

Highlighting Challenges Facing Evaluation Systems in Egypt

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Abstract: The paper investigates sustainable trends and building evaluation systems with an emphasis on local implementation issues. It compares local and worldwide rating systems using an inductive-deductive-analytical-comparative methodology. Previous studies have revealed that GPRS did not adhere to the Egyptian Building Code, highlighting the necessity for context-appropriate national categorization **criteria**. The study draws attention to the shortcomings of environmental assessment techniques, such as the absence of thorough data, the complexity of the ecosystem, and the engagement of stakeholders. It also draws attention to the need for better strategies, taking into account things like pollution, climate change, biodiversity loss, and variations in climate and nature as well as construction codes. It also draws attention to the difficulties in putting Green Pyramid Rating System (GPRS) into practice in Egypt because of cheap energy costs, and a lack of knowledge. A minimum GPRS certification score and incentives should be instituted by the government.

Keywords: BREEAM, Egypt, Environmental systems Challenges, Green Pyramid Rating System, GPRS, LEED, Local challenges, Sustainable trends.

1. Introduction:

Environmental problems were brought about by the industrial revolution's increased energy usage and resource limitations. By encouraging renewable energy sources and minimizing waste, sustainability seeks to enhance people's quality of life (Golubchikov, O., 2012). Table 01 shows the key sustainability trends in architecture, including the main concerns for zero-energy building, green building, and sustainable architecture (Post, S. 2021). Green architecture promotes sustainable design, reducing environmental impact to address resource extinction and population growth, using systems like BREEAM, LEED, and Green Pyramid to evaluate environmentally friendly buildings (Pramesti, P. U., 2021).

2. The objectives of this paper are:

1. Study of sustainable trends and building evaluation systems with an emphasis on local implementation issues.
2. Comparison of local and worldwide rating systems using an inductive-deductive-analytical-comparative methodology.
3. The research highlights the limitations of environmental assessment methodologies, including

the lack of comprehensive data and the intricacy of the ecosystem.

4. Highlighting the need for more effective strategies that consider factors such as building codes, pollution, climate change, biodiversity loss, and environmental differences.
5. Drawing attention to the difficulties in Putting Green Building Rating Systems (GPRS) into practice in Egypt because of misdirected incentives, cheap energy costs, and a lack of knowledge (Ragheb, A., 2016).

3. The Sustainability Trends

Sustainability trends in architecture focus on zero-energy buildings, green buildings, and sustainable architecture. These trends involve energy saving, renewable energy use, site planning, water conservation, rationalization and conservation of resources, indoor environment quality, natural environment preservation and recycling. Green architecture aims to create environmentally friendly structures by promoting efficient energy and material use. These themes are shown in table 02. The table outlines key sustainability trends in architecture, including the main concerns for zero-energy building,

green building, and sustainable architecture (Hafez, F. S., 2023).

The key themes of the architectural sustainability trends:		
"zero-energy building" is concerned with the following:	"Green building" addresses the following issues:	"Sustainable architecture" addresses the following issues:
<ul style="list-style-type: none"> ○ Energy saving. ○ use of sustainable energy sources. 	<ul style="list-style-type: none"> ○ Site planning. ○ Saving water. ○ Use of renewable energy. ○ Rationalization and conservation of resources. ○ Quality of the indoor environment. 	<ul style="list-style-type: none"> ○ Preserving the natural environment. ○ Use of renewable resources. ○ Recycling. ○ Use energy-saving devices.

Table- 01: Sustainable Trends in Architecture Analysis (Hussein, E. S. 2010)

The word "green architecture," which also refers to sustainable architecture, is a broad term used to describe architectural design methods that create environmentally friendly structures. Sustainable design encourages the economical use of resources and energy in an effort to lessen the adverse effects of buildings on the environment (Bibri, S. E., 2024).

4. Summary of green buildings systems

The current environmental assessment methods are quantitative that measures energy and water with fixed standards. They overlook the relationship between environmental design quality and psychological and social impact on building occupants, disregard sustainable building standards, and reward a narrow elite group. However these methods did not assess the comfort and efficiency of

users therefore (Zhang, Y., 2019), Environmental Qualitative Evaluation assesses the comfort and efficiency of users in a space, considering their needs and requirements. To enhance the program's usage and sustainability, it proposes tailoring certification requirements, defining intended performance, and addressing existing use characteristics (Coleman, S. 2004).

Green buildings are gaining popularity in the construction industry to reduce environmental impact and promote sustainable practices. Evaluation systems like LEED and BREEAM have been developed to assess sustainability in buildings. The Egyptian Green construction Council has played a significant role in advancing green construction practices in Egypt by addressing regional issues and emphasizing water shortages and energy use in harsh climates.

