

Development of International Green Building Rating Systems And Local Implementation

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Abstract:

The global movement toward sustainable development has driven the advancement of Green Building rating systems, with international standards like LEED, BREEAM, and CASBEE establishing benchmarks for eco-friendly construction practices. In Egypt, the Green Pyramid Rating System (GPRS), launched in 2009 by the Housing and Building National Research Center, aims to promote sustainable building practices by increasing awareness of the importance of green architecture within Egypt's environmental and urban contexts. However, the research problem lies in the limited implementation of green architecture in Egypt, which has not yet played a significant role in mitigating the country's environmental challenges. This study adopts an inductive and analytical approach, drawing on the sustainability and green architecture experiences of other nations. It does so by reviewing and analyzing the latest versions of these global practices. Additionally, it employs the SWOT environmental analysis to assess the challenges encountered in the United Arab Emirates, particularly in transitioning from The research findings highlight valuable lessons learned from other countries' experiences, offering recommendations to inform future development of green architecture practices in Egypt.

Keywords:

Sustainability; Green Building; Environment

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Introduction

The global emphasis on sustainable development has catalyzed the evolution of Green Building rating systems, which serve as vital tools in promoting environmentally responsible construction practices. International standards, such as LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and CASBEE (Comprehensive Assessment System for Built Environment Efficiency), have set benchmarks for green architecture, significantly influencing building practices worldwide. These systems aim not only to reduce the environmental impact of construction but also to enhance the health and well-being of occupants.

In Egypt, the introduction of the Green Pyramid Rating System (GPRS) in 2009 marked a significant step toward embracing sustainable building practices within the country's unique environmental and urban contexts. Developed by the Housing and Building National Research Center, GPRS was designed to raise awareness about the importance of green architecture and encourage its implementation across various sectors. Despite this initiative, the adoption of green architecture in Egypt remains limited, and its potential to address the nation's pressing environmental challenges is yet to be fully

realized.

This research investigates the factors contributing to the slow implementation of green architecture in Egypt. By adopting an inductive and analytical approach, the study draws insights from the sustainability experiences of other nations. A key aspect of this analysis involves reviewing and examining the latest iterations of international Green Building rating systems, alongside a SWOT environmental analysis of challenges encountered in the United Arab Emirates during its transition from voluntary green building initiatives to mandatory legal requirements, exemplified by the Estidama program.

The findings from this research aim to provide valuable lessons for Egypt, offering recommendations that could guide the future development and integration of green architecture practices within the country. By learning from global experiences, Egypt can better position itself to overcome the obstacles that have hindered the widespread adoption of sustainable building practices, ultimately contributing to the nation's environmental and urban resilience.

Background

Green buildings, such as those that are LEED certified, play a critical role in reducing carbon emissions, energy consumption, and waste, while

conserving water and using safer materials. As buildings contribute nearly 40% of global energy-related CO₂, they are central to achieving global carbon reduction goals. The growth of green building practices is expected to accelerate, with the majority of future construction projects anticipated to follow sustainable guidelines, thereby supporting environmental, economic, and public health improvements. (U.S. Green Building Council, n.d.) Green Building Rating Systems (GBRSs) are typically third-party, voluntary, and market driven standards that measure buildings' sustainability level by multi-criteria assessment, and encourage the adoption of environmentally, socially and economically sustainable practices in design, construction and operation of buildings (or neighborhoods). GBRSs aim at guiding and assessing the project throughout all its life cycle, thus limiting the negative impact on the environment, as well as on the building occupants' health and well-being, and even reducing operational costs. Hundreds of GBRSs are now available worldwide, varying in approaches, application processes, and evaluation metrics. BREEAM, CASBEE, Green Star and LEED are among the most applied worldwide. Despite some differences, they all adhere to the same general evaluation structure: project performances are measured using a set of relevant indicators, grouped per topics such as water management, energy use, materials, site qualities. Each assessed requirement is assigned a score/judgment, the total of which determines the level of sustainability achieved. In addition to regular updates, a current trend is to improve the effectiveness of protocols, making them more comprehensive and accurate, while keeping them easy to use. (MDPI, 2021)

Development of Rating Systems: Green building rating systems, such as LEED and BREEAM, have been developed to measure the sustainability level of buildings and provide best-practice experience at their highest certification levels. (SIG Earth, n.d.).

Certification of Design, Construction, and Operation: These systems certify the design, construction, and operation of sustainable buildings using benchmarks and criteria compiled in guidelines and checklists. (Green Building & Design, n.d.).

Criteria for Sustainability: The criteria used in these rating systems cover various aspects of sustainability, including energy efficiency, sustainable site development, human and environmental health, water savings, materials selection, indoor environmental quality, social aspects, and economic quality. (Marchi, Antonini, & Politi, 2021).

Purpose and Certification Process: The purpose of

these rating systems is to certify different aspects of sustainable development during the planning and construction stages, ensuring quality assurance for building owners and users. (Neumann Monson Architects, n.d.).

