The Role of Green Finance Technologies in Shaping Sustainable Real Estate: A Systematic Review of Literature

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ABSTRACT

The real estate sector is really important for the economy because it helps with growth, getting money together and it also affects the environment. Because people want to be sustainable, new ways of dealing with money like green finance have become popular for making sure real estate projects are good for the environment. This study looks at how green finance has changed and been used in the real estate sector from 2007 to 2025.

The study looks at a lot of research in 100 pieces, including articles, books and doctoral work to see what people have found out about green finance in real estate. It checks things like how many papers were published, how they did their research, where the research was done and what the papers were about. It pays attention to things like green bonds, loans that are linked to being sustainable green mortgages and using new technologies like artificial intelligence, big data and blockchain in real estate money matters.

What the study found is that more and more people are using green finance in real estate and it seems to be working well with good results for the value of properties, rent, saving money, avoiding risks and doing well in the long run. The study also found that some parts of the world like Asia, North America and Europe are doing more research and actually using green finance than other places. Even though things are getting better there are still problems like not being sure about rules, not having information, high costs at the start and not all countries supporting green finance in the same way.

This study helps us understand how green finance and real estate work together and how they can help the economy be more sustainable. By looking at what people have researched and what has been found, the study gives us ideas for research and suggestions, for governments, banks and people who work in real estate to make green finance a bigger part of how the economy grows.

Keywords: *Green Finance; Sustainable Finance; Real Estate Economics; Green Financial Technologies; Sustainable Development; Market Efficiency*

1. INTRODUCTION

Finance plays a critical role at both the micro and macro levels of any economy. Since the establishment of the Sustainable Development Goals (SDGs), organizations are expected to pursue objectives that address present needs without compromising the opportunities of future generations. As green finance has become essential to ensuring sustainability, financial investments increasingly incorporate environmental initiatives aimed at fostering and maintaining a green economy. These include investments, loans, and other instruments designed to support environmentally beneficial activities. A key purpose of green finance is also to mitigate risks associated with environmental projects.

Sustainable development has emerged as a widely discussed concept, as all commercial and non-commercial activities are now expected to align with environmental responsibility. The term underscores the need to continue current development without diminishing the ability of future generations to thrive. To harmonize global efforts, 17 SDGs have been introduced, supported by international stakeholders. These goals emphasize social equity, environmental protection, economic prosperity, and global cooperation, requiring countries to collaborate to ensure the success of sustainable development initiatives. A central concept aligned with this agenda is the green economy, which promotes environmental protection while advancing equitable development.

The term "green economy" was first introduced in 1989 by environmental economists advising the UK government. In India, the relevance of sustainable development and green finance was first emphasized by the Reserve Bank of India (RBI) in 2007 and further strengthened through its participation in the Network for Greening the Financial System (NGFS) in 2021. India's introduction of green bonds in 2015 significantly advanced the national green economy framework. As economic sectors evolved, continuous monitoring became essential to safeguarding the environment. The United Nations reinforced this need through the adoption of global goals aimed at protecting the planet and promoting peace.

Although the terms *green finance* and *sustainable finance* are often used interchangeably, they represent distinct concepts. Green finance refers to specific loans or investments that support environmentally friendly activities. In contrast, sustainable finance encompasses broader standards and policies that generate financial returns while fulfilling Environmental, Social, and Governance (ESG) objectives. Among the most prominent green finance instruments are green bonds, which mobilize funds for projects such as energy efficiency, conservation, and eco-friendly waste management.

This paper focuses exclusively on the impact of green finance technologies—also termed Green FinTech—on the real estate sector. Green FinTech includes the use of Artificial Intelligence, Big Data, and Blockchain to achieve environmental objectives. The primary aim is to assess how such technologies influence the real estate market and the outcomes associated with their adoption.