Table 03: Using of qualitative and quantitative methods for environmental evaluation (Ismaeel, W. S. E., 2018)

Enviromental Qualitative Evaluation	Enviromental Quantitative Evaluation
Independence	Current environmental assessment methods are quantitative and measure energy, water, etc. with fixed measurable standards.
Efficiency	
Suitability	
Measure the comfort of the users of the space (physical/ chemical/ radiological/ psychological balance) with consideration for achieving users' demands	Disregarding the connections that exist between the psychological and social effects of poor environmental design and the building's inhabitants
It considers beneficiaries' wants and the possibilities available to meet their desires according to the standards of sustainable buildings.	Ignore the beneficiary's wants and desires according to sustainable building standards.
It is suggested that deficiencies in the present usage characteristics be noted, that the principles of the needed end performance be made clear, and that the certification requirements be revised to reflect the altered use of the program.	Instead of being utilized by a wide spectrum of people, its incentives are mostly utilized by a select few elite users and are self-serving.

Table- 02: Comparison between environmental qualitatively and quantitatively environmental evaluations (Daoud, A. O., 2022)

Environmental Qualitative Evaluation assesses user comfort and efficiency in a space, focusing on needs, performance, and sustainability standards, addressing quantitative methods that overlook design quality and elite groups.

5. An analysis of environmental systems for evaluating the performance

Buildings play a significant role in shaping our environment. However, the traditional form of buildings often poses several problems that need to be addressed through environmental assessment approaches. These approaches aim to evaluate the impact of buildings on the environment and find sustainable solutions (HBRC, 2017)

6. Sustainable building evaluation systems:

Evaluation systems for energy efficiency and environmental performance have become widespread in many countries, with some establishing their own systems. However, some face challenges due to lack of

awareness, high costs, and the need for specialists⁽¹³⁾. The world's population growth has led to a growing concern about the extinction of non-renewable resources, leading to economic crises. A number of systems, such as the BREEAM (Building Research Establishment Environmental Assessment Method) in the UK, LEED (Leadership in Energy and Environmental Design) in the US, and the Green Pyramid Rating System in Egypt, have been developed to assess environmentally friendly and sustainable buildings in order to address this (Hazem, N., 2020)

6.1. LEED Rating System:

LEED is a system for buildings that meets environmental design requirements, evaluating their compatibility with the environment, health, and comfort. It aims to rationalize energy and water, preserve materials, and improve the quality of the internal environment (Ammar, M. G., 2012). See table 04: Components of the LEED rating system (Hegazy, I.R., 2024).

Categories	The relative weight of each category	LEED V4 score
Location and transportation	16%	Minimum accreditation (≥ 45-59) (Certified)
Sustainable sites	10%	
Water efficiency	11%	
Energy and atmosphere	33%	Silver rating (≥ 60-74)
Building materials	13%	Gold rating (≥ 75-89)
Indoor environmental quality	16%	
Creativity in design	6%	Platinum rating (≥90)
Regional priority	4%	
Completing operations	1%	

Table- 03: LEED rating system components (O'Malley, C., 2014)

Within the national market, this is the most extensively used grading system. Its high market value draws both domestic and foreign investment, as seen by Egypt's growing number of LEED registered and certified projects. But it's important to remember that other Arab nations have embraced the LEED system first. Eight projects in the Egyptian market were LEED certified—four of them were gold certified and four of

them were silver certified—while sixteen projects were LEED registered. Almost all of these projects are LEED BD+C version 3.0^(*), and depending on the

^(*)LEED BD+C version 3.0 rating system is designed for projects where the developer manages the core and shell of the mechanical, electrical, plumbing, and fire protection system, but not the tenant fit-out.

project's status, different cases may demand different LEED points (Hegazy, I.R., 2024).

6.2 GPRS Rating System:

The Egyptian Green Building Council and Housing and Building National Center (HBRC) have introduced the first sustainability rating system for buildings in Egypt, categorizing them into Platinum, Gold, Silver, Bronze, and Certified. The system aims to enhance natural resource consumption, preserve strategic reserves, and promote renewable energy technologies (Omer, A.M., 2008). The first Green Pyramid Rating System (GPRS) version was released in April 2011, and the second version, which was based on the third LEED edition, was released in 2017. It was created in order to fulfill Egypt's Vision 2030 and adjust to the local environment. The following certification levels are available through the system: Certified (≥ 30 - < 40), Bronze (≥ 40 - < 50), Silver (≥ 50 - < 65), Gold (≥ 65 - < 80), and Platinum (≥ 80) (Moussa, R.R., 2019).

