Conference Paper

International Sustainability Rating Tools: A Methodology for Adoption to Local Contexts

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Abstract

Building assessment tools were developed since the beginnings of the twentieth century to evaluate the sustainability of local buildings. This came as a response to the increasing international attention focused on the extensive damage humans caused to the environment after industrialization. Today, there are tens of evaluation tools that focus on a variety of parameters; nevertheless, no specific tool is currently being used in Bahrain; the small, yet environmentally challenged urban archipelago in the Arabian Gulf. This study assesses five building sustainability-rating tools. The selected tools were chosen because of their relevance to the context, popularity and importance, their alleged internationalism and versatility, the availability of free data and technical manuals, and their number of projects certified internationally. The American LEED; The UK BREEAM; The UAE's Pearl Rating System (PRS) and the international DGNB and SBTools. By using tabulations, cross-comparisons, and comparative analysis, this article sheds light on the appropriateness of the selected rating tools for adoption in Bahrain. Although the study focuses on the Bahraini context, however, the research introduces a methodology to integrate international sustainability rating tools with local governance systems and processes in other countries, particularly in the developing world where local building sustainability assessment tools are not yet established.

Keywords: Sustainability, Rating Tools, LEED, BREEAM, DGNB, SBTool, Pearl Rating System, Bahrain

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1. Introduction

Buildings globally account for 17% of the fresh water usage, 25% of the harvest of wood, 33% of carbon dioxide emissions and 40% of the energy and materials use (Say & Wood 2008). Those high percentages persuaded governments and industries to pay more attention to issues relating to sustainable development (Reeder 2010).

Consequently, today, the need to measure and assess the environmental performance of buildings raises progressively, and to meet such demand, sustainability assessment tools are continually being adopted by local governments and the building industries (Clevenger et al. 2013).

Existing sustainability evaluation tools assist designers and constructors to develop sustainable priorities while providing stakeholders with a scheme to analyze buildings performances (Reeder 2010). The majority of sustainability assessment tools target five areas of enquiry: energy consumption, use of resource, transportation, water and waste management (CEM 2008) other areas of analysis that are less common between the different rating systems include: indoor air quality, innovation, cultural values, urban communities, management and operations.

Bahrain, the small and sustainably challenged urban island in the Arabian Gulf does not effectively enforce the adaptation of any international sustainability rating system and, unlike its neighboring countries did not develop a rating system of its own. In addition, Bahrain does not have any certified building with any rating system yet. The Supreme Council for the Environment mentioned in their reports the suitability of adopting the LEED rating system in their reports (Supreme Council of the Environment 2012). However, no actions were taken in that regard, and no empirical evidence that proves the suitability of the LEED system exists. Like the rest of the world, the need to strictly monitor the impact of buildings on the environment continues to grow, and the Bahraini government is looking more seriously for solutions and implementation strategies that will ensure the adaptation of sustainable principles within the built environment.

This paper investigates the suitability of five international rating systems for adoption in Bahrain. The rating tools were chosen because of their relevance to the context, popularity and importance, their alleged internationalism and versatility, the availability of free data and technical manuals, and the number of projects they have certified nationally and internationally. The investigation utilizes the technical manuals and official websites of the selected rating systems. By using comparative analysis and table comparisons, the paper examines the rating systems in relationship to Bahrain's National Planning Development Strategy (NPDS) 2030 and the National Environmental Strategy.

While the main contribution of this study is to review the selected rating tools and suggest their suitability for Bahrain, the findings could also inform decisions on the adaptation of international rating systems elsewhere in the world, particularly in countries like Bahrain, where no sustainability evaluation tool is enforced. The findings

can also guide local governances in making decisions on the feasibility and necessity to develop local rating tools to address fundamental social and cultural matters and pay attention to the precise environmental challenges of their location.

2. Sustainability Assessment Tools

Sustainability is a complex and multifaceted subject, that is still under continues development. Although the current assessments contribute to the overall sustainability agenda, the tools were initially not effective (Gibson 2001), this called for holistic approaches and rigorous development and implementation strategies (Poveda & Lipsett 2011; Peter S. Brandon 2010). After years of development, today, assessment tools for the rating of sustainable buildings are convenient technical means to evaluate the impact of buildings and constructions on the environment.