Recent years have witnessed significant global shifts in sustainable development, particularly in sustainable finance. The World Economic Forum now refers to sustainable finance as "Nature-Positive Finance," recognizing its beneficial environmental effects. Ten major global trends have emerged:

Growth in Sustainable Finance: ESG-focused funds have gained prominence, with Amundi leading global capital allocation. ESG funds are expected to reach remarkable levels by 2026.

Carbon Pricing and Trading: Addressing carbon emissions is central to sustainability. Climate Impact X leads initiatives to enhance transparency in carbon credits and incentivize emission-reducing practices.

ESG Metrics in Investment Decisions: Firms such as MSCI have developed tools to quantify ESG performance, integrating these metrics into investment strategies.

Sustainable Bonds (Transition Finance): Institutions like BNP Paribas promote funds tied to ESG achievement.

Green Bonds: The European Union has set high standards for green bonds, with companies like Iberdrola driving strong investor engagement. By 2025, Europe's green bond market is expected to surpass that of the U.S.

Impact Investing: Organizations such as Generation Investment Management support investments addressing health, poverty, and education without compromising financial returns.

Blended Finance: The Rockefeller Foundation champions models combining public and private capital for sustainable development.

Ethical AI Tools: Given AI's growing influence, firms like Refinitiv are establishing ethical guidelines to ensure transparent use of ESG data.

Climate Adaptation Finance: Catastrophe bonds (Cat Bonds), promoted by Swiss Re in collaboration with the World Bank, support climate-related disaster resilience in sovereign nations.

Sustainability Innovations: Companies such as Climeworks are pioneering carbon removal technologies.

Real estate represents a major component of most economies, encompassing residential and commercial assets. Given its scale, understanding how green fintech interacts with this sector is essential. Technologies such as AI and Blockchain assist investors in identifying green buildings, evaluating cost differentials, and understanding environmental benefits. These innovations also support informed investment decisions and promote sustainable property development.

For this systematic literature review, the following categories were considered:

- Year of publication
- Nature of publication

- Research methodology
- Country
- Continent
- Major findings

The objectives of the study are:

- To identify research methodologies used to examine associations between green finance activities and the real estate sector.
- To develop a comprehensive overview of existing literature on green finance practices in real estate.
- To determine the impact of green finance activities on the real estate sector.

2. LITERATURE REVIEW

A literature review serves as a critical tool for identifying existing research conducted by scholars on a given topic. It highlights key areas of significance and helps reveal research gaps, thereby enabling the formulation of objectives for current or ongoing studies. The present research is a Systematic Literature Review (SLR) aimed at identifying notable global contributions on green finance technologies within the real estate sector. It also provides insights into the gradual developments in this domain and their influence on the real estate market over an 18-year period. In the early stages, when the concept of green technology was emerging, the landscape was markedly different. *Circo (2007)* emphasized that policy initiatives related to green technology should focus on industry construction and design. To understand U.S. green building standards, *Wedding (2008)* examined the relationship between certification levels and their associated impacts. *Simons et al. (2009)* highlighted the need for research on the role of government agencies in promoting green technology adoption. In the Indian context, *Pandit et al. (2010)* stressed the importance of tracking state and central policies to assess their impact on eco-housing. *Bansal et al. (2011)* identified key challenges in green finance, including stringent regulations, inadequate funding, and limited land availability. *Warren-Myers (2012)* noted the scarcity of research on the connection between sustainable technologies and real estate market values. *Geiger et al. (2013)* concluded that sustainable real estate presents expanded investment opportunities. *Li and Tsoi (2014)* found that the application of green real estate practices is more prominent in urban areas than in low-income communities. *Szumilo and Fuerst (2015)* reported that green buildings command higher rental values. *Faruque et al. (2016)* observed minimal public awareness of green finance, a situation attributed to high costs and lack of initiatives, as noted by *Shen et al. (2017)*. *Coën et al. (2018)* found that non-green REITs outperform green REITs. *Dasgupta et al. (2019)* asserted that the success of green finance depends on the efficiency of the Group of Initiatives for Climate Finance (GICF). *Fu and Ng (2020)* argued that imposing constraints is necessary to reduce the costs of unsustainable development and maintain ecosystem balance. *Chaturvedi (2021)* observed that local rental prices are influenced by proximity to managed and unmanaged urban green spaces. *Akomea-Frimpong et al. (2022)* concluded that both research and practice are essential for balancing financial markets and environmental needs. *Chen (2023)* found that green finance initiatives help reduce high real estate prices. *Hua et al. (2024)* identified that effective green policies significantly support the green transformation of the real estate sector. In a recent study, *Bui and Vu (2025)* determined that the adoption of green policies strengthens the transition to a green economy and reduces investor uncertainty.

