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Research Article

Bridging the Green Premium Gap: Policy Incentives to Mainstream Climate-Resilient Retrofitting in Institutional Real Estate Portfolios

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Abstract

Institutional real estate portfolios face mounting pressure to decarbonize and enhance climate resilience, yet the "green premium" – the financial value premium associated with sustainable and resilient building attributes – remains insufficiently quantified and inconsistently applied across markets. This valuation gap creates a fundamental barrier to scaling climate-resilient retrofitting, as institutional investors require robust financial justification for capital expenditure decisions. This conceptual paper addresses this challenge by developing a comprehensive framework for understanding how policy incentives can bridge the green premium gap and accelerate climate-resilient retrofitting in institutional real estate portfolios. The study employs a conceptual research methodology based on systematic literature review and theoretical synthesis across real estate economics, climate finance, and public policy domains. The analysis reveals that climate-resilient retrofitting generates value through multiple channels, including enhanced asset values, reduced risk exposure, insurance cost savings, and tenant retention premiums. However, these benefits remain incompletely capitalized due to valuation methodology gaps, information asymmetries, and fragmented policy frameworks. The conceptual framework identifies five policy instruments capable of bridging the green premium gap: regulatory standards, financial incentives, risk transfer mechanisms, information disclosure requirements, and capacity-building programs. The study concludes that effective policy design must address both supply-side barriers and demand-side drivers, with coordinated action across

multiple governance levels essential for mainstreaming climate-resilient retrofitting in institutional real estate. This paper contributes to emerging scholarship on climate finance and sustainable real estate by providing theoretical foundations for policy development and practical guidance for institutional investors navigating the climate transition.

Keywords: Green premium; Climate resilience; Institutional real estate; Retrofitting; Policy incentives; Property valuation; Climate risk; Sustainable finance; Decarbonization

Introduction

The commercial real estate sector confronts an unprecedented imperative to decarbonize and enhance climate resilience, yet the financial case for retrofitting remains incompletely articulated and inconsistently applied across institutional portfolios (Addoum et al., 2024). Climate change poses both physical risks to property assets and transition risks as regulatory frameworks evolve, creating pressure for building owners to invest in climate-resilient retrofits (Warren-Myers & Hurlimann, 2022). Institutional real estate investors, who collectively manage trillions of dollars in assets globally, face particular challenges in justifying retrofitting investments, as the financial benefits of resilience measures are difficult to quantify and capitalize into property valuations (Coulson et al., 2024). The concept of the "green premium" the financial value premium associated with sustainable and resilient building attributes – has gained prominence in real estate discourse, yet its measurement and application remain inconsistent across markets and asset classes (Sirmans et al., 2025). This valuation gap creates a significant barrier to scaling climate-resilient retrofitting in institutional portfolios, as investors require robust financial evidence to commit capital to adaptation measures (Boland et al., 2022).

Understanding the relationship between policy incentives and the green premium is critical for mobilizing capital toward climate-resilient retrofitting in institutional real estate portfolios (Barkham et al., 2022). Policy interventions at multiple governance levels shape the financial case for retrofitting by influencing property values, operating costs, risk exposure, and investment returns (Orazalin et al., 2024). Financial incentives, including tax exemptions, grants, and preferential lending, can bridge the gap between upfront retrofitting costs and long-term financial benefits (Voland et al., 2022). Regulatory requirements, including building performance standards and disclosure mandates, create market signals that influence investor behavior and property values (Akhtyrska & Fuerst, 2024). Risk transfer mechanisms, including insurance premium adjustments and resilience bonds, align financial incentives with risk reduction investments (Zhou et al., 2023). However, the effectiveness of these policy

instruments in mainstreaming climate-resilient retrofitting remains poorly understood, particularly in the context of institutional real estate portfolios (Clayton et al., 2021).

This conceptual paper addresses these gaps by developing a comprehensive framework for understanding how policy incentives can bridge the green premium gap and accelerate climate-resilient retrofitting in institutional real estate portfolios (Bienert, 2016). The framework integrates insights from real estate economics, climate finance, urban planning, and public policy to identify the mechanisms through which policy interventions influence retrofitting decisions (Kahn, 2017). The analysis examines both supply-side barriers, including capital constraints and valuation gaps, and demand-side drivers, including tenant preferences and investor expectations (Hirsch et al., 2015). The study contributes to emerging scholarship on climate finance and sustainable real estate by providing theoretical foundations for policy development and practical guidance for institutional investors navigating the climate transition (Wieteska-Rosiak, 2020). Ultimately, bridging the green premium gap is essential for mobilizing the trillions of dollars in investment needed to decarbonize the global building stock and enhance urban resilience to climate change (Petkov et al., 2023).

