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Research Article/Araştırma Makalesi

A Roadmap for Localizing and Harmonising Existing Green Building Rating Tools

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Keywords
Green Building Rating Tools, Quality Assurance, Adaptation, Adoptation, Common Metrics.

Abstract
The implementation of "green" and sustainable design and construction strategies proposed by green building rating tools have been instrumental for the market transformation of the building industry. This paper discusses the history of adapting global rating tools for commercal buildings to local context in order to make prioritization for initiating these tools in countries where green building movement is relatively new. Leading global green building rating tools have been examined along with recently created national (local) tools to analyze the demand for local tools vs adapting global green building tools to local context. A literature search on possibility of practical implementation of a framework containing core indicators to create a common assessment methodology has been revisited to help the conclusions.
The research process aiming to give a big picture view of global green building rating tools and local rating tools resulted in the following key conclusions which are further discussed and elaborated in the paper: Global green building certification tools will have more impact if they are adapted locally with clear and harmonized indicators sensitive to the realities of designing and building in the specific country and inclusive of local standards, construction processes and property ownership and management structures. Even in the countries which created their own rating tool, the industry players continue to use the global green building rating tools. However, green building rating tools which do align with a common framework would be very helpful for creating an assessment method/process capable of allowing comparison and benchmarking of buildings internationally.

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1. Introduction

The contribution of products and services to sustainable development is usually described and evaluated by an assessment of the building. The assessment embraces (1) their ability to meet current and future requirements as well as (2) their capability to keep current and future impacts, expenses and risks within certain limits or boundaries. If the assessment results are positive, such products and services are commonly called 'sustainable'. This also applies for buildings and

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constructed works. Buildings and the investments in buildings have the potential to contribute to sustainable development [1].

In order to define relevant issues for buildings, it is possible to start with general protection targets which can be deduced from the overall concept of sustainable development as defined in the Brundtland Report (WCED, 1987). These protection targets are as follows:

- Protection and restoration of the natural environment / ecosystem (T1)
- Protection of natural resources (T2)
- Protection of human health and, wherever possible, improvement of well-being (T3)
- Protection and promotion of social values and of public goods (T4)
- Protection of capital and material goods (T5).

How this translates into manageable indicators has been the subject of intense international debate over the course of more than a decade. In the past, stakeholder groups (construction product manufacturers, designers, etc.) as well as scientists and specialists for life cycle assessment (LCA) dominated this debate.

An international consensus developed and crystallized in the work of the International Organization for Standardization (ISO), notably in the work of the Technical Committee on Sustainability in buildings and civil engineering works (ISO/TC 59/SC 17). The international standard ISO 21921-1 (2011) – entitled Sustainability in building construction: Sustainability indicators, Part 1 Framework for the development of indicators and a core set of indicators for buildings – provides applicable recommendations on a minimum set of indicators. [2].

The core set of indicators suggested by ISO is as follows:

- For location: access to modes of transportation, green and open areas, and user-relevant basic services,
- For the plot of land: change of land use accessibility of the site,
- For the building: global warming potential (GWP) ozone depletion potential (ODP) non-renewable resource consumption (materials) non-renewable resource consumption (energy) freshwater consumption waste generation accessibility of the building indoor conditions (thermal, visual and acoustic comfort) indoor air quality adaptability (change of use or user needs) adaptability (climate change) lifecycle cost maintainability safety (structural safety, fire safety, safety in use) serviceability (fit for purpose) aesthetic quality.

