinions of real estate professionals are important in housing studies [49], thereby necessitating their involvement in this study. The target population for this present study comprised property investors and estate agents who have visibility within the study area. Property investors own the premises, while estate agents provide advisory services during the investment process. While both are stakeholders in real estate transactions, their motivations, responsibilities, and perspectives on risk can vary significantly, especially when considering the challenges posed by flood risks. It is therefore crucial to examine more deeply the role both stakeholders play in the property market and how their opinion differs in terms of risk assessment, particularly in flood-prone areas.

Investors are primarily concerned with the financial returns on their investments, often weighing risks against potential profits. Their risk perception is influenced by various factors such as property values, potential rental income, the long-term appreciation of the asset, and external influences like governmental policies and incentives. In flood-prone areas, investors are likely to assess the risks of property damage, loss of income due to tenant displacement, and increased maintenance costs as key determinants in their decision-making processes. They may also factor in the availability of flood insurance, the presence of mitigation measures (e.g., levees or drainage systems) [50], and broader market conditions when evaluating the feasibility of an investment. For investors, the ultimate focus is on whether the financial rewards justify the environmental risks associated with flooding. Estate agents, on the other hand, play a more intermediary role between buyers and sellers, providing market insights, facilitating transactions, and offering advice on property values and trends. Their risk perception is typically shaped by their need to serve clients, both buyers and sellers, and maintain the reputation of their business within the local market. While estate agents are aware of the risks associated with flood-prone properties, their primary focus is on ensuring that properties are marketed and sold successfully, often based on client needs and current market demand. Estate agents may emphasize mitigation efforts or local government initiatives that reduce flood risks, but they may not have the same depth of concern over long-term financial implications that investors typically consider.

To ensure the inclusion of property investors into this present study population, establishing their years of experience or investment portfolio is required considering the complexity of the real estate market being studied, and the depth of insights required. Generally, it is expected that a reasonable threshold should ensure that participants have sufficient experience to provide meaningful responses regarding investment trends, risk management, and market behaviour, particularly in contexts involving environmental risks such as flooding. For this present study, the inclusion criteria purposively coopt investors who own two or more residential properties as portfolios with the estate agents being studied, with a minimum of one of such properties in the flood-prone area understudy. This ensures that the sample consists of participants with firsthand experience and direct exposure to the challenges of flood risk assessment, mitigation, and financial implications. However, in selecting these investors, the referral system from the estate agents was used as a benchmark.

3. Data collection techniques

The study sample for the estate agents was obtained from the directory of the Nigerian Institution of Estate Surveyors and Valuers (NIESV). In the context of Lagos State's property market, where data scarcity and informality are prevalent, snowball sampling was the most practical method for reaching property investors in flood-risk areas. The exploratory nature of this research, which sought to understand how flood risk perception influences property investment decisions, further supported the use of this non-probabilistic approach. Although snowball sampling is prone to selection bias and high sampling error [51,52], it was considered appropriate given the challenges of identifying participants (property investors) through their residence in Nigeria, where land records are often inaccurate or unregistered. The snowball method leveraged on the estate agents' existing networks within the study area, proving effective in housing market research in developing countries [53]. Data collection was facilitated through an email drop-off survey, where estate agents were asked to refer the researcher to three clients, including one from each of the study locations: Ibeju Lekki (Island) and Ikorodu (Mainland). This referral process adhered to data security regulations in Nigeria. The decision to use snowball sampling in this study was driven by the specific challenges of accessing property investors who own or occupy premises in flood-risk areas of Lagos State. The absence of publicly accessible records or formal databases of property investors, particularly in flood-prone zones, made traditional sampling methods impractical. Snowball sampling was thus chosen as an appropriate method to identify and reach these hard-to-reach participants [54]. The study relies on the estate agents to refer clients within their networks, this approach facilitated access to a crucial but elusive group of property investors whose property decisions are directly influenced by the presence of flood risks.

Several alternative sampling techniques could have been considered to mitigate these limitations and enhance the robustness of the study's findings. Purposive sampling, for example, offers another alternative. It allows researchers to deliberately select participants based on specific criteria relevant [55] to the study, such as the investor's experience [50] in managing flood risks or the value of their property investments. This method could have yielded more targeted insights by focusing on those likely to provide valuable information. However, purposive sampling also carries the risk of bias, as participant selection is based on the researcher's judgment, potentially limiting the sample's representativeness. On the other hand, simple random sampling is the most reliable method for generating a representative sample, as every member of the population has an equal chance of being selected. While this method minimises bias and maximises the likelihood of representativeness, it is often difficult to implement, especially in studies that involve hard-to-reach populations, such as property investors in flood-prone areas, especially when a complete sampling frame is not available. Finally, convenience sampling, though easy and cost-effective, would likely introduce significant bias into the study. It selects participants based on their availability and willingness to participate, making it unsuitable for studies where representativeness is crucial,

such as this one.

Nonetheless, snowball sampling has inherent limitations [54], particularly in relation to sample bias. The reliance on referrals introduces the risk of over-representation of investors within specific social or professional networks, potentially resulting in a lack of diversity in the sample. Investors who share similar backgrounds or views on flood risks may be more likely to dominate the participant pool, thereby limiting the range of insights captured. Additionally, smaller or less connected property investors could be underrepresented, skewing the results toward more prominent or formalised investor groups. To counteract these potential biases, several strategies were employed. First, the selection of initial participants - property investors who own properties in different flood-prone areas of Lagos - was carefully designed to include a range of investor profiles. These initial participants varied in terms of the types of properties they owned, their investment scale, and their geographic location within flood-risk zones. This diverse selection helped to ensure that a broad spectrum of investor perspectives was incorporated into the study from the outset. Second, the referral process was closely monitored to avoid over-reliance on any single network or subgroup. When necessary, new participants were introduced to extend the sample to underrepresented categories of property investors, ensuring a more balanced representation across the spectrum of property investors in flood-risk areas. Furthermore, to validate the findings, the data collected through snowball sampling were cross-checked with secondary sources such as government publications, real estate reports, and existing studies on flood risk and property markets in Lagos. This process of triangulation served to enhance the robustness of the results, ensuring that they were consistent with broader market patterns and not unduly influenced by network bias. The data collection process was also iterative, allowing for adjustments as needed to ensure the sample remained representative of the broader population of property investors in flood-prone areas. This flexible approach ensured that any emerging biases could be addressed in real time, improving the quality and diversity of the data.

4. Data sources

A preliminary content analysis of existing literature and the authors' expertise in residential investment was conducted to identify factors influencing investment decisions [27,56–58]. This analysis identified 37 factors, categorized them into location, neighbourhood, structural, market/economic, behavioural, and risk factors, and labeled them as F1-F37 for ease of reference and analysis. The reliability of the questionnaire was confirmed through a Cronbach alpha test, yielding values of 0.858 and 0.862 for property investors and estate agents, respectively, indicating strong internal consistency and validity of the instrument. Fig. 2 shows the conceptualised factors investigated in the study.

