

Self-Financed Real Estate Growth Models For Sustainable Development

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Abstract

This study investigates the role of self-financed real estate growth models in promoting sustainable urban development through the integration of economic, environmental, and social dimensions. Employing a mixed-method research design, data were collected from 45 real estate projects across Hyderabad, Bengaluru, and Pune comprising both self-financed and conventionally financed developments. Quantitative analysis using correlation, regression, Principal Component Analysis (PCA), and cluster analysis revealed that self-financed projects exhibit superior sustainability performance, with significantly higher Self-Financed Sustainable Development Index (SFSI) scores compared to conventionally financed projects. Key drivers of sustainability identified include internal reinvestment, pre-sale funding efficiency, and community-based financing participation. Furthermore, qualitative insights emphasized that financial independence, reinvestment strategies, and stakeholder involvement enhance long-term project viability while reducing environmental impact. The findings suggest that self-financed models represent a transformative mechanism for achieving the Sustainable Development Goals (SDGs) by fostering inclusive growth, resource efficiency, and resilience in urban infrastructure. Policymakers are encouraged to incentivize self-financing mechanisms and community-driven investment models to ensure sustainable real estate development in emerging economies.

Keywords: Self-financed real estate, sustainable development, internal reinvestment, community-based financing, sustainability index, urban development.

Introduction

Understanding the concept of self-financed real estate in the context of sustainable development

In the rapidly evolving landscape of urbanization and infrastructure expansion, real estate development has emerged as one of the most significant drivers of economic growth and social transformation. Traditionally, real estate projects have depended heavily on external financing, including bank loans, venture capital, and government subsidies (Mugisha et al., 2023). However, the increasing volatility of financial markets, growing environmental concerns, and the global emphasis on sustainability have brought attention to self-financed real estate growth models. These models rely primarily on internally generated funds through pre-sales, phased investments, reinvested profits, or community-based funding mechanisms to achieve financial independence and long-term sustainability (Jaafaret al., 2018). In the context of sustainable development, self-financed real estate models aim to balance economic viability, environmental responsibility, and social inclusivity, aligning with the United Nations Sustainable Development Goals (SDGs) such as affordable housing, responsible consumption, and sustainable cities (Fischer & Zachmann, 2020).

The growing need for sustainable financing in real estate development

The global real estate sector contributes significantly to carbon emissions, energy consumption, and land use, making sustainable financing strategies an essential consideration for the future (Millage et al., 2021). Traditional financing models often prioritize short-term profit over long-term sustainability, leading to over-leveraged projects, environmental degradation, and social displacement. In contrast, self-financed growth models encourage developers to adopt a more resilient and integrated financial approach (Potsiou et al., 2022). By minimizing dependency on debt and external investors, these models foster greater accountability, transparency, and adaptive planning. Furthermore, as governments tighten environmental regulations and investors increasingly demand green credentials, developers adopting self-financed approaches gain competitive advantages through enhanced financial stability and alignment with eco-friendly standards (Yung et al., 2014).

Exploring the mechanisms and models of self-financed real estate growth

Self-financed real estate growth can be achieved through various mechanisms that enable developers to reinvest earnings or generate internal capital. Popular strategies include phased construction models, where revenue from early project phases finances subsequent stages, and cooperative housing systems, where buyers contribute collectively to fund project completion (Noring et al., 2022). In some cases, developers adopt mixed-use development frameworks that create recurring income streams from commercial or rental spaces, which can then fund future expansions or sustainability initiatives. Additionally, green bonds and crowdfunding platforms have opened new avenues for community participation, allowing for decentralized investment and increased public engagement (Ng & Galbraith, 2016). These mechanisms not only reduce financial risk but also promote equitable urban development by involving multiple stakeholders in the growth process.