Literature Review

1. The Green Premium in Real Estate Markets

The concept of the green premium has garnered substantial academic attention, with researchers documenting the financial value premium associated with sustainable and resilient building attributes (Addoum et al., 2024). Empirical studies demonstrate that green-certified buildings command rental premiums, higher occupancy rates, and enhanced asset values compared to conventional properties (Coulson et al., 2024). Evidence from global markets suggests that green building certification can generate rental premiums of 5% to 15% and sales price premiums of 10% to 20%, though significant variation exists across regions and asset classes (Sirmans et al., 2025). However, the relationship between green building certification and climate resilience is complex and often conflated in both academic literature and market practice (Warren-Myers & Hurlimann, 2022). While some green building features contribute to climate resilience, certification focuses primarily on environmental performance and operational efficiency rather than adaptive capacity (Voland et al., 2022). This conflation creates confusion in real estate markets, as investors may assume that certified green buildings are climate-resilient without explicit verification (Vanhuyse et al., 2023).

The valuation of resilience features presents significant methodological challenges that limit effective pricing of climate adaptation investments (Clayton et al., 2021). Traditional valuation methodologies focus on historical transaction data and current market conditions, with limited incorporation of forward-looking climate risks and resilience benefits (Barkham et al., 2022). Quantifying avoided damage requires modeling climate hazards and property vulnerability across different scenarios and time horizons, involving significant uncertainty and methodological complexity (Zhou et al., 2023). Insurance premium savings are more readily quantifiable but depend on insurer behavior and market conditions that may change over time (Orazalin et al., 2024). Tenant preference premiums for resilient properties are evident in some market segments but remain difficult to separate from other property attributes and market

factors (Bienert, 2016). These challenges underscore the need for robust valuation methodologies that can capture the multi-dimensional benefits of climate-resilient retrofitting in institutional portfolios (Boland et al., 2022).

2. Barriers to Climate-Resilient Retrofitting

Institutional real estate portfolios face significant barriers to scaling climate-resilient retrofitting, including capital constraints, valuation gaps, and organizational inertia (Warren-Myers & Hurlimann, 2022). The upfront costs of deep retrofits can be substantial, with estimates suggesting that achieving net-zero emissions in existing buildings may require investments exceeding $200,000 per residential unit and comparable amounts for commercial properties (Petkov et al., 2023). Institutional investors face trade-offs between short-term capital requirements and long-term value creation, with retrofitting investments often competing with other portfolio priorities (Addoum et al., 2024). The split incentive problem creates additional barriers, as building owners bear retrofitting costs while tenants benefit from reduced operating costs, particularly in multi-tenant properties (Kahn, 2017). This misalignment of financial incentives can deter retrofitting investment despite positive net present value outcomes (Hirsch et al., 2015).

Valuation gaps represent another critical barrier to climate-resilient retrofitting in institutional portfolios (Clayton et al., 2021). Appraisers and lenders lack standardized methodologies for incorporating resilience benefits into property valuations and credit assessments, limiting the ability of owners to capture value from retrofitting investments (Sirmans et al., 2025). Market evidence suggests that the green premium is inconsistently applied across markets and asset classes, creating uncertainty about the financial returns on retrofitting investments (Boland et al., 2022). Information asymmetries compound these challenges, as limited disclosure and data availability regarding climate risk exposure impede investor decision-making (Vanhuyse et al., 2023). Organizational inertia and path dependence in real estate valuation practices create additional barriers, as established methodologies and professional norms reinforce existing approaches even as climate risks become more evident (Coulson et al., 2024).

3. Policy Instruments and Incentive Mechanisms

A diverse range of policy instruments has been deployed to incentivize climate-resilient retrofitting in real estate markets, with varying degrees of effectiveness (OECD, 2025). Regulatory instruments, including building performance standards and energy efficiency requirements, establish minimum performance thresholds that create compliance-driven demand for retrofitting (Akhtyrska & Fuerst, 2024). Minimum energy performance standards have been implemented in jurisdictions worldwide, requiring building owners to meet specified energy efficiency benchmarks or face penalties (Petkov et al., 2023). Financial incentives, including tax exemptions, grants, and concessional loans, reduce the upfront cost of retrofitting and improve the financial case for investment (Voland et al., 2022). Property tax exemptions, such as the Climate Action Revitalization Tax Exemption programs in Canadian municipalities, provide substantial incentives for building owners to invest in energy efficiency and climate resilience improvements (Coulson et al., 2024).