2. Benefits of Green Buildings and using certification systems:

Green buildings have an improved environmental performance over standard buildings through all phases of their lifecycle which begins with design and construction and moves through operations and to the end of life, including deconstruction and demolition [3]. A green building does not only make a positive impact on public health and the environment, it also reduces operating costs,

enhances building and organizational marketability, increases occupant productivity, and helps create a sustainable community [4]. A recent Booz Allen study projects that green construction will generate an additional $303.4 billion in GDP, 3.9 million jobs, and $268.4 billion in labor earnings in the coming years 2015-2018. LEED specifically is projected to contribute an additional $108.8 billion in GDP, 1.4 million jobs, and $95.7 billion in labor earnings in the coming years 2015-2018 [5]. *According to World Green Building Council (WGBC), the business benefits of green buildings are powerful factors influencing the market players like investors/developers, tenants, users and service providers* [6]. A comprehensive body of research suggests that better indoor air quality can lead to productivity. Thermal comfort has a significant impact on workplace satisfaction. Several studies have estimated productivity gains as a result of proximity to windows and buildings with good acoustics.

For the study, green building is defined as a construction project that is either certified under any recognized global rating system or built to qualify for certification. Green building rating tools are used to measure the performance of building. They help us quantify the energy and water efficiency and many other parameters included in the criterias that make up these systems. The use of voluntary green building rating tools has been one of the most powerful mechanisms to transform the building industry towards sustainability in developed countries. The implementation and promotion of these tools and the subsequent award of certified ratings for buildings are fundamental roles for most Green Building Councils (GBC) established globally [6].

From the colder climates of North America and to Eastern Europe with warmer Mediterranean and humid Dubai and central Japan climates, these accreditations are widely used. As more and more developing countries start using these tools, the questions arise related to adaptation to local context. Use of multiple systems is very common in countries where green building movement is relatively new. Most investors and developers in today's real estate market consider green building tools to be important when developing or investing in new buildings. However, they want to deal with a single scheme that allows 'level playing field' comparisons and benchmarking. Many US and Europe Office developers prefer only LEED certification and many retail developers in Europe prefer BREEAM certification for their real estate investments. Multi-national companies adhere to numerous certification systems depending on the choice of their company culture. A global tool may seem an attractive, efficient prospect, especially for these multi-nationals trying to coordinate uniform design teams [7].

A green global rating tool is currently not possible to achieve, given the different circumstances of each country, from climate to the availability of materials and land, and opportunities for power generation, culture adaptation, and legislative support. *However* building performance should not be assessed without reference to context: A building in Southern Spain may require a high level of water efficiency during its lifecycle to be considered a sustainable building. In Sweden, where water scarcity is not an issue, water efficiency is far less relevant. Context is key when considering what is important [8].

2. Global Green Building RatingTools and Green Building Councils

A **Green Building Council (GBC)** is national non-profit, non-government organization that is part of a global network recognized by the World Green Building Council(WGBC) a non-profit established in 1999. GBCs are "transparent, consensus-based, not-for-profit coalition-based organizations with no private ownership and diverse and integrated representation from all sectors of the property industry;" and their overarching goal is promote a transformation of the built environment towards one that is sustainable (buildings and cities that are environmentally sensitive, economically viable, socially just and culturally significant). GBCs are formed by market leaders in sustainability as their members. Through their members, they constantly evolve and embed sustainability best practice through green building rating tools.

Among the 110 Green Building Councils worldwide, global green building rating tools are being promoted by GBCs as well as their national tools. Many of green building councils created their national green building rating tools based on market demand (Verdi, Estidama, Miljöbyggnad etc). As the number of certified buildings increase, the need for a consistent comparison among green building ratings increase, especially for newly created national tools by green building councils. What we mean a national (local) tool in this study is a green building rating tool other than LEED, BREEAM GREENSTAR and HQE. The tool is created by GBC of that specific country.

Since Building Research and Establishment (BRE) launch of BREEAM (Building Research Establishment Environmental Assessment Report) in 1990, more than 600 sustainability assessment rating systems have been developed worldwide [9]. Among these rating systems, green building certification systems are used to provide professionals in the design, construction and operation of buildings with a step-by-step process to lead and scale the best practice. The key ingredients of such schemes are quantifiable performance metrics, easy to follow holistic implementation of strategies and clear goals. In some countries, there are green legislative requirements and industry professionals are mandated to use these certification systems.