4.1. Questionnaire design and administration

The questionnaire was designed in a simple and clear form to ensure the participants fully understood the subject matter and

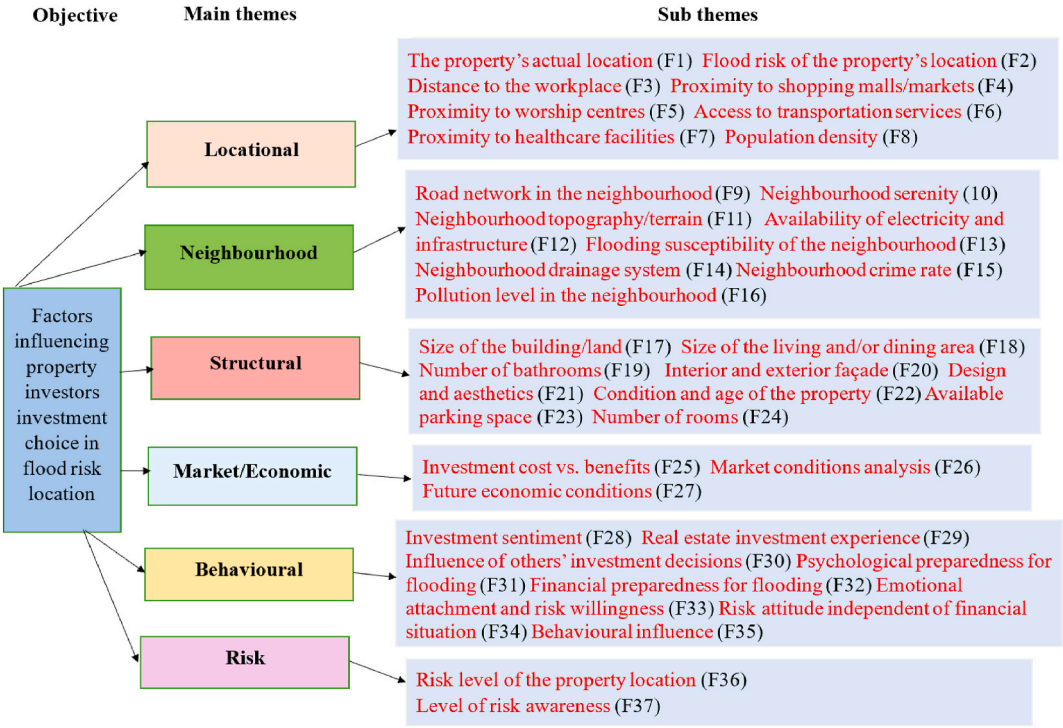

Fig. 2. Predetermined and emergent themes for factors influencing investment choice in flood risk location.

minimise potential bias from insufficient knowledge. The questionnaire was structured into two sections with section A focusing on the respondent's demographics while section B was designed with a Likert scale response to questions revolving around the 37 factors identified and stated in Fig. 2. The research aimed to understand the factors influencing property investors' decisions when investing in flood-risk locations. A structured questionnaire was designed to capture insights across six main themes: locational, neighbourhood, structural, market/economic, behavioural, and risk-related factors. Each of these themes was broken down into specific sub-themes, guiding the questions asked to the respondents.

In the locational theme, questions focused on how the actual location of a property influenced investment decisions, particularly in relation to its exposure to flood risks. Respondents were asked about the importance of proximity to workplaces, shopping malls, transportation services, worship centers, and healthcare facilities. Another key aspect explored was whether population density in each area played a role in investment choices. The neighbourhood theme covered broader environmental and infrastructural aspects. Questions were designed to assess how factors such as the quality of road networks, serenity, topography, and the availability of electricity and infrastructure affected decision-making. Additionally, the study explored concerns about flooding susceptibility within the neighbourhood, drainage systems, crime rates, and pollution levels, all of which could shape investment preferences. For structural considerations, the questionnaire delved into the physical attributes of properties. Respondents were asked about their preferences regarding the size of the land and living spaces, the number of rooms and bathrooms, and the availability of parking spaces. Aesthetic features such as interior and exterior design, as well as the condition and age of the property, were also examined to understand their influence on desirability.

From a market and economic perspective, the study sought to understand how financial considerations influenced investment choices. Questions were framed to explore how investors balanced the cost versus benefits of an investment, the role of market conditions, and expectations regarding future economic trends in flood-prone areas. The behavioural theme was crucial in capturing investor psychology and decision-making influences. The research investigated sentiments toward real estate investments in flood-risk locations, past investment experiences, and how social influence shaped decision-making. Further questions probed psychological and financial preparedness for flooding, emotional attachment to properties, risk willingness, and how individuals perceived risk independent of their financial situation. Finally, the risk theme directly addressed investor perceptions of flood-related risks. Questions in this section focused on the perceived risk level of investing in flood-prone locations and the extent of investors' awareness of such risks.

The questionnaire was administered to these two sets of stakeholders (property investors & estate agents) to compare their perspectives on the subject matter in order to arrive at a more validated result for the study findings. The questionnaire survey aims to assess property investors' attitudes toward flood-prone areas by identifying the factors influencing their investment decisions in these settings. The questionnaire was administered using a combination of online surveys and paper-based distribution, ensuring broad participation. Although the data for this study was gathered using a structured questionnaire survey, only questionnaires containing relevant answers were essential to the study. They were validly reported as a valuable response to the research. The responses which formed the basis of the research findings for this present study were obtained from 75 property investors and 75 estate agents. Table 1 summarises the completed questionnaires found suitable for the analysis for this present study, based on the questionnaire distribution strategy used.

As shown in Table 1, the distribution and retrieval of questionnaires among estate agents and property investors provided insights into the response rate and validity of the collected data. A total of 186 questionnaires were distributed to estate agents, of which 93 (50.00 %) were returned. Among these, only 75(80.64 %) were deemed valid for analysis. Similarly, 111 questionnaires were distributed to property investors, with 89(80.18 %) returned, and 75(84.27 %) considered valid. The relatively higher returned rate among property investors (80.18 %) compared to estate agents (50.00 %) suggests that investors may have a greater interest in the research topic, possibly due to their direct financial exposure to flood risks. The validity of the responses (80.64 % for estate agents and 84.27 % for property investors) indicate a high level of response rate, ensuring reliable data for assessing investment behaviour in flood-prone areas. The response pattern highlights the engagement of both estate agents and property investors in discussions surrounding flood risk and property investment with the valid responses underscores the reliability of the dataset in exploring how flood risk perceptions could shape real estate decision-making.

Fig. 3 provides insights into the demographic and investment characteristics of the property investors. With respect to Fig. 3, the sample of the property investors consists of 75 participants, with males comprising 48 % and females 36 %, while 16 % preferred not to disclose their gender. The age distribution indicates the majority (41.33 %) aged 41–50 years, followed by 32 % who are above 60 years and 22.67 % within the 51-60-year range. This age concentration suggests that middle-aged and older individuals, who typically have more experience and financial stability, dominate the real estate investment market in flood-prone areas. The marital status data reveal that 68 % of respondents are married, while smaller proportions are widowed (14.67 %), divorced (6.66 %), single (2.67 %), or preferred not to disclose their status (8 %). As per experience in real estate investment, 28 % have more than 11 years of experience, while an equal proportion (28 %) have between 6 and 8 years. Investors with 9–11 years of experience constitute 21.33 %, while those

Table 1
Distribution and retrieval of the administered questionnaires.

