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Governance Strategy Model for Earthquake-Prone Urban Areas: A Türkiye-Focused Perspective

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Abstract: This study investigates a conceptual Regional Real Estate Governance Strategy Model for high-earthquake-risk urban areas, focusing specifically on Türkiye. While current approaches to managing seismically risky real estate prioritize structural safety, legal regulations, and subsequent technical urban transformation, economic, behavioral, and governance aspects affecting market outcomes are systematically overlooked. This study utilizes international academic literature, policy documents, and secondary institutional data to present an integrated governance model that systematically harmonizes seismic risk, market dynamics, and multi-stakeholder coordination. The research is qualitative and literature-based. This synthesis of relevant international literature, global best practices, and national policy context identifies critical mechanisms for the impact of seismic risk on real estate valuation, investment decisions, and market transparency. Based on this integration, a Hybrid Integrated Model (MIM) is proposed that clearly outlines the roles and interactions of public institutions, market players, and civil society in the management of seismically risky real estate markets. The proposed model, which emphasizes risk-sensitive pricing, open information sharing, and participatory governance as key determinants of sustainable real estate management in at-risk areas, allows for easy implementation. Addressing seismic risk as a technical, economic, and governance challenge, this study offers a practical and flexible framework for policymakers and implementers to improve market stability, market resilience, and long-term value preservation in developing countries at risk of earthquakes.

Keywords: *Earthquake Risk, Real Estate Governance, Conceptual Model, Multi-Stakeholder Management, Türkiye.*

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I. INTRODUCTION

The Republic of Türkiye lies at the junction of active and complex tectonic plates, which makes the country among the most seismically active regions in the world (AFAD, 2022). Such a natural inclination of the land not only affects roadside signs and other structural integrity but also affects the real estate market dynamics in the country (Keskin et al., 2017). Apart from the direct physical risks, market-based behaviour in high-seismic regions is also at odds with standard model predictions: property prices tend to be systematically discounted due to the increased perception of financial and safety risks, which induces conspicuous risk premium (Boelhouwer & van der Heijden, 2018; Ikefuji et al., 2022). Risk perception, insurance availability, and expectations for long-term value are the critical determinants for both investors and property owners. Behavior responses—cautious investing, portfolio diversification, and a preference for seismically resilient buildings—penetrate market supply, demand, and pricing (Apergis, 2020). Viewing from a behavioral economics perspective, people often see too much short-term benefits relative to the costs of long-term risk management. This systematic deviation in behavior has led to the underinvestment in seismic safety (Kunreuther & Schupp, 2021). Therefore, it is indeed imperative to comprehend the intertwined dynamics of these economic implications and behavioral tendencies to develop effective regional real estate management strategies that can appropriately consider both a market-oriented efficient processor and its associated risk-averse stakeholders to future uncertainty.

There is a consistent reporting of a robust association between perceived earthquake risk and the house prices in the international literature. Findings emanating from developed countries give a very good indication: it has been shown, for instance that land prices in Japan are subject to systematic discounts in earthquake prone areas (Ikefuji et al., 2022; Paudel, 2025). Related studies that focused on induced seismicity in the Netherlands revealed that an increase in seismicity was associated with a decrease in housing prices (Boelhouwer & van der Heijden, 2018). U.S./other earthquake prone studies reiterate the need for the risk perception – market behavior relation reemphasizing the potential that forced risk disclosure could substantially influence hedonic pricing model (Ojeda, 2020). Taken together, the findings suggest real estate management in such high risk areas must

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adopt a dual perspectives in economic valuation and structural resilience. Strategic real estate management becomes more essential for Türkiye in particular due to the size of the aging building stock combined with an accelerating pace of urban regeneration in cities (Ministry of Environment and Urbanization, 2021; TURKSTAT, 2022). The devastating 1999 Marmara earthquake and recent events revealed, among other things, that the impact of risk is not geographically uniform; the largest fall in house prices was observed in those sub-market areas which were most vulnerable to weak structures (Gorfe, 2025).