Tens of evaluation tools exist today covering a variety of parameters relating to the management of resources in buildings and construction projects in addition to other pressing issues relating to community projects, neighborhoods, urban projects, and infrastructures (Bernardi et al. 2017). Some of those tools are more popular than others and are used more frequently internationally. This study utilizes five of these tools. There is, however, still unavoidable criticism today from researches about the deficiencies of the existing sustainability rating tools. The critique highlights the overemphasis on environmental criteria, the casualness, and uncertainty in scoring and the strong presence of non-scientific benchmarks (Siew 2017).

Many of the literature that exists today about sustainability rating tools surveys and compares between numbers of selected tools, sometimes in an attempt to justify a selection of the acclaimed 'best.' See for example (Mehdizadeh & Fischer 2012; Say & Wood 2008; Nguyen & Altan 2011; Khogali 2016). Others looked at the application of specific rating tools to particular fields. For example, (Clevenger et al. 2013) discusses the use of sustainability rating tools for infrastructure projects. Some other studies assessed the use of sustainability rating tools for specific climatic conditions. (Khogali 2016) Studies four rating tools with a focus on hot and dry climates. There is, however, very limited research that tests the applicability of existing internationally acclaimed building rating tools to countries or regions where there are none enforced. The selection of international rating tools globally, especially in countries that did not develop a rating tool of their own seems to be controlled by the eco-political scene and are not justified with empirical shreds of evidence. This study attempts to fill this gap using Bahrain as a case study.

3. The Case of Bahrain

Commitments to the plans of Sustainable Development worldwide were strengthened in 1992 after the Rio Summit. The world witnessed an unprecedented focus on matters related to the pillars and ambitions of sustainability. Later in 2002, the goals of sustainable development were reiterated in the World Summit in Johannesburg and Bahrain was one of the countries that submitted a national report. The island country later participated in many events that discussed the development of the worldwide agenda for Sustainable Development organized under the umbrella of the United Nations. The latest of these was the United Nations Sustainable Development Summit 2015 in New York where the participating countries agreed on the adoption of the post-2015 sustainable development with its 17 Goals and 169 targets (Central Informatics Organisation 2015).

The local authority in Bahrain is informed about the importance of sustainable development goals to override the goals of government policy despite the limitations faced in the implementations of such goals. Sustainable construction has been viewed as one of the primary contributors to sustainable development and that the economic growth of a country is merely a product of a setting/society created from the effective use and management of existing resources (Ghina 2003). Assessment tools are therefore required to make progress towards establishing the goals of sustainable development. Sustainability rating tools are designed to evaluate the environmental capacity and measure whether progress has been made; they also help in supporting decision makers in making current and future decisions (Peter S. Brandon 2010). The sustainability evaluation process is therefore very relevant to the Bahraini context today, and the monitoring of the progress will have a definitive impact on accomplishing the goals of sustainable development in the country (Poveda & Lipsett 2011).

The NPDS were drafted to transform Bahrain to be more sustainable by achieving economic sustainability, promoting effective governmental institutions, managing the natural resources in an efficient way, recognizing the environmental limitations of the island status of the country and ensuring a healthy, robust, fair and just society. The NPDS document identified the following issues:

1. The country is in need to address its international obligations relating to sustainable development
2. Sustainability issues need to have sufficient importance on the political agenda.
3. The low level of public awareness to issues related to sustainability

4. Sustainability is not being taken seriously in development projects

5. Bahrain is in need of a sustainable natural resource management system.

6. The lack of sustainability matters in national policies.

In any discussion about sustainability rating tools, it is necessary to highlight the financial burdens and challenges associated with them. The use of sustainability assessment measurements and certification programs requires fund allocation not just to cover the fees of the certifying organization, but also to pay the consultant who would put together and manage the paperwork for the certification process (Poveda & Lipsett 2011). The economic result of this process is often merely a title or a status particularly in countries like Bahrain, where there are no tax breaks or benefits yet (for example, some countries offer an increased speed in building permits). In such cases, the use of a rating system could not be justifiable financially in the long run. Moreover, the subsidization of energy and water in addition to the free sanitation services is another obstacle that hinders the developers desire to certify projects (Al-Khalifa 2015).

Volume 7 of the NPDS titled sustainability and infrastructure strategies indicates that Bahrain should benchmark itself against international indicators of sustainable development and in particular comparative Gulf/Arab states and international renowned island states such as Singapore. The document presented sustainable development framework targets under which environmental sustainability indicators were: Energy efficiency, Minimizing pollution, Efficient use of natural resources, in addition to Protecting and improving biodiversity.