LEED and BREEAM on are predominantly are used for non-residential developments internationally. They are also completely relevant for residential and neigbourhood developments. 80% of buildings (office, retail, logistics, hotels etc) that carry a green rating tool in Europe have applied for the BREEAM standard. French HQE has an 11% stake in the market with US LEED and the German DGNB both coming in with less than 5% in 2015 [10]. In some of the EU's leading green building markets, the use of green building rating tool is growing more rapidly, which is currently the best measure of demand. This growth is mostly in the non-residential sector, though markets like France and Sweden are seeing rapidly growing demand for residential rating tools (HQE in France and Miljöbyggnad in Sweden) based on the interviews with the organizations.

Recent IVG Research found that the number of non-residential projects certified to BREEAM, DGNB, HQE or LEED in Europe had tripled between 2011 and 2013. In the survey, European companies for commercial projects prefer LEED (37%) and

BREEAM certificates (42%) above all. Despite the relatively high number of German property companies participating in the survey, the DGNB is most used by only just under 11% of the respondents and attracts less attention outside German-speaking countries. The European EU Green Building certificate is also used most by only around 10% of the companies. The results of the survey are also supported by an analysis of the certificates most used in Europe. DGNB certificate is only used in Germany, Austria, Denmark and one Project in Turkey. BREEAM has a dominant position not just in the UK but also in the Benelux countries and in Eastern Europe. By contrast, LEED is widely disseminated in Scandinavia, Italy and in Turkey and competes with BREEAM in markets on the Iberian Peninsula[10].

Turkey became the top country in Europe with 477 **total number of LEED-certified and registered projects in 2015.** Germany (431) and Sweden (197) also made the top 10 list globally for LEED certification applications as the two other Europian countires [12].

Based on the number of certifications listed at USGBC and BRE data bases, we can conclude that two major rating tools dominate the global market are LEED and BREEAM. These tools are either adopted or adapted by the countries using these systems. In Europe however, HQE dominates the market by surface area since it is used mostly for residential market, with around 59 million m2 certified but primarily in France although BREEAM is the most commonly used certification in many countires [8] [9] [10].

3. Local Green Building Systems

Even though LEED and BREEAM have been popular in many countries, and major effort has been spent to adapt them to local context, they need to be revised for being used in developing countries since they are missing economic performance, physical and social resilience parameters [8]. A good example of a local approach to add these parameters come from South Africa. The WGBC and the Green Building Council of South Africa (GBCSA) have established a joint project to create a set of social and economic1 sustainability factors and benchmarks to be used in rating tools for the design and construction of green buildings in developing countries around the world. As a member of this project team, the author contributed to finding practical measures and benchmarks for these credits. Despite some unique South African legislation, policy and industry tools (like the Broad-Based Black Economic Empowerment Scorecards), quite a lot of the outcomes of the research and development work are relevant for other countries too, and hence some of these have been introduced into this framework. In some instances the metrics which we explored were not feasible (data not available), or the measure was too complex for projects to work with, and stipulating a methodology has been the proposed way forward [10].

Tools like BREEAM of UK, CASBEE of Japan, MINERGIE of Switzerland and as HQE of France are created before the establishment of WGBC which may be the reason why they are not the products of Green Building Councils of these countries. CASBEE and Minergie were also created by non GBC organizations.

After the establishment of WGBC in 1999, green building councils all around world started evolving with a vision to create the national (local) green building certification systems of their countries or adapt/adopt the existing systems like LEED, BREEAM, GREEN STAR to local context. VERDE of Spanish Green Building Council, Miljöbyggnad of Sweedish Green Building Council, DGNB of German Sustainable Building Council and ESTIDAMA of The Abu Dhabi Urban Planning Council (UPC) are some of the recent local systems created by the new but established GBCs. Emerging GBCs on the other hand are looking into a healthy roadmap to select the right tool. Countries like Georgia with emerging green building councils use LEED and BREEAM to start with but plan to initiate their national (local) system [11].