Respondents	Number of Questionnaires		
	Distributed	Returned	Valid
Estate agents	186(100.00 %)	93(50.00 %)	75(80.64 %)
Property Investors	111 (100.00 %)	89 (80.18 %)	75 (84.27 %)

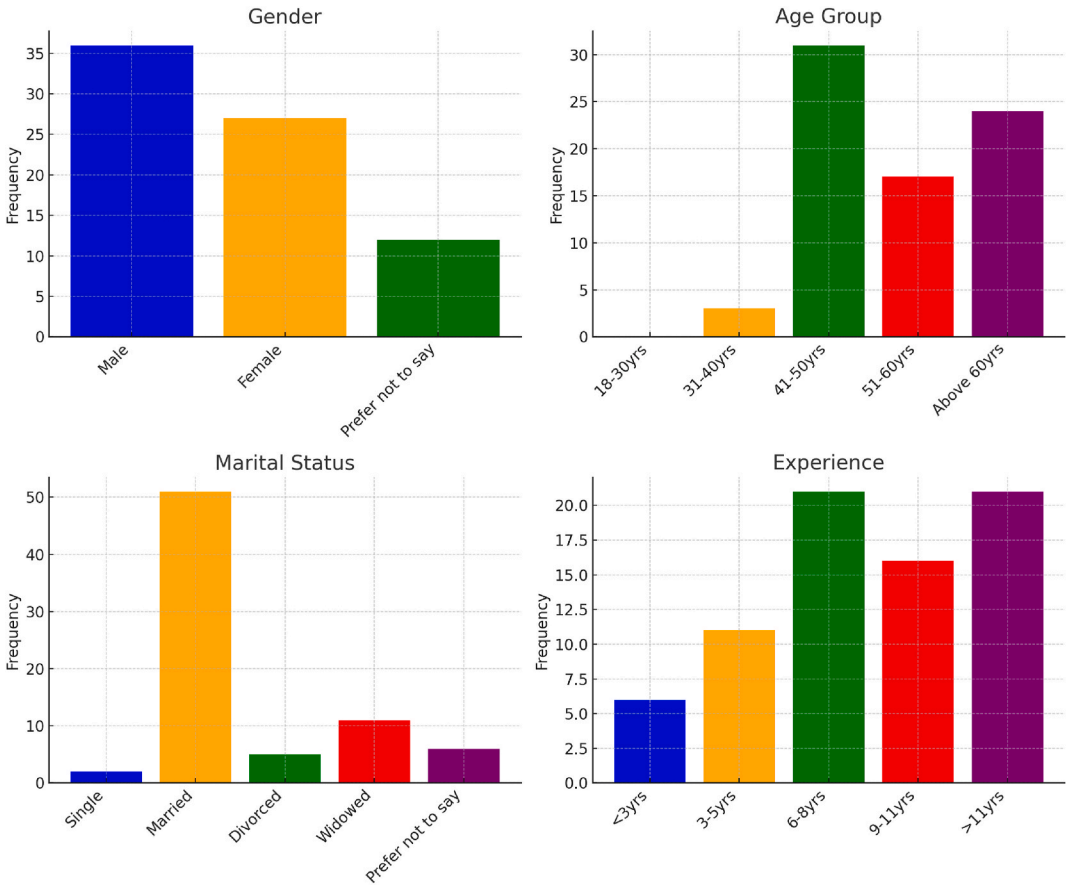

Fig. 3. Demographics information of the property investors.

with 3–5 years and less than 3 years make up 14.67 % and 8 %, respectively. This suggests that more experienced investors, who are likely to have encountered flood-related challenges, dominate the market. Their investment choices may be influenced by their prior exposure to flood risks, adaptive strategies, and perceptions of long-term property sustainability.

4.2. Ethical considerations

The ethical considerations in this study were key in developing the research and ensuring that the data are used as stated in the questionnaire. The data used for the study were collected between February and May 2022. The data was obtained from respondents who were all informed about the purpose of the study. The respondents gave their consent to use the data for the research and they shared their responses willingly. The research questionnaire was also used to inform the respondent about the research and the responsibility of the researchers in the investigation. The data collection in this study protects the respondents' data and ensures that the interests of the respondents are safeguarded. There was no coercion exerted on the people who participated in the survey to induce them to respond. The research participants were all given a rundown of the objectives of the study as well as the rationale behind their selection. Due to their participation in this study, they were in no way misled or subjected to any kind of stress that may affect the information provided. The respondents were also assured that they would remain anonymous during the process.

4.3. Method of data analysis

To easily understand, ensure consistency and reliability and unify the responses, the study employed the Likert scale as a tool. The Likert scale is a well-established psychometric tool that facilitates the measurement of attitudes, perceptions, and opinions across various contexts. Its structured format allows respondents to express varying degrees of agreement or disagreement regarding specific statements, which provides nuanced insights into their perceptions of each factor. This study had to adopt the tool following its adoption and vast use in various studies as a significant tool in evaluating the perception of stakeholders on studies [59,60] in the built environment. The tool used in this study possess the ability to capture the complexity of participants' attitudes toward multiple factors influencing investment decisions in flood-prone areas. This enables respondents to convey the intensity of their feelings, which is crucial for evaluating factors with potentially significant variability in perceived importance.

The Likert scale allowed for the calculation of average agreement levels across various statements, which were then ranked to provide a clearer interpretation of the data. Responses regarding the motivations for property investment were rated using a five-point Likert scale [61–63], where 1 indicated "strongly disagree", 2 "disagree", 3 "neutral", 4 "agree", and 5 "strongly agree". The average scores for each factor were computed based on perceived importance, and these factors were ranked according to their weighted significance. Calculating the mean score involves averaging the categorized responses, considering the parameters used for categorisation. In this research, the decision rule is implemented according to the guidelines provided in Table 2.

As stated earlier, a comprehensive literature review helped identify a range of factors relevant to investment decisions in contexts affected by flood risk. This identification process ensured that the factors considered were not only pertinent but also reflective of the current discourse surrounding the subject. Participants were then asked to rate each factor using the Likert scale. This approach allowed for the quantification of subjective perceptions, translating qualitative insights into quantitative data that could be analysed statistically. Following the collection of responses, the data were aggregated to calculate mean scores for each factor. Factors with higher mean scores indicated greater perceived importance among respondents, thus emerging as more significant in influencing investment decisions. This method of weighing ensures that factors with widespread agreement or strong opinions are prioritised in the analysis, thereby providing a clearer picture of their relative significance.