Egypt is addressing the negative effects of global warming and climate change by enhancing energy efficiency and waste treatment management. The Egyptian Green building Council has developed the Green Pyramid classification system to aid designers in making informed decisions. Local efforts to improve the energy efficiency of buildings and address greenhouse gas emissions have been primarily based on the LEED system (Suzer, O., 2019). Buildings have been assessed for their sustainable performance using the Pyramid Green Rating System (GPRS). A research on an Islamic structure in Old Cairo received 65% of the possible marks, making certification possible. Another examination, however, discovered that several criteria in the GPRS did not match those of the local codes 1. It is thus advised that the structure and grading criteria be developed in a way that is consistent with the national environment. 4 Main Categories of GPRS is described in table 09 (Rezaallah, A., 2012).

Categories	The relative weight of each category	The total score of the GPRS standard
Sustainable Sites (SS)	10%	Denied (≥ 30) Certified rating (≥ 30 - 40) Bronze rating (≥ 40 - 50) Silver rating (≥ 50 - 65) Gold rating (≥ 65 - 80) Platinum rating (≥ 80)
Energy Efficiency (EE)	28%	
Water Use Efficiency (WE)	30%	
Materials and Resources (MR)	12%	
Indoor Environmental Quality (IEQ)	12%	
Management Protocols (MP)	8%	
Innovation and added values (IN)	5%	

Table – 04: Primary GPRS Category (Daoud, A. O., 2022).

6.3 BREEAM standard:

The BREEAM standard, launched in 1990 by the British Building Research Establishment (BRE), is the first method to evaluate and classify the environmental performance of buildings (Suter, G. W., 2011). It includes homes, mixed housing buildings, offices, hospitals, schools, industrial buildings, prisons,

and courts. The standard focuses on management, health, energy conservation, water conservation, materials, pollution, surface runoff water, waste management, and environmental science. The BREEAM standard aims to provide adequate airflow, comfortable temperature, and natural lighting for the space (<https://egyptindependent.com>). BREEAM categories are shown in Table 10.

Categories	The relative weight of each category	Total score of BREAM standard
Administration	9 %	≥ 30 Acceptable
Energy and CO2 emissions	29%	
Water	6%	Good (≥ 45)
Materials	24%	
pollution	4%	

Waste	7%	Excellent (≥ 70) Above excellent(85 ≤)
health	12%	
Surface runoff water	4%	
Ecology	9%	

Table – 05: BREEAM ratings (Zhang, Y., 2019).

Environmental systems like LEED and BREEAM assess building sustainability and resource efficiency, promoting eco-friendly design, renewable energy, efficient insulation, and responsible waste management for a sustainable future. When social, economic, and environmental considerations line up, green building evaluation technologies—which use the BREEAM benchmark—direct sustainable development processes in nations like the UK, and UAE (Zhang, Y., 2019).

7. Evaluating building performance:

Environmental assessment systems like BREEAM, Green Pyramid Rating System, and LEED classify building performance, promoting sustainable design, energy consumption reduction, and efficient resource use. They enhance stakeholder management, neighborhood development, energy optimization, renewable energy sources, and project performance monitoring (Coleman, S., 2004).

The core of the paper includes a comparative analysis of LEED and BREEAM rating systems and GREEN PYRAMID rating systems; they include the design process and recycling of solid waste, assessing their adaptability and relevance to the LEED-certified Egyptian office buildings. It explores many sustainability issues such as Date, Uses of environmental assessment systems, Requirements and points for each classification, Accreditation level, Rating development, Community participation, Optimize Energy Use. The paper explores sustainability in LEED-certified Egyptian buildings, highlighting local challenges like economic and policy constraints. It suggests opportunities for improvement through market attitude, construction, economic issues, education, information, governmental management, materials and resources, and technology and training (De Castro, D., 2021). (See following Table 6).

	BREEAM	GREEN PRYAMID	LEED
Date	1990	HBRC- Second version (2017)	1998
Uses of environmental assessment systems	<ul style="list-style-type: none"> It is the first method in the world to evaluate and classify the environmental performance of buildings. It includes the uses of homes, mixed residential buildings, offices, hospitals, schools, industrial buildings, prisons, and courts. For buildings under Construction New For buildings under renovation Refurbishment For the sustainability of homes - for urban communities- For buildings in use Use-In BREEAM 	<p>In 2009, the Egyptian Green construction Council was founded with the intention of encouraging environmental preservation, halting desertification, and lowering construction energy usage. Next, in 2010, it created the first iteration of the Green Pyramid Rating System, which was revised in 2017 for the second iteration. The system seeks to improve Egypt's building stock by establishing a standard for best practices, empowering building designers to make decisions based on environmental impact, raising awareness of sustainable green buildings, facilitating informed discourse, and promoting the design and construction of sustainable buildings.</p>	<p>For the purpose of planning, developing, and managing high-performance, an ecologically friendly building, this method is acknowledged globally as the industry standard. The stages of building consist of:</p> <ul style="list-style-type: none"> LEED standards for design and construction Leed standards for interior design and construction Leed operating standards LEED v4 for Building Design and Construction Leed standards for homes LEED standards for neighborhood development. <p>The U.S. Green Building Council established LEED, a global green building certification program, to support environmentally aware design and efficient use of resources in green homes, neighborhoods, and structures.</p>