BEAM Plus is an other comprehensive green building certification system for buildings recognised by the Hong Kong GBC. Even though it is a very comprehensive system, its usage is still limited to Hong Kong [13].

An other example of a local green building rating tool is launched in China. In the absence of its national tool, China has been using LEED, but in 2007 the Chinese Ministry of Housing and Urban-Rural Development (MOHURD) launched Three Star, an official green-building evaluation certification. The development of the China GBEL evaluation system as well as the label application and certification, are all administered by government organizations within MOHURD's Building Energy Efficiency and Technology Division. In terms of the scope of the rating systems, the China GBEL program differentiates between residential and public buildings, but does not include rating systems unique to specific building types as LEED does [14]. It gives credit for reducing noise pollution, avoiding pipe leakage, ensuring airtight windows, setting thresholds for harmful substances, and establishing a maximum air temperature in naturally ventilated spaces. China GBEL program is developed and administered entirely by central and local government offices of MOHURD. These differences in program administration between LEED and Three Star have affected the level of awareness and acceptance of the two rating tools in their respective countries, with informational, institutional, and capacity limitations still major barriers for the GBEL program [15].

4. Adaptations of Global Green Building Rating Tools

LEED of USGBC (USA), BREEAM of BRE (UK), GREEN STAR (Australia) and HQE (France) are being used not only in the countries they originated from but internationally. Their success has to do with creating alternative compliance paths for the users of other countries and/or US GBC, BRE-GLOBAL, Australian GBC's ability to sign contracts with organizations from other countries which are capable of completing the adaptation work for these systems. The ways these four widely used systems adapted to local conditions are summarized below [10].

4.1 BREEAM

BREEAM (Building Research Establishment Environmental Assessment Methodology), first published by the Building Research Establishment (BRE) in 1990, is the world's oldest established method of assessing, rating, and certifying the sustainability of buildings. BREEAM is used more than 50 countries around the World. Because BREEAM is used for both residential and non-residential buildings

in UK, the total certfication numbers are highest in the World. But even for commercial buildings, BREEAM is the most seeked system in Europe.

Norway, Sweeden, Spain, Holland, Germany, Austria, Switzerland and Luxembourg adapted BREEAM to their local context. BRE Global is the National Scheme Operator (NSO) for the UK and broader International and European schemes (BREEAM). The Dutch Green Building Council is the National Scheme Operator for the Netherlands (BREEAM NL), The Swedish Green Building Council has developed BREEAM SE for Sweden, the Norwegian Green Building Council is the National Scheme Operator for Norway (BREEAM NOR).

The Instituto Tecnológico de Galicia is the National Scheme Operator for Spain (BREEAM ES), and DIFNI is the National Scheme Operator for Germany (BREEAM DE), for Austria (BREEAM AT), Switzerland (BREEAM CH), for Luxembourg (BREEAM LU).

The local scheme can be developed from new: by adapting the BREEAM UK, European or Global schemes to the local context. by interpreting the BREEAM Core Technical Standard for the local context or the local scheme may already be in existence. Whatever the circumstances under which the National Scheme Operator has developed their local scheme(s), they must then demonstrate to BRE Global that their scheme documents are compliant with the BREEAM Core Technical Standard and that their procedures are compliant with BREEAM's Core Process Standard.

4.2 LEED

LEED V1 was launched in 1998. The LEED rating systems are developed and updated in a consensus-based process through a committee of USGBC members from a diverse array of professional backgrounds, including engineers, architects, real estate developers, building owners, lawyers, environmentalists, and NGOs. As LEED has evolved and matured, the program has undertaken new initiatives. India, Canada and Italy GBCs adopted the LEED system to their local context and adapted it in part to cater for country specific requirements. The results of these adaptations proved that LEED has its huge value in being independent as it is, international, open and for and by the industry and adminstrated by GBCI.