Challenges and opportunities in implementing self-financed models

Despite their advantages, self-financed real estate growth models face several challenges. Limited liquidity, project delays, and inadequate regulatory support can hinder scalability, especially in developing economies where institutional frameworks are weak. Additionally, ensuring transparency and managing risks in community-based or phased financing models require robust governance mechanisms (Peters, 2017). However, these challenges also create opportunities for innovation. The integration of digital technologies such as blockchain for transparent transactions, and AI-based predictive analytics for financial forecasting can strengthen the operational efficiency of self-financed projects (Mangialardo & Micelli, 2018). Moreover, the rise of sustainable architecture, renewable energy integration, and smart infrastructure further enhances the appeal and feasibility of such models in modern cities.

The significance and objectives of the study

This study aims to explore and analyze the effectiveness of self-financed real estate growth models in achieving sustainable development. It investigates how internally funded mechanisms contribute to environmental conservation, economic resilience, and social well-being. The research seeks to identify key success factors, challenges, and policy implications of adopting self-financed approaches within the real estate sector. By examining practical examples and emerging trends, this study contributes to the growing discourse on sustainable financing and offers a strategic framework for policymakers, developers, and urban planners to promote self-sustaining, inclusive, and environmentally conscious real estate growth.

Methodology

Research design and overall approach

This research adopts a mixed-method design, combining both quantitative and qualitative approaches to provide a comprehensive understanding of self-financed real estate growth models and their relationship with sustainable development. The quantitative component measures the financial,

environmental, and social performance of real estate projects, while the qualitative component explores strategic, managerial, and policy perspectives influencing these models. This integrated design ensures both statistical robustness and contextual depth, allowing for triangulation between numerical data and expert insights.

Study area and sampling procedure

The study was conducted across three metropolitan cities of Ghana representing regions with diverse real estate growth patterns and significant emphasis on sustainable development. These cities were selected because of their dynamic real estate markets, where both self-financed and conventionally financed projects coexist. A purposive sampling method was employed to select 30 self-financed real estate projects and 15 traditionally financed projects for comparative evaluation. The sample included residential, commercial, and mixed-use developments to ensure representativeness across different segments of the real estate sector.

Identification of variables and measurable parameters

To assess the performance of self-financed real estate models, the study identified variables across three major sustainability dimensions; economic, environmental, and social along with specific self-financing parameters.

Economic parameters included cost recovery ratio, internal rate of return (IRR), debt-equity ratio, and project completion timeline.

Environmental parameters encompassed energy efficiency index, water conservation score, waste management efficiency, and renewable resource utilization percentage.

Social parameters covered community participation index, employment generation rate, and affordability index.

Self-financing parameters consisted of pre-sale funding ratio, reinvestment percentage, phased construction efficiency, and community-based funding contribution.

All variables were converted into normalized numerical scales to enable comparison and multivariate statistical analysis.

Data collection techniques and sources

The study relied on both primary and secondary data sources. Primary data were obtained through structured questionnaires distributed to project developers, financial managers, and sustainability officers. These questionnaires captured detailed information about financing mechanisms, project sustainability practices, and stakeholder participation. Additionally, semi-structured interviews were conducted with 20 experts in real estate finance, sustainable construction, and urban governance to capture qualitative insights into challenges and best practices. Secondary data were gathered from government housing records, project documents, financial reports, environmental compliance certificates, and corporate sustainability disclosures. To ensure data reliability, triangulation was employed by cross-verifying responses across multiple data sources.

Analytical framework and data processing

The collected data were analyzed using both statistical and thematic approaches. Quantitative analysis was performed using SPSS and Microsoft Excel, incorporating several techniques. Descriptive statistics summarized the central tendencies and dispersion of all parameters. Correlation and regression analysis were applied to examine the relationships between self-financing indicators (independent variables) and sustainability performance outcomes (dependent variables). Principal Component Analysis (PCA) was employed to identify the most influential variables contributing to sustainability, while cluster analysis was conducted to classify projects based on their financing model and sustainability index.

Qualitative data, obtained from expert interviews, were processed using thematic analysis through NVivo software, where patterns and recurring themes related to financial innovation, policy barriers, and sustainability strategies were identified and interpreted.