To further substantiate the ranking, statistical techniques such as standard deviation analysis were employed to assess the variability in responses for each factor. Factors with lower standard deviations indicated a higher level of consensus among respondents regarding their significance, while those with higher standard deviations suggested more divergent opinions. This analysis provided additional context to the rankings and highlighted the factors that were viewed with greater uniformity among participants. Finally, the ranked factors were interpreted within the broader research objectives, analysing those that emerged as most significant in relation to existing literature and theoretical frameworks. This ensured that the findings were grounded in both empirical evidence and theoretical relevance. This approach not only clarified how factors were weighed but also illuminated why certain factors emerged as particularly significant in influencing investment decisions.

To further support the research findings, additional data interpretation tools known as agreement analysis were carried out to determine the extent of consensus (if any) between the measured constructs of the perceptions of the target participants. This agreement analysis, as adopted by Adabre et al. [64] & Oyetunji et al. [65] was conducted to determine the extent of agreement between the opinion of property valuers cum developers and service users. According to Zhang [66], rank agreement analysis is a quantitative approach that adopts the rank agreement factor (RAF). RAF reveals the absolute average disparity in the factors ranking between the two groups. The equations for computing the RAF can be computed using the equations put forward by Zhang [66]; Adabre & Chan [67] & Adabre et al. [64]. The referenced literature presents the details of the equations for the ranking analysis, the Rank Agreement Factor (RAF), the Maximal Rank Agreement Factor (RAF_{max}), the Disagreement Percentage (DP), and the Agreement Percentage (DP). Other terms include the R_i of a benefit, which is the summation of the ranks of the benefits or drivers from the two groups. R_{i1} denotes the rank of benefits within a component in group 1. R_{j2} represents the mean value of the total ranks. N denotes the number of variables in each component. K denotes the number of groups ($k = 2$). R_{ij} represents the summation of the ranks of a given factor by the two groups. R_{i2} represents the rank of factors within a component in group 2. (R_{i1}-R_{i2}) gives the ranking difference in the perception obtained from the two groups.

5. Results

The analysis of the motivations behind real estate investments in flood-risk areas in Table 3 reveals a hierarchy of significance based on the mean values, standard deviations, and standard errors associated with various factors (labeled as F1 to F37). These factors represent the different motivations or considerations investors might have when choosing to invest in such high-risk areas. The factors labeled F12 and F15 emerged as the most significant motivations, each with a mean value of 4.74 and low standard deviations (0.470 and 0.525, respectively), indicating a strong consensus among respondents. The small standard errors (0.055 and 0.061) further reinforce the reliability of these results. Since these factors share the highest rank, it suggests that they are critical drivers for investment decisions in flood-risk areas.

The exact nature of these factors, while not specified in the table, is likely central to the decision-making process, potentially reflecting high return expectations, government incentives, or unique market conditions that outweigh the perceived risk. Following closely is F1 with a mean value of 4.69 and similarly low variability (standard deviation of 0.466). The narrow range of responses (standard error of 0.054) further supports consistency in the perceived importance of this factor. Other factors like F13, F3, F10, and F16 also rank highly with mean values above 4.5, although they display slightly higher variability (standard deviations between 0.577

Table 2
Mean analysis criteria.

Decision Criteria	Decision Category
4.50 - 5.00	Most Significant
3.50 - 4.49	Significant
2.40 - 3.49	Moderately Significant
1.50 - 2.39	Slightly Significant
1.00–1.49	Less Significant
0.00–0.99	Not Significant

Table 3
Property investors' motivations for property investment decisions in flood risk areas.

Factors	*Code*	*Mean*	*Std. Dev.*	*Std Error*	*Rank*	*Decision*
Availability of electricity and infrastructure	F12	4.74	0.470	0.055	1	*Most Significant*
Neighbourhood crime rate	F15	4.74	0.525	0.061	1	*Most Significant*
The property's actual location	F1	4.69	0.466	0.054	3	*Most Significant*
Flooding susceptibility of the neighbourhood	F13	4.62	0.590	0.069	4	*Most Significant*
Distance to the workplace	F3	4.55	0.644	0.075	5	*Most Significant*
Neighbourhood serenity	F10	4.55	0.577	0.067	5	*Most Significant*
Pollution level in the neighbourhood	F16	4.55	0.622	0.072	5	*Most Significant*
Access to transportation services	F6	4.50	0.815	0.095	8	*Most Significant*
Road network in the neighbourhood	F9	4.47	0.624	0.073	9	*Significant*
Condition and age of the property	F22	4.42	0.776	0.090	10	*Significant*
Emotional attachment and risk willingness	F33	4.38	0.607	0.076	11	*Significant*
Level of risk awareness	F37	4.37	0.604	0.076	12	*Significant*
Risk attitude independent of financial situation	F34	4.33	0.672	0.085	13	*Significant*
Investment cost vs benefits	F25	4.31	0.580	0.070	14	*Significant*
Neighbourhood topography/terrain	F11	4.26	0.76	0.088	15	*Significant*
Neighbourhood drainage system	F14	4.26	0.777	0.090	15	*Significant*
Flood risk of the property's location	F2	4.25	0.790	0.091	17	*Significant*
Number of rooms	F24	4.23	0.609	0.071	18	*Significant*
Interior and exterior façade	F20	4.22	0.815	0.095	19	*Significant*
Size of the building/land	F17	4.20	0.740	0.086	20	*Significant*
Market conditions analysis	F26	4.19	0.718	0.087	21	*Significant*
Population density	F8	4.12	0.843	0.098	22	*Significant*
Available parking space	F23	4.12	0.827	0.096	22	*Significant*
Proximity to healthcare facilities	F7	4.08	0.872	0.101	24	*Significant*
Design and aesthetics	F21	4.08	0.697	0.081	24	*Significant*
Number of bathrooms	F19	4.03	0.875	0.102	26	*Significant*
Proximity to shopping malls/markets	F4	4.00	0.876	0.102	27	*Significant*
Investment sentiment	F28	3.87	0.945	0.115	28	*Significant*
Size of the living and/or dining area	F18	3.85	0.788	0.092	29	*Significant*
Risk level of the property	F36	3.52	0.965	0.122	30	*Significant*
Behavioural influence	F35	3.38	1.038	0.131	31	*Moderately Significant*
Proximity to worship centers	F5	3.35	1.152	0.134	32	*Moderately Significant*
Future economic conditions	F27	3.28	1.195	0.145	33	*Moderately Significant*
Financial preparedness for flooding	F32	3.27	1.221	0.154	34	*Moderately Significant*
Real estate investment experience	F29	3.24	1.053	0.128	35	*Moderately Significant*
Influence of others' investment decisions	F30	2.56	1.070	0.130	36	*Moderately Significant*
Psychological preparedness for flooding	F31	2.44	0.998	0.121	37	*Moderately Significant*

and 0.644). These findings indicate that while these motivations are widely acknowledged as significant, there is slightly more variation in how respondents perceive their importance.

