Social Sciences Indexed

International
SOCIAL MENTALITY AND RESEARCHER THINKERS JOURNAL
Open Access Refereed E-Journal & Refereed & Indexed
SMARTjournal (ISSN:2630-631X)

Architecture, Culture, Economics and Administration, Educational Sciences, Engineering, Fine Arts, History, Language, Literature, Pedagogy, Psychology, Religion, Sociology, Tourism and Tourism Management & Other Disciplines in Social Sciences

2019	Vol:5, Issue:19	pp.805-819
www.smartofjournal.com	editorsmartjournal@gmail.com	

THE ENVIRONMENTAL ASSESSMENT METHODS IN THE CONTEXT OF SUSTAINABLE CONSTRUCTION

SÜRDÜRÜLEBILIR YAPI BAĞLAMINDA ÇEVRESEL DEĞERLENDİRME YÖNTEMLERİ

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Article Arrival Date : 07.03.2019
Article Published Date : 14.05.2019
Article Type : Research Article
Doi Number : http://dx.doi.org/10.31576/smryj.279
Reference : Osmanoğlu, İ. (2019). "The Environmental Assessment Methods In The Context Of Sustainable Construction", International Social Mentality And Researcher Thinkers Journal, 5(19): 805-819

ABSTRACT

It has been seen that since 1990s sustainable construction concept and the environmental assessments methods related to this have been developed and the environmental performances of the buildings have been assessed. These systems are shaped according to the conditions of the producer country but some of them has gained importance internationally and spread among many country. In this study, internationally accepted basic texts and concepts on Sustainable Construction were examined. Key themes and key topics have been drawn up and tabulated according to the concepts and principles of Sustainable Construction. The Environmental Assessments Methods (EAM), which is internationally recognized, was examined from its original primary sources to determine the main categories and topics. The fourteen different assessment methods have been studied comparatively. But since every system is shaped according to their national regional and local conditions of the country it is produced, the assessment systems like LEED, BREEAM, etc. make it hard to do a realistic assessment in another country than its own, it can be even said that it make assessment impossible in a country where the conditions are very different. Instead of this, especially for under-developed countries it could be suitable to shape a global and flexible assessment framework which could be used adaptable to every country's national regional and local conditions.

Keywords: Environment, Sustainability, Sustainable Construction, Green Building, Environmental Assessment Methods

ÖZET

Sürdürülebilir yapı kavramı ve buna bağlı çevresel değerlendirme yöntemlerinin 1990'lı yıllardan itibaren geliştirildiği ve yapıların çevresel performanslarının ölçümlendiği görülmektedir. Bu sistemlerin her birinin geliştirildiği ülkeninin yerel koşullarına uygun olarak oluşturulduğu ancak, içlerinden bir kaçının uluslararası önem kazanarak bir çok ülkede yaygınlaştığı gözlenmektedir. Bu çalışmada, sürdürülebilir yapı ile ilgili uluslararası kabul görmüş temel metin ve kavramlar incelenmiştir. Sürdürülebilir yapı kavram ve ilkelerine göre anahtar temalar ve anahtar başlıklar saptanmıştır. Uluslararası kabul görmüş Çevresel Değerlendirme Yöntemleri'nin (EAM), ana kategorileri ve konuları, özgün birincil kaynaklardan belirlenerek karşılaştırmalı olarak incelenmiştir. Her bir sistem kendi ortaya konduğu ülkenin ulusal, bölgesel ve yerel koşullarına uygun oluşturulmuşken, LEED, BREEAM, vb. gibi değerlendirme sistemlerinin ortaya çıktıkları ülkelerin dışında, koşulları oldukça farklı ülkelerde uygulanması, gerçekçi değerlendirme yapabilmeyi güçleştirmekte ve hatta mümkün kılmamaktadır. Dolayısıyla bu sistemleri her ülkede uygulanabilecek tip sistemlere dönüştürmek uygun ve gerçekçi bir çözüm olarak gözükmemektedir.