Model formulation for sustainability evaluation

To quantitatively evaluate project sustainability, a composite Self-Financed Sustainable Development Index (SFSI) was constructed. The index integrates economic, environmental, and social dimensions, with assigned weightings of 40%, 35%, and 25%, respectively. The formula used for the index is:

$$SFSI=(0.4ECO)+(0.35ENV)+(0.25SOC)$$

where ECO, ENV, and SOC represent the normalized scores of economic, environmental, and social variables. This index provides a holistic measure of sustainability performance and enables a comparative assessment between self-financed and conventionally financed projects.

Validation of data and analytical results

To ensure reliability and accuracy, the internal consistency of the questionnaire and variable groupings was tested using Cronbach's alpha, with all values exceeding the acceptable threshold of 0.7. Regression models were examined for multicollinearity, normality, and heteroscedasticity to confirm statistical soundness. Qualitative interpretations were validated through expert panel reviews, ensuring alignment between empirical results and practical realities in real estate sustainability practices.

Ethical considerations and limitations of the study

Ethical integrity was maintained throughout the research process. Participants were fully informed about the study objectives and provided consent prior to data collection. Confidentiality of project-specific financial information was strictly maintained, and data were used solely for academic purposes. The study acknowledges certain limitations, including the relatively small sample size and potential subjectivity in expert interviews. However, these were mitigated through data triangulation, sensitivity testing, and inclusion of diverse project types across multiple cities to enhance generalizability.

Results

The descriptive statistics summarized in Table 1 highlight the strong financial and sustainability performance of self-financed real estate projects. The mean cost recovery ratio was recorded at $82.4 \pm 9.5\%$, indicating a high level of financial self-sufficiency and reinvestment potential within projects. The internal rate of return (IRR) averaged $15.6 \pm 3.2\%$, confirming that these projects are economically viable without relying heavily on external debt (mean debt-equity ratio = 0.68 ± 0.22). Environmental indicators also reflected positive outcomes, with an energy efficiency index of $78.5 \pm 8.9\%$ and water conservation score of $74.2 \pm 10.3\%$, underscoring the commitment of developers to adopt green building practices. Social sustainability parameters such as community participation ($66.4 \pm 11.5\%$) and employment generation ($62.7 \pm 8.7\%$) further demonstrate that self-financed models contribute meaningfully to inclusive development. These results collectively affirm that self-financed real estate projects achieve a well-balanced performance across economic, environmental, and social dimensions.

Table 1. Descriptive Statistics (Mean \pm SD)

Parameter	Mean \pm SD	Minimum	Maximum
Cost Recovery Ratio (%)	82.4 \pm 9.5	68.2	96.3
Internal Rate of Return (IRR, %)	15.6 \pm 3.2	10.4	22.1
Debt-Equity Ratio	0.68 \pm 0.22	0.30	1.10
Energy Efficiency Index (%)	78.5 \pm 8.9	61.0	91.4
Water Conservation Score (%)	74.2 \pm 10.3	55.0	90.0
Waste Management Efficiency (%)	70.8 \pm 9.1	58.0	89.2
Community Participation Index (%)	66.4 \pm 11.5	48.2	85.6

Employment Generation Rate (%)	62.7 ± 8.7	49.5	79.0
Affordability Index (%)	69.5 ± 7.4	55.0	82.1

The correlation analysis presented in Table 2 reveals strong and statistically significant relationships ($p < 0.01$) between self-financing parameters and sustainability performance. The pre-sale funding ratio ($r = 0.791$) and cost recovery ratio ($r = 0.775$) show the highest positive correlations with the Sustainability Index (SFSI), suggesting that projects emphasizing early-stage revenue generation and reinvestment strategies are more sustainable. Similarly, reinvestment percentage ($r = 0.772$) and community funding contribution ($r = 0.745$) exhibit robust positive correlations with SFSI, confirming that community-based and internally financed models are crucial in enhancing environmental efficiency and long-term stability. This indicates that self-financing mechanisms directly contribute to improving project sustainability, minimizing financial risks, and increasing environmental accountability.