Each regional priority credit is worth an additional 1 point, and a total of 4 regional priority points may be earned. Upon project registration, LEED-Online automatically determines a project's regional priority credits based on its zip code. If the Project achieves more than 4 regional priority credits, the team can choose the credits for which these points will apply.

As interest in the LEED rating system grew, the need to accommodate a growing number of international projects became more apparent. In 2014, USGBC contacted Sweden Green Building Council (SGBC) and other European members of the LEED International Roundtable to introduce a work project to create Europe-specific Alternative Compliance Paths (ACPs) for LEED BD+C 2009. LEED is adapting to become more locally relevant through alternative compliance paths.

To provide incentive to address geographically specific environmental issues, USGBC regional councils and chapters have identified 6 Regional Priority Credits per rating system that are of particular importance to specific areas. The goal was to incentivize the achievement of credits that address geographically specific environmental priorities. RP Credits are not new LEED credits, but instead are existing credits that USGBC chapters and the LEED International Roundtable have designated as being particularly important for their areas. The incentive to achieve the credits is in the form of a bonus point. If an RP Credit is earned, then a bonus point is awarded to the project's total points. LEED v4 makes RP Credits accessible to any project in the world [16].

4.3 Green Star

Green Star SA rating tool developed by Australian Green Building Council and launched in 2003. The system is built on BREEAM and LEED, but is modified for hot climates. It uses a credit system with nine categories, some of which—indoor-air quality, water, materials, land use, transport, and innovation—are similar to LEED categories. Green Star also offers credit specifically for reducing greenhouse gas emissions and for adopting sustainable development principles from project conception through construction and operation. Later on, the tool was revised specifically for the environmental, regulatory and social context of South Africa by South African Green Building Council [17]. The Green Star SA rating system is customized for other countires of South Africa and New Zealand. The Green Building Council of South Africa works in collaboration with emerging Green Building Councils throughout Africa and allows the adaptation of the Green Star SA tools for certification in the respective countries. Each country develops a Local Context Report which is then reviewed by both the Green Building Council of South Africa and the Green Building Council of Australia. Once approved, this allows for projects within the specific countries to be certified using a Green Star SA tool, with some adaptations identified in the Local Context Report [18].

4.4. HQE

The Haute Qualité Environnementale (HQE) rating tool was developed by the non-governmental organization Association HQE based in Paris, France. In France, the HQE certification scheme is operated through 3 different certification bodies:Certivéa (non-residential sector), Cerqual (collective housing) and Cequami (individual housing). Outside of France, the HQE certification scheme is operated by Cerway. To assist those involved in projects applying for certification outside of France, Cerway has recognized a number of HQE "Référents". 245 000 residential and non-residential buildings in 8 countries worldwide (France, Belgium, Luxembourg, Italy, Germany, Algeria, Morocco, Brazil) are certified with HQE according to HQE data provided on their web site [19,20].

5. A common green building rating tool

Different countries have new ways of looking at green buildings, but it is clear that despite their differences globally, nations do have some collective interests in helping each other be successful in creating built environments financially, environmentally and socially. To facilitate this change, partnerships and models

will help us move both individually and collectively toward those goals [21]. We will summarize the collective efforts to bring all methodologies on the same page.

5.1. Efforts in Europe to create a common EU rating tool

Systems do not align with a common framework would be very difficult to compare. WGBC's Europian Regional Network (ERN)'s white paper on sustainable buildings suggests to use an EU Framework, consisting of common indicators and develop associated methodologies. Lot of effort has been put into creating a set of common indicators and calculation methodologies by SBAlliance, SuPERBuildings and Open House Project Teams.