Most sustainability rating tools account for the indicators mentioned above. This research focuses on these when comparing the five rating tools selected for this study in addition to other factors such as how international and comprehensive the assessed rating tools are and whether they can easily be adapted in Bahrain by looking at the ease of information access and the relevance of the tool to the Bahraini context.

4. Methodology

The aim of this study is not to compare the efficiency of the existing international sustainability rating tools on the mitigation, elimination or reduction of the different social, economic, environmental, cultural and political impacts of a specific development. It is instead to compare the existing international rating tools and find the best

fit for a specific culture, geographical location, eco-political system and environmental circumstances.

Five sustainability-rating systems were chosen for this study to ensure that a broad spectrum of assessment methodologies and geographical locations are represented, and the practices of more cultures were reviewed. Comparative analysis using tabulations was adopted as the primary methodology for this study. The comparison is an essential process in any empirical scientific inquiry (Rihoux & Ragin 2009) and any descriptive effort, typology or classification involve some sort of a comparison (Bailey 1994). Technical manuals and official websites for the selected certification bodies were used as resources for the comparison.

As illustrated in Table 1.0 A system of assessing and marking was adopted with seven indicators; each was given weight with a total of 100 points (Nguyen & Altan 2011). The initial assessment of each rating system was carried out through subdividing each rating tool into their main features then cross-comparing them to realize the gaps and similarities in each of the rating tool (Bernardi et al. 2017). Table 2.0 shows that whether the selected systems use similar procedures or metrics to outline a specific parameter for each section is also looked at (Mehdizadeh & Fischer 2012).

Table 1: Indicators and weighting system.

No.	Indicator	Weight
1	Popularity and Importance in the Region	15
2	Ease of Access	20
3	Number of projects certified internationally	10
4	Number of Projects Certified Internally	5
5	Internationalism and Versatility	10.0
6	Relevance to Bahrain	20
7	Comprehensiveness of the pillars, categories and certification types	20
Total Score		**100**

One of the limitations of the study is the large number of sustainability assessment tools that are out of the scope of this work either because they do not have international influence, their unpopularity or because of their irrelevance to the context of Bahrain. Another limitation is the unavailability of the full technical manuals for some of the evaluation tools online. In such cases, the comparison depended on third-party documents and the literature.

Table 2: A brief description of the selected tools.

No.	Rating System	Launching Year	Latest Version	Launching Country	Certification Body	International Versions and National Adaptations	Pillars	Comparison	Rating levels	Categories Covered	Rating Tools
1	**PRS**	2010	V (1) 2010	UAE	Abu Dhabi Urban Planning Council	N/A	Environmental Economic Social Cultural	Applied to each category	1 PEARL 2 PEARLS 3 PEARLS 4 PEARLS 5 PEARLS	Integrated Development Process Natural Systems Livable Buildings Livable Indoors Precious Water Resourceful Energy Stewarding Materials Innovating Practice	Pearl Community Rating System: Design & Construction Pearl Building Rating System: Design & Construction Pearl Villa Rating System: Design & Construction
2	**BREAM**	1990	BREEAM New Construction 2018	UK	BRE	International versions: Nondomestic refurbishment In-use New construction: buildings National adaptations: United Kingdom USA Germany Netherlands Norway Spain Sweden Austria	Environmental Economic Social	Applied to each category	Unclassified Pass Good Very good Excellent Outstanding	Management Health and Wellbeing Energy Transport Water Materials Waste Land Use and Ecology Pollution Innovation	BREEAM Communities for the master-planning of a larger community of buildings BREEAM New Construction for new build, domestic and non-domestic buildings BREEAM In-Use for existing non-domestic buildings in-use BREEAM Refurbishment for domestic and, from summer 2014, non-domestic building fit-outs and refurbishments

No.	Rating System	Launching Year	Latest Version	Launching Country	Certification Body	International Versions and National Adaptations	Pillars	Comparison	Rating levels	Categories Covered	Rating Tools
3	**LEED**	1998	LEED v.4.1	USA	USGBC	International versions: LEED v3.0 for new construction and major renovations LEED for homes LEED for core and shell LEED for existing buildings: operations and maintenance LEED for commercial interiors LEED for schools LEED for retail LEED for healthcare LEED for neighborhood development (inpilot stage) National adaptations: Argentina Brazil Canada Italy	Environmental Economic Social	All credits are equally-weighted, but the number of credits related to each issue is different	Certified Silver Gold Platinum	Location and Transportation (LT) Sustainable Sites (SS) Water Efficiency (WE) Energy and Atmosphere Materials and Resources (MR) Indoor Environment Quality (EQ) Innovation (IN) Regional Priority (RP)	LEED BD+C: New Construction LEED BD+C: Core and Shell LEED BD+C: Schools LEED BD+C: Retail LEED BD+C: Data Centers LEED BD+C: Warehouses and Distribution Centers LEED BD+C: Hospitality LEED BD+C: Healthcare