Information-based instruments, including disclosure requirements and certification schemes, enhance market transparency and enable better-informed investment decisions (Orazalin et al., 2024). Energy performance disclosure mandates create market signals that influence property values and tenant preferences, as building performance becomes more visible to market participants (Akhtyrska & Fuerst, 2024). Green building certification provides a mechanism for signaling resilience and sustainability attributes to investors, tenants, and lenders (Bienert, 2016). Risk transfer mechanisms, including insurance premium adjustments and resilience bonds, align financial incentives with risk reduction investments (Zhou et al., 2023). The effectiveness of these policy instruments depends on their design, implementation context, and interaction with other market forces (Warren-Myers & Hurlimann, 2022). Policy coherence across governance levels is essential, as fragmented approaches can create confusion and undermine investment incentives (OECD, 2025).

4. Institutional Investment and Portfolio Decarbonization

Institutional real estate investors face distinctive challenges in decarbonizing portfolios, including the scale of investment required, portfolio diversification constraints, and fiduciary obligations to beneficiaries (Petkov et al., 2023). Global institutional investors collectively manage trillions of dollars in real estate assets, creating both systemic risk and opportunity for climate action (Boland et al., 2022). The scale of retrofitting investment needed to achieve net-zero targets is substantial, with estimates suggesting that annual retrofitting rates must increase by a factor of five to meet decarbonization goals (OECD, 2025). Institutional investors must balance climate objectives with financial performance requirements, navigating trade-offs between short-term returns and long-term value creation (Bienert, 2016). Portfolio diversification constraints may limit the ability of investors to concentrate retrofitting investments in specific assets or geographies, requiring portfolio-wide strategies (Vanhuyse et al., 2023).

Emerging evidence suggests that climate-resilient retrofitting can generate positive financial returns for institutional investors, particularly when considering avoided risk and enhanced asset values (Coulson et al., 2024). Research indicates that green-certified assets outperform conventional properties across multiple performance metrics, including rental growth, occupancy rates, and sales prices (Addoum et al., 2024). Retrofit investments that combine energy efficiency and climate resilience features can generate revenue premiums of 25% to 50% through enhanced tenant attraction and retention (Sirmans et al., 2025). The financial benefits of climate-resilient retrofitting are increasingly recognized by institutional investors, with environmental, social, and governance (ESG) criteria becoming mainstream considerations in portfolio management (Orazalin et al., 2024). However, the translation of these benefits into property valuations and investment decisions remains inconsistent across markets, highlighting the need for improved valuation methodologies and policy frameworks (Warren-Myers & Hurlimann, 2022).