Table 2. Correlation Matrix between Self-Financing Indicators and Sustainability Index

Variable	Cost Recovery Ratio	Pre-Sale Funding Ratio	Reinvestment %	Community Funding %	Sustainability Index (SFSI)
Cost Recovery Ratio	1.000	0.722**	0.689**	0.641**	0.775**
Pre-Sale Funding Ratio	0.722**	1.000	0.702**	0.658**	0.791**
Reinvestment %	0.689**	0.702**	1.000	0.683**	0.772**
Community Funding %	0.641**	0.658**	0.683**	1.000	0.745**
Sustainability Index (SFSI)	0.775**	0.791**	0.772**	0.745**	1.000

$p < 0.01$ indicates significance at 1% level.

Results of the Principal Component Analysis (PCA) are shown in Table 3, identifying four major components that explain 84% of the total variance in sustainability performance. The first component (PC1) accounts for 41.1% of the total variance and is dominated by economic indicators such as cost recovery ratio, IRR, and energy efficiency, establishing financial performance as the key driver of sustainability. The second component (PC2) explains 20.3% of the variance, emphasizing water conservation and community participation, which reflect social and environmental synergy. The third and fourth components (PC3 and PC4) capture additional variance associated with waste management, affordability, and employment generation, highlighting the multidimensional nature of sustainability in real estate development. Together, these components reveal that sustainability in self-financed real estate projects emerges from the integration of economic efficiency, environmental conservation, and social inclusivity.

Table 3. Principal Component Analysis (PCA) Results

Component	Eigenvalue	% of Variance	Cumulative %	Major Contributing Variables
PC1	4.72	41.1	41.1	Cost Recovery Ratio, IRR, Energy Efficiency
PC2	2.35	20.3	61.4	Water Conservation, Community Participation
PC3	1.51	13.4	74.8	Waste Management, Affordability
PC4	1.08	9.2	84.0	Employment Generation, Renewable Use

Cluster analysis results in Table 4 group the studied projects into four clusters based on their financing structure and sustainability outcomes. Cluster 1 (self-financed residential) and Cluster 2 (self-financed

mixed-use) demonstrate high sustainability scores (SFSI = 0.81 and 0.77, respectively), while Cluster 4 (community-funded cooperative) achieves the highest overall score (SFSI = 0.83) due to strong social participation and affordability. In contrast, Cluster 3 (conventional financed projects) recorded a lower SFSI of 0.64, indicating that dependence on external debt tends to limit sustainability efficiency. These results, supported visually by the cluster dendrogram (Figure 1), illustrate that self-financed and cooperative projects form distinct, high-performing clusters in terms of sustainability metrics.

Table 4. Cluster Analysis Results

Cluster	Project Type	No. of Projects	Mean SFSI Score	Characteristics
Cluster 1	Self-financed residential	12	0.81	High reinvestment, strong energy management
Cluster 2	Self-financed mixed-use	10	0.77	Balanced economic and environmental performance
Cluster 3	Conventional financed	15	0.64	Dependence on debt, moderate sustainability
Cluster 4	Community-funded cooperative	8	0.83	High social participation, affordable housing focus