Many of the remaining factors fall into the "Significant" category, with mean values ranging from 4.00 to 4.47. Factors like F9 with a mean of 4.47 and F22 with a mean of 4.42 are on the higher end of this group, indicating strong but slightly less unanimous agreement among respondents. These factors may represent important, but not decisive, considerations in investment decisions, such as secondary financial benefits, moderate government support, or perceived market trends. The factors labeled F36 and F18, although still categorized as significant, have lower mean values (3.52 and 3.85, respectively) and relatively higher standard deviations, suggesting greater disagreement among respondents. These may represent motivations that are recognized by some investors but are not universally considered important.

At the lower end of the spectrum, factors F35 through F31 exhibit mean values between 2.44 and 3.38, with standard deviations generally exceeding 1.0. This high variability indicates a broad range of opinions, suggesting that these factors are less critical and perhaps only relevant to specific niches within the investment community. These factors may relate to less tangible or less immediate considerations, such as environmental concerns, long-term market predictions, or personal attachment to the area. Notably, F30 and F31 have the lowest mean values (2.56 and 2.44, respectively), indicating that they are considered the least significant motivations for real estate investment in flood-risk areas. The relatively high standard deviations (over 1.0) reflect considerable divergence in opinions, possibly indicating that these factors are only occasionally relevant or are viewed as minor considerations by most investors.

The analysis of the motivations for real estate investment in flood-risk areas in Table 4 reveals a clear hierarchy of factors influencing investor decisions. The data shows a range of opinions, from factors considered most significant to those viewed as moderately significant. The insights gathered from these findings shed light on how investors perceive opportunities and risks in flood-prone areas. F1 emerged as the top motivator with a mean score of 4.76, making it the most significant factor influencing investment in flood-risk areas. The low standard deviation (0.516) and standard error (0.060) indicate a strong consensus among investors regarding the importance of this factor. This suggests that F1 represents a fundamental consideration for investors, likely involving high expected returns, robust government incentives, or strategic advantages that outweigh the inherent risks associated with flood-prone areas.

Closely following are F2 and F12, both with a mean score of 4.64. These factors also display low standard deviations (0.538 and 0.629, respectively), indicating a high level of agreement among respondents. The ranking of these factors as the most significant

Table 4
Estate agents' perspectives on motivations for property investment decisions in flood risk areas.

Factors	*Code*	*Mean*	*Std Deviation*	*Std Error*	*Rank*	*Decision*
The property's actual location	F1	4.76	0.516	0.060	1	*Most Significant*
Flood risk of the property's location	F2	4.64	0.538	0.063	2	*Most Significant*
Availability of electricity and infrastructure	F12	4.64	0.629	0.073	2	*Most Significant*
Access to transportation services	F6	4.60	0.510	0.059	4	*Most Significant*
Road network in the neighbourhood	F9	4.51	0.529	0.061	5	*Most Significant*
Neighbourhood crime rate	F15	4.45	0.599	0.069	6	*Significant*
Condition and age of the property	F22	4.45	0.577	0.067	6	*Significant*
Flooding susceptibility of the neighbourhood	F13	4.32	0.681	0.079	8	*Significant*
Influence of others' investment decisions	F30	4.31	0.620	0.073	9	*Significant*
Distance to the workplace	F3	4.29	0.941	0.109	10	*Significant*
Size of the building/land	F17	4.28	0.562	0.065	11	*Significant*
Neighbourhood serenity	F10	4.24	0.714	0.082	12	*Significant*
Population density	F8	4.23	0.781	0.090	13	*Significant*
Interior and exterior façade	F20	4.18	0.765	0.089	14	*Significant*
Design and aesthetics	F21	4.18	0.817	0.095	14	*Significant*
Number of rooms	F24	4.15	0.715	0.083	16	*Significant*
Financial preparedness for flooding	F32	4.15	0.696	0.081	16	*Significant*
Psychological preparedness for flooding	F31	4.14	0.678	0.080	18	*Significant*
Neighbourhood topography/terrain	F11	4.12	0.900	0.104	19	*Significant*
Available parking space	F23	4.09	0.847	0.098	20	*Significant*
Pollution level in the neighbourhood	F16	4.08	0.834	0.096	21	*Significant*
Market conditions analysis	F26	4.07	0.793	0.093	22	*Significant*
Proximity to shopping malls/markets	F4	4.03	0.915	0.106	23	*Significant*
Future economic conditions	F27	4.01	0.814	0.095	24	*Significant*
Number of bathrooms	F19	3.95	0.858	0.100	25	*Significant*
Investment cost vs benefits	F25	3.88	0.918	0.108	26	*Significant*
Emotional attachment and risk willingness	F33	3.84	0.811	0.095	27	*Significant*
Behavioural influence	F35	3.84	0.861	0.100	27	*Significant*
Neighbourhood drainage system	F14	3.81	0.881	0.102	29	*Significant*
Risk attitude independent of financial situation	F34	3.80	0.758	0.088	30	*Significant*
Real estate investment experience	F29	3.78	0.676	0.080	31	*Significant*
Risk level of the property	F36	3.70	0.789	0.092	32	*Significant*
Size of the living and/or dining area	F18	3.58	0.965	0.112	33	*Significant*
Proximity to healthcare facilities	F7	3.47	0.977	0.113	34	*Moderately Significant*
Proximity to worship centers	F5	3.44	1.017	0.117	35	*Moderately Significant*
Investment sentiment	F28	3.32	0.990	0.117	36	*Moderately Significant*
Level of risk awareness	F37	2.68	1.035	0.120	37	*Moderately Significant*

suggests that investors see multiple core benefits in investing in these areas, possibly linked to financial incentives, perceived undervaluation of properties, or long-term market potential. The close scores and low variability for these factors reflect a strong belief that the rewards justify the risks. F6 with a mean of 4.60 and F9 with a mean of 4.51 are also ranked as the most significant, though slightly lower than the top three. The consistency of responses (standard deviations of 0.510 and 0.529) suggests that these factors are still critical but may involve slightly more nuanced considerations, such as manageable risk levels or specific local market conditions that make flood-risk properties attractive.

The second tier of factors, classified as "Significant," includes F15 and F22 (both with a mean of 4.45), and others like F13, F30, and F3 (mean scores ranging from 4.29 to 4.32). These factors are important but not as universally critical as the top-ranked ones. Investors likely view these factors as significant but with a recognition that they come with higher variability in risk assessment or return expectations. For example, F15 and F22 might represent considerations like flood insurance availability or infrastructural improvements that mitigate flood risks, making these properties viable for investment under certain conditions. Factors such as F13 and F30 could involve strategic considerations that add value in specific contexts, such as proximity to urban centers or anticipated future development. F3, with its relatively higher standard deviation (0.941), suggests that while it is significant, there is more diversity in investor opinions, possibly reflecting differing views on long-term market trends or personal investment strategies. Investors may believe that despite the risks, these factors contribute to a property's long-term value appreciation, especially in areas expected to benefit from urban growth or climate adaptation strategies. The factors ranked as moderately significant, such as F7, F5, F28, and F37, have lower mean scores (ranging from 2.68 to 3.47) and higher standard deviations, indicating more diverse opinions and less consensus.