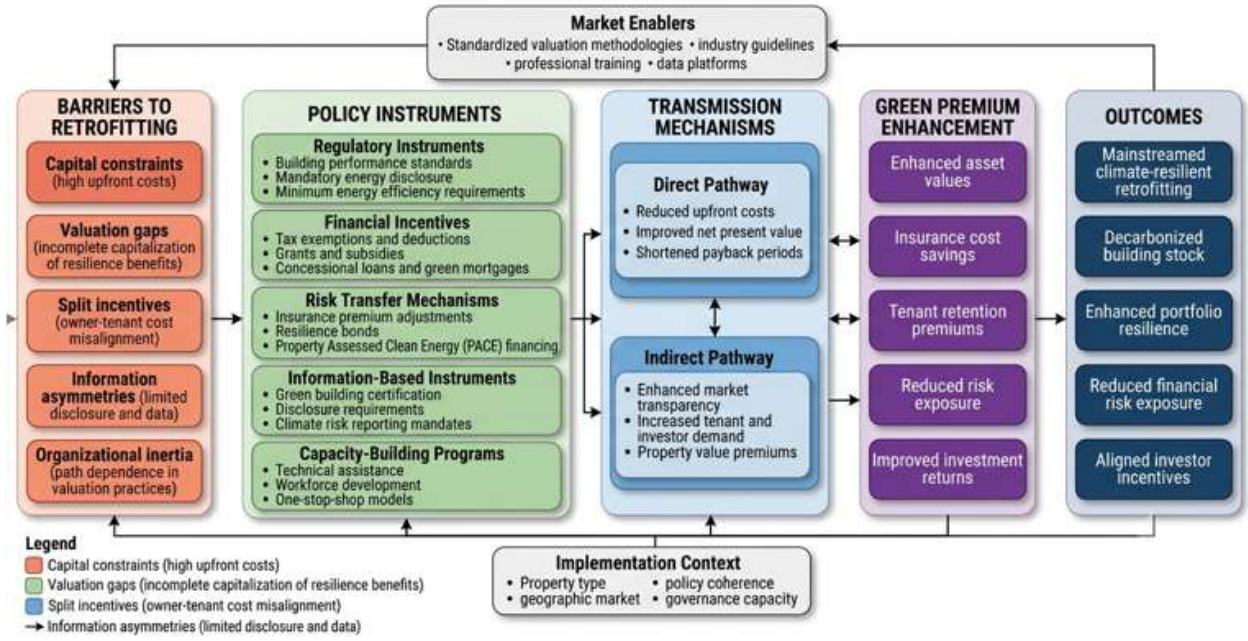

Figure 1: conceptual framework for Bridging the Green Premium Gap: Policy Incentives to Mainstream Climate-Resilient Retrofitting in Institutional Real Estate Portfolios

Methodology

his study adopts a conceptual research methodology based on systematic literature review and theoretical synthesis across multiple disciplines. The conceptual research design enables the systematic integration of diverse literature streams to generate new theoretical insights and practical frameworks, which is particularly appropriate for emerging topics requiring theoretical elaboration before empirical investigation can proceed. This study employs a comprehensive review of existing theoretical and empirical literature, drawing from real estate economics, climate finance, urban planning, and public policy. The conceptual framework is developed through iterative synthesis of key concepts, mechanisms, and relationships identified in the literature. Secondary data from published research, policy documents, and industry reports inform the conceptual development process. The resulting framework identifies policy instruments and mechanisms through which the green premium gap can be bridged, providing a foundation for subsequent empirical validation and practical application. This methodology aligns with established practices in conceptual research, where the goal is theory building rather than empirical testing.

Results and Discussion

1. The Conceptual Framework: Bridging the Green Premium Gap

The conceptual analysis reveals five primary policy instruments capable of bridging the green premium gap and accelerating climate-resilient retrofitting in institutional real estate portfolios (OECD, 2025). Regulatory instruments, including building performance standards and

mandatory disclosure requirements, establish minimum performance thresholds that create compliance-driven demand for retrofitting (Akhtyrska & Fuerst, 2024). Financial incentives, including tax exemptions, grants, and concessional loans, reduce the upfront cost of retrofitting and improve the financial case for investment (Voland et al., 2022). Risk transfer mechanisms, including insurance premium adjustments and resilience bonds, align financial incentives with risk reduction investments (Zhou et al., 2023). Information-based instruments, including certification schemes and disclosure requirements, enhance market transparency and enable better-informed investment decisions (Orazalin et al., 2024). Capacity-building programs, including technical assistance and workforce development, address implementation barriers and enable market transformation (Petkov et al., 2023).

The framework identifies two primary pathways through which policy incentives influence the green premium (Boland et al., 2022). The direct pathway operates through financial mechanisms that reduce the cost of retrofitting and enhance the financial returns on investment (Coulson et al., 2024). Financial incentives, including tax exemptions and grants, directly improve the net present value of retrofitting investments by reducing upfront costs and accelerating payback periods (Warren-Myers & Hurlimann, 2022). The indirect pathway operates through market mechanisms that enhance the value premium associated with resilient building attributes (Sirmans et al., 2025). Regulatory requirements and disclosure mandates create market signals that influence property values and tenant preferences, as building performance becomes more visible to market participants (Akhtyrska & Fuerst, 2024). These pathways interact with each other and with existing market structures to influence retrofitting investment decisions (Bienert, 2016).