In addition, the emerging market aspects of the Turkish real estate market make it distinctive, with features such as high turnover rates (for instance, sales of 1.478 million housing units in 2024, indicating a strong growth flow in spite of economic adversity) (KPMG Turkey, 2024). This expansion is contrasted by increasing borrowing costs and the pressing need for structural revitalization, and both greatly influence investor risk appetites and the results of the risk perception–market performance nexus (Kartal, 2024). Seismic risk is a key factor in this process so regional management must be multi-faceted. While the seismic hazard is high and the real estate market is quite active in Türkiye, there is a clear research gap: strategic models (broad regional-focused) for "real estate management under earthquake risk" that take a multi-stakeholder approach are limited (GYODER, 2025). Current approaches, dominated by the central government's urban transformation law (Law No. 6306) emphasize technical and legal (purely legal) aspects and systematically ignore market signals, behavioral responses and mechanisms of decentralised governance (Ay et al., 2021).

The present research is thought to fill this void in literature hence is guided by two primary ends. It aims, firstly, to frame earthquake risk and real estate management as a complex management and governance issue, rather than just a technical/structural matter, involving a multi-actor State-market-society array (central and local administrations; investors, developers and insurers; property owners and citizens). Second, the study also forwards a Regional Real Estate Management Strategy Model for Türkiye with a special consideration of the İstanbul metropolitan area as a high-risk and policy-making urban context. Based on a Mixed Integrated Model (MIM) strategy, the aforementioned approach prioritizes the alignment of actions between the State and Market to the extent possible for the sake of advancing risk-sensitive, sustainable, and resilient real estate governance (AFAD, 2022; Keskin et al., 2017; Ikefuji et al., 2022). The study is driven by the following research questions:

- RQ1: In high-risk metropolitan areas like İstanbul, in what ways does earthquake risk affect the conceptual foundation of real estate market and governance?
- RQ2: How to design a sustainable real estate management system for high-risk areas through integrated partnership among the public, market, and societal actors?
- RQ3: What are the conceptual strengths of the suggested model compared to other models of real estate management in Türkiye?

II. LITERATUR REVIEW

➢ *The World Scale of Seismic Risk and Property Valuation*

The influence of earthquake risk on the property market has been the subject of inquiry in a well-established subfield of international academic literature. Decisions concerning property owners and investors are fundamentally influenced by earthquake hazards, which is a key factor in market valuation. Extensive studies clearly support a reduction in house prices and the emergence of risk premia in areas that are regularly exposed to high seismic risk (Boelhouwer & van der Heijden, 2018; Keskin et al, 2017; Ahiadu et al., 2024).

This valuation effect is not just related to the damage potential of this system in the short term; it is also associated with investor trust, insurability, and the retention of value of assets in the long run (Apergis, 2020). Similar international case studies confirm this relationship. For example, research in Japan shows that real estate prices in seismic areas are related to past earthquakes and future risk expectations (Ikefuji et al., 2022). Likewise, studies in the United States have also found a negative association between earthquake risk and the value of residential property (Ojeda, 2020).

In addition, studies on developing countries show that large earthquakes can cause substantial short-term drops in home values, especially in areas of high seismic intensity (Paudel, 2025). An analysis of the effects of induced seismicity on the housing market in the Dutch region of Groningen further shows how perceived risk translates into prices, highlighting the crucial importance for the real estate market of developing strong governance arrangements and policies in markets vulnerable to seismic hazard (Boelhouwer & van der Heijden, 2018).

➢ *The Turkish Context: Vulnerability, Perception, and the Valuation Disparity*

In the case of Türkiye, the vulnerability factor is more intense as the country is situated on two main fault lines and has a large share of old and fragile houses (AFAD, 2022). Large seismic events, such as the devastating 1999 Marmara and 2023 Kahramanmaraş earthquakes, have clearly shown that seismic risk must be considered in all aspects of real estate management. Quantitative research on the İstanbul housing market also corroborates that earthquake risk perception-addressing proximity to fault lines and negative soil conditions-is a statistically significant valuation factor (Alas, 2019). This is a spatially heterogeneous impact: sub-markets are affected differently and the generally inferior parts of the market tend to carry a much higher negative impact (Crofton, 2024).