No.	Rating System	Launching Year	Latest Version	Launching Country	Certification Body	International Versions and National Adaptations	Pillars	Comparison	Rating levels	Categories Covered	Rating Tools
4	**DGNB**	2008	DGNB 2018	Germany	DGNB	International version Core 14 National adaptation: Austria Bulgaria China Denmark Germany Switzerland Thailand	Environmental Economic Social Cultural	Applied to each category, Main Categories are equally weighted	Bronze Silver Gold Platinum	Environmental Quality Economic Quality Sociocultural and Functional Quality Technical Quality Process Quality Site Quality	Existing Buildings New Construction Interiors Districts
5	**SBTool**	2002	SBTool 2016	Canada	iiSBE	National adaptations: Czech Republic (SBToolCZ) Portugal (SBToolPT) Italy (Protocollo Itaca) Spain (Verde)	Environmental Economic Social Cultural	Applied to each category -quasi-objective-	−1 0 1 3 5	Site Regeneration and Development, Urban Design and Infrastructure Energy and Resource Construction Environmental Loadings Indoor Environmental Quality Service Quality Social, Cultural and Perceptual Aspects Cost and Economic Aspects	New Buildings Existing Buildings

Table 3: Popularity and importance in the region.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Popularity and Importance in the Region	15	Number of Google Mentions "System" and "Gulf Cooperation Council"	1,100	968	7,360	218	53
		Number of Google Mentions "System" and "Arabian Gulf"	1470	1070	15500	150	63
		Number of Google Mentions "System" and "Persian Gulf"	650	6990	2800	357	130
		Total Score	**3,220**	**9,028**	**18,300**	**725**	**246**
		Weight allocated	**3.0**	**12.0**	**15.0**	**3.0**	**0.0**

Key	
Very Popular > 10000	15
Popular 5000–10000	12
Somewhat Popular 1000–5000	6
Not very popular 500–1000	3
Not popular at all < 500	0

Table 4: Ease of access.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Ease of Access	40	Availability of Free Manuals	10	10	10	2	10
		Cost of Certification	10	8	4	2	0
		Access to qualified assessors	10	5	10	0	0
		Languages of the assessment tool	10	10	10	2	4
		Total Score	**40**	**33**	**34**	**6**	**14**
	20	**Weighted score**	**20.0**	**16.5**	**17.0**	**3.0**	**7.0**

Key	
Very Good	10
Good	8
Acceptable	4
Limited	2
No Access	0

5. Research Findings

The selected tools for this study are vary in maturity; the oldest system is the British BREEAM developed in 1990 followed by the American LEED in 1998. The latest is the Emirate's Estidama PRS developed in 2010. Given that BREEAM and LEED are the eldest

Table 5: Availability of free manuals and tools.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Availability of Free Manuals and tools	10	Fully Available	X	X	X		X
		Mostly Available					
		Partially Available					
		Limited Availability				X	
		Not Available					
		Weight allocated	**10**	**10**	**10**	**2**	**10**

Key	
Fully Available	10
Mostly Available	8
Partially Available	4
Limited Availability	2
Not Available	0

and perhaps the most developed, many other systems which are outside the scope of this study used them as references throughout the development of their new tools; for example, the American Green Globes and Australian Green star tools have similar characteristics and were based on the BREEAM and LEED systems (Bose 2010). The PRS was initiated within somewhat similar cultural, climatic and eco-political conditions to Bahrain. Nevertheless, Bahrain is still distinctive in the region because of the lack of resources and its geographical limitations.

A brief description of the structure and sections of each rating system is given in Table 2.0. The table shows that the application of each credit-weighting system is different from the other. The table also demonstrations that an essential distinction in developing a rating system is the allocation of points and weights across the different categories and criteria of the rating system (Trusty 2008; Poveda & Lipsett 2011).

5.1. Popularity and importance in the region

Table 3.0 shows the popularity and importance of the different rating systems in the region. A simple Google search of the number of entries published online of the rating system and the different names identified with the region indicated that the most popular system is the LEED, mentioned more than 18 thousand times followed by BREEAM with more than 9 thousand entries. The least popular system is the SBTool with a little below 250 entries.