	BREEAM	GREEN PRYAMID	LEED
Date	1990	HBRC- Second version (2017)	1998
Requirements and points for each classification	<ul style="list-style-type: none"> Administration the health energy Water Materials Pollution Surface runoff water Waste Ecology 	<ul style="list-style-type: none"> Sustainable Sites Energy efficiency Water use efficiency Materials and resources Indoor environment quality Management Protocol Innovation and added value 	<ul style="list-style-type: none"> Location and transportation Sustainable sites Water efficiency Energy and atmosphere Building materials Indoor environmental quality Creativity in design Regional priority Complementary operations
Accreditation level	<p>The grades a building receives through BREEAM according to the requirements and points for each classification:</p> <ul style="list-style-type: none"> Acceptable (≥ 30) and the building is certified Good (≥ 45) Very good (≥ 55) Excellent (≥ 70) Above excellent (≥ 85) 	<p>The building's total score through the Green Pyramid GPRS evaluation according to the requirements and points of each classification:</p> <ul style="list-style-type: none"> Certified: ≥ 30-40 points Bronze: ≥ 40-50 points Silver: ≥ 50-65 points Golden: ≥ 65-80 points Platinum: ≤ 80 points Projects of less than 30 credit hours will be classified as "Denied". 	<p>The building's LEED certification is determined by how many points it was able to achieve in accordance with each classification's standards and points:</p> <ul style="list-style-type: none"> Minimum accreditation (≥ 45-59) (Certified) Silver rating (≥ 60-74) Gold rating (≥ 75-89) Platinum rating (≥ 90).
Rating development	<p>Enhancing asset performance, lowering net carbon, controlling social and health consequences, encouraging circularity, resilience, and biodiversity, and facilitating disclosures in millions of buildings globally, third-party recognized BREEAM standards have been in place since 1990.</p>	<p>The global system (LEED) was utilized in its development, notwithstanding the disparities in economic, technological, social, and cultural aspects between the two nations. The knowledge of ancient Egyptian architecture was not leveraged, and local issues like poor administration, ignorance, and inadequate training were disregarded.</p>	<p>The USGBC and NRDC are set to update the LEED green building rating system in 2016, incorporating stricter carbon reduction and human health requirements, which will transform the private sector, accounting for half of US construction.</p>
Community participation	<p>BREEAM Communities enhances stakeholder management in master planning, addressing limited involvement and potential delays. However, the last update, in 2017, lacks a final version that addresses evolving technology and pandemic situations.</p>	<p>Without the assistance of other societal groups, it was established by a government agency.</p>	<p>LEED-ND and LEED for Cities and Communities are two certification programs that promote efficient, sustainable, and well-connected neighborhood development. LEED-ND offers a prescriptive approach, while LEED for Cities and Communities helps local leaders create sustainable plans, enhancing quality of life through social, economic, and environmental performance indicators.</p>
Optimize Energy Use	<p>Gains minus losses kWh/m (anticipated based on building design and structure). Local renewable energy sources provide at least 10% of the building's power and heating needs. In order to reduce political lighting, the outside lighting design adheres to IKE norms. Electricity sub metering for critical usage scenarios Sub metering power usage in rental properties.</p>	<p>Reduce the loads for lighting, heating, and cooling by using conservation and climate-responsive design techniques. Make use of energy sources that are efficient or renewable. Make an efficient lighting and HVAC system selection. Boost system control techniques and building performance. Keep an eye on the project's performance (Bibri, S.E., 2018).</p>	<ul style="list-style-type: none"> EA Prerequisite 2- Minimum energy Performance EA Credit 1- optical Energy performance EQ credit 7 – Thermal Comfort EQ credit 1 – Outdoor Air Delivery Monitoring Ea Credit 2-on-side Renewable energy EA Credit – Green power EA credit 1-Optimize Energy performance EA Credit 1- Optimize Energy Performance EA Credit 5- M&V EA Credit 3 Enhanced commission(Ismaeel, W.S.E., 2018)

7.1 Comparison between environmental rating systems:

Table- 06: The rating comparison (Source: The researcher)

8. An overview of the comparison of systems

1. Among rating systems that include green building design concepts, comparative rating systems make use of efficient use of water and energy, rationalization of materials and resources, the current indoor environment, and a disproportionately high criterion for sustainable placement. These criteria are used to analyze the system; the relative weight of each criterion varies depending on the viewpoint of the system.
2. The broadness of BREEAM is attributed to its disproportionate application of sustainability concepts, which are more expansive and all-encompassing than the notion of green building. This is achieved through social communication, the consideration of cultural, economic, and social characteristics as well as traditions and customs, and the expression of local identity and character.