The study also emphasizes that external non-economic disturbances, like a seismic catastrophe, can drastically raise the demand for safer and lower-rise homes, increasing speculation in seismic areas and the balance of housing supply and demand (Shi & Naylor, 2023). In addition, it is argued by the scholars that geological attributes (active faults, type of soil) are neglected also in common real estate appraisal in Türkiye which suggest that a multidisciplinary method is needed to assess risk in place reliably (Çelik & Çiçek, 2023).

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While the risk for the large building stock is also high in large cities like Istanbul, Izmir, and Ankara because of high population densities, at the geographical scale, studies on how to manage real estate governance models consisting of multiple stakeholders is extremely limited (GYODER, 2025).

➢ *The Imperative of Multi-Stakeholder Regional Governance*

The above all calls for the development of sustainable management practices for regional real estate that are based on a cooperative relationship among the public propietary, the private propietary, and the community at large (Jayashree, 2022). This approach calls for a shift from a top–down management towards a Multi-Stakeholder Integrative Model (MSIM), in which these three main stakeholders have specific roles in the co-production of a viable and resilient system against seismic risks (Bradley et al., 2022). The aim of such a model would be to enhance investor and market confidence in vulnerable regions, and to provide a mechanism for meaningful regulation of municipalities and national government (Siangulube, 2022).

The existing legal and organisational framework of Turkey (dominated by Law No 6306 'The Law on the Transformation of Areas Under Disaster Risk') and concentrated on urban regeneration projects, which is intermittently criticised for primarily prioritising engineering and legal aspects (World Bank, 2021). critiques have criticised for fostering the emergence of segmented risk patterns in megacities such as İstanbul, resulting in market-led real estate speculation masquerading as disaster risk reduction (Ay et al., 2021).

On the other hand, global practice has revealed the superiority of holistic multi-stakeholder approaches over those that are limited to regulation compliance, with these approaches being key to ensuring long-term market stability and sustainable property management (Apergis, 2020; Ikefuji et al., 2022). As a result, the Regional Real Estate Governance Strategy Model to be developed for Istanbul shall have to be developed in a way, which would be able to bridge the gap of national absence in practice, with the best known, multi-dimensional and sustainability based governance principles from around the world.

➢ *Behavioral Economics and EMs Market Outcomes*

A heightened sense of earthquake risk will also affect asset prices and investment decisions from the behavioral economics and market results perspective. Investors in high-risk area usually hedge their bets or move capital to a more safer geographic Regions-lock.in-region, or to other less-Volatile-similar-behavioral-correcting mechanism even surrounding or maybe vicariou areas (Paudel, 2025).

Turkey is located on several active fault lines and is therefore very earthquake prone. This, in turn, influences not just the physical integrity of the buildings but also the financial apparatus of its housing market. Real estate prices in areas of high seismic risk tendÂ to fall due to higher perceived financial and safety risk, but the decisions of investors and owners are impacted by risk perception, availability of insurances and expectations about value in the long term. Investor behavior including caution, diversification of portfolios and preference for more resilient buildings, impacts directly supply, demand and pricing.

Turkey is a key case in point, particularly in the sphere of EME (Emerging Market Economies) where disaster risk is not just a physical threat but a determining aspect of economic stability and market performance. EMEs, structurally fragile, tightly packed urban centers, and often having high inflation, are prone to be hit the hardest by post-seismic things, inducing the need for tailored risk management (Nguyen & Nguyen, 2024; Özüdoğru, 2023).