Table 6: Cost of certification.

Category	Weight		PRS	BREEAM (based on 1 British Pound equals1.40 US Dollar exchange rate)	LEED	DGNB (based on 1 Euro equals1.23 US Dollar exchange rate)	SBTool
Cost of Certification	10	Registration Fee	FREE	$ 350.4	$ 1500	$0	No Information Available
		Assessment Collation Fee	$3000–15000	$3971–19,857**	$75000	N/A	
		Certification Fee	FREE	$1469–2979	$2250–22,500	$8,138.13–90,629.18	
		Cost of Credit Appeals	FREE	FREE	$500–800	$2466.10 for up to 10 then $ 616.53 for each	
		Credit Interpretation Requests Cost/Allowance	FREE	Free / Unlimited	$220 per credit/ Unlimited	N/A	
		Weight allocated	**10**	**8**	**4**	**2**	**0**

Key	
Affordable	10
Moderate	8
Very Expensive	4
Expensive	2
No information	0
* Sourced from literature	

5.2. Ease of access

The ease of access was measured using four criteria: availability of free manuals, the cost of certification, and the ease of access to qualified assessors. This methodology was used before by (Nguyen & Altan 2011). The authors weighted five rating systems using keys based on a 6-point scale. This study, however, adds one more important criterion, which is the language of the assessment tool because of the importance of the Arabic language in the region and uses a five-point scale to weight the tools.

Table 7: Access to qualified assessors.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Access to Qualified Assessors in Bahrain and/or the region	10	Available > 10	X		X		
		Limited availability < 10 > 2		X			
		Not Available <= 2				X	X
		Conditions	A Pearl Qualified Professional (PQP) is an integral member of a project team who facilitates the Pearl Rating System (PRS) throughout the development process. To benefit all development types, which encompasses Master Plans, Buildings and Villas, a PQP will provide expert guidance from the planning concept design stage through to construction and implementation.	**BREEAM assessors BRE QA** Quality assurance is handled by BRE or the National Scheme Operator. All BREEAM assessors must attend training. Training is specific to each of the BREEAM schemes. After successfully passing the test, BREEAM Assessors receives a license and are able to register to carry out assessments in the scheme they have trained for.	**(LEED accredited professional) LEED AP** Quality assurance is handled by the Green Building Certification Institute (GBCI). GBCI performs the technical reviews and verification of all LEED-registered projects to determine if they have met the standards set forth by the LEED rating system. It also manages the training and accreditation of LEED Accredited Professionals. Finally, the GBCI administers the LEED Quality Assessment and certification award process.	**DGNB auditors** Quality assurance is handled via the DGNB Compliance Testing Team or its equivalent amongst DGNB international partners. All project documentation compiled by a DGNB auditor for its client is submitted to a thorough and independent review (there is no contractual relationship between the DGNB and DGNB accredited auditors). DGNB Auditors must have comprehensive knowledge of the structure, criteria and practice-based aspects of the DGNB System. The DGNB Auditor qualification is awarded on successfully completing the DGNB Consultant training, a pilot project audit (or homework assignment). DGNB Auditors must have completed academic studies in architecture, civil or construction-related engineering, natural sciences, economics or building physics and 4 years of relevant professional experience following completion of a post-graduate degree or for building schemes only: 6 years of relevant professional experience following completion of an undergraduate degree or for building schemes only: at least 8 years of professional experience and involvement in planning processes for sustainable building	An accred-ited/authorized assessor who works with the project team to compile the documentation required for the certification A review by the authorized third party who operates the national certification scheme Delivery of the certificate by the authorized third party who operates the national certification scheme
		Weight allocated	10	5	10	0	0

Table 8: Languages of the assessment tool and available assessors.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Languages of the assessment tool and assessors	10	English (5 points)	X	X	X	X*	X
		Arabic (5 points)	X	X	X		
		Other Languages				X	
		Weight allocated	10	10	10	3	5
* Limited Availability							

Table 9: Number of certified projects.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Number of Projects Certified	10	Internationally	5	6161	48150	153	< 2000 including local projects
		Total Score	0	10	10	5	10
	5	In the home country	2025	10089	63514	1,073	N/A
		Weight allocated	5	5	5	5	0

Key	
Internationally	
High Number > 1000	10
Good Number 100–1000	5
Low Number < 100	0
Locally	
High Number > 1000	5
Good Number 100–1000	2.5
Low Number < 100	0

5.2.1. Availability of free manuals

The majority of the rating tools have their technical manuals published online. The only rating tool that lacked online technical manuals was the DGNB tool.