3. The desire in adhering to environmental management standards is what most systems have in common; this is evident from the outset of the project through its design, implementation, and operation.
4. Systems are distinguished by their varying degrees of interest in the local dimension by assigning a higher relative weight to the criteria that address local issues.
5. Achieve green architecture; most solutions include enhancing existing treatments with varying degrees of creativity, innovation, and perfection.
6. GPRS was created using the global system (LEED), despite the disparities in the two nations' economies, technologies, social and cultural aspects. It also failed to address regional issues like poor management and a lack of awareness and training (Aly, H., 2024).

9. Evaluation of the various categorization systems' criteria in comparison

Three distinct building categorization systems were compared based on their respective criteria, as Table 07 illustrates.

Category	Criteria	LEED V4	BREEAM	GPRS
Site	site assessment	0		
	Construction activity	0	0	
	Light pollution reduction	0		
	Shaded parking			
	Accessibility		0	0
	Site selection	0	0	0
	Protection of natural system	0		0
Water	Indoor water use	0		0
	Water leak prevention		0	0
	Water consumption	0	0	0
	Landscape water use reduction			0
	Water monitoring		0	0
Materials	Insulation		0	
	Toxic material elimination		0	

Category	Criteria	LEED V4	BREEAM	GPRS
	Regional materials	0		
	Impact of lifecycle		0	
	Waste management	0		
	Material reuse	0		0
Energy	Outdoor light control		0	
	Energy efficient equipment		0	0
	Renewable energy production	0		0
	Maintenance and operation			0
	Environmental impact		0	0
	Reduction of CO ₂	0	0	
Indoor Environmental Quality (IEQ)	Thermal comfort	0	0	0
	Security and safety		0	
	Air quality	0	0	
	Natural ventilation			0
	Glare control			
	Visual comfort	0	0	0
	Materials emissions	0		0
acoustics	0	0	0	
Others	Culture identity			0
	Public transportation			0
	Green cars	0		
	Earthquake resistance			
	Economy support			0

Table- 07: Rating Systems Criteria Comparison (Daoud, A.O., 2022).

LEED, despite its weaknesses like extensive documentation and inability to achieve sustainable goals, strengthens through green modeling recognition, universal approach, and systemic investment in green design. While, BREEAM has weaknesses such as complexity and less transparency in its calculation process, but strengths include the ability to express multiple environmental objectives

and handle different rating systems. At last, Green Pyramid, created by a governmental body, offers a uniform benchmark for evaluating future structures' compliance with green practices, promoting green building approaches, and increasing awareness in the area, despite its weaknesses due to differences in economic, technology, and social problems (Suzer, O., 2015).