3. METHODOLOGY

Research methodology refers to the systematic approach employed to conduct a study in an organized and logical manner. It outlines the techniques and procedures used for collecting, presenting, and analysing data, and serves as a guiding framework for the entire research process.

The present study adopts a systematic literature review (SLR) approach. For this purpose, highly cited works by eminent researchers over an 18-year period (2007–2025) have been examined. The dataset comprises 100 research contributions, including 95 journal articles, 3 books, and 2 doctoral dissertations. The primary aim of this review is to trace the evolution and identify the association of green finance technologies within the real estate sector. Accordingly, an average of five research papers per year has been analysed in detail from 2007 to 2023. From 2024 onwards, additional online publications have been incorporated to capture the most recent advancements in the field.

The review draws on studies from various regions of the world to provide a comprehensive understanding of diverse perspectives and findings related to the sector. To enhance clarity and facilitate interpretation, various graphical tools—including bar charts, pie charts, and other visual representations—have been employed. These are presented and discussed in detail in the subsequent section.

4. ANALYSIS AND INTERPRETATION

This section presents the analysis of data obtained through a systematic review of 100 research works. As outlined earlier, to examine the in-depth association and impact of green fintech, the analysis has been organized into six categories: Year of Publication, Nature of Publication, Research Methodology, Country, Continent, and Major Findings. The detailed analysis based on these categories is presented below.

4.1 Year of publication

The first criteria for analysis is the year wise publications of research work which is highlighted in *Figure 4.1*. Year of Publication includes the total number of publications considered for a particular period. In this section the publication details have been provided in terms of percentage and according to the years of study. Based on 100 research works, the average of per year publications have been considered.
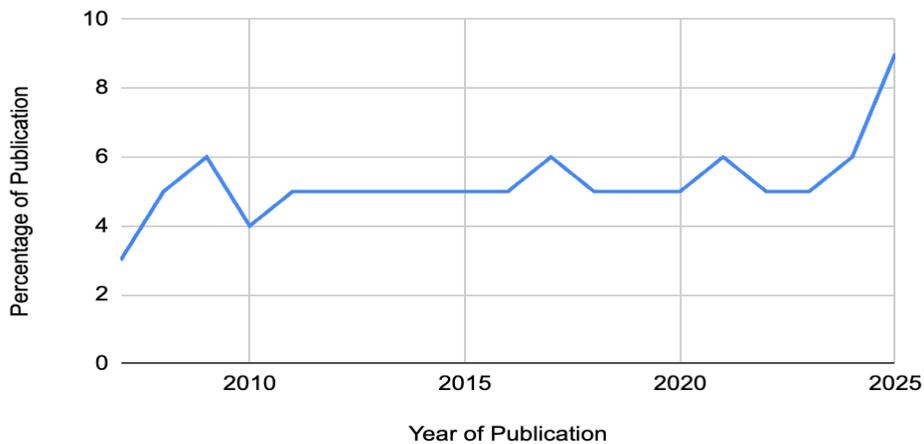

Figure 4.1: Year Wise Publications of research works

It has been observed that in the initial years (2007-2008) less no. of researches have been conducted specifically related to green finance technologies with the real estate sector. For systematic review on an average 5 papers per year have been considered between 2009-2023. However few publications are highly impactful to the real estate sector due to which for certain years (2009, 2017, 2019, 2023) 6% publications have been considered. Highest no. of works have been identified and purposefully included from 2024 onwards to identify recent trends and impact of green finance technologies in the real estate sector.