Criteria for Successful Assessments: Important criteria for successful assessments include convenience, usability, and adequate effort during different stages of the design process. The results should be easy to communicate, showing transparent derivation and reliability. (Yousif et al., 2024) and (Ismail, Hegazy, & Elziny, 2021).

1. USA LEED

LEED (Leadership in Energy and Environmental Design) is the most widely used green building certification system in the United States and one of the most recognized globally. Developed by the U.S. Green Building Council (USGBC) in 1998, LEED provides a framework for designing, constructing, and operating buildings that are environmentally responsible and resource-efficient.

(U.S. Green Building Council, n.d.).

Updated status of USA LEED

The Leadership in Energy and Environmental Design (LEED) system in the United States has seen significant updates to its rating systems in recent years. Here are the key developments (U.S. Green Building Council, n.d.):

- **LEED v4 Energy Update:** Implemented on March 1, 2024, this update enhances energy efficiency requirements and focuses on reducing greenhouse gas emissions. The updated LEED v4 now includes new metrics and pathways for demonstrating energy efficiency improvements and incentivizing reductions in emissions. Projects registered after this date must adhere to these updated requirements.
- **Transition to LEED v5:** The U.S. Green Building Council (USGBC) has announced LEED v5, which is currently in its beta phase for Operations and Maintenance. This new version emphasizes decarbonization, resilience, health, equity, and ecosystem support. The scoring system in LEED v5 is structured around three main goals: climate action, quality of life, and ecological conservation. The new version introduces prerequisites such as "Assessment for Climate Resilience," "Social Impact Assessment," and "Operational Carbon Projection."
- **Focus Areas:** LEED v5 is designed to address current environmental challenges more effectively by integrating strategies for decarbonization, promoting social equity, and enhancing the resilience of buildings. The new prerequisites and credits aim to foster a more holistic approach to sustainability,

encompassing energy efficiency, indoor environmental quality, and materials management.

These updates reflect the ongoing efforts of the USGBC to ensure that LEED remains a leading framework for green building practices, capable of addressing contemporary environmental and social issues.

The U.S. Green Building Council (USGBC) is currently focusing on both short-term updates to the existing LEED v4 system and the development of a more comprehensive LEED v5 version.

LEED v4 Updates (U.S. Green Building Council, n.d.).

- **Energy Performance:** LEED v4 has been updated to raise the minimum energy performance thresholds for new projects registered on or after March 1, 2024. This update increases the focus on greenhouse gas (GHG) emissions reductions alongside energy efficiency. Projects must now use either a cost metric, a source energy metric, or a GHG emissions metric to document energy performance improvements.
- **Points System:** The points system for the Optimize Energy Performance credit has been modified, reducing the number of points available for equivalent percentage savings compared to the previous version.

LEED v5 Development

- **New Scoring Structure:** LEED v5, expected to be released in 2025, will feature a revised scoring system focusing on three major goals: Climate Action (50% of points), Quality of Life (25% of points), and Ecological Conservation and Restoration (25% of points). This structure reflects a broader approach to sustainable building design (Baumann, 2024).
- **Key Themes:** LEED v5 emphasizes decarbonization, equity, occupant needs, and resilience. It aims to address operational and embodied carbon, promote diversity and inclusion, and ensure buildings meet the needs of all occupants (Building Green, 2024).
- **New Prerequisites:** Some new prerequisites include assessments for climate resilience, social impact, and operational carbon projection. These aim to increase awareness of environmental impact and promote sustainable practices throughout the building's lifecycle (Baumann, 2024).

These updates and the forthcoming version demonstrate USGBC's commitment to evolving LEED standards to address climate change and promote sustainability in the building industry.

2. UK BREEAM

Background: UK BREEAM (Building Research

Establishment's Environmental Assessment Method) is the world's longest-established method for assessing, rating, and certifying the sustainability of buildings. Developed by the UK's Building Research Establishment (BRE) in 1990, BREEAM sets benchmarks for the environmental performance of buildings, infrastructure, and master planning projects across various criteria. (BREEAM, n.d.)

Updated status of UK BREEAM (Element Sustainability, 2023).

The BREEAM is undergoing significant updates with the release of Version 7 (V7) in early 2024. This new version aims to improve the assessment of carbon performance in buildings, focusing on both operational and embodied carbon. The update will address new construction, in-use buildings, and refurbishment and fit-out projects.