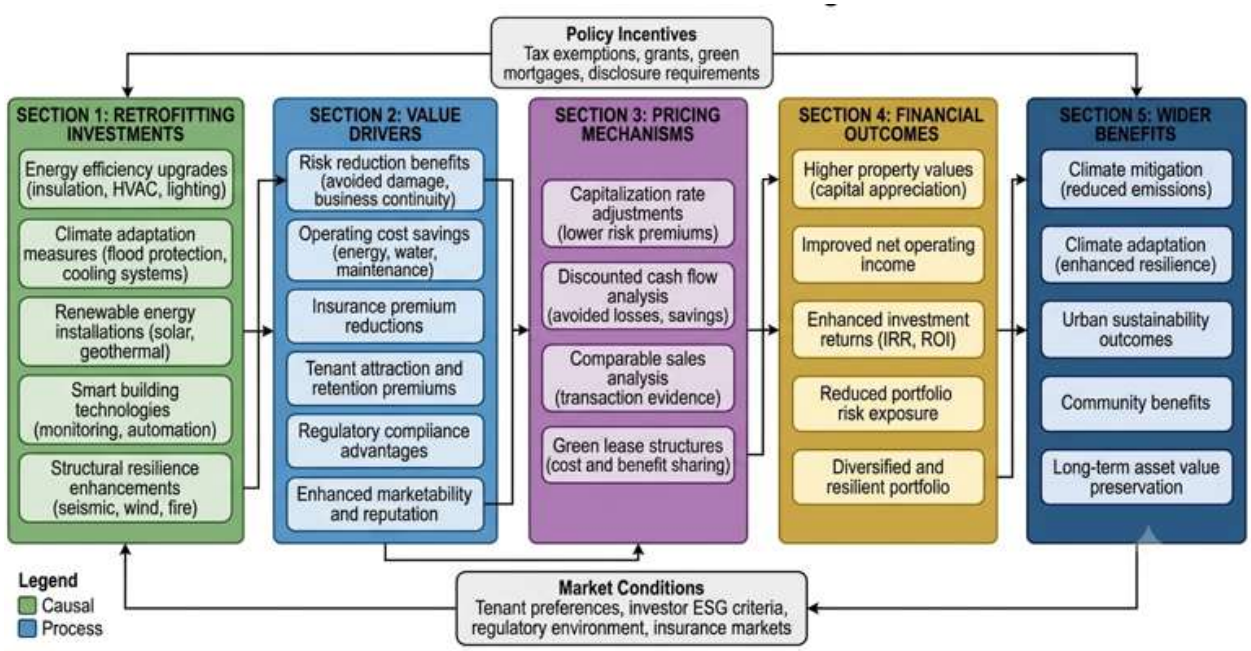

Figure 2: Conceptual framework for value creation mechanism of climate-resilient retrofitting in institutional real estate portfolios

2. Regulatory Instruments and Mandatory Standards

Regulatory instruments represent a powerful mechanism for bridging the green premium gap, as mandatory standards create baseline requirements that drive demand for retrofitting (Akhtyrska & Fuerst, 2024). Building performance standards establish minimum energy efficiency and carbon emissions thresholds that building owners must meet, with non-compliance resulting in penalties or restrictions on property use (OECD, 2025). Evidence from jurisdictions with mandatory energy performance standards indicates that these requirements create significant retrofitting demand, as building owners must invest in improvements to maintain compliance (Petkov et al., 2023). Minimum energy performance standards in the Netherlands, which require offices to achieve specific energy label ratings, have driven substantial retrofitting investment as non-compliant buildings face restrictions on rental and use (Coulson et al., 2024). Similar standards in other jurisdictions are creating market signals that influence property values and investment decisions (Warren-Myers & Hurlimann, 2022).

Disclosure requirements represent another category of regulatory instrument that can bridge the green premium gap by enhancing market transparency (Orazalin et al., 2024). Mandatory energy performance disclosure enables market participants to assess building performance and incorporate climate risks into investment decisions (Akhtyrska & Fuerst, 2024). Evidence suggests that disclosure mandates create market signals that influence property values, as building owners are incentivized to improve performance to attract tenants and investors (Sirmans et al., 2025). However, the effectiveness of disclosure requirements depends on the quality and comparability of reported data, with fragmented disclosure frameworks creating challenges for cross-market comparison (OECD, 2025). The development of standardized disclosure frameworks and data platforms can enhance the effectiveness of information-based instruments in bridging the green premium gap (Vanhuyse et al., 2023).