These factors might represent niche or less immediate considerations, such as environmental sustainability, long-term environmental risk management, or personal values. The higher variability suggests that these motivations are important to a smaller subset of investors or under specific circumstances. The higher standard deviations and lower mean scores indicate that these factors are seen as less reliable or less impactful on the overall decision to invest in flood-risk areas. F37, with the lowest mean score of 2.68, likely represents a factor that is generally viewed as unimportant or only relevant in very specific scenarios. Investors may be more risk-averse regarding these factors, seeing them as potential deal-breakers unless compensated by significant returns or other strong incentives. This could include concerns about the long-term habitability of flood-prone areas or doubts about the effectiveness of mitigation strategies.

The agreement analysis between property investors and estate agents on factors influencing real estate investment decisions in flood-risk areas shown in Table 5 offers valuable insights into how these two groups perceive the risks and opportunities associated with such investments. The analysis, which considers the rankings and deviations in their perspectives, highlights both areas of consensus and divergence.

5.1. Areas of high agreement

Several factors show a relatively small difference in rankings between property investors and estate agents, indicating a strong alignment in their perceptions. For factor F1, both property investors (Rank 3) and estate agents (Rank 1) highly prioritize the potential for high returns, with a minor difference in ranking ($|Ri1 - Ri2| = 2$). This small disparity indicates a shared understanding that financial incentives are a primary motivator for investing in flood-risk areas. Estate agents likely emphasize this factor in their sales pitches, knowing it resonates strongly with investors. Another key area of agreement is F12, where both groups rank this factor very highly (Property Investors Rank 1, Estate Agents Rank 2). The slight ranking difference ($|Ri1 - Ri2| = 1$) reflects a mutual acknowledgment of the importance of government support in mitigating flood risks, which can make such investments more attractive. The agreement in the ranking of F22 (Property Investors Rank 10, Estate Agents Rank 6) further reinforces the shared belief in the market's potential in flood-risk areas. Both parties seem to recognize that demand for property, even in risk-prone areas, can present lucrative opportunities, especially if market conditions are favorable. These areas of high agreement suggest that estate agents are effectively turning into key motivators for investors, aligning their strategies to highlight aspects that both parties consider crucial for successful investment.

Table 5
Agreement analysis of factors influencing investment decisions in flood risk areas: Property investors vs estate agents' perspectives.

Factors	*Code*	*Property Investors*			*Estate Agents*			*Agreement analysis*		
		Mean	*Std Deviation*	*Rank (R_{i1})*	*Mean*	*Std Deviation*	*Rank (R_{i2})*	*R_i*	*(R_{i1} - R_{i2})*	*(Ri - Rj_2)*
The property's actual location	F1	4.69	0.466	3	4.76	0.516	1	4	2	34
Flood risk of the property's location	F2	4.25	0.790	17	4.64	0.538	2	19	15	19
Distance to the workplace	F3	4.55	0.644	5	4.29	0.941	10	15	5	23
Proximity to shopping malls/markets	F4	4.00	0.876	27	4.03	0.915	23	50	4	12
Proximity to worship centers	F5	3.35	1.152	32	3.44	1.017	35	67	3	29
Access to transportation services	F6	4.50	0.815	8	4.60	0.510	4	12	4	26
Proximity to healthcare facilities	F7	4.08	0.872	24	3.47	0.977	34	58	10	20
Population density	F8	4.12	0.843	22	4.23	0.781	13	35	9	3
Road network in the neighbourhood	F9	4.47	0.624	9	4.51	0.529	5	14	4	24
Neighbourhood serenity	F10	4.55	0.577	5	4.24	0.714	12	17	7	21
Neighbourhood topography/terrain	F11	4.26	0.76	15	4.12	0.900	19	34	4	4
Availability of electricity and infrastructure	F12	4.74	0.470	1	4.64	0.629	2	3	1	35
Flooding susceptibility of the neighbourhood	F13	4.62	0.590	4	4.32	0.681	8	12	4	26
Neighbourhood drainage system	F14	4.26	0.777	15	3.81	0.881	29	44	14	6
Neighbourhood crime rate	F15	4.74	0.525	1	4.45	0.599	6	7	5	31
Pollution level in the neighbourhood	F16	4.55	0.622	5	4.08	0.834	21	26	16	12
Size of the building/land	F17	4.20	0.740	20	4.28	0.562	11	31	9	7
Size of the living and/or dining area	F18	3.85	0.788	29	3.58	0.965	33	62	4	24
Number of bathrooms	F19	4.03	0.875	26	3.95	0.858	25	51	1	13
Interior and exterior façade	F20	4.22	0.815	19	4.18	0.765	14	33	5	5
Design and aesthetics	F21	4.08	0.697	24	4.18	0.817	14	38	10	0
Condition and age of the property	F22	4.42	0.776	10	4.45	0.577	6	16	4	22
Available parking space	F23	4.12	0.827	22	4.09	0.847	20	42	2	4
Number of rooms	F24	4.23	0.609	18	4.15	0.715	16	34	2	4
Investment cost vs benefits	F25	4.31	0.580	14	3.88	0.918	26	40	12	2
Market conditions analysis	F26	4.19	0.718	21	4.07	0.793	22	43	1	5
Future economic conditions	F27	3.28	1.195	33	4.01	0.814	24	57	9	19
Investment sentiment	F28	3.87	0.945	28	3.32	0.990	36	64	8	26
Real estate investment experience	F29	3.24	1.053	35	3.78	0.676	31	66	4	28
Influence of others' investment decisions	F30	2.56	1.070	36	4.31	0.620	9	45	27	7
Psychological preparedness for flooding	F31	2.44	0.998	37	4.14	0.678	18	55	19	17
Financial preparedness for flooding	F32	3.27	1.221	34	4.15	0.696	16	50	18	12
Emotional attachment and risk willingness	F33	4.38	0.607	11	3.84	0.811	27	38	16	0
Risk attitude independent of financial situation	F34	4.33	0.672	13	3.80	0.758	30	43	17	5
Behavioural influence	F35	3.38	1.038	31	3.84	0.861	27	58	4	20
Risk level of the property	F36	3.52	0.965	30	3.70	0.789	32	62	2	24
Level of risk awareness	F37	4.37	0.604	12	2.68	1.035	37	49	25	11

$\boldsymbol{RAF} = 306/37 = 8$; $\boldsymbol{RAF_{max}} = 580/37 = 16$; $\boldsymbol{Rj_2} = \sum f/n = 38$; $\boldsymbol{DP} = (306/580)*100 = 52.76\ \%$; $\boldsymbol{AP} = 100 - DP = 47.24\ \%$.