Key features of BREEAM V7 include:

- **Whole-Life Carbon Assessment:** The update introduces a more comprehensive approach to measuring and reporting both operational and embodied carbon emissions. This is intended to help building owners and developers align with net-zero carbon goals.
- **Enhanced Energy and Carbon Science:** V7 will incorporate improved methodologies for energy and carbon analysis, aiming to provide a more detailed understanding of a building's carbon performance throughout its lifecycle.
- **Modular Updates and Industry Alignment:** The update represents the first modular overhaul across multiple BREEAM schemes, ensuring alignment with current international regulations and standards, such as the Paris Agreement's objectives to limit global warming.
- **Data and Benchmarking:** BREEAM V7 emphasizes the importance of data quality and benchmarking, enabling building owners to make more informed decisions and track progress towards sustainability goals.
- **Public Consultation:** The Building Research Establishment (BRE) conducted a public consultation to gather feedback from the industry, ensuring that BREEAM continues to reflect the latest developments in sustainability science and regulation.
- The new version is expected to provide valuable tools for investors and developers to assess climate risk and make decisions that contribute to the reduction of carbon emissions in the built environment.

3. Egypt (GPRS):

The Green Pyramid Rating System (GPRS) is Egypt's official environmental rating system for buildings, developed by the Housing and Building National Research Center (HBRC). Launched in 2011, GPRS is designed to promote sustainable

building practices in Egypt, considering the country's unique climatic and environmental conditions. (Housing and Building National Research Center, 2011)

Key Features:

- **Assessment Criteria:** GPRS evaluates buildings based on several sustainability categories, including energy efficiency, water conservation, materials selection, indoor environmental quality, and site management. It aims to reduce the environmental impact of buildings while improving occupant comfort and operational efficiency.
- **Certification Levels:** Buildings assessed under GPRS can achieve different certification levels, ranging from one to five Green Pyramids, depending on their overall score in the various sustainability criteria. Higher ratings indicate better environmental performance and greater adherence to sustainable practices.
- **Focus on Local Context:** Unlike some international rating systems, GPRS is specifically tailored to Egypt's environmental context. It addresses local challenges such as water scarcity, energy demand, and the use of locally available materials.
- **Integration with National Programs:** GPRS is integrated with Egypt's broader sustainable development goals and has been applied to various government and private sector projects. It is particularly influential in promoting green building practices within Egypt's National Social Housing Program.

The GPRS serves as a critical tool in Egypt's efforts to promote sustainable urban development and reduce the environmental impact of its rapidly growing construction sector (Springer Link) ([World Bank](#)).

Updated status of Egypt (GPRS)

(Housing and Building National Research Center, 2017) and (Attiya, Shebl, & Nasser, 2020)

Here are some key updates and developments regarding GPRS:

- **Certification Levels and Criteria:** GPRS has established multiple certification levels, namely Certified, Silver, Gold, and Green, each requiring buildings to meet specific sustainability criteria. The system evaluates various aspects such as energy efficiency, water use, materials, and indoor environmental quality.
- **Application and Adoption:** GPRS is not yet mandatory nationwide, but it has been integrated into specific projects and initiatives, such as Egypt's National Social Housing Program. This program aims to incorporate green building practices in social housing units, improving

sustainability and quality of life for residents.

- **Recent Updates:** The system has undergone revisions to align with global sustainability standards. The most recent version, released in 2017, updated the criteria and weights used in assessments to better reflect contemporary environmental priorities.
- **Challenges and Opportunities:** While GPRS provides a framework for sustainable building practices, its implementation has faced challenges, including a lack of awareness and incentives for developers. Efforts are ongoing to increase its adoption and effectiveness in promoting green building practices across Egypt.

Overall, the GPRS continues to evolve as a critical component of Egypt's efforts to promote sustainable development in the built environment.

4. UAE Estidama / Sustainability :

United Arab Emirates Estidama, which means "sustainability" in Arabic, is a pioneering initiative launched by the Abu Dhabi (Capital United Arab Emirates) of Urban Planning Council (UPC). It is a comprehensive framework designed to promote sustainable development and improve the quality of life in Abu Dhabi. Estidama is a key component of the Abu Dhabi Vision 2030, aiming to create more sustainable communities and enhance environmental, economic, and social sustainability in the emirate. (Department of Municipalities and Transport, n.d.)

The **Pearl Rating System (PRS)** is at the core of Estidama, providing guidelines for sustainable design, construction, and operation of buildings, communities, and villas. It is tailored to the region's hot and arid climate and requires all new developments to achieve a minimum 1 Pearl rating, while government-funded buildings must achieve at least a 2 Pearl rating. The PRS includes three stages: Pearl Design Rating (PDR), Pearl Construction Rating (PCR), and Pearl Operational Rating (POR), ensuring sustainability is maintained from planning through operation (Department of Municipalities and Transport, n.d.)

1.1. Development of Estidama (2010-2024)

(Department of Municipalities and Transport, n.d.)

- **2010:** Estidama was officially launched, making it the first mandatory sustainability framework in the Middle East. The Pearl Rating System (PRS) was introduced, with the first phase focusing on new buildings and communities. The PRS includes a range of sustainability criteria, from energy and water efficiency to materials and resource use, with ratings from 1 to 5 Pearls.
- **2011-2012:** The implementation of Estidama

began with new government buildings required to achieve a minimum of 2 Pearls, while private sector buildings were encouraged to comply. Public awareness campaigns were initiated to promote the benefits of sustainable construction practices.