In addition, seismic risk affects investor behavior with implications for real estate prices, capital allocation and insurance take-up, which implies that it shapes the behaviour of these markets directly (Büyükkaracığan, 2023). OECD (2023) reports on the large seismic shocks such as 2023 Kahramanmaraş earthquakes/streets have significantly affected the regional economy by changing the supply and demand pattern – particularly in the housing market and in commercial real estate. Together with findings related to Economy of Regions (see chapter 3), these two chapters conclusively showed that regional real estate governance in Türkiye should not be confined to structural measures and building standards but should include investor behaviour, market transparency and economic policy frameworks (OECD, 2023).

In brief, both international good practice findings and empirics from Türkiye confirm that seismic risk is a key parameter influencing real estate management and that the need for regional strategy models is indispensable. The Multi-Stakeholder Integrated Model developed in line with collaborative governance and risk-centred management principles is a feasible and holistic model to be adopted in a big megacity such as İstanbul. options.

III. CONCEPTUAL FRAMEWORK: THE MİXED INTEGRATED MODEL (MIM)

The Mixed Integrated Model (MIM) is introduced as a conceptual tool in a governance perspective aimed at analyzing the relation switching seismic risk and real estate markets in high-risk urban areas. Based on governance theory, institutional economics, and the risk- informed real estate literature, the model focuses on the institutionalized interaction of three main stakeholders that are the public sector, the market players, and the local communities.

Evidence suggests disaster risk management of real estate markets is very commonly in the realm of the technical and regulatory compliance ends of a very diverse supply of policy tools. But these approaches often do not consider market dynamics, asymmetries of information, or stakeholder coordination— critical drivers of market stability and value retention in high-risk environments (OECD, 2015; World Bank, 2021). To this end, the MIM fills this void by articulating an overarching governance paradigm that integrates risk knowledge, economic decision-making, and participatory procedures.

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In the model of MIM, the public sector plays a pivotal role in its coordination and facilitation. Seismic risk mapping, regulation of land use, policies on urban transformation, and good quality, clear, and reliable information related to risk are the tasks of the public authorities. For the case of Türkiye, so far AFAD's official seismic hazard analysis and risk mitigation measures have represented a core knowledge for governance and market regulation (AFAD, 2018; AFAD, 2023). The literature shows that risk mapping, and institutional communication around these be more transparent and risk maps credible are important for boosting investor confidence, house prices, and long term development strategies in regions prone to natural disasters (Kousky, 2014; Kunreuther et al., 2019).

Second pillar model The second pillar of the model are the market agents, including investors, developers, financial institutions and appraisal specialists. Seismic risk from a real estate economics perspective is now deemed to emanate as seismically discounted market prices, risk premiums, insurance costs, financing costs, and investment time horizons (Shilling et al., 2019). MIMs view market players as transmission mechanisms that shape the institutional risk signals and regulatory regimes into economic behaviors. Structural features of the building stock in Türkiye and the dynamics of building construction and destruction as registered by official statistics shape, in turn, how the market responds to seismic threat (TÜİK, 2022; TÜİK, 2023). The model outlines that in the absence of sufficient information disclosure and institutional trust, responses to market shocks may be exacerbated, resulting in misallocation of capital and increased systemic risk.

MIM third core Within MIM, the third core stakeholder group is the local community. Current governance literature progressively portrays communities as co-producers of disaster risk management rather than passive objects of policy interventions (Aldrich & Meyer, 2015). Community-based awareness of risk, engagement in planning, and longer-term attachment to place have all been shown to have an impact on rule compliance, demand-side behaviour, and the sustainability of value retention measures. In a seismic urban environment, such social factors are determinant in the capacity of governance and market resilience.

A hallmark of the MIM is that it focuses on the bidirectional flows of information and the shared accountabilities of all actors. Instead of adopting a purely top-down regulatory stance, the model envisions a hierarchical mode of decision-making where public bodies, market players and local communities are in a constant dialogue. This interaction helps to mitigate information asymmetries, contributes to a better pricing of seismic risk, and promotes institutional trust – elements that are deemed as fundamental for well-functioning, stable and resilient real estate markets (North, 1990; Ostrom, 2010).