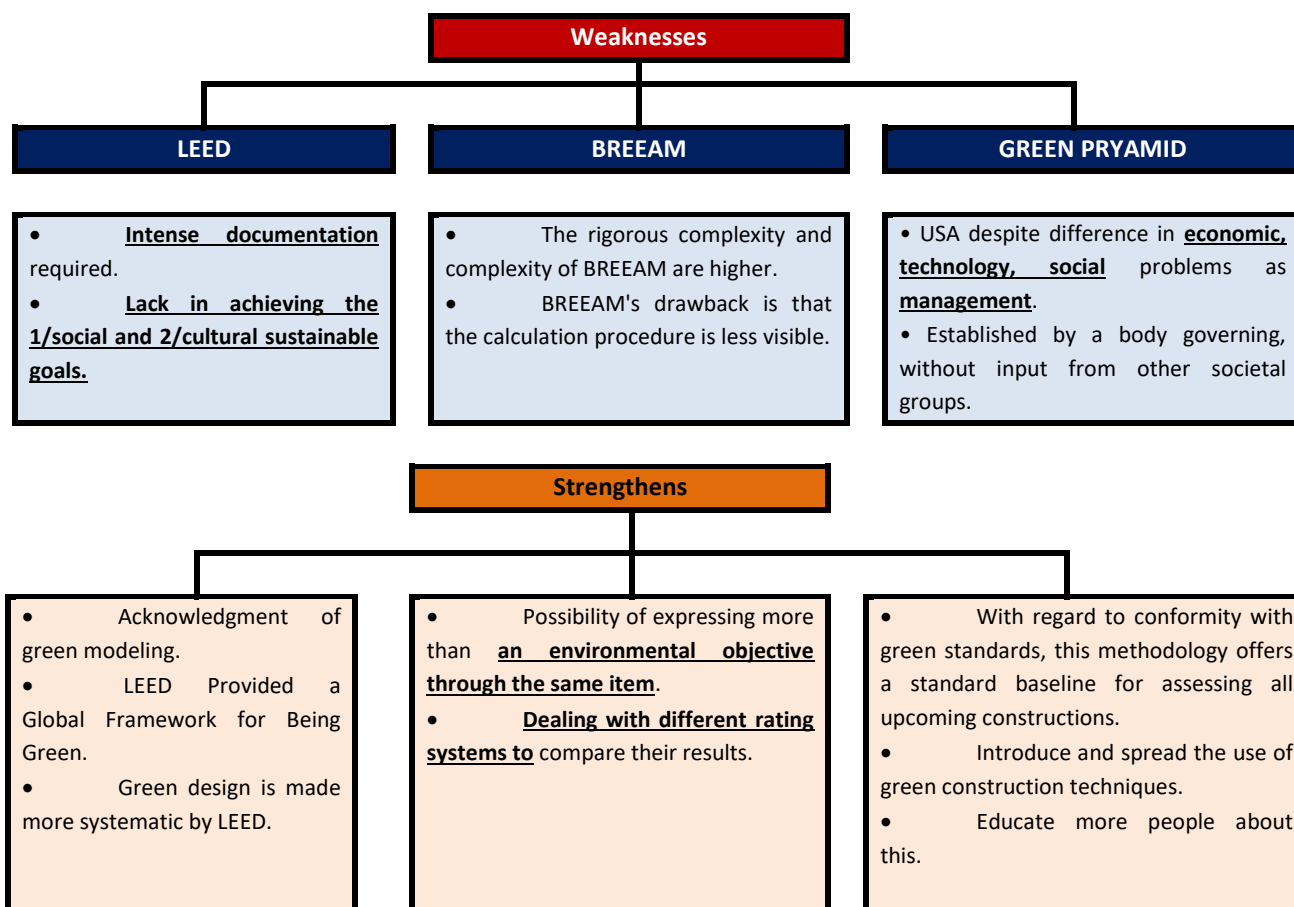


Fig. 01: Describes LEED, BREEAM and green pyramid comparison in weakness and strengths (Mattoni, B., 2018).

LEED, BREEAM, and Green Pyramid are all green design standards that aim to achieve sustainable goals. LEED emphasizes green modeling recognition and universal approach, while BREEAM has complexity and less transparency. Green Pyramid, created by a governmental body, provides a uniform benchmark for evaluating compliance with green practices and increasing awareness, despite differences in economic, technology, and social issues. The research analyzed the many aspects of sustainable constructions using a number of green building rating systems, including BREEAM, GPRS, and LEED. The study aims to comprehend the reasons behind the low adoption of sustainable construction practices in Egyptian communities and districts, utilizing a limited measurement set of just ten variables. The research's objective is to understand Egyptian communities and districts (Moussa, R.R., 2019).

10. Findings and discussion

The study compares BREEAM, GPRS, and LEED credit issues, finding high consistency with 83% overlap.

However, the unaddressed LEED standard is higher. Comparing assessment methods is challenging as what applies to one technique doesn't apply to another (Moussa, R.R., 2019). LEED and BREEAM certification systems need to clarify if higher ratings improve building efficiency and operational performance. GPRS's vision for rating beyond the building's operation is unclear, with LEED requiring facility consumption data after five years and BREEAM 2011 focusing on first-year operation. BREEAM, GPRS, and LEED rating systems aim to enhance building performance, minimize environmental impact, and establish objective evaluation standards. They require premium buildings to complete BREEAM In-USE ratings within three years, while LEED targets reductions in materials and water use (Moussa, R.R., 2019).

The increasing number of structures certified by reputable green building organizations raises questions about their performance, leading to a trend of projects seeking dual certification from LEED and BREEAM. Two methods promote environmental

performance in building stock, updating criteria based on legislative developments and best practices, with differences arising from policies and bureaucratic environments (Hazem, N., 2020).

11. Problems of environmental assessment methods

The lack of comprehensive data, including baseline data and historical trends, poses a significant challenge to environmental assessment. Without reliable data, it becomes difficult to assess the true extent of environmental impacts. The complexity of ecosystems makes it difficult to isolate specific causes and effects, and assessors must consider factors like biodiversity loss, habitat destruction, pollution, and climate change. Stakeholder involvement and political pressure also impact assessments (Hazem, N., 2020).