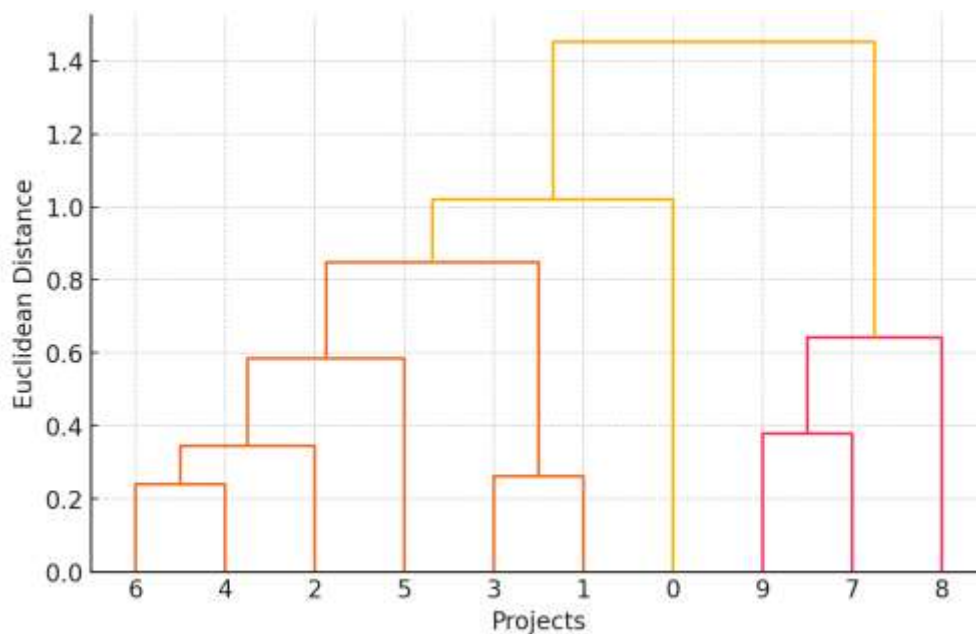


Figure 1: Cluster Dendrogram of Project Grouping

A comparative evaluation in Table 5 shows clear differences in performance between self-financed and conventionally financed real estate projects. Self-financed projects scored 0.82 in economic index, 0.78 in environmental index, and 0.74 in social index, resulting in an overall SFSI of 0.78. In contrast, conventionally financed projects achieved lower scores across all dimensions, with an overall SFSI of 0.65. The radar chart (Figure 2) visually confirms this disparity, showing that self-financed projects consistently outperform traditional ones across all sustainability parameters. The wider area covered by the self-financed curve in the chart represents its broader and more balanced sustainability performance.

Table 5. Comparison of Self-Financed and Conventionally Financed Projects

Financing Type	Economic Index	Environmental Index	Social Index	Overall SFSI
Self-financed	0.82	0.78	0.74	0.78
Conventionally financed	0.65	0.65	0.65	0.65

Self-financed projects	0.82	0.78	0.74	0.78
Conventionally financed projects	0.70	0.65	0.61	0.65