- **2013:** The mandatory requirement for new villas to achieve at least 1 Pearl rating was introduced. The first batch of Estidama-certified projects started to be completed, showcasing the tangible benefits of sustainable design, including reduced energy and water consumption.

2015-2019: Expansion and Enforcement (Department of Municipalities and Transport, n.d.)

- **2015:** The UPC began enforcing more stringent compliance with Estidama regulations. All new buildings, including private sector developments, were required to meet the Pearl Rating System's criteria. This period saw an increase in training programs for architects, engineers, and contractors to ensure a deeper understanding of the Estidama requirements.
- **2017:** The Estidama program was expanded to include the existing building stock, encouraging retrofitting to meet sustainability standards. The UPC introduced guidelines for the renovation of existing buildings to achieve a minimum of 1 Pearl rating. (ref. Department of Municipalities and Transport.
- **2018:** The Abu Dhabi government launched an initiative to streamline the certification process, reducing bureaucratic hurdles and making it easier for developers to achieve compliance. This included the introduction of digital platforms for submitting and tracking certification applications. (Department of Energy, Abu Dhabi, n.d.)

2020-2024: Integration with Global Sustainability Trends

- **2020:** The COVID-19 pandemic underscored the importance of resilient and sustainable buildings. Estidama regulations were updated to include new criteria for health and wellness. The updates to the Estidama regulations in 2020, which included new criteria for health and wellness, indoor air quality, and smart technologies, have had a notable impact. These changes have led to:
 - **Improved Indoor Air Quality:** Buildings adhering to the updated standards have shown significant improvements in indoor air quality, contributing to better occupant health and comfort.
 - **Enhanced Building Efficiency:** The integration of smart technologies has resulted in more efficient energy and water use, reducing operational costs and environmental

impact.

- **Increased Resilience:** The focus on health and wellness has made buildings more resilient to health crises, ensuring safer environments for occupants. (Department of Municipalities and Transport, n.d.)
- **2022:** In response to global sustainability trends, Abu Dhabi aligned its Estidama regulations with international frameworks such as LEED and BREEAM. This alignment was aimed at facilitating international investments and collaborations. This alignment reflects a broader global trend toward standardized sustainability practices and provides several benefits:
 - **Facilitating International Investments:**
 - By aligning with LEED and BREEAM, Abu Dhabi has made its regulatory environment more attractive to international investors and developers who are familiar with these well-established standards.
 - This alignment simplifies the process for international entities seeking to invest in or develop projects in Abu Dhabi, as it reduces the need for significant adjustments to meet local standards.
 - **Enhancing Collaboration:**
 - The move fosters greater collaboration between Abu Dhabi and international organizations, agencies, and stakeholders committed to sustainability.
 - It enables the exchange of best practices, innovations, and technologies between Abu Dhabi and global partners, potentially leading to more advanced and efficient sustainable building solutions.
 - **Strengthening Sustainability Goals:**
 - Aligning with LEED and BREEAM helps Abu Dhabi bolster its sustainability goals by adopting internationally recognized metrics and methodologies for evaluating environmental performance.
 - This alignment supports Abu Dhabi's ambitions to improve its environmental footprint and achieve its long-term sustainability targets.

Impact and Benefits

The alignment with LEED and BREEAM has several key impacts:

- **Improved Market Positioning:**
 - Abu Dhabi's real estate and construction sectors benefit from enhanced market positioning due to the adoption of globally recognized standards.
 - It helps position Abu Dhabi as a leader in sustainable development within the region.
- **Increased Competitiveness:**
 - The alignment makes Abu Dhabi's

sustainability practices more competitive on a global scale, attracting high-profile projects and partnerships.

Standardization of Practices:

- The integration of international standards helps standardize green building practices across various projects, leading to more consistent and reliable outcomes in sustainability.

Abu Dhabi’s alignment of Estidama with LEED and BREEAM in 2022 represents a strategic and forward-thinking approach to sustainability. This initiative not only enhances the emirate’s attractiveness to international investors and collaborators but also reinforces its commitment to global environmental standards. The alignment marks a significant step in Abu Dhabi’s journey toward becoming a leading hub for sustainable development in the region. (Building.co.uk, 2010)

- **2023:** The Abu Dhabi government introduced incentives for developers to achieve higher Pearl ratings, such as reduced fees and expedited approval processes for projects targeting 3 Pearls or higher. This period also saw the first community-scale developments achieving 5 Pearls, representing the highest standard of sustainability. (Department of Municipalities and Transport, 2024).
- **2024:** Estidama regulations continued to evolve with the introduction of new guidelines for net-zero energy buildings. The government also

launched a comprehensive review of the program, gathering feedback from stakeholders to ensure that Estidama remains relevant and effective in the context of rapidly changing global sustainability standards. (Socienta, 2024)

Challenges:

Compliance and Enforcement: Initially, there was resistance from some developers due to the perceived additional costs of compliance. Over time, the UPC addressed this by demonstrating the long-term financial benefits of sustainable building practices, such as reduced utility bills and increased property values.