12. Challenges and difficulties locally:

- Defect in evaluating the psychological interaction with the user of space

A defect in assessing the local characteristics of buildings, as the design of environmental assessment approaches does not take into account the differences in nature, climate, building codes and standards between countries.

- Proving that the design of environmental assessment approaches does not take into account differences in nature, climate, and building codes and standards between countries. The LEED system was applied to one of the environmentally Egyptian buildings, the White Mountain Hotel in Siwa, which was chosen as one of the best global models in environmental projects and development by the Earth Summit in Johannesburg, but this hotel did not achieve the points required for accreditation, and the research concluded that it is necessary to develop the hotel to suit the global idea of sustainability and to qualify it to obtain LEED accreditation.

- Defect in the assessment of the building that obtained LEED certificate after operation, which leads to the building obtaining additional degrees without verifying their feasibility and the extent of benefit from them (Hazem, N., 2020).

13. Towards green Egypt: assessing LEED-certified Egyptian buildings through sustainable frameworks

Ahmed Rashad, a British University professor, states that green architecture in Egypt is still in its experimental phase, with projects focusing on sustainable buildings for local implementation to reduce environmental impact and improve economic performance. The EU-funded initiative in Egypt supported an administrative building in Sharm el-Sheikh, focusing on sustainable development of built-up environments (Ammar, M.G., 2012).

Expert Florianine Visser^(*) highlights the importance of low energy building and urban planning in Egypt, highlighting low-tech techniques for residential and small-scale office buildings and high-tech solutions like solar chillers. A 5-year-old pilot project in Upper Egypt restored 18 adobe constructions using local materials. Egypt is implementing green architecture to reduce environmental impact and improve economic performance (Ammar, M.G., 2012).

14. Comparative examinations of various grading system requirements

The following Table, which compares the criteria of various building rating systems, shows the comparison. The rating systems that were selected are separated into two groups: the first group consists of international rating systems with LEED and BREEAM included. Furthermore, the Egypt rating system (GPRS) constitutes the second category (Suzer, O., 2019).

Several green building rating systems, such as LEED, BREEAM, and GPRS, were used in the study's analysis of the various characteristics of sustainable structures. Understanding the causes of the lack of implementation in Egyptian districts and neighborhoods is the goal of the research (El-Hafeez, A., 2014).

15. Problems of environmental assessment methods

One key problem affecting environmental assessment is the lack of comprehensive data. Assessors often face challenges in obtaining accurate information about the environment, including baseline data and historical trends. Without reliable data, it

^(*) Florentine Visser is a MED-ENEC (Energy Efficiency in the Construction Sector in the Mediterranean) expert in low-energy buildings and urban planning.

becomes difficult to assess the true extent of environmental impacts (Doan, D.T., 2017).

Another problem is the complexity of ecosystems. Environmental systems are intricate webs of interdependent variables, making it challenging to isolate specific causes and effects. Assessors must consider various factors such as biodiversity loss, habitat destruction, pollution levels, and climate change when evaluating environmental impacts.

Furthermore, variables like stakeholder involvement and political pressure can significantly affect environmental assessments. Stakeholders may have conflicting interests or biases that can influence decision-making processes. Political pressure can also lead to biased assessments or inadequate consideration of certain issues (Moussa, R.R., 2019).

16. Challenges and difficulties of environmental tools:

- Defect in evaluating the psychological interaction with the user of space
- A defect in assessing the local characteristics of buildings, as the design of environmental assessment approaches does not take into account the differences in nature, climate, building codes and standards between countries (Díaz, S.M., 2019).
- Proving that the design of environmental assessment approaches does not take into account differences in nature, climate, and building codes and standards between countries. The LEED system was applied to one of the environmentally Egyptian buildings, the White Mountain Hotel in Siwa, which was chosen as one of the best global models in environmental projects and development by the Earth Summit in Johannesburg, but this hotel did not achieve the points required for accreditation, and the research concluded that it is necessary to develop the hotel to suit the global idea of sustainability and to qualify it to obtain LEED accreditation.

Defect in the assessment of the building that obtained LEED certificate after operation, which leads to the building obtaining additional degrees without verifying their feasibility and the extent of benefit from them (Hussein, E.S., 2010).