5.2.2. Cost of certification

Registration fees, assessment collation fees, certification fees, cost of credit appeals and credit interpretation request costs were looked at in this section. As seen in Table 6.0, a five-point weighting scale was used to assess the different rating tools. There was no available information for the SBTool and limited information about this for the DGNB certification system.

Table 10: Internationalism and versatility.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Internationalism and Versatility	5	Number of international Versions	0	3	9	1	0
		Weight allocated	0	3	5	3	0
	5	Number of National Adaptations	0	0	4	7	4
		Weight allocated	0	0	3	5	3
	10	Total Weight allocated	0	3	8	8	3

Key	
Internationally	
High Number > 5	5
Good Number 1–5	3
None < 1	0
Local	
High Number > 5	5
Good Number 1–5	3
None < 1	0

Some of the most expensive reviewed rating tools are the LEED and DGNB. Comparatively BREEAM has a somewhat reasonable price. On the other hand, the most affordable system in the list is the PRS by ESTIDAMA; most of the services included in the certification process are free of charge. In the case of Bahrain and with the overall funding limitations in both the governmental and private sectors, using a system that does not cost much an important criterion.

5.2.3. Access to qualified assessors

The certification process of any rating system requires a team guided by a qualified assessor to prepare the necessary documentation and evidence for the project to earn credits. The assessor undergoes an examination to be certified by the organization responsible for the rating tool. In some cases, assessors will even need to work on a number of green projects as part of their training before obtaining their status. The existence of such assessors locally or at least regionally is, thus, very important for the successful completion of any certification process. In this section, the availability of professional assessors for the different rating systems is reviewed, and the different conditions required by various rating systems are looked at.

There is a general shortage of certified assessors for all sustainability-rating tools in the region. The PRS and LEED have more than ten certified assessors in the region, a

Table 11: Relevance and adaptability to Bahrain.

Category	Weight		Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Relevance and adaptability to Bahrain	10	Coverage of the four NPDS Environ-mental Indicators	Energy efficiency	Yes	Yes	Yes	Yes	Yes
			Minimizing pollution	Yes	Yes	Yes	No	Yes
			Efficient use of natural resources	Yes	Yes	Yes	Yes	Yes
			Protecting and improving bio-diversity	Yes	Yes	Yes	Yes	Yes
		Total		10	10	10	7.5	10
	10	Relevance of the culture / context and climate		10	8	8	4	2
	20	Total		20	18	18	11.5	12

Key	
Very Relevant	10
Relevant	8
Somewhat Relevant	4
Little Relevance	2
No relevance	0

number that can be considered acceptable. As seen in Table 7.0 BREEAM assessors are less available than the above mentioned two, and all other rating systems have very limited availability. A discussion about buildings sustainability rating tools in Bahrain should with no doubt highlight the need to certify more professionals locally.

5.2.4. Languages

While English is widely used and understood in the country, Arabic is the primary official communication language in Bahrain. It is therefore essential for the selected rating tool and/or its available assessors to incorporate and be familiar with those two languages. Table 8.0 shows that five points were awarded to the rating system if it uses or certifies assessors who are familiar with either language. Other languages are noted; nevertheless, no points are awarded to them for their irrelevance to the context.

Table 12: Comprehensiveness of the pillars, categories and certification types.

Category	Weight	Indicator	PRS	BREEAM	LEED	DGNB	SBTool
Comprehensiveness of the pillars, categories and certification types	5	Comprehensiveness of the pillars	5	3	3	5	5
	5	Comprehensiveness of the categories	5	5	5	3	5
	10	Comprehensiveness of the certification types	2	2	8	2	0
	Total		12	10	16	10	10

Pillars	
4 Pillars	5
3 Pillars	3
< 3 Pillars	0
Categories	
>= 8	5
4 to 7	3
< 4	0
Types	
> 10	10
8 to 10	8
5 to 7	4
2 to 4	2
=< 1	0

BREEAM and LEED use the English language for their technical manuals and documentation process and certify Arabic speaking assessors. The PRS is the only system that has a complete set of technical manuals in the Arabic language. The German DGNB, use mostly its home languages, nevertheless is increasingly trying to incorporate more English into the rating tools. Lastly, SBTool is only available in English.