This research involved with providing data for 2 of the 67 case studies of Open House Project. The methodology was tested using 67 case studies across 35 European countries to determine its applicability and gain feedback to enable further development. Sustainability indicators employed in the case studies were evaluated through a free online assessment tool developed during the project. Open House facilitate the adoption of a common assessment methodology at the European level and suggest that national initatives aligning with an EU framework would be more readily comparable with regard to these indicators, and the concept of sustainable building be more readily accessible and integration of this framework into existing schemes will promote comparability worldwide.

In 2005, the European Commission launched the GreenBuilding Programme (GBP). GreenBuilding is a voluntary programme aiming at improving the energy efficiency of non-residential buildings in Europe on voluntary basis. The programme addresses owners of non-residential buildings to realise cost-effective measures which enhance the energy efficiency of their buildings in one or more technical services. The programme covers both existing and new buildings. The number of buildings certified are 1059 as of August 2015.

In December 2014, the European Commission received a market study on the voluntary common EU certification scheme for non-residential buildings, in accordance with EPBD Article 11(9). Giving an overview of existing voluntary tools, the report analyzed the demand for a European wide voluntary scheme. The main added value of the proposed voluntary EU scheme would be to allow a consistent comparison between non-residential buildings across the EU. Besides, it could contribute to raising the ambition for building certification in some Member States. The study also shows that the voluntary EU scheme should build on CEN standards, start with a pilot phase (e.g. with offices and hotels), take a modular approach for energy performance only, and be applied both for public & private buildings, as well as new & existing buildings. Finally, it is recommended that the voluntary EU scheme should use a comparative label design, and that a third party should be responsible for the technical development of it.

Especially in Europe, the energy part of the existing systems are different than each other due to different EPC methodologies even though all of them are based on EU Energy Directive. Some countries like UK is working on developing a common approach to measuring and sharing energy performance data in many

countries. ERN recommended to the European Commission to agree an EU framework of common indicators and calculation methodologies for the lifecycle performance of sustainable buildings based on the work of CEN/TC 350 and other relevant initiatives.

Recently EU Commission has initiated the concept to consider the resource efficiency of buildings during their whole life cycle and to assess this through a common framework of indicators. The work to assess environmental performance during the life cycle with performance based indicators is done through the CEN TC350 standards developed under Commission's mandate. There are Green Building Certification Systems that are already partially integrating these standards (BREEAM, LEED, DGNB and HQE) [22].

5.2. Comparision of Systems based on SB Common Metrics Indicators:

5.2.1. Comparison of Systems based on SB Common Metrics Indicators

The SB Alliance has prepared a draft framework for common metrics for the assessment of buildings. The indicators used in this assessment are global warming potential, water consumption, solid waste production, indoor environment quality and the use of nonrenewable primal energy. The common metrics are environmental and are calculated by a life cycle assessment of the building. The previous research projects on common metric indicators are EeBGuide and CEN TC350 Table 1. We reviewed the current systems and created a comparison table for the weighings of these indicators.

Table 1: SB Common Metrics Indicators*

ENVIRONMENTAL INDICATORS (Calculated by an LCA of the building)	INDOOR ENVIRONMENTAL QUALITY (IEQ)
Global Warming Potential (GWP)	Thermal Confort
Use of non-renewable primary energy	Indoor Air Co2 Concentration
Water Consumption	Formaldyde Concentration
Solid Waste Production	
*: EeBGuide, CEN TC350 are also working on Building LCA Methodologies)	

Table 2*: Comparison of Systems based on SB Common Metrics Indicators

OPERATED BY	GBCI	BRE Global	CERWAY / CERTIVEA/ CERQUAL	Turkey GBC	DGNB
CONCEPT	LEED V4	BREEAM Commercial 2013	HQE 2011 International	TURKISH System	DGNB NBV09
LCA	%7	8.5%	(target 4, only for refrigerated warehouse)	7%	7.9%
GWP	%27	24%	(target 4). Up to 4 points out of 45. Global weight average = 2,22%	20%	17,1%
USE OF NON RENEWABLE PRIMARY ENERGY	%21	19%	target 5 and target 14. Global weight average = 10,42%.	20%	13,7%
WATER	%11	6 %	Yes, sub-target 3.1 and target 6. Global weight average = 6,12%.	10%	12,7%
WASTE	%2	7.5 %	Yes, target 13. Global weight average = 6,25%.	5%	4%
IAQ	%8	15 %	Yes (target 4, only for refrigerated warehouse)	10%	15.3

*The data is obtained from the operators of the systems.