Anahtar Sözcükler: Çevre, Sürdürülebilirlik, Sürdürülebilir Yapı, Yeşil Bina, Çevresel Değerlendirme Yöntemleri

1. INTRODUCTION

In this study, firstly the occurrence of the concepts; the relation of sustainability and construction, how the construction sector interprets sustainability, what is sustainable construction and what are its principles, the relation of built environment and sustainable development will be discussed. At this basic, environmental assessment methods will be analyzed in detail and comparing and the main and sub criteria's of environmental platform assessment methods will be presented. After the open contrasts and conflicts between these data got from the analyzes and assessments will be discussed and the question of whether the criteria's put ahead by these systems produce the same result for every country and geography will be asked. And also the need for environmental assessment methods for All Countries in the world will be discussed. But, what features should this system have is the subject of advanced researches. This research just focuses on the direct understanding of the problem.

2. LITERATURE REVIEW

When the studies related to the subject are examined, it is understood that the studies carried out are not taken into consideration in the context of Sustainable development and Sustainable structure. It seems that only Environmental Assessment Methods are compared among themselves. Studies such as "Sustainable rating systems around the world" (Say and Wood, 2008) and "A Discussion Document Comparing International Environmental Assessment Methods For Buildings" (Saunders, 2008), which LEED, BREEAM, Green Star and CASBEE rating systems are compared to can be considered in this context. Similarly, the study named "Analysis of five approaches to evaluation of BREEAM, HQE, DGNB and C2C systems" (Schmidt, 2012) compared 4 different assessment methods. BREEAM, DGNB and LEED systems are compared in the study "Building Environmental

Assessment - a useful tool in the future delivery of holistic sustainability" (Brophy, 2014). LEED and CSH systems have been studied in the Master Thesis study "Environmental Assessment of Buildings and the Influence on Architectural Design" (Wallhagen, 2010). One of the most comprehensive reviews on this topic is Vierra's "Green Building Standards and Certification Systems" (Vierra, 2016). However in Vierra's study, some of the Certification & rating systems were examined individually, but no comparison was made. The rating system of the "Sustainability Assessment in the Construction Sector: Rating Systems and Rated Buildings" has been examined in the same way (Berardi, 2012).

3. METHODOLOGY

In the study, internationally accepted basic texts and concepts on Sustainable Construction were examined. Key themes and key topics have been drawn up and tabulated according to the concepts and principles of Sustainable Construction. In the continuation of the study, 14 International Environmental Assessments Methods (EAM), which is internationally recognized, was examined from its original primary sources to determine the main categories and topics. The fourteen different assessment methods have been studied comparatively. The findings were evaluated together with the themes and main topics set out under sustainable construction, The findings were evaluated together with the themes and main topics set out under sustainable construction, as well as original results in tabular form. This study features the fact that almost all of the existing rating systems are considered together and are one of the original studies evaluated together with the basic concepts of sustainable construction.

4. SUSTAINABLE CONSTRUCTION

At the seven part of Agenda 21 which is constitute as an international plan for sustainable development at Earth Summit of 1992 there have been an important basic for sustainable human settlement area improving according to sustainable development aim, at following years the agenda

of 1996 Environment II's providing enough house for everyone and aiming to accomplish sustainable settlement in the urbanized world and for this acclaiming that cities and the whole human settlements becoming sustainable. In the years following these processes, it has been understood that building and architecture sector began to interpret sustainability in their own sense and there is a study for accomplishing this aim at the international summits especially at Agenda 21 and Environment II.

Therefore, sustainable construction can be summarized as the reflection of sustainability and sustainable development to construction sector. The shaping of "sustainable building agenda" in internationally accepted construction sector and in this context International Council for Research and Innovation in Building and Construction became the leader for starting serious studies, in 1998 CIB World Building Congress; it took a pioneering role to implement the sustainability principles to construction sector. They put forward a conceptual framework in their report named Agenda 21 on Sustainable Construction, published in 1999 and in Agenda 21 for Sustainable Construction in Developing Countries report it underlined that the approaches of sustainable building in under-developed countries and in developed countries cannot be compared (CIB & UNEP-IETC, 2002).