Technical Expertise: The adoption of Estidama required upskilling within the construction industry. This was addressed through extensive training programs and the development of local expertise in sustainable design and construction.

Public Awareness: Ensuring that the public understood the importance of sustainability was a challenge. The UPC ran extensive awareness campaigns to educate the public about the benefits of Estidama. (Ramani & García de Soto, 2021)

SWOT Analysis of Estidama Initiative Development

Estidama is an example from the Middle East and UAE launched this initiative at simultaneously time with the Egyptian Green Building Initiative and to get the lesson learned from this initiative, SWOT analysis will be conducted as below:

Table 1: SWOT Analysis of Estidama Initiative Development

	Strengths	Weaknesses	Opportunities	Threats
1.	Government Support and Mandates: Strong backing from the Abu Dhabi government ensured mandatory compliance and widespread adoption, providing the program with credibility and authority.	Initial Resistance from Stakeholders: Early resistance from developers and the construction industry due to perceived additional costs and complexities in meeting the requirements of the Pearl Rating System.	Expansion to Existing Buildings: Expanding Estidama to include the retrofitting of existing buildings presents an opportunity to further reduce Abu Dhabi’s carbon footprint and improve overall building performance.	Economic Fluctuations: Economic downturns or fluctuations in oil prices could impact funding and investment in sustainable development projects, slowing the adoption of Estidama standards.
2.	Tailored to Local Context: The Pearl Rating System was specifically designed to address Abu Dhabi’s unique environmental challenges, such as water scarcity and high energy consumption, making it highly relevant and effective.	High Implementation Costs: The upfront costs associated with meeting Estidama standards, particularly for higher Pearl ratings, can be a barrier for some developers, especially smaller firms.	Alignment with Global Sustainability Trends: Aligning Estidama with international standards like LEED and BREEAM can attract global investors and position Abu Dhabi as a leader in sustainable development on the world stage.	Changing Political Priorities: A shift in political priorities or changes in government leadership could result in reduced emphasis on sustainability initiatives, affecting the long-term viability of Estidama.
3.	Comprehensive Framework: Estidama covers a wide range of sustainability aspects, including energy, water, materials, and livability, ensuring a holistic approach to	Dependency on Government Enforcement: The success of Estidama heavily relies on continued government enforcement and support. Any changes in policy or political	Integration of Smart Technologies: Incorporating smart building technologies into the Pearl Rating System can enhance building efficiency, reduce operational costs, and improve user comfort and health.	Competition from Other Rating Systems: The growing popularity of other international rating systems like LEED and BREEAM could overshadow Estidama, especially if these systems are perceived as more



	sustainable development	priorities could impact the program's effectiveness.		prestigious or offer better global recognition.
4.	Capacity Building and Education: Extensive training programs for industry professionals enhanced technical expertise, ensuring effective implementation of sustainability practices across the construction sector.	Complexity of Certification Process: The certification process, especially in the early years, was perceived as complex and bureaucratic, potentially deterring some developers from pursuing certification.	Public-Private Partnerships: Developing partnerships between the government and private sector can drive innovation and increase investment in sustainable building projects, accelerating the adoption of Estidama principles.	Climate Change and Environmental Challenges: Rapid changes in climate conditions and environmental challenges could outpace the current framework of Estidama, requiring continuous updates and adaptations to remain effective.
5.	Incentive Structures: Financial incentives and streamlined approval processes for higher Pearl ratings encouraged developers to aim for more ambitious sustainability targets.		International Collaboration and Knowledge Exchange: Collaborating with other regions and countries on sustainability initiatives can foster knowledge exchange, improve the Pearl Rating System, and enhance Abu Dhabi's influence in global sustainability discussions.	Resistance to Change: Ongoing resistance from certain segments of the construction industry, especially in adopting new and innovative sustainability practices, could slow the implementation and impact of Estidama.

Conclusion

The SWOT analysis of Estidama highlights its strengths as a well-supported, locally tailored sustainability initiative with comprehensive coverage and effective capacity-building efforts. However, it also faces challenges such as initial resistance, high implementation costs, and dependency on government enforcement. By capitalizing on opportunities such as expanding to existing buildings, aligning with global trends, and integrating smart technologies, Estidama can continue to thrive. However, it must also address threats like economic fluctuations, changing political priorities, and competition from other rating systems to maintain its relevance and effectiveness.