3. Financial Incentives and Market Transformation

Financial incentives represent a critical mechanism for bridging the green premium gap by reducing the upfront cost of retrofitting and improving the financial returns on investment (Voland et al., 2022). Tax exemptions, including revitalization tax exemption programs, provide substantial incentives for building owners to invest in energy efficiency and climate resilience improvements (Coulson et al., 2024). Evidence from Canadian municipalities implementing climate action revitalization tax exemption programs suggests that these incentives can significantly enhance the financial case for retrofitting, with exemption amounts reaching up to 100% of eligible project expenses over 10-year periods (Warren-Myers & Hurlimann, 2022). Grants and concessional loans similarly reduce the cost of retrofitting, with programs such as the Canada Greener Affordable Housing Program providing funding for deep energy retrofits in multi-unit residential buildings (OECD, 2025).

Green mortgage products and preferential lending conditions offer another mechanism for aligning financial incentives with climate-resilient retrofitting (Zhou et al., 2023). Institutions such as Fannie Mae and Freddie Mac in the United States offer green mortgage products that enable borrowers to finance retrofitting costs as part of property purchases or refinancing (Petkov et al., 2023). Evidence suggests that green mortgages can reduce borrowing costs and improve loan terms for properties with strong sustainability and resilience characteristics, creating financial incentives for retrofitting investment (Boland et al., 2022). However, the uptake of green mortgage products remains limited, highlighting the need for expanded

availability and enhanced market awareness (Sirmans et al., 2025). The integration of green mortgage products with other policy instruments, including tax incentives and disclosure requirements, can enhance their effectiveness in bridging the green premium gap (Bienert, 2016).

4. Risk Transfer Mechanisms and Insurance

Risk transfer mechanisms, including insurance premium adjustments and resilience bonds, represent an emerging category of policy instruments for bridging the green premium gap (Zhou et al., 2023). Insurance premium adjustments that reward resilience investments create direct financial incentives for retrofitting, as building owners can reduce operating costs through investment in risk reduction measures (Warren-Myers & Hurlimann, 2022). Evidence suggests that resilient properties can qualify for insurance premium reductions of 20% to 40% compared to non-resilient properties, generating significant annual savings that improve the financial case for retrofitting (Addoum et al., 2024). However, the availability and magnitude of premium reductions depend on insurer behavior and market conditions, creating uncertainty that may limit investment (Coulson et al., 2024).

Resilience bonds and other risk transfer mechanisms offer alternative approaches to financing retrofitting investment (OECD, 2025). Property Assessed Clean Energy (PACE) financing provides upfront capital for retrofitting investments, with loan repayment attached to property tax assessments that transfer to new owners in case of sale (Petkov et al., 2023). PACE programs in the United States have grown in popularity, with some programs explicitly including resilience features such as seismic strengthening, flood protection, and wind risk reduction (Zhou et al., 2023). Green bonds and sustainability-linked bonds provide another mechanism for financing retrofitting investment, with bond proceeds dedicated to climate-related activities including building decarbonization and resilience (Boland et al., 2022). Investor demand for these instruments has grown rapidly, creating opportunities for scaling retrofitting investment (Bienert, 2016).

5. Information and Capacity Building

Information-based instruments, including certification schemes and disclosure requirements, enhance market transparency and enable better-informed investment decisions (Orazalin et al., 2024). Green building certification provides a mechanism for signaling resilience and sustainability attributes to investors, tenants, and lenders (Akhtyrska & Fuerst, 2024). Evidence suggests that certified buildings command rental premiums and enhanced asset values, as certification provides a credible signal of building quality (Sirmans et al., 2025). However, the relationship between green building certification and climate resilience is complex, with certification focusing primarily on environmental performance rather than adaptive capacity (Warren-Myers & Hurlimann, 2022). The development of resilience-specific certification frameworks and rating systems can enhance the effectiveness of information-based instruments in bridging the green premium gap (Vanhuyse et al., 2023).

Capacity-building programs, including technical assistance and workforce development, address implementation barriers and enable market transformation (Petkov et al., 2023). The complexity of climate-resilient retrofitting presents challenges for building owners and

investors, requiring specialized technical expertise and project management capacity (Coulson et al., 2024). Evidence from capacity-building initiatives suggests that technical assistance can significantly enhance retrofitting uptake by reducing information barriers and supporting investment decision-making (Boland et al., 2022). Workforce development programs address supply-side constraints by building the skilled labor force needed to deliver retrofitting projects at scale (OECD, 2025). The development of "one-stop-shop" models that bundle retrofitting services, including financing, installation, and performance guarantees, can simplify the retrofitting process and reduce barriers to investment (Bienert, 2016).