Drawing on governance theory and real estate market mechanisms as well as official risk and statistical information, the Mixed Integrated Model functions as a multifaceted conceptual instrument for analysing and steering real estate markets within the context of enduring seismic risk. The model can be tailored to the regional absence or presence of specific institutions, but is always grounded in a requirement for transparency, coordination, and long-term stewardship in earthquake urban settings.

This paper is a qualitative conceptual work, drawing on institutional analysis of existing literature and documents. There were no primary data collection instruments like surveys, interviews, experiments, or involvement of humans; hence, ethical committee approval was not necessary. The Mixed Integrated Model (MIM) with its novel core features is conceptualised by drawing together and building upon extant academic works, policy frameworks, and institutional reports.

IV. CONCEPTUAL RESULTS AND MODEL OUTCOMES

In contrast to empirical research which produces results based on data collection, this work produces findings by way of a systematic synthesis and conceptual integration of scholarly literature, policy documents and agency evidences. The main deliverable of the work is the development of the MIM, a hierarchical governance modular-based model responding to the challenge of governing the real estate market under long-term seismic threat.

The first theoretical contribution of the research is that it demonstrates how fragmented governance constitutes a key vulnerability in current real estate risk management models. The literature and policy review cited above suggests that seismic risk is often dealt with by means of scattered regulatory instruments, technical building standards and post-disaster actions. Such disaggregation hampers risk mitigation and fosters market fragility, notably in urban areas with high seismic risk (OECD, 2015; World Bank, 2021). The MIM brings together these traditionally dispersed activities within one integrated governance mechanism.

Another important result is that information asymmetry also matters for the conduct of the market. The Kousky and Kunreuther (2014), Kunreuther et al. (2019) literature review indicates that a lack of transparency related to mappings of seismic risk, regulation enforcement and characteristics of the building stock results in misinforming market participants and leads to market distortions and inefficient investment decisions. With bidirectional information flow between public authorities, market actors and local communities explicitly built into the model, the MIM offers a conceptual solution to mitigate these asymmetries and enhance risk-sensitive pricing in real estate markets.

The third conceptual finding addresses the integration of local communities in real estate governance arrangements. Traditional models typically treat communities as the regulated. In turn, the MIM-groups communities as active governance participants in the shaping of long-term value preservation and market resilience (Aldrich & Meyer, 2015) whose awareness, engagement and place-based identity inform risk perception. This transformation marks a significant theoretical contribution to the governance

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literature with the introduction of social concerns into the domain of real estate risk management.

Another consequence of the study is the expression of seismic risk as an economic and an institutional variable, as opposed to a purely technical hazard. Based on the institutional economics and real estate finance literature, MIM explains that risk perception, institutional credibility, and governance quality have a direct impact on the investment horizon, financing terms, and development strategies (North, 1990; Shilling et al., 2019). In the case of Türkiye, the incorporation of official risk calculations and statistical realities (AFAD, 2018; AFAD, 2023; TÜİK, 2022) further enhances the model's policy relevance and contextual embedment.

In the end, MIM provides a conceptual device that is transferable, adaptable, and able to inform policy design, urban transformation strategies, and market regulation more generally in seismically hazardous areas. Even though the model does not aspire for empirical generalization, it does provide a logically consistent analytical framework which can be used as a tool for empirical testing and comparative study in the future. In this regard, the implications of this study are beneficial to the literature and the policy practice by integrating governance theory with real estate economics and disaster risk management.

V. DISCUSSION

Our research takes a fresh look at how we think about seismic risk management in real estate markets. Instead of viewing it as just a technical or engineering issue, we propose that it's really about governance and institutional challenges. Previous studies have mostly focused on the construction aspects of earthquake risk, like building codes, safety standards, and emergency responses after disasters. While these elements are certainly important, our findings suggest that their effectiveness is limited without coordinated governance, institutional coherence, and clear communication in the market (OECD, 2015; World Bank, 2021). Without this alignment, even well-designed risk mitigation strategies might not lead to resilient market outcomes or informed investment decisions.