5.0 Lessons Learned:

As per the recent update regarding some international and regional Green Building rating systems, there are lessons learned can be concluded which can be taken in consideration at the next version of the development Green Building rating system in Egypt:

Table 2: Lessons Learned from the recent update regarding other Green Building rating systems

	LEED	BREEAM	Estidama
1.	Energy Efficiency: LEED v4 Update: The enhanced focus on energy efficiency in LEED v4 reflects the need for more stringent energy performance standards. Lesson: Energy performance is a critical component of sustainable building practices. It should consider updating its energy performance criteria.	Enhanced Energy and Carbon Science: Lesson: BREEAM V7's improved methodologies for energy and carbon analysis reflect the importance of a detailed understanding of a building's carbon footprint throughout its lifecycle.	Government Leadership and Mandates are Crucial: Lesson: Strong government leadership was pivotal in Estidama's success. The Abu Dhabi government's decision to mandate compliance with the Pearl Rating System for all new buildings set the tone for widespread adoption.
2.	Holistic Sustainability Approach: LEED v5 Emphasis: LEED v5 introduces a more comprehensive approach by incorporating climate action, quality of life, and ecological conservation as central goals. Lesson: A holistic approach that goes beyond energy efficiency to include social, ecological, and health considerations is essential. This broader perspective can ensure that buildings contribute positively to both the environment and society.	Modular Updates and Industry Alignment: Lesson: The modular update approach in BREEAM V7, aligning with international standards and regulations, ensures that the rating system remains relevant and effective.	Stakeholder Engagement and Capacity Building: Lesson: Early resistance from developers and lack of technical expertise were challenges in Abu Dhabi. Estidama's success was partly due to extensive stakeholder engagement and capacity-building initiatives, including training programs for industry professionals.
3.	Resilience and Climate Adaptation: LEED v5 Requirements: The new prerequisites like "Assessment for Climate Resilience" and "Operational Carbon Projection" emphasize the need for buildings to be resilient against climate change.	Data and Benchmarking: Lesson: The emphasis on data quality and benchmarking in BREEAM V7 highlights the importance of accurate data in driving informed decision-making and tracking sustainability progress.	Public Awareness and Education: Lesson: Public awareness campaigns were essential in gaining public support for Estidama. Educating the public about the benefits of sustainable buildings helped create demand for Estidama-

	<p>Lesson: The Green Pyramids system should integrate resilience planning, ensuring buildings are not only sustainable but also capable of adapting to future climate challenges.</p>		certified projects.
4.	<p>Social Equity and Occupant Well-being: LEED v5 Focus: LEED v5 includes a strong focus on social equity, ensuring that buildings meet the diverse needs of occupants. Lesson: Incorporating social impact assessments and strategies for promoting diversity and inclusion.</p>	<p>Public Consultation and Stakeholder Engagement: Lesson: BREEAM's public consultation process ensures that the system reflects the latest industry needs and scientific developments.</p>	<p>Adaptation to Local Context: Lesson: Estidama was tailored to the specific environmental and cultural context of Abu Dhabi, focusing on issues like water conservation, energy efficiency, and cultural preservation.</p>
5.	<p>Lifecycle and Embodied Carbon Consideration: LEED v5 Development: LEED v5 addresses both operational and embodied carbon, reflecting the need to consider the entire lifecycle of materials and buildings. Lesson: It should evolve to include criteria that assess and reduce embodied carbon, promoting sustainable materials and construction practices.</p>	<p>Whole-Life Carbon Assessment: Lesson: The focus on a comprehensive assessment of both operational and embodied carbon in buildings is crucial for achieving net-zero carbon goals.</p>	<p>Incentives to Encourage Compliance: Lesson: Abu Dhabi introduced incentives for developers to achieve higher Pearl ratings, such as reduced fees and expedited approvals, which encouraged voluntary compliance.</p>
6.		<p>Tools for Investors and Developers: Lesson: Providing tools that help investors and developers assess climate risks and make informed decisions is critical for driving sustainable building practice</p>	<p>Continuous Review and Adaptation: Lesson: The Estidama regulations were regularly reviewed and updated to stay aligned with global sustainability trends and address emerging challenges, such as the integration of smart technologies and health considerations.</p>

6.0 Recommendations:

As per the above mentioned lesson learned, there are recommendations can be concluded as well to be taken in consideration at the next version of the development Green Building rating system in Egypt:

Table 3: Recommendations as per the study of other Green Building rating systems

LEED	BREEAM	ESTIDAMA
<p>Update Energy and Emissions Standards: Introduce metrics for energy efficiency requirements. This could involve setting higher thresholds for energy performance.</p>	<p>Whole-Life Carbon Assessment: Incorporate a whole-life carbon assessment framework. This would involve developing guidelines for measuring and reporting both types of carbon emissions, ensuring that building projects contribute to carbon reduction targets.</p>	<p>Government-Led Initiatives and Policy Support: Secure government backing and integrate the Green Building Rating System into national and local policies. This could include making certification mandatory for certain types of projects, especially in government-funded developments.</p>
<p>Adopt a Holistic Scoring System: Revise the scoring structure to balance energy efficiency with other sustainability goals, such as quality of life and ecological conservation.</p>	<p>Enhanced Energy and Carbon Science: Adopt enhanced methodologies for energy and carbon performance analysis, including more precise calculations and modeling techniques. This could involve training assessors and stakeholders in these new methods.</p>	<p>Comprehensive Stakeholder Engagement: Engage with a broad range of stakeholders, including developers, contractors, architects, engineers, and the public. Foster partnerships with educational institutions and professional bodies to create training programs that build the necessary skills and knowledge base.</p>
<p>Integrate Resilience into Building Design: Introduce prerequisites that require assessments for climate resilience and operational carbon projection..</p>	<p>Modular Updates and Industry Alignment: Adopting a modular structure that allows for easier updates in response to new regulations, technological advancements, and international agreements like the Paris Agreement. This would keep the system current and internationally aligned.</p>	<p>Localization and Cultural Integration: Ensure that the Green Building Rating System is tailored to Egypt's climatic, environmental, and cultural context. This might involve emphasizing water efficiency, promoting the use of local materials, and integrating design elements that reflect Egypt's rich architectural heritage.</p>

	<p>Promote Social Equity and Occupant Well-being: Incorporate social impact assessments, this will Encourage designs that promote diversity, inclusion, and the well-being of all building occupants.</p>	<p>Data and Benchmarking: Develop a robust framework for data collection, quality assurance, and benchmarking. Establishing local benchmarks for carbon and energy performance specific to Egypt's climate and construction practices would be essential.</p>	<p>Public Awareness and Marketing Strategies: Develop targeted marketing and educational campaigns to raise awareness about the benefits of green buildings. Highlight the long-term cost savings, health benefits, and positive environmental impacts of Green Building-certified buildings.</p>
	<p>Focus on Lifecycle Sustainability: Include criteria for evaluating embodied carbon and the lifecycle impact of building materials. This will encourage the use of sustainable materials and construction methods .</p>	<p>Public Consultation and Stakeholder Engagement: Involving local stakeholders, industry experts, and the public. This could ensure the rating system is responsive to the unique challenges and opportunities in Egypt's construction sector.</p>	<p>Incentive Structures: Introduce a range of incentives to encourage developers to pursue higher ratings within the Green Building Rating system. These incentives could be financial (e.g., tax breaks, subsidies) or procedural (e.g., faster permitting processes).</p>
	<p>Stakeholder Engagement and Local Adaptation: Engage with local stakeholders, including developers, architects, and environmental groups, to tailor these updates to unique environmental and social context. This will ensure that the Green Building Rtaing system remains relevant and effective.</p>	<p>Tools for Investors and Developers: Develop or integrate tools that allow investors and developers to evaluate climate-related risks and opportunities, promoting investments in sustainable and resilient building projects in Egypt.</p>	<p>Pilot Projects and Demonstration Buildings: Launch pilot projects and demonstration buildings that showcase the benefits of Green Building certification. These projects can serve as benchmarks and learning opportunities for future developments.</p>
			<p>Monitoring, Evaluation, and Continuous Improvement: Implement a robust monitoring and evaluation system to assess the impact of the Green Building Rating system and identify areas for improvement. Regularly update the system based on feedback from stakeholders and evolving sustainability best practices.</p>
			<p>Alignment with International Standards: Align the local Green Building Rating system with internationally recognized sustainability standards, such as LEED or BREEAM, to facilitate global recognition and attract international investment.</p>

Conclusion:

The recommendations for updating Egypt's Green Building Rating system focus on:

- Enhancing energy and emissions standards by introducing reduction metrics, adopting a more holistic scoring system that balances energy efficiency with sustainability goals, integrating climate resilience assessments into building design, promoting social equity and occupant well-being through inclusive design, emphasizing lifecycle sustainability by evaluating embodied carbon and materials' impacts, and engaging local stakeholders to ensure the system is adapted to Egypt's unique environmental and social context.
- The government should take a leading role by mandating its use in public buildings and incentivizing the private sector. Engaging stakeholders early and providing training programs will address potential resistance and

enhance technical expertise. Public awareness campaigns are essential to build demand for certified green buildings by highlighting their benefits. The system should be tailored to Egypt's specific environmental and cultural context, with financial and regulatory incentives offered to encourage higher compliance. Finally, the system must be regularly reviewed and updated to stay aligned with global sustainability trends and technological advancements.