6. Implications for Institutional Investors

The conceptual framework has significant implications for institutional real estate investors seeking to navigate the climate transition and capture value from climate-resilient retrofitting (Petkov et al., 2023). The analysis suggests that policy incentives can substantially improve the financial case for retrofitting by reducing upfront costs, enhancing asset values, and reducing risk exposure (Warren-Myers & Hurlimann, 2022). Institutional investors should actively engage with policy development processes to ensure that incentive frameworks are aligned with investment needs and portfolio strategies (Boland et al., 2022). The integration of climate risk and resilience considerations into investment decision-making is essential for capturing the green premium and avoiding stranded asset risks (Addoum et al., 2024). Portfolio-wide strategies that incorporate retrofitting into capital expenditure planning and asset management can enhance investment returns while advancing climate objectives (Coulson et al., 2024).

The framework also highlights the importance of data and disclosure for institutional investors seeking to capture the green premium (Orazalin et al., 2024). Access to reliable, comparable data on climate risk exposure and resilience attributes is essential for informed investment decision-making (Akhtyrska & Fuerst, 2024). Institutional investors should support the development of standardized data platforms and disclosure frameworks that enhance market transparency and enable effective pricing of climate resilience (Vanhuyse et al., 2023). Collaboration across the investment value chain, including with lenders, insurers, and appraisers, can accelerate the development of valuation methodologies and pricing mechanisms for climate resilience (Bienert, 2016). The development of industry guidelines and best practices for resilience valuation can enhance market confidence and accelerate investment (Sirmans et al., 2025).

Conclusion

This conceptual paper has developed a comprehensive framework for understanding how policy incentives can bridge the green premium gap and accelerate climate-resilient retrofitting in institutional real estate portfolios. The analysis reveals that climate-resilient retrofitting generates value through multiple channels, including enhanced asset values, reduced risk exposure, insurance cost savings, and tenant retention premiums. However, these benefits remain incompletely capitalized due to valuation methodology gaps, information asymmetries, and fragmented policy frameworks. The conceptual framework identifies five policy

instruments capable of bridging the green premium gap: regulatory standards, financial incentives, risk transfer mechanisms, information disclosure requirements, and capacity-building programs. The analysis demonstrates that effective policy design must address both supply-side barriers and demand-side drivers, with coordinated action across multiple governance levels essential for mainstreaming climate-resilient retrofitting. The framework also highlights the importance of data and disclosure for institutional investors seeking to capture the green premium, with access to reliable, comparable information essential for informed investment decision-making. This paper contributes to emerging scholarship on climate finance and sustainable real estate by providing theoretical foundations for policy development and practical guidance for institutional investors navigating the climate transition. Ultimately, bridging the green premium gap is essential for mobilizing the trillions of dollars in investment needed to decarbonize the global building stock and enhance urban resilience to climate change.

Recommendations

Based on the conceptual analysis, several recommendations emerge for bridging the green premium gap through policy incentives and market mechanisms. First, policymakers should implement mandatory building performance standards that establish clear decarbonization pathways and create compliance-driven demand for retrofitting. Second, governments should expand financial incentive programs, including tax exemptions, grants, and concessional loans, to reduce the upfront cost of retrofitting and improve investment returns. Third, regulators should mandate climate risk disclosure for institutional real estate portfolios and integrate resilience assessment into property transaction processes. Fourth, insurance regulators should encourage premium reductions for resilient properties and develop insurance products that incentivize adaptation investment. Fifth, industry bodies should develop standardized valuation methodologies for climate resilience and provide training for appraisers and lenders. Sixth, institutional investors should integrate climate risk and resilience considerations into portfolio management and engage with policy development processes. Seventh, international organizations should develop guidance and best practices for green premium measurement and resilience valuation, promoting knowledge exchange across markets. Finally, researchers should conduct empirical studies validating the conceptual framework across different property types, geographic markets, and policy contexts, strengthening the evidence base for policy development.

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No datasets were generated or analyzed during the current study.

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Ethics approval and consent to participate

The author(s) declare that not applicable.

Consent for publication

The author(s) declare that not applicable.

Competing interests

The author(s) declare no competing interests.

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