Table 4.0 shows that the PRS has the highest score in the ease of access category followed by LEED, and BREEAM. On the other hand, the SBTool obtained the lowest ease of access score.

5.3. Number of certified projects

The number of projects certified by a rating system is an important criterion used in determining the tool's popularity and influence (Nguyen & Altan 2011). The higher the number of projects certified the more recognized the rating system should be.

Table 13: Final assessment.

No.	Indicators	Rating System					
		Weight	PRS	BREEAM	LEED	DGNB	SBTool
1	Popularity and Importance in the Region	15	3	12	15	3	0
2	Ease of Access	20	20	16	17	3	7
3	Number of projects certified internationally	10	0	10	10	5	10
4	Number of Projects Certified Internally	5	5	5	5	5	0
5	Internationalism and Versatility	10	0	3	8	8	3
6	Relevance to Bahrain	20	20	18	18	11.5	12
7	Comprehensiveness of the pillars, categories and certification types	20	12	10	16	10	10
Total Score		100	60	74	89	45.5	42

Table 9.0 compares the number of projects certified by the selected rating systems internationally and locally.

This research looks for a suitable rating tool for Bahrain, thus, for this study, the number of projects certified internationally is more critical than those certified locally. For a total of 15 points for this criteria, the number of internationally certified projects were given a maximum of 10 points while the number of locally certified projects were given a maximum of 5 points.

Among the highest number of internationally certified projects is the LEED with a little over 48 thousand certified projects internationally followed by BREEAM, SBTool, and DGNB consecutively. On the other hand, the PRS has the lowest number of internationally certified projects with only five projects certified.

It, of course, makes more sense that most rating systems have a high number of internally certified projects. The geographical controls of the country also influence the number of projects certified internally. The numbers of projects certified internally by SBTool were also lacking. The larger the home country of the rating system is, the more projects should be on the certification list. Subsequently, the highest number of internally certified projects is for the American LEED followed by the British BREEAM and the UAE's PRS (which are in ratio size considerably high as well). DGNB has a little over a thousand certifications internally.

5.4. Internationalism and versatility

This criterion includes two sections, the number of international versions of the rating tool and the number of national adaptations of the system. Both are equally important for this study and therefore were given equal weights of five points maximum. Table 10.0 shows that three tools have international versions; those are the LEED with nine, BREEAM with three and DGNB with one. As for national adaptations, DGNB has the most with seven followed by SBTool and LEED with four each. Details of those international versions and national adaptations can be found in Table 2.0.

5.5. Relevance to Bahrain

This is an essential criterion because it is directly related to the Bahraini culture, contextual circumstances and the government's NPDS. As shown in Table 11.0 This criterion is divided into two segments equally weighted. The first is the coverage of the system to the four environmental indicators of the NPDS, those are Energy efficiency, minimizing pollution, the efficient use of natural resources and protecting and improving biodiversity. Each of those indicators is weighted two and a half points with a total of ten. The second segment is the relevance of the culture/context and climate in which the rating system is developed and Bahrain. A five-point rating scale varying from very relevant with ten points to not relevant at all with zero points is used.

The data here shows that the most relative and adaptable rating tool to Bahrain is the PRS. A country from the Arabian Gulf region developed the system. In addition, the PRS covers all four environmental indicators of the NPDS, which makes it the most relevant.

The LEED and BREEAM rating systems are up to the same level of relevance and adaptability to the Bahraini context. The two systems cover all environmental indicators, nonetheless, were developed initially for the US and UK with different climatic, environmental and cultural concerns. Bahrain is influenced the most by the American and British cultures, which makes them more relevant to the island country than other western cultures.

5.6. Comprehensiveness of the pillars, categories and certification types

Table 2.0 shows a detailed comparison between the selected rating tools. While the majority of the tools globally only consider the three main pillars of sustainability: the environment, economy and the social, a few added the fourth, latest pillar: the culture (Hawkes 2001). Those are the PRS, DGNB, and SBTool. This is one of the reasons for their selection for this study. Table 2.0 also shows that most of the rating systems have six to eight categories of inquiry. The most common areas are energy consumption, use of resources, transportation, water and waste management (CEM 2008) other areas of analysis that are less common include indoor air quality, cost, and economic aspects, health, mind and wellness, innovation, cultural values, urban communities, management, and operations.