4.2 Nature of publications

The nature of the publication indicates the type of the publication considered for the current research work. In order to understand the type of research work, this section expresses the nature of study in numbers which is highlighted in *Figure 4.2*.
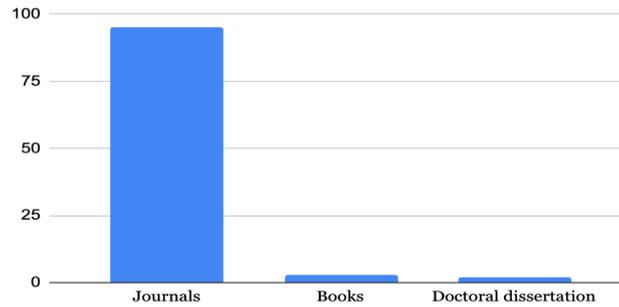
Nature of Publications

Figure 4.2: Nature of Publications

Out of 100 research works from all round the world, 95 are highly cited papers which have been published in different reputed journals from Elsevier, Scopus, WOS and other peer reviewed journals. 3 Books have been considered from 3 different countries in order to identify how green finance technologies is applied in different geographical real estate markets. Also 2 doctoral dissertations have been considered to understand the ongoing updates at the grass root level of the market.

4.3 Research Methodology

Every research work is an art. Having said that, different methodologies have been applied to find out the results from different research work. Research Methodologies include the plan or the roadmap followed by different authors all round the world to conduct their respective researches.
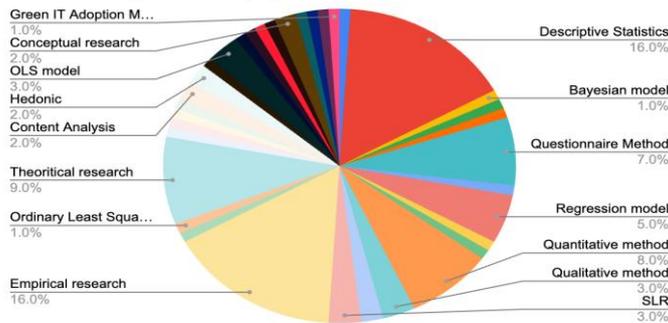

Figure 4.3: Methodologies adopted in research works

In the Pie Chart shown in *Figure 4.3*, the methodologies used for different research work has been highlighted in percentage. From the above chart, we can identify that the methodologies which have been highly used are Descriptive Statistics and Empirical research. This has been closely followed by theoretical research. The Quantitative method is followed by 8 % research work which is closely followed by the Questionnaire method (7%). Apart from this specific models like Content analysis, OLS model, Bayesian model etc. have been also applied in few research papers.

4.4 Country

While conducting this research work, it was observed that green fintechs are adopted by many countries all round the world. Few countries have applied such technologies in different sectors displaying various results. Few countries have significantly made the usage of green fintechs in the real estate sector specifically. The main objective of this section is to identify the countries involved in the adoption of Green finance technologies in the real estate sector. To this end, *Figure 4.4* shows the countries adopting Green Finance Technologies.
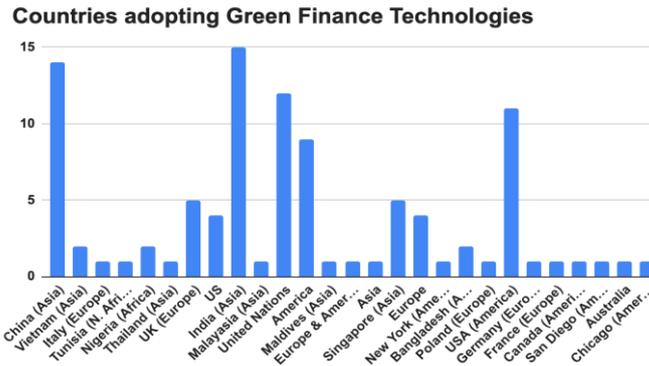
Figure 4.4: Countries adopting Green Finance Technologies