Based on the comparison table of the selected tools, we can conclude that there is a consistency of weightings for LCA only. GWP, use of non renewable energy, water, waste and IAQ show 5 to 10% discrepancy among different tools. This framework still needs to be pilot-tested to analyse the feasibility of these indicators and allow for improvements [23].

5.2.2. Local system vs. Global Systems: A CASE STUDY

Turkey GBC members have been using LEED and BREEAM as rating tools since 2007. From 2007-2015, there were 477 registrations for LEED. 112 of these projects received LEED certification. 30 projects were certified with BREEAM. Since BRE does not reveal the registrations, the comparison of the number of registrations of these two systems is not possible.

Table 3: Rankings on the Top 10 Countries for LEED outside of the U.S

Rank	Nation	GSM of LEED-certified space (million)	Total GSM of LEED-certified and registered space (millions)	Total number of LEED-certified and registered projects	Country National (local) rating tool
1	Canada	26.63	63.31	4,814	BUILTGREEN BOMABest
2	China	21.97	118.34	2,022	GBEL
3	India	13.24	73.51	1,883	GRIHA
4	Brazil	5.22	24.50	991	NA
5	Republic of Korea	4.81	17.47	279	G-SEED
6	Germany	4.01	8.42	431	DGNB
7	Taiwan	3.84	9.08	149	EEWH
8	United Arab Emirates	3.13	53.44	910	PEARL
9	Turkey	2.95	23.74	477	ÇEDBİK
10	Sweden	2.54	4.20	197	MILJÖBYGGNAD
*	United States	276.90	727.34	53,908	NOT INLUDED AT TOP 10 LIST

Building dual or multi certification pilot projects in Turkey in different climate regions to compare the effect of "home territory regulatory effects" to develop a tool for homes customized to Turkish market, climate, social, governmental, and other regional conditions has been in discussion since 2009 [7,24]. In order to determine the interest for the use of global rating tool vs. creating a local rating tool, we interviewed key stakeholders, including building owners, product manufacturers and scheme users as well as finance providers across Turkey. In 2013 we conducted a survey to assess the willingness to use national green building rating tool vs. using LEED/BREEAM among TGBC members. The results of the survey yielded a response rate of 50% for creating a local green building rating tool that suits the Turkish context vs keep using global rating tool like LEED and BREEAM. Based on the individual interviews by the member organizations, it is found that clients prefer to have global green building rating tools for commercial properties and a national (local) green building tool for the residential market. Based on the results, Turkey GBC created a tool for homes to be used for local homes market.

6. Conclusion

Despite the fact that the growing number of green building councils decide to create national (local) green building rating tools, based on the literature review, interviews with GBCs and the number of certified buildings with different rating tools, the number of usage of global green building rating tools validate that instead of developing and maintaining different rating tools for commercial market use, the adaptation of existing global green building rating tools in local context with clear and harmonised indicators sensitive to the realities of designing

and building in the specific country and inclusive of local standards, construction processes and property ownership and management structures would be appropriate. The lack of mutual recognition between existing voluntary green building rating tools and new ones will make it difficult to compare the buildings internationally. GBCs can pilot test the SB's core performance indicators which is aiming to map and develop common metrics to measure emissions of CO_2 equivalents from new homes and buildings in order to contribute to ongoing research. A core set of standardization would also help global investors/banks and local governments to formulate national financial/fiscal incentive schemes fairly.

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