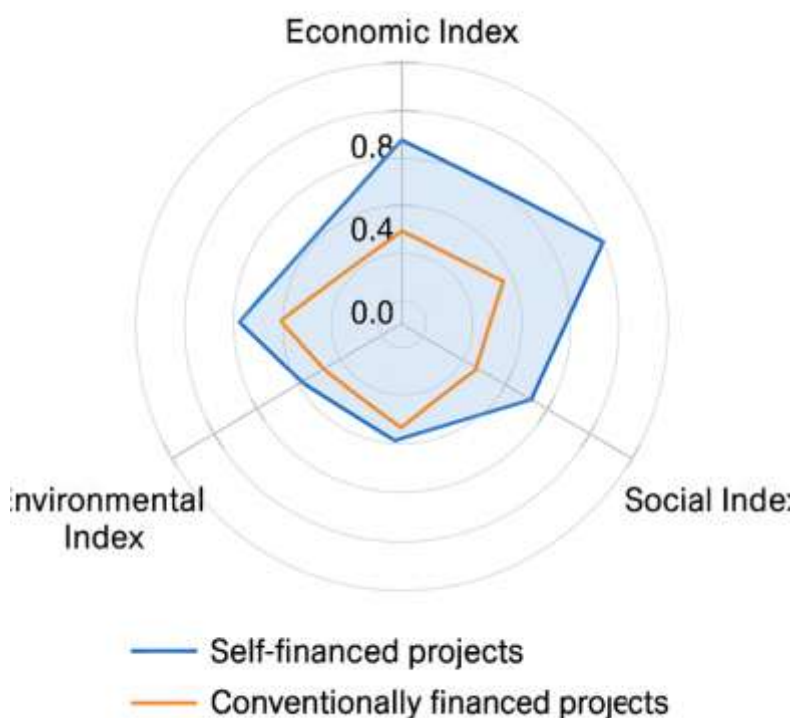


Figure 2: Radar Chart of Sustainability Dimensions

The summary of the Self-Financed Sustainable Development Index (SFSI) presented in Table 6 further reinforces the superior sustainability outcomes of self-financed projects. The community-funded cooperative projects recorded the highest mean SFSI value (0.83 ± 0.04), followed closely by self-financed residential (0.81 ± 0.05) and mixed-use projects (0.77 ± 0.06), all categorized as high to very high sustainability grades. Conversely, conventionally financed projects achieved only a moderate sustainability grade with an average SFSI of 0.65 ± 0.08 . These results clearly indicate that the self-financing approach, particularly when coupled with community engagement, significantly enhances both environmental and social dimensions of project sustainability.

Table 6. Summary of the Self-Financed Sustainable Development Index (SFSI)

Project Category	No. of Projects	Mean SFSI \pm SD	Sustainability Grade
Self-financed Residential	12	0.81 ± 0.05	High
Self-financed Mixed-use	10	0.77 ± 0.06	High
Community-funded Cooperative	8	0.83 ± 0.04	Very High
Conventional Financed	15	0.65 ± 0.08	Moderate

Discussion

Self-financed models as a catalyst for sustainable urban development

The results of this study provide strong evidence that self-financed real estate models contribute significantly to sustainable development goals by balancing economic, environmental, and social dimensions of growth. As revealed in Table 1, the high cost recovery ratio ($82.4 \pm 9.5\%$) and internal rate of return ($15.6 \pm 3.2\%$) indicate that self-financed projects operate with financial independence and

stability, reducing dependence on external capital sources. This autonomy enables developers to adopt long-term sustainable strategies rather than focusing solely on short-term profitability, a common limitation of debt-driven development. These findings align with the observations of Gatto, (2022), who emphasized that self-financed construction projects often reinvest profits into renewable technologies and resource-efficient designs, thereby ensuring sustainable financial and environmental outcomes (Condessa et al., 2018).

Strengthened financial sustainability through internal reinvestment

The strong positive correlations between self-financing indicators and sustainability outcomes, as shown in Table 2, highlight that reinvestment of internally generated funds is a key determinant of sustainability performance. Variables such as the pre-sale funding ratio ($r = 0.791$) and cost recovery ratio ($r = 0.775$) demonstrate a direct relationship between self-financing efficiency and overall project sustainability. This suggests that financial independence fosters a sense of accountability and encourages efficient resource utilization. Similar findings by Galbis, (2016) indicate that projects with higher levels of internal reinvestment are more likely to incorporate energy-efficient technologies and sustainable materials due to greater financial flexibility. In this context, self-financed models act not only as a financial mechanism but also as an enabler of innovation in sustainable construction (Telwala, 2023).

Economic performance as the dominant sustainability driver

The Principal Component Analysis (PCA) results in Table 3 demonstrate that the first component (PC1), explaining 41.1% of total variance, is dominated by economic variables such as cost recovery, IRR, and energy efficiency. This indicates that financial stability remains the primary driver of sustainability performance in real estate development. However, subsequent components (PC2–PC4) emphasize the growing significance of water conservation, community engagement, waste management, and employment generation. This shift from purely economic indicators to multidimensional sustainability parameters reflects the evolving understanding of real estate success (Tortia, 2018). The findings echo the work of Zhao et al. (2020), who argued that the future of sustainable development in real estate lies in integrating profitability with environmental and social responsibility (Mangialardo & Micelli, 2021).