Out of the total data, 15 works have been undertaken in India. It has been followed by China. The next few highly contributing countries are the USA, Singapore, and the UK. It is observed that, many research works have been conducted based on a database of the United Nations. Similar contributions have been considered by Italy, Tunisia, Thailand, Malaysia, Maldives, New York, Poland, France, Germany, Canada, San Diego and Chicago.

4.5 Continents

In the previous section country wise analysis has been done. In the current section in order to get a broader picture, continent wise analysis has been undertaken. Despite the fact that so many countries are taking initiatives in order to contribute to the ultimate objective of sustainable development, it is important to find out the major contributors continent wise. We know that there are 7 continents in the world namely: Asia, North America, South America, Europe, Africa, Antarctica and Australia (also known as Oceania). For the sake of better understanding both North and South America has been considered as America in the Data collection stage.
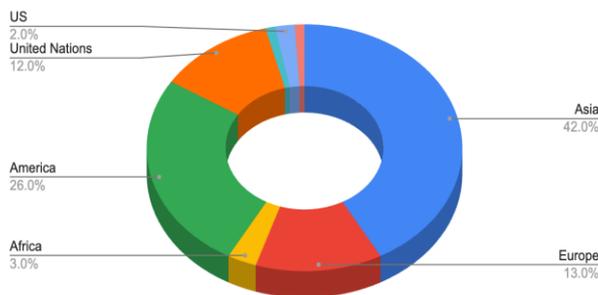

Figure 4.5: Continents majorly focusing on Green Finance Technologies

From the above *Figure 4.5*, it can be clearly observed that, majority of the research works related to the concerned sector have been conducted from Asia (42%). America follows the race by 26%. The 3rd and 4th position is held by Europe (13%) and the United Nations (12%) as a whole. Thus we can identify the dominance of green technologies in a few continents significantly.

4.6 Major Findings

In a systematic review of literature, the major findings from different papers help to draw the conclusions to the problem of the current paper. This

section includes the major findings in the area of green finance technologies related to the real estate sector over the period of study (18 years). These findings are highlighted in *Table 4.1* which are some of the representatives of the total database of 100 research works providing the basis of this systematic review of literature. The following papers or research works have been undertaken based on the journal of publication along with the number of citations a paper has achieved. In order to systematically identify the best papers the research work with the highest citations have been considered for major findings from a particular period of study i.e. a year.