17. Analyses of the Variables Affecting the Environmental Assessment

Environmental assessment is a crucial process that evaluates the potential impacts of human activities on the environment. It aims to identify, predict, and mitigate any adverse effects before implementing a project or policy. However, several variables can influence this assessment and its outcomes. One significant variable affecting environmental assessments is political pressure. Governments often face pressure from various interest groups, such as industries or communities, to prioritize economic development over environmental concerns. This pressure can lead to biased assessments that downplay potential negative impacts (Suter II, 2011). Another variable is the availability and quality of data. Accurate and comprehensive data are essential for conducting a thorough environmental assessment. However, limited access to relevant information or unreliable data sources can hinder the accuracy of these assessments. Furthermore, technological advancements play a vital role in environmental assessments (Bashir, M. F., 2024).

New technologies enable more precise measurements and predictions of environmental impacts. For example, remote sensing techniques can provide detailed information about land use changes or pollution levels. However, these advancements also require skilled personnel and adequate resources for their implementation (Suter II, G. W., 2011). By identifying areas for improvement in terms of energy efficiency, resource usage, and waste management, these approaches pave the way for more sustainable and environmentally friendly buildings. It is essential to prioritize such assessments to ensure a greener future for the built environment (Karmany, H. M. 2015).

18. Problems of applying GPRS locally:

Despite having a thorough set of building design norms and regulations, Egypt does not effectively apply green building principles for the following reasons (Diaz, S. M., 2019): (1) Inappropriate incentives; (2) Low energy and power pricing; and (3) Insufficient understanding of the significance of resource efficiency. The following five main groups of barriers were identified by Chan et al. (2017): (1) economic issues; (2) attitude and market; (3) information, knowledge, and awareness; (4) management and government; and (5) technology and

training. The survey looked at the barriers affecting the adoption of green building practices and technologies in 20 countries, including Egypt. As seen

in, each set of obstacles is made up of a number of distinct barriers.

<i>Principal group of obstacles</i>	<i>List of Specific Obstacles</i>
Attitude and market	Conflicts of interest among stakeholders, lack of interest and market demand, mistrust of sustainable building technologies, and a dearth of vetted sustainable building technologies, demonstration projects, and suppliers are some of the reasons why traditional technologies encounter opposition. The adoption of green construction methods is influenced by these variables.
construction and demolition waste	GPRS implementation in local areas faces challenges due to higher material costs and unsustainable practices in handling construction and demolition waste. Four main obstacles include human, technology, industry, process, and governmental sources. Promoting green solutions can reduce waste and mitigate environmental and economic impacts.
Financial concerns	Due to their high market costs, leasing fees, lengthy payback periods, and absence of bank loan financing choices, green technologies are costly, time-consuming, and labor-intensive.
Education and knowledge	The absence of integration between postsecondary education institutions and the job market is the second difficulty, stemming from a lack of data gathering and links between educated individuals and their respective businesses. The understanding of the green pyramid that undergrads and recently graduated architects possess varies from that of those with job experience, according to the Egyptian National Authority to assure quality of education and accreditation (NAQAEE).
Knowledge, awareness, and information	The lack of sustainable building technologies databases, knowledge and awareness, reliable research and education, lack of familiarity with these technologies, and limited experience with untraditional procurement methods contribute to the challenges faced in sustainable construction.
Management and government	The absence of government incentives, restrictive laws and regulations, inadequate grading systems, a lack of marketing, and leaders' disregard for sustainable building technology are all contributors in the underutilization of sustainable construction.
Materials and Resources	GPRS has limitations in the "Materials and Resources" category, including weight and lack of certified materials. The Egyptian government should establish a minimum GPRS certification score for building permits and introduce incentives for companies implementing green building principles (Suter II, G. W., 2011).
Technology and training	Implementing new sustainable building technologies presents risks and uncertainties, including difficulties in providing training, lack of technical standard procedures, and a lack of expertise, as well as complex and rigid requirements (Bashir, M. F., 2024).

Table- 08: The main barriers to adopting sustainable building practices and technologies (source: the researchers)

19. Conclusions

The research explores the challenges of implementing sustainable building evaluation systems in Egypt, focusing on environmental performance. It uses an inductive-deductive-analytical-comparative approach to compare international and local rating systems. The study found that the GPRS did not meet the national Egyptian building code's requirements and some criteria did not align with the local code. The research also highlighted the need for improved environmental tools and a focus on the relationship between environmental design quality and psychological and social impact on building occupants. The study also highlighted the challenges in implementing Green Building Practices (GPRS) in Egypt due to misplaced incentives, low energy prices, and lack of awareness about resource efficiency.

20. Statement of Conflicting Interest

The authors state that none of their known conflicting financial interests or interpersonal connections could have seemed to have an impact on the work presented in this study.

21. Recognition

The team supplied the authors with all the data needed for this work, for which they are incredibly appreciative.

22. References

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