The Mixed Integrated Model (MIM) we propose builds on earlier frameworks of governance and risk management by broadening their focus to include public institutions, real estate market players, and local communities all within one integrated governance structure. This comprehensive approach addresses the institutional fragmentation that has been repeatedly highlighted in the literature. It also provides a structured way to connect scientific knowledge about risks with economic decision-making processes. In this way, the model aligns closely with institutional economics perspectives, which emphasize the importance of rules, information flow, enforcement mechanisms, and trust in shaping market performance and long-term stability (North, 1990).

From the perspective of the real estate market, our discussion highlights how crucial systematic transparency and two-way information exchange about seismic risks are. When information related to risks is incomplete, inconsistently shared, or communicated through fragmented channels, markets can misprice assets. This can lead to inefficient capital allocation and the buildup of hidden systemic risks. By focusing on the governance of information flow between regulators, market participants, and communities, the MIM resonates with risk economics research that identifies transparency, credibility, and institutional trust as essential for stable and predictable market behavior (Kunreuther et al., 2019).

Moreover, our framework emphasizes the often-overlooked role of local communities as active participants in governance within real estate regulation systems. Instead of seeing communities as passive recipients of top-down regulations, the MIM views them as sources of contextual risk knowledge and co-owners of long-term urban value. This perspective aligns with governance and resilience theories that highlight the importance of social capital, local participation, and collective learning in effectively mitigating risks and enhancing adaptive capacity in areas prone to hazards (Aldrich & Meyer, 2015).

Specifically in the context of Turkey, our findings suggest that integrating official seismic risk assessments, spatial planning tools, and publicly available statistical data into governance-oriented analytical models can significantly improve policy relevance while avoiding the heavy burden of extensive, theory-driven data collection. In this setting, the MIM serves as a conceptually grounded analytical framework, allowing for a structured comparison between universal governance principles and the unique institutional characteristics of national regulatory frameworks. Thus, the model acts as both a diagnostic tool and a heuristic guide for understanding how governance configurations influence real estate market responses to seismic risks in earthquake-prone countries.

VI. CONCLUSIONS

In this study, we've developed a conceptual model called the Regional Real Estate (RRE) Governance Strategy for urban areas that are especially vulnerable to natural hazards. We focus particularly on Türkiye, where seismic risk presents a ongoing challenge for urban development and real estate markets. Our research takes a systematic look at international academic literature, comparative governance frameworks, and disaster risk management policies. This approach helps us identify a significant gap in existing studies: there's a lack of integrated governance models that tackle seismic risk, real estate market dynamics, and coordination among multiple stakeholders within a unified framework.

The main contribution of this paper is our rethinking of seismic risk. Instead of viewing it solely as a technical or engineering issue, we see it as a complex variable intertwined with economic structures, institutional arrangements, and governance mechanisms. Through our proposed Mixed

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Integrated Model (MIM), we position seismic risk as a key factor that influences investment behavior, market valuation processes, regulatory decisions, and interactions between public and private sectors in urban real estate systems. This model goes beyond traditional risk mitigation strategies by explicitly connecting disaster vulnerability with market behavior and governance performance.

The MIM acts as a framework that helps regulate relationships among public authorities, market participants, and local communities. It offers a solid theoretical structure for reducing information gaps, improving risk-sensitive pricing mechanisms, and promoting long-term market stability in urban areas prone to earthquakes. By combining governance theory with real estate economics and disaster risk management, our model enhances our understanding of how institutional coordination and policy design can impact resilience in urban property markets.

While our findings aren't meant to be universally applicable, the proposed model serves as a useful conceptual tool for shaping policies, guiding urban transformation initiatives, and strategic planning in regions facing similar hazards. The flexibility of the MIM allows it to be tailored to different institutional and regulatory contexts, providing a strong basis for future research—both quantitative and qualitative—that aims to empirically test governance configurations and their effects on real estate markets in seismically active areas.

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