Table 4.1: Major Findings Eminent from research works

Journal of Publication	Findings of Research works
QI, X. et. al.(2025)	Deeper interconnections are developing between the Real estate market and green market. However the intensity of risk spillover is different in both the markets.
Milala, S. I., & Ariffin, K. B. M.(2025)	Negligence in Government initiatives are negatively impacting sustainable practices in the real estate sector.
Alahouel, F. (2025)	High Transition risk amplify extreme volatility in REIT
Akin, I., and Akin, M. (2025)	The inclusion of Green investments including green bonds have helped in promotion of sustainable practices in real estate sector
Zeng, H. (2024)	Existence of asymmetric spillovers and risk hedging portfolio for ESG Real estate Investment Trusts (REITs).
Liu, B., & Pan, X.(2024)	Involvement of concerned authorities are required to minimize negative impact on the environment.
Kamal, N. Y. (2024)	Restricted rules and incentives have to be overcome in order to expand the use of green financing in real estate sector
Li, S.et.al., (2003)	Cooperative behaviour & evolutionary patterns help stakeholders to plan their goals and simultaneously to promote the green building industry
Ametefe, F. K. (2003)	It is observed that debates are growing regarding the topic of whether to include green technologies in the real estate market or not
Nagar, P. (2022)	Increase in green investment through multilateral & international banks to help in the meeting emerging needs of the economy.
Gholipour, H. F. (2002)	The impact of green finance technologies are more eminent in developing nations
Gilchrist, D.et.al.,(2021)	The majority of green finance loans belong to the real estate market. Also it impacts both shareholder and non shareholder values.
Morri, G. (2021)	A positive relationship exists between Green Indicators and REITs.
Schletz, M.,et.al.,(2020)	A proper financial system needs to be developed in order to implement the green finance technologies effectively in the real estate sector.
Jain, S. (2020)	Implementation of green finance strategies is only possible through proper policies, rules and regulations.
Nassiry, D. (2019)	Low cost contribution in each organization leads to the overall reduction in cost of the real estate market by using green technologies.
Ryszawska, B. (2018)	Huge impact on green finance is only possible through slow development in finance.
Sharma, M. (2018)	The role of stakeholders is eminent in the development of green buildings.
Shen, L.(2017)	The objective of implementing green policies are market benefits & pressure existing in the real estate market.
Welling, A.(2017)	Different initiatives have been undertaken to develop the field of green finance and simultaneously it has affected the real estate

	market.
Cooperman, E. (2016)	Focuses on how sustainable finance slowly is being adopted in real estate and other markets.
Robinson, S. J., and Sanderford, A. R. (2016)	Building attributes are better predictors in green and non green buildings.
Tathagat, D., & Dod, R. D.(2015)	The existence of green buildings are equally important for environmental balance & overall development of the real estate sector.
Zhang, X. (2015)	The major focus is on green building. Other aspects of sustainability are often overlooked.
Islam, M. A.et.al.,(2014)	Different opportunities of green banking exist to improvise the adoption of green technologies in the real estate sector.
Chegut, A. et. al. (2014)	The gentrification effect of green buildings exists on rental and transactional values of real estate.
Keerthi, B. S. (2013)	Focuses are made to enhance energy effective technologies in the real estate sector in order to impact the environment in a positive way.
Cajias, M., and Piazolo, D. (2013)	Energy conservation has a positive impact on the rental prices of housing properties.
Cajias, M.et.al., (2012).	Positive correlation is observed between green agenda & revenue generation.
Attuyer, K.et.al.,(2012)	In order to adopt green technologies, FCI has to direct tenants to utilize energy optimally & also to invest in green projects.
Eichholtz,P. et. al., (2012)	Stocks with green technologies were less prone to market risk comparatively.
Sekhar, G. S., & Gudimetla, V. (2011)	Even though green finance is gaining popularity, the success of it lies in its effective usage by the fund manager.
Martín, C. (2011)	Counseling can be one of the best measures to convince home buyers regarding purchase of green buildings.
Zhang, X. et. al. (2011)	Lack of awareness exists about the green technologies and green finance in the real estate sector.
Wiley, J. A. (2010)	Green buildings are able to fetch higher rents with occupancy.
Jackson, J. (2010)	The rent of green buildings change over time based on demand & supply of green space.
Keeping, M., & Shiers, D. (2009)	There are different methods like efficient usage of resources in order to adopt green technologies effectively.
Addae-Dapaah, K. (2009)	The key reasons for investment in green buildings are high values and minimisation of cost.
Molla, A. (2008)	GITAM involves different components comprising Drivers, Context, Intention, Adoption & Readiness.
Pivo, G., & Environment Programme Finance Initiative Property Working Group, U. N. (2008)	Major researches are conducted in order to identify the economical impact of green technologies in the real estate sector.
Pitts, J. (2008)	Valuation of green buildings are based on market evidence.
Nelson, A. (2007)	Different parts of the world real estate community have been proactive regarding the green issues and technologies.