5.2. Areas of moderate agreement

Several factors exhibit moderate differences in rankings, suggesting that while there is some alignment, there are also significant variations in how these factors are valued by investors and estate agents. For factor F6, both property investors and estate agents rank this factor highly (Property Investors Rank 8, Agents Rank 4), with a ranking difference of 4. This indicates that both groups value the presence of resilient infrastructure, but estate agents might place a slightly higher emphasis on it, possibly due to their direct involvement in property transactions and their need to reassure clients about flood risks. Factor F33 shows a difference in ranking (Property Investors 11, Agents Rank 27), with a |Ri1 - Ri2| of 16. This suggests that property investors are more optimistic about the growth potential in flood-risk areas than estate agents, who may be more cautious due to their broader market experience. Estate agents might temper investor expectations, focusing instead on more immediate returns. F9 (Accessibility and Location): Both groups consider accessibility important (Property Investors Rank 9, Agents Rank 5), with a moderate ranking difference (|Ri1 - Ri2| = 4). This reflects a shared understanding of the importance of location, though estate agents might place slightly more importance on it due to their focus on marketability and resale potential. The moderate agreement areas indicate where estate agents and investors might need to bridge the gap in perceptions. Estate agents may need to adjust their communication strategies to better align with investor priorities or provide more detailed explanations of their rationale.

5.3. Areas of significant disagreement

The analysis reveals several factors where there is a significant divergence between the rankings of property investors and estate agents, indicating differing priorities or perceptions. For F37, this factor shows one of the largest ranking discrepancies (Property Investors Rank 12, Agents Rank 37), with a |Ri1 - Ri2| of 25. This significant difference suggests that property investors may place more importance on the community and environmental impacts of their investments, possibly due to long-term sustainability concerns or personal values. In contrast, estate agents may view this factor as less critical to the financial success of a property, focusing instead on immediate market factors. Another area of disagreement is F30, where property investors rank this factor very low (Rank 36), while estate agents rank it much higher (Rank 9), leading to a |Ri1 - Ri2| of 27. Estate agents may emphasize short-term profitability to attract clients interested in quick returns, while investors might be more concerned with long-term stability, especially in flood-risk areas. Factor F31 also shows a significant discrepancy (Property Investors Rank 37, Agents Rank 18), with a |Ri1 - Ri2| of 19. Investors may deprioritize social factors in their decision-making, focusing more on financial metrics, while estate agents might recognize the importance of these aspects in making a property attractive to a broader range of buyers. These significant disagreements highlight areas where estate agents may need to better understand investor motivations or where property investors might benefit from the market insights of estate agents. Bridging these gaps could involve more in-depth discussions about the importance of various factors and how they impact the overall investment strategy.

6. Discussion of results

The actual location of the property (F1, Mean = 4.76) stands out as the most critical factor influencing investment decisions according to the perception of the property investors shown in Table 3. This aligns with the findings of Lieser and Groh [68], who argue that location is a fundamental determinant of real estate value and investment attractiveness. Their research underscores that desirable locations not only enhance property values but also attract higher levels of investment, reinforcing the significance of location in our results. The flood risk of the property's location (F2, Mean = 4.64) and distance to the workplace (F3, Mean = 4.64) are tied for second place. This finding is consistent with Ullah et al. (2020), who demonstrate that flood risk significantly affects property values, especially in flood-prone areas. Their study highlights that flood risk perception is a major determinant of property value and investment decisions. Additionally, the significance of the distance to the workplace supports the findings of Manaugh et al. (2010), which show that proximity to work locations influences residential choices and investment decisions due to commuting convenience. Proximity to shopping malls/markets (F4, Mean = 4.60) and proximity to worship centers (F5, Mean = 4.51) rank fourth and fifth, respectively. These results are corroborated by Pivo and Fisher [69], who find that access to amenities, such as shopping centers and places of worship, enhances property desirability and investment attractiveness. Kaluthanthri and Jayawardhana [70] also highlight the importance of neighbourhood factors, including community facilities, in shaping housing choices and investment decisions. Factors such as access to transportation services (F6, Mean = 4.45), proximity to healthcare facilities (F7, Mean = 4.45), and population density (F8, Mean = 4.32) are also significant. The work of Dudzińska et al [71] supports this view by emphasizing the role of infrastructure and services in influencing property values. Their study demonstrates that access to transportation and healthcare services is crucial for residential decisions and aligns with our findings. Risk attitude independent of financial situation (F34, Mean = 3.47) and behavioral influence (F35, Mean = 3.44) have moderate significance. This is consistent with Ndung'u and Kung'u [72], who argue that while investor behavior and risk perceptions are relevant, they are secondary to more immediate factors such as location and risk mitigation. The level of risk awareness (F37, Mean = 2.68) is identified as the least significant factor. This finding aligns with Fox-Rogers et al. [73], who suggest that while awareness of risk is acknowledged, it does not always translate into significant investment decisions compared to more tangible factors like location and flood risk.

The analysis presented in Table 4 shows that the property's actual location emerges as the most influential factor, with a mean score of 4.76, placing it at rank 1 among the factors investigated. This finding aligns with the work of Lieser and Groh [68], who underscore the primacy of location in determining real estate values and investment potential. Their study suggests that prime locations are inherently more attractive to investors, reinforcing the significance of the location identified in this study. Tied for second place, with a

mean score of 4.64, are the flood risk of the property's location and the availability of electricity and infrastructure. The prominence of flood risk as a key factor corroborates the findings of Ullah et al. (2020), who observed that properties in flood-prone areas often face diminished values due to perceived and actual risks. The equal importance given to infrastructure echoes the research of Pivo and Fisher [69], who highlights the value of accessible amenities, which can significantly enhance a property's desirability even in risk-laden areas. Access to transportation services ranks 4th (Mean = 4.60), and the road network in the neighbourhood ranks 5th (Mean = 4.51), both of which are considered most significant by estate agents. This is in line with Manaugh et al. (2010), who argued that proximity to transportation is critical in residential location decisions, as it directly influences commuting times and overall convenience. Neighbourhood crime rate and the condition and age of the property, both with a mean score of 4.45 and ranked 6th, are identified as significant factors. The importance of the crime rate aligns with findings by Kaluthanthri and Jayawardhana [70], who suggest that safety concerns can heavily influence investment decisions. Similarly, the property's condition is a key consideration for investors, as older or poorly maintained properties may require substantial additional investments. The susceptibility of the neighbourhood to flooding ranks 8th (Mean = 4.32), reinforcing the findings by Fox-Rogers et al. [73] and Nkwunonwo et al. [74] that the perceived risk of flooding is a crucial concern for investors, impacting their willingness to invest in such areas. Moreover, the influence of others' investment decisions (Rank 9, Mean = 4.31) indicates a trend where estate agents are swayed by peer actions, a well-documented phenomenon in investment behavior studies [75]. Lower-ranked factors, such as proximity to healthcare facilities (Rank 34, Mean = 3.47) and proximity to worship centers (Rank 35, Mean = 3.44), are deemed moderately significant. These results suggest that while these amenities are valued, they do not weigh as heavily on investment decisions in flood-risk areas compared to more pressing factors like location and infrastructure. Lastly, the level of risk awareness, with the lowest mean score of 2.68 and ranked 37th, is identified as the least significant factor. This finding echoes Fox-Rogers et al. [73], who found that even when investors are aware of risks, this awareness does not always deter them from making investments in flood-prone areas. The findings of the study are consistent with existing literature, reinforcing the established importance of these factors in real estate investment decisions.