Table 2.0 further explains that the most comprehensive rating system regarding areas of inquiry is the BREEAM with ten categories. The PRS, LEED, and SBTool all have eight areas of inquiry. On the other hand, DGNB has only six. Accordingly, Table 12.0 compares between the elven systems regarding their comprehensiveness.

The last column of Table 2.0 shows the comprehensiveness of the rating systems based on the number of tools available for each. The majority of the tools incorporate a building design and construction-rating tool for both under construction and completed projects. Another rating tool that is becoming more popular is interiors, both completed and core and shell. A few systems like the PRS, LEED, and BREEAM expanded their scope to include the urban scale with the community, neighborhood and cities versions of the assessment tool. Others like the LEED and BREEAM differentiate between residential and other buildings by specifying tools that are specific for retail, industrial, hospitality, education, and healthcare. LEED even has a rating tool specially designed for data centers.

In this section, it appears that the most comprehensive rating tool is the LEED. It has the highest number of rating tools. Other tools like those of the PRS, DGNB, and SBTool are more comprehensive in the sustainability pillars they adhere too; nevertheless, they are less advanced than LEED in the availability of different rating tools. The PRS comes second in overall comprehensiveness.

6. Conclusion and Discussion

Table 13.0 shows the total score for all five systems and compares between their scores through the seven indicators. The top three rating systems appear to be the LEED, BREEAM, and PRS and the lowest three are SBTool, and DGNB.

In a comparison between the top three systems, LEED is the most popular in the region and is the most international and versatile. BREEAM comes in the second place for those two indicators. LEED and BREEAM, however, both have a high number of projects certified internationally and internally. These numbers could be attributed to the geographical area they cover and the maturity of those systems given that they are two of the oldest available rating systems.

The PRS, on the other hand, is the most relevant to Bahrain and is the easiest to access. The certification process is much cheaper than most other systems, a factor that is important given the financial circumstances of Bahrain. The number of projects certified by the PRS internationally is zero, which is a shortfall that needs further investigation. Nevertheless, the number of internally certified projects by the PRS are comparable to the LEED and BREEAM. The PRS is in the middle ground between the two other systems in terms of its comprehensiveness. This is expected given that the PRS is much younger than the other two. The PRS could in the future introduce more rating tools, a strategy that should allow it to compete with the two systems more rigorously. Given the proximity of the developing country to Bahrain and the similarities in various political, cultural, climate and environmental circumstances, the PRS should also be more popular in the region, an opportunity window that remains underutilized by its developers.

Throughout its quest to address its international obligations relating to sustainable development, Bahrain is looking for a rating tool that is dependable, easy to access but one, which will also allow it to benchmark itself against international indicators of sustainable development. The NPDS clearly outlined that international benchmarking should be done compared to other Gulf/Arab states. Thus, both Bahrain and the UAE could benefit from the adaptation of the PRS in Bahrain and unify the efforts of organizations concerned with the sustainability of the built environment in both countries. Such uniting should allow the PRS system to compete with others by increasing its internationalism and popularity in the region. Experts in Bahrain could also assist the UAE in the development of more rating tools for the system.

Overall, all three systems the LEED, BREEAM and the PRS are the best suited be adopted in Bahrain. If the aim was to look for a more established, renowned and

popular system, LEED should be the first choice for the government and developers. Alternatively, if ease of access and relevance to Bahrain is more at stake, the PRS should be adopted.

7. Author's Biography

Dr. Al-Khalifa is a researcher with a Master's degree in Conservation and Regeneration and a Ph.D. in Landscape, which is, focused on the interrelationship between Cultural Change and Urban Sustainability, particularly in the Arabian Gulf Context. Her research aspires to contribute to the understanding of sustainable urbanism within the context of transformed cultures, urban islands, and urban archipelagos. She was part of a team that won the Golden Lion award in the Venice Biennially in 2010, and she was awarded RIBA's president's award for research in 2012. Dr. Al-Khalifa is also interested in the importance of sustainability in real estate, as an asset class, the dynamics of considering sustainability assessment tools in real estate development and the influence of visualization on the opinions and actions of decision makers. She has published two journal articles and two articles in conference proceedings. She also obtained two professional certificates; the ISM Certificate in Sales and Marketing Management and the NAIOP Advanced Certificate in Commercial Real Estate Development. Dr. Al-Khalifa is currently the lead researcher in a $22,000 research project that looks into visual discomfort and architecture from a trypophobic perspective and is also leading several other research projects related to sustainable urbanism and real estate development.

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