5. DISCUSSION AND CONCLUSION

The Analysis and Interpretation section provides clear insights that address the objectives of this research paper. The first objective—identifying the association between green finance technologies and the real estate sector—has been accomplished through an extensive review of existing literature. The second objective focuses on examining prior studies related to the topic and the relevant market. To achieve this, 100 research works were systematically reviewed and analysed across six categories: Year of Publication, Nature of Publication, Research Methodology, Country,

Continent, and Major Findings. The third objective—determining the impact of adopting green technologies within the real estate sector—has been fulfilled by synthesizing the major findings, which highlight both the positive effects of green technologies and the areas requiring further enhancement.

The systematic literature review reveals that the adoption of green finance technologies has steadily increased across various sectors, including real estate—an area that contributes significantly to national economies. The sector has demonstrated growing interest in implementing sustainable technologies such as solar energy and hydropower. Numerous studies also examine the influence of green financial instruments, including green bonds and sustainability-linked mortgages, within the real estate market. Earlier research indicated limited public awareness and insufficient institutional initiatives, which constrained progress. However, over the past five years, rapid advancements have occurred as sustainability has become a central developmental priority. Consumer interest in green buildings has also risen substantially.

Recent developments show substantial transformation in both residential and commercial properties toward green infrastructure. Although misconceptions persist regarding the high costs of green technologies, long-term evidence suggests that their per-unit costs are lower relative to the benefits achieved. Consequently, such technologies not only support organizational cost-efficiency but also contribute positively to environmental sustainability.

As awareness among developers and buyers has grown, the adoption of green finance technologies has increased correspondingly. Financial institutions have also introduced new instruments to support sustainable and environmentally focused projects. It is important to recognize that green finance, sustainable finance, and climate finance represent long-term commitments. Their success depends on public awareness, strategic planning, and continuous monitoring. Only through these measures can sustainable development goals be fully realized within the real estate sector.

Overall, the systematic analysis provided in this study successfully addresses all research objectives and underscores the significant role of green finance technologies in shaping the future of real estate.

6. LIMITATIONS

Research limitations refer to the constraints or weaknesses encountered by a researcher during the course of a study. All research endeavors inherently involve certain limitations; however, acknowledging these constraints provides valuable guidance for addressing potential challenges in future studies.

As this paper is a systematic literature review, uniformity was maintained by including an average of five highly cited research works from each year within the study period. Although a total of 100 research works were examined, a larger number of publications could have been incorporated to provide an even more comprehensive understanding of the topic. To capture recent developments and emerging trends, additional studies from the last two years were also considered.

This research focuses specifically on identifying the association, adoption, and impact of green finance technologies within the real estate sector. While the study provides significant insights into this domain, it does not encompass the broader applications of green finance in other sectors or markets, which remain outside the scope of the current work.

7. FUTURE SCOPE

The future scope of a research study highlights the broader areas where further investigations can be conducted, extending the understanding of the topic. Any research work remains incomplete without a discussion of potential future directions, as research contributes to the ongoing expansion of knowledge within a field.

During the course of this study, it was observed that the application of green finance technologies within the real estate sector presents considerable opportunities for further research. This work represents only a preliminary contribution to the broader field of sustainable development. Notably, there is limited research on the impact of green finance specifically in the housing sector. The buying behaviour of consumers with respect to green buildings, for example, remains largely unexplored in a systematic manner.

Several research questions remain open for investigation, including:

- Are real estate properties incorporating green technologies practically affordable for consumers?

- Do green buildings demonstrate greater longevity compared to conventional constructions?

- To what extent do green finance technologies contribute to achieving long-term environmental objectives?

These questions offer opportunities for both new and existing researchers to expand the knowledge base. Such studies will not only enhance academic understanding of green finance technologies but also raise awareness among the general public. Additionally, the findings can guide real estate developers and companies in designing effective strategies to promote green buildings, communicate their benefits, and encourage greater adoption among consumers. Exploring these areas will strengthen the linkage between sustainable development goals and the real estate sector while supporting environmentally responsible growth.

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