The agreement analysis presented in Table 5 shows a high degree of agreement between property investors and estate agents on certain key factors investigated. For instance, Factor 1 (the property's actual location) was ranked 3rd by property investors and 1st by estate agents, with a small rank difference of 2. This close alignment highlights the critical importance of location in property investment decisions, even in flood-risk areas. This finding aligns with previous research emphasizing the importance of location as a primary determinant of property value, especially in high-risk environments [73]. Similarly, Factor 12 (availability of electricity and infrastructure) is another area of strong agreement, ranked 1st by property investors and 2nd by estate agents. The minimal rank difference highlights the consensus that robust infrastructure is a key motivator for investment, even when flood risks are present. This consensus is consistent with the findings of Lieser and Groh [68], who noted that the availability of essential services and infrastructure significantly influences real estate investment decisions in emerging markets. However, the analysis also reveals significant divergences in perspectives, particularly concerning risk perception and economic factors. Factor 30 (Influence of others' investment decisions) shows the most pronounced disagreement, with property investors ranking it as 36th and estate agents ranking it as 9th, resulting in a large rank difference of 27. This discrepancy suggests that estate agents may place more value on the role of social and market trends in influencing investment decisions than property investors do. This divergence is supported by Ndung'u and Kung'u [72], which highlights that herd behavior can significantly influence real estate investments in certain markets, a factor more keenly observed by professionals than individual investors. Factor 31 (psychological preparedness for flooding) also shows considerable divergence, ranked 37th by property investors but 18th by estate agents. This suggests that estate agents may recognize the importance of psychological preparedness in mitigating the perceived risks of flood-prone investments, a factor that individual investors might undervalue. This is consistent with findings by Aerts et al. [76], who noted that professional advisors often consider psychological factors more critically when advising clients on property investments in risk-prone areas. There is moderate agreement on factors related to property aesthetics and functionality. For example, Factor 20 (interior and exterior façade) and Factor 21 (design and aesthetics) show small rank differences (5 and 0, respectively). Both groups recognize the significance of these factors, albeit not as the top priorities. This moderate agreement aligns with studies that while aesthetics is important, they are secondary to more critical factors like location and infrastructure in investment decisions [77]. The Relative Agreement Factor (RAF) for the entire set of factors is calculated at 8, with a maximum possible RAF of 16, leading to a disagreement percentage (DP) of 52.76 %. This indicates that there is a moderate level of disagreement between property investors and estate agents, with the remaining 47.24 % representing areas of agreement. The observed disparities indicate the different lenses through which these two groups assess investment risks and opportunities in flood-prone areas.

7. Conclusion

The results highlight a clear stratification of motivation for real estate investment in flood-risk areas, with a few factors emerging as the most significant drivers of decision-making. The findings suggest that investors place high importance on certain key considerations, potentially related to economic incentives or market opportunities, while other factors are perceived as less critical or more subjective. Understanding these motivations can help policymakers and real estate professionals better address investor concerns and develop strategies that balance risk and reward in these challenging environments. Overall, the results indicate that property investors are primarily motivated by the potential financial benefits and strategic opportunities associated with investing in flood-risk areas. While there is a strong consensus on the importance of high returns, government incentives, and market opportunities, opinions diverge more when it comes to secondary concerns and niche interests. This variability highlights the complex decision-making process that investors undergo when considering real estate in high-risk environments.

From the perspective of estate agents, the results provide a clear guide on how to approach the marketing and sales of real estate in

flood-risk areas. The most significant motivations align with the core financial drivers that investors prioritize, suggesting that agents focus heavily on these aspects to attract and reassure clients. Significant factors offer additional leverage in negotiations, helping to tailor pitches to specific investor needs. Moderately significant motivations present more complex challenges, requiring agents to carefully navigate investor concerns and preferences. Ultimately, estate agents would see these results as a roadmap for crafting targeted, persuasive strategies to maximize investment interest in flood-prone properties while addressing the diverse range of investor perceptions. The agreement analysis reveals a complex interplay between the perspectives of property investors and estate agents regarding investment in flood-risk areas. While there are areas of strong alignment, particularly regarding financial incentives and market opportunities, there are also notable discrepancies in how both groups value certain factors. Estate agents generally prioritize factors that align with marketability and immediate financial returns, while property investors might take a broader view, considering long-term impacts and personal values. To enhance decision-making and foster better collaboration, estate agents might need to adjust their strategies to account for these differences, ensuring they address investor concerns more effectively. Conversely, investors could benefit from the practical insights and market expertise of estate agents, leading to more informed and balanced investment decisions.

The insights from this study provide significant implications for shaping local policies in Lagos and other flood-prone areas globally. These insights, especially regarding the motivations behind property investments in flood-risk environments, can inform policymakers in developing strategies that address flood risks while encouraging sustainable development. One of the key findings of this research is that property investors are often driven by the potential for high financial returns, confidence in flood mitigation measures, and governmental incentives. Policymakers in Lagos could use this information to refine their approach to flood risk management. Specifically, they could focus on strengthening flood protection infrastructure to boost investor confidence. Many investors may feel more secure in flood-prone areas if they know that governments are investing in flood defenses like levees, improved drainage systems, and barriers. In Lagos, where recurrent flooding is a pressing issue, public investment in such infrastructure can reduce risk perception and encourage more responsible investment. Furthermore, governments should make these infrastructure projects highly visible to reassure investors and the public alike that flood risk is being managed effectively. This approach is not unique to Lagos; other cities facing similar flood challenges could adopt similar strategies to create resilient urban environments.

Another important policy implication relates to enhanced communication of flood risks. Many investors make decisions based on perceived rather than actual risk. Governments in flood-prone regions like Lagos can play a critical role in providing clearer, more accessible information about flood risks. This could include regularly updated flood risk maps, detailed assessments of flood-prone areas, and real-time information on mitigation efforts. By making flood risk data easily accessible to both investors and the public, governments can help investors make more informed decisions, reducing the chances of poorly calculated investments in vulnerable areas. Educational campaigns, targeted specifically at real estate investors and estate agents, could further improve understanding of long-term risks related to climate change and flooding. Such efforts would encourage a more sustainable approach to property development and investment.

Moreover, policymakers should consider how flood risk management can be better integrated into long-term urban planning decisions. In Lagos and other cities where flood risks are increasing due to climate change, urban development often proceeds without sufficient regard for future environmental challenges. Governments should prioritize urban planning strategies that incorporate climate adaptation, such as zoning regulations that restrict development in the most flood-prone areas. Focusing development on less vulnerable regions and promoting green infrastructure solutions such as creating wetlands, permeable surfaces, and green spaces that can absorb floodwater policymakers can both mitigate flood risks and create a more sustainable urban environment. This kind of policy approach has implications beyond Lagos and could be adopted by other cities globally that face similar flood-related challenges. Sharing knowledge and best practices between cities could enhance global responses to flood risk management and urban sustainability.

CRediT authorship contribution statement

A.K. Oyetunji: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Data curation, Conceptualization. **M.A. Olukolajo:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Formal analysis, Data curation. **N. Ndudirim:** Writing – review & editing, Validation, Project administration, Methodology, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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