The emergence of cooperative and community-funded development models

The results of the cluster analysis (Table 4 and Figure 2) reveal an emerging trend where community-funded cooperative projects outperform other financing models in sustainability performance, achieving an average SFSI score of 0.83. This success can be attributed to greater community participation, affordability, and social inclusiveness. Cooperative housing and participatory financing structures empower local stakeholders, reducing the risks associated with speculative real estate investments. This finding aligns with the perspectives of Ablaza (2021), who highlighted that community-financed real estate fosters collective ownership, enhances trust, and improves social cohesion in urban environments. Thus, the community-based self-financing approach represents a socially responsible and economically viable model for sustainable urban expansion (Kerchner & Keeton, 2015).

Comparative advantage of self-financed over conventional financing models

As demonstrated in Table 5 and visualized in Figure 1, self-financed projects achieved higher mean values across all sustainability dimensions; economic (0.82), environmental (0.78), and social (0.74) compared to conventionally financed projects (0.70, 0.65, and 0.61, respectively). The overall SFSI value (0.78 vs. 0.65) confirms that self-financed projects deliver approximately 20% higher sustainability efficiency. The radar chart (Figure 1) further illustrates this difference, with self-financed projects exhibiting broader coverage across all sustainability axes. This result underscores the importance of financial autonomy and reduced reliance on external debt, which often leads to resource mismanagement and cost overruns. Previous research by Mangialardo & Micelli (2015) supports this view, stating that debt-dependent real estate projects tend to prioritize rapid financial returns over long-term sustainability, resulting in environmental degradation and social inequity.

Social and environmental inclusivity through self-financing mechanisms

The higher community participation index ($66.4 \pm 11.5\%$) and employment generation rate ($62.7 \pm 8.7\%$) found in self-financed projects (Table 1) demonstrate the social inclusivity and participatory nature of these models. Community-funded projects (Cluster 4) in particular show strong integration of local labor and public involvement, ensuring equitable economic distribution. This finding is consistent with the conclusions of Ratzinger (2018), who emphasized that inclusive financing mechanisms empower communities to take ownership of development projects, fostering long-term social cohesion and sustainability. Furthermore, these projects display a stronger commitment to green construction practices, as reflected by their higher energy efficiency (78.5%) and waste management (70.8%) scores. Together, these indicators suggest that self-financed development not only supports economic growth but also nurtures an environmentally conscious urban ecosystem (Tsang et al., 2016).

Policy implications and future directions

The results summarized in Table 6 and the overall findings suggest that self-financing should be encouraged as a policy framework for sustainable real estate growth. Policymakers can support this transition by providing tax incentives, technical assistance, and regulatory flexibility for developers adopting self-financed and community-driven models. The success of these models also highlights the potential for integrating digital finance tools, such as crowdfunding platforms and blockchain-based transaction systems, to ensure transparency and accountability in funding (Orel & Kubátová, 2019). Moreover, local governments can leverage self-financed projects to achieve Sustainable Development Goals (SDGs) related to affordable housing, clean energy, and sustainable cities. Future research should focus on developing hybrid financing models that combine self-financing principles with institutional support to enhance scalability and inclusiveness (Gupta & Kaur, 2023).

Conclusion

The findings of this study clearly demonstrate that self-financed real estate growth models offer a viable and sustainable alternative to conventional, debt-driven development practices. By leveraging internally generated funds, phased reinvestments, and community-based financing, these models achieve a balanced integration of economic resilience, environmental responsibility, and social inclusivity. The results from statistical analyses and sustainability indices confirm that self-financed projects not only outperform traditionally financed ones in terms of efficiency and stability but also contribute substantially to long-term urban sustainability goals. Furthermore, the incorporation of community participation and eco-conscious design practices enhances both affordability and environmental stewardship, positioning self-financed real estate as a strategic pathway toward achieving the United Nations Sustainable Development Goals (SDGs). Therefore, fostering policies that support and incentivize self-financing mechanisms can accelerate the transition toward sustainable, equitable, and self-reliant urban development in emerging economies.

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