Construction sector has an indisputable importance over natural environment which is one of the biggest of social and economic sectors. Therefore, the concept of sustainability and architecture are the most discussed concepts internationally. Sustainable development can be defined as adaptable to natural environment and conditions, using natural conditions at best by using natural parameters like energy, material, enlightening, air conditioning and less harmful material to nature. Sustainable construction process means the implication of sustainability principles in the process from planning, programming and designing to usage of the sources, implementation, usage of the building, destroying and reusing and waste management and it is defined by Kibert as caring ecological principles and sources, creating and managing a sound environment (Kibert, 1994). According to Keleş and Yılmaz; this designing insight which focused on compromising with environment is a kind of design which respect natural sources, adapt cultural and historical differences (Keleş and Yılmaz, 2004).

In architecture education condition UNESCO/UIA says that; architecture has to centre a life quality suitable to human honour, respectful to social, cultural and aesthetic needs, and with the effective usage of materials a technical implementation both considering the first equipments and future equipments, rational usage of the sources of artificial and natural environment, ecologically balanced and sustainable development, sustainable designs, environmental protection and bettering works, using the information of natural systems and artificial environments, protection and waste management, the life cycle of the materials, ecological sustainability, environmental effect, low energy usage, passive systems and the insights about the usage of these (UNESCO/UIA, 2011).

And it is also stated that in order to prevent the problems arising from the usage of the energy sources and beside energy protection in building, the decreasing of the effects of the materials at least should be the first aim in sustainable architecture and building. To decrease the energy need at least in building, it should be foreseen that design and material preference should be in this way. While passive design principles are implemented in design, in building and systems which will be integrated with material and building the aim should be to contribute the energy production in building (Altın, 2002). When constituting building model, the environmental and economic effects about environment, source usage, and the interactions between social and cultural effects should be determined and these aims should be implemented on building sector which is made up of many elements and is very complex. Sustainable construction is a total process of providing and sustaining the harmony between natural and constructed environment and constituting the settlements adaptable to human honour and promoting economic legacy (CIB & UNEP-IETC, 2002).

In addition to these, regional and cultural differences are also a significant project for sustainable construction. When designing a building, the physical conditions of the city and local area , socio-economic pattern, the damages sourcing from past and likely to happen in the future should be considered (Bourdeau, 1999). In this context sustainable construction approaches have many stages as national, regional and local (Bourdeau and Nibel, 2004). Local sustainable construction is about the usage of the local material and techniques, bettering of the life level and local economy of the local society, protecting and improving the local abstract and concrete cultural elements and life styles.

Socially and nationally different principles have been improved about sustainable construction and architecture. Kibert (1994) defines the principles of sustainable construction as: minimizing the consumption of the source, by recycling of the sources maximizing the reusing, in the usage of the sources preferring the ones which can be recycled and reused, protecting the natural environment, creating an a not dirty, sound environment, keeping the quality high when creating the constructed environment. The basic principles sustainable architecture has to consider are: protection of the natural environment, the effective usage of the sources, the productive usage of the energy, design of construction flexible and adaptable to changing conditions, diminishing wastes, local and recycled sources usage, minimizing health and security risks, protecting clean water sources, avoiding harmful and dangerous materials, providing internal weather quality, protecting biological variances (Bourdeau, 1999). For Agenda 21 on sustainable construction there are three themes: reduce, conserve and maintain. These themes and their main key points are:

Reduce: As key points the usage of energy sources, material sources, water sources and land use were decided. About these issues these are seen as principles: minimizing consumption, reusing, recycling, renewable sources usage, productive usage.

Conserve: Natural areas and bio-variance are decided to be key points. The considered principles are: limited land usage by protection, diminishing separation, avoiding toxic emissions, improves with restoration.

Maintain: Indoor environmental quality and constructed environmental quality are the key points. The principles of key points are: low emissions materials through maintain, productive/effective air-conditioning, providing activity/transportation/entertainment/security according to user needs, decreasing noise, contamination and smell, renovate and improve through restoration (CIB, 1999). Additionally, It would be appropriate to include socio-cultur and economy and c in this themes.

In a study done for South West Regional Assembly (SWRA) in England, the key points of sustainable construction principles are stated as: sitting, materials, construction techniques, information communication techniques, community involvement and local sourcing (SWRA, 2003). Again in England, in Sustainable Construction Brief 2 prepared by Department of Trade and Industry (DTI), the key points are stated like this: design for minimum waste, lean construction & minimise waste, minimise energy in construction & use, do not pollute, preserve & enhance biodiversity, conserve water resources, respect people & local environment, monitor & report (ie use benchmarks), environmental responsibility, social awareness, economic profitability (DTI, 2004). The themes DTI has proposed in " Aims for Sustainable Construction and 2015 Vision" are: climate change/ energy waste, materials, costs, water/water quality, flood risk, quality risk, quality aesthetic, sector abilities, capacity improvement, security, facility management, equality/respect to community (DTI, 2006).

The themes Strategic Forum For Construction has proposed in The Strategy for Sustainable Construction are: procurement, design, innovation, people, better regulation, climate change mitigation, climate change adaptation, water, biodiversity, waste, materials (HMG & SFC, 2008). The California Green Building Standards Code (CALGreen Code) is Part 11 of the California Building Standards Code and was the first statewide "green" building code in the US. CAL Green is

designed to save water and promote environmentally responsible, cost-effective, healthier places to live and work. The purpose of CALGreen is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a reduced negative impact or positive environmental impact and encouraging sustainable construction practices in the following categories: Planning and design, Energy efficiency, Water efficiency and conservation, Material conservation and resource efficiency, Environmental quality (CAL Green, 2017).In the reviews, It is understood that there are 5 main themes related to sustainable construction and 14 basic problems related to these themes (Table 1).

Table 1:The Themes And Main Issues On Sustainable Construction

THEMES	MAIN ISSUES
Reduce	Energy
	Water
	Materials & Resources
	Land Use & Ecology/ Sustainable Sites
	Waste & Recycling,
Conserve	Land Use & Ecology/ Sustainable Sites
	Pollution & Emissions
Maintain	Indoor Environmental Quality, Health &Wellbeing
	Location & Linkages & Transport
	Materials & Resources
	Innovation And Design
	Function & Service Quality
	Technical Quality
Socio-Cultur & Economy	Socio Cultural Aspects
	Economic Aspects

5. ENVIRONMENTAL ASSESSMENT METHODS (EAM)

In very near past, green building certification systems were shaped in order to assess the environmental performance and sustainability of the buildings. There are different assessment reports many member countries of World Green Building Council – (WGBC) have accepted mostly. The certification systems which propose to assess the environmental performances of the buildings have been started with the constituting of BREEAM (1992) In England which carries pioneering studies in this field. Later many certificate systems were founded as BEAM (Hong Kong), LEED (USA), SBTool (Multi National), CHS (UK), Green Globes (Canada), NABER & Green Star (Australia), CASBEE (Japan), Green Mark (Singapore), HQE (France), SIB (Sweden), CEEQUAL (UK), DGNB (Germany), Estidama (UAE), Concerto (Italy), EcoLab (Holland), C2C (Multi National), European Eco–labelling (EU) (Figure 1).

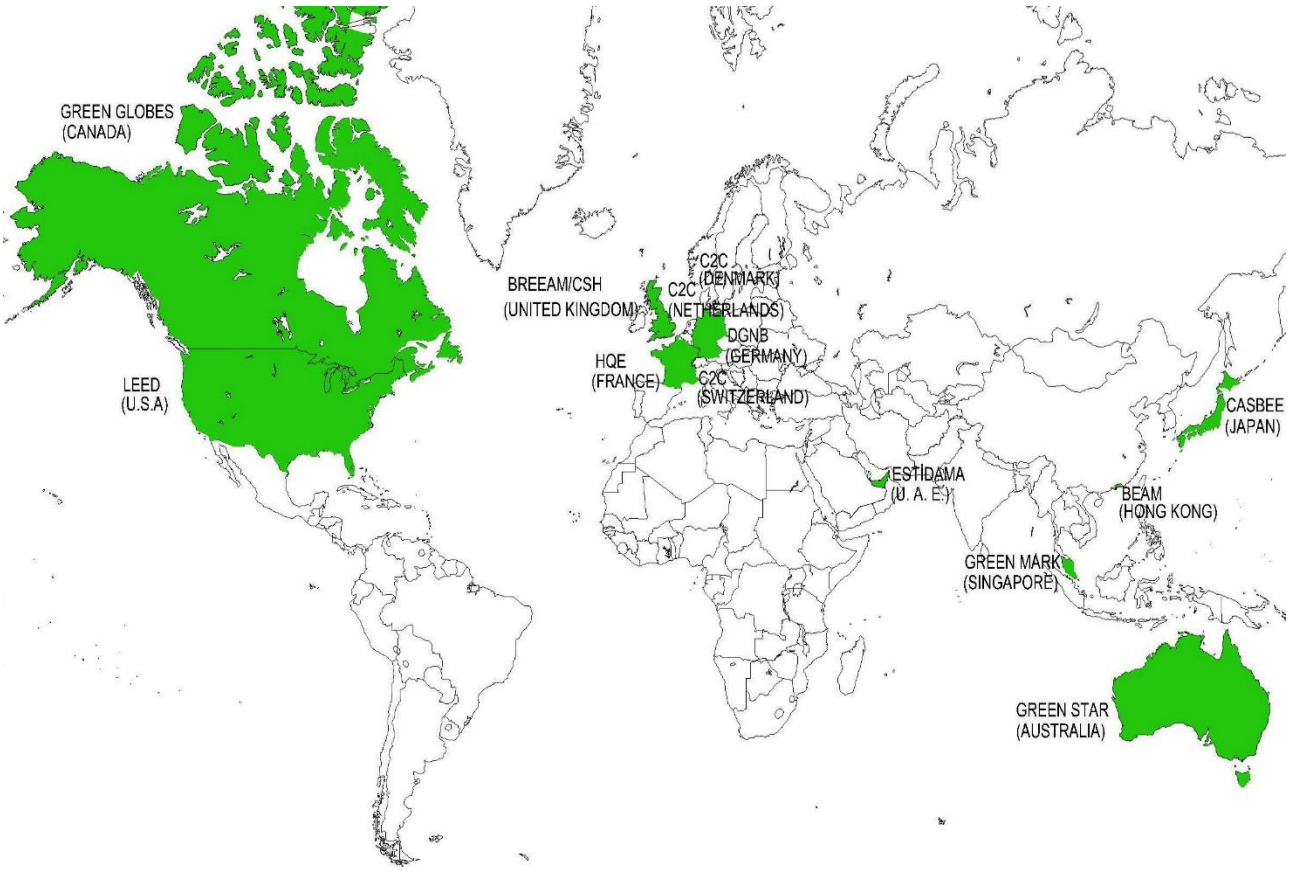

Figure 1. The Main Environmental Assessment Methods in The World.

BREEAM is a voluntary measurement rating for green buildings that is operated in the UK by the Building Research Establishment (BRE), which describes itself as an independent and impartial, researchbased consultancy, testing and training organisation. BREEAM was first launched in 1990 and is currently updated annually to keep ahead of UK Building Regulations and to stay in line with current best practice. The first version of BREEAM was developed to assess the environmental performance of offices. The BREEAM scheme distinguishes between at least 11 different building types, plus a "bespoke" category in case a suitable predefined category does not exist. The present report does, however, not examine the differences between criteria for different building types. The relative importance of the BREEAM sections is determined not only by the number of credits available in each section, but also by a weighting factor applied to each section (Saunders, 2008; Schmidt, 2012). The main BREEAM sections are categorized in ten groups: Management; Health and Wellbeing; Energy Transport; Water; Materials; Waste; Land use and ecology; Pollution and Innovation (BREEAM, 2017).

The BEAM (Building Environmental Assessment Method) scheme was established in 1996 with the issue of two assessment methods, one for 'new' and one for 'existing' office buildings largely based on the UK Building Research Establishment's BREEAM. Environmental issues were categorised under global', 'local' and 'indoor' impacts, respectively. The Building Environmental Assessment Method (BEAM) is a significant private sector initiative in Hong Kong to promote buildings that are more sustainable, through enhanced design, construction, commissioning, management, and operation and maintenance practices. BEAM 2009 has been developed by the BEAM Society. The scheme is owned by the BEAM Society and is operated under the guidance of the BEAM Society Executive Committee. Secretarial and logistics support is provided by the Business Environment Council (BEAM, 2010). In BEAM the various performance aspects covered are grouped within the following categories: Management (MAN), Site Aspects (SA), Materials and Waste Aspects (MWA), Energy Use (EU), Water Use (WU), Indoor Environmental Quality (IEQ) (BEAM, 2016).

LEED (Leadership in Energy and Environmental Design) which is improved and implemented by one of the most comprehensive sustainable construction assessment systems. The U.S. Green Building Council (USGBC) established LEED in 1998 under a pilot version to transform the way buildings and communities are designed, built and operated. By being environmentally and socially responsible LEED enables a healthy and prosperous environment that improves quality of life. LEED New Construction and Major Renovation points are broken down into six categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and the additional category is regional priority (USGBC, 2009). One hundred points are available across these categories with mandatory prerequisites such as minimum energy and water-use reduction, recycling collection, and tobacco smoke control. Within each category are credits that pertain to specific strategies for sustainability, such as the use of low-emitting products, reduced water consumption, energy efficiency, access to public transportation, recycled content, renewable energy, and daylighting.

SBTool is a software system formerly known as GBTool, that is designed to assess the environmental and sustainability performance of buildings. SBTool is the software implementation of the Sustainable Building Challenge (SBC) assessment method that has been under development as the GBC process since 1996 by a group of more than a dozen teams. The GBC process was launched by Natural Resources Canada, but responsibility was handed over to the International Initiative for a Sustainable Built Environment (iiSBE) in 2002. The generic method and software is calibrated by national teams to suit their local conditions, and is then tested on case study buildings. Results are displayed at international SB conferences, the most recent of which was the Tokyo SB05 conference in late September 2005 (SBTool, 2007). SBTool method creates a general assessment framework and includes a method which proposes constituting main performance criteria adaptable to every different country, region or local conditions. The performance criterias SBTool base on for assessment are stated in 8 categories as: Site Location, Available Services and Site Characteristics; Site Regeneration and Development, Urban Design and Infrastructure; Energy and Resource Consumption; Environmental Loadings; Indoor Environmental Quality; Service Quality; Social, Cultural and Perceptual Aspects; Cost and Economic Aspects (Larsson, 2016).

Green Globes is similar to LEED and BREEAM. Based on the 1996 CSA publication of BREEAM Canada, Green Globes for Existing Buildings was developed in 2000 by ECD Energy and Environmental Canada. It was brought to the U.S. by the Green Building Initiative (GBI) in 2004. The system is commonly used in the United States and Canada, although it does not have an affiliation with one country like the previously mentioned systems. It is accredited as a standards developer by the American National Standards Institute. Buildings are rated on a 1,000 point scale spread across seven categories: Project Management, Site, Energy, Water, Materials & Resources, Emissions and Indoor Environment (Green Globes, 2004, 2008).

Green Star was developed in 2003 in a partnership between Sinclair Knight Merz and BRE. As BREEAM was used as the basis of the Green Star methodology the two methods are very similar. However, adaptations have been made in order to reflect the various differences between Australia and the UK, such as the climate, local environment and the construction industry standard practice (Saunders, 2008). Since the initial launch of Green Star the GBCA (Green Building Council Australia) have also adapted the assessment methodology to make the delivery mechanism more akin to the LEED approach Green Star is broken down into the following categories: management, indoor environmental quality, energy, transport, water, materials, land use and ecology, emissions and innovation (Green Star, 2013). Like LEED and BREEAM, a large amount of points are applied to energy conservation and improved indoor air quality. Green Star also includes an innovation section like LEED, although the points do not have as great of an impact (Say and Wood, 2008).

CASBEE was first launched in 2004 by the Japan Sustainable Building Consortium (JSBC). The methodology used to calculate the score is called BEE (Building Environmental Efficiency) that

distinguishes between environmental load reduction and building quality performance. This approach was first developed by IISBE (International Initiative for a Sustainable Built Environment) in the form of GBTool. Assessment contains two points of view: the Assessment of Environmental Quality of the Building (Q) and Decreasing Load Reduction of the Building (LR). Under these main categories are sub-categories. CASBEE the assessment of newly constructed buildings are stated as:

Environmental Quality of the Building;

- ✓ Indoor Environment;
- ✓ Quality of Service;
- ✓ Outdoor Environment on Site.

Environmental Load Reduction of the Building;

- ✓ Energy;
- ✓ Resources & Materials;
- ✓ Off-site Environment (CASBEE, 2005).

Green Mark Scheme based in Singapore. Green Mark was launched by the Building and Construction Authority (BCA) in January 2005 to promote environmental awareness in the construction and real estate sectors. Green Mark sets parameters and establishes indicators to guide the design, construction and operation of buildings towards increased energy effectiveness and enhanced environmental performance. BCA Green Mark comprises a number of distinct rating tools that together holistically rate the built environment for its environmental performance. These include: new buildings, existing buildings, user centric, beyond buildings. The BCA Green Mark Scheme rates buildings according to five key criteria including: climatic responsive design, building energy performance, resource stewardship, smart and healthy building, advanced green efforts, and other green and innovative features that contribute to better building performance (BCA, Green Mark, 2015).

The Code for Sustainable Homes (CSH) is an environmental assessment method for rating and certifying the performance of new homes. It is a national standard for use in the design and construction of new homes with a view to encouraging continuous improvement in sustainable home building. The Code is based on EcoHomes. It was launched in December 2006 with the publication of Code for Sustainable Homes: A step-change in sustainable home building practice (CSH, 2010). The Code became operational in April 2007 in England, and having a Code rating for new build homes mandatory, from 1st May 2008. The implementation of the Code is managed by BRE Global under contract to the Department for Communities and Local Government under arrangements based on the EcoHomes operating systems. The Code for sustainable homes covers nine categories of sustainable design including: Energy and CO2 Emissions, Water, Materials, Surface Water Run-off, Waste, Pollution, Health and Wellbeing, Management, Ecology (CSH, 2008).

HQE is a French certification scheme, administered by the HQE Association a publicly recognized non-profit organization. The three independent organizations CERTIVEA, CEQUAMI and CERQUAL have been mandated by the French standardization body AFNOR to develop certification reference documents and perform building certifications. The HQE association was founded in 1996 and the HQE scheme has until 2011 been used for about so many building projects, the majority of which are found in France. To achieve a certificate, it must be documented that the building meets specified targets for environmental quality within 14 different categories:energy, site, components, worksite, water, waste, upkeep-maintenance, hygrothermal, acoustic, visual, olfactory, quality of spaces, air quality, health quality of water (France GBC, 2015; Schmidt, 2012).

The German Sustainable Building Certificate was developed by the German Sustainable Building Council (DGNB) to be used as a tool for the planning and evaluation of buildings in this comprehensive perspective on quality. On the more general level, the purpose of establishing DGNB was to create a second generation system for building certification, based on upcoming European standards for sustainable buildings and with focus on sustainability as an entity including ecology, economy, sociocultural and functional topics, techniques, processes, and location. The DGNB certification system was launched in 2009, followed shortly thereafter by the launch of its internationalization. The DGNB Certification System has 6 basic evaluation fields and 49 criteria. There are six basic evaluation fields in the assessment system: Ecological Quality, Economical Quality, Sociocultural and Functional Quality, Technical Quality, Quality of the Process, Quality of the Location (DGNB, 2016).

Estidama was launched in 2010. Estidama, which means 'sustainability' in Arabic, is the initiative which will transform Abu Dhabi into a model of sustainable urbanization. Its aim is to create more sustainable communities, cities and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural and social. The Pearl