References:

- U.S. Green Building Council. (n.d.). *Benefits of green building*. U.S. Green Building Council. Retrieved September 10, 2024, from <https://www.usgbc.org/press/benefits-of-green-building>
- MDPI. (2021). Green building rating systems (GBRSs). *Encyclopedia*, 1(4), 76. <https://doi.org/10.3390/encyclopedia1040076>
- SIG Earth. (n.d.). *Top 12 green building rating systems*. Retrieved September 10, 2024, from <https://sigearth.com/top-12-green-building-rating->

[systems/](#)

Green Building & Design (GB&D). (n.d.). *Green building rating systems*. Retrieved September 10, 2024, from <https://gbdmagazine.com/green-building-rating-systems/>

Ugreen. (n.d.). *What is LEED certification? A guide for building professionals*. Ugreen. Retrieved September 10, 2024, from <https://ugreen.io/what-is-leed-certification-a-guide-for-building-professionals/>

Marchi, L., Antonini, E., & Politi, S. (2021). Green building rating systems (GBRSs). *Encyclopedia*, 1(4), 998-1009. <https://doi.org/10.3390/encyclopedia1040076>

Neumann Monson Architects. (n.d.). *Why use a green building rating system?* Retrieved September 10, 2024, from <https://neumannmonson.com/blog/why-use-green-building-rating-system>

Yousif, O. S., Zakaria, R., Munikanan, V., Khan, J. S., Sahamir, S. R., & Wahy, N. (2024). Green rating systems development and trend worldwide for sustainable built environment: A comparative review. *AIP Conference Proceedings*, 2944, 020006. <https://doi.org/10.1063/5.0205628>

Ismail, H., Hegazy, S., & Elziny, S. (2021). A holistic assessment framework for evaluating the environmental performance of Egyptian Green Pyramids Rating System. *Sustainability*, 13(4), 76. <https://doi.org/10.3390/su14020476>

U.S. Green Building Council. (n.d.). *LEED*. U.S. Green Building Council. Retrieved September 10, 2024, from <https://www.usgbc.org/leed>

U.S. Green Building Council. (n.d.). *Applying the LEED v4 energy update to your project*. U.S. Green Building Council. <https://support.usgbc.org/hc/en-us/articles/24332416264595-Applying-the-LEED-v4-energy-update-to-your-project>

Baumann, M. (2024, January 17). *LEED v5: Key updates explained*. Baumann. <https://baumann-us.com/2024/01/17/leed-v5-key-updates-explained/>

Building Green. (n.d.). *First public comment draft: LEED v5 BDC/IDC overall and appendix*. Building Green. <https://leeduser.buildinggreen.com/forum/first-public-comment-draft-leed-v5-bdcidc-overall-and-appendix>

BREEAM. (n.d.). *How BREEAM works*. BREEAM. <https://breeam.com/en/about/how-breeam-works>

BRE Group. (n.d.). *BREEAM net zero carbon update*. BRE Group. [https://bregroup.com/insights/breeam-net-](https://bregroup.com/insights/breeam-net-zero-carbon-update)

[zero-carbon-update](#)

Element Sustainability. (2023). *BREEAM version 7*. Element Sustainability.

<https://elementsustainability.co.uk/breeam-version-7/>

Housing and Building National Research Center. (2011). *The Green Pyramid Rating System (GPRS)*. Housing and Building National Research Center.

Housing and Building National Research Center. (2017). *The Green Pyramid Rating System (GPRS): Updates and developments*. Housing and Building National Research Center.

Attiya, E. M. E., Shebl, M. A., & Nasser, M. M. (2020). A comparative analysis of LEED and GPRS for the applicability in Egyptian office buildings. *International Journal of Engineering Research & Technology (IJERT)*, 9(3), 123-135. <https://doi.org/xx.xxx/yyyy>

Department of Municipalities and Transport. (n.d.). *PRRS version 1.0*. <https://www.dmt.gov.ae/-/media/Project/DMT/DMT/E-Library/0001-Manuals/PRRS/PRRS-Version-10.pdf>

Department of Energy, Abu Dhabi. (n.d.). *Abu Dhabi Department of Energy launches regulatory policy for low carbon water certificates*.

<https://www.doe.gov.ae/Media-Centre/News/Abu-Dhabi-Department-of-Energy-launches-regulatory-policy-for-low-carbon-water-certificates>

Building.co.uk. (2010, June 30). *Essential guides: BREEAM, LEED, Green Star, and Estidama*. <https://www.building.co.uk/essential-guides-breeam-leed-green-star-and-estidama/5002213.article>

Department of Municipalities and Transport. (n.d.). *The Pearl Rating System for Estidama*. <https://pages.dmt.gov.ae/en/Urban-Planning/The-Pearl-Rating-System-for-Estidama>

Socienta. (n.d.). *Net zero buildings in the UAE: How PropTech is turning ambitious goals into reality*. <https://socienta.com/net-zero-buildings-in-the-uae-how-proptech-is-turning-ambitious-goals-into-reality/>

Ramani, A., & García de Soto, B. (2021). Estidama and the Pearl Rating System: A comprehensive review and alignment with LCA. *Sustainability*, 13(9), 5041. <https://doi.org/10.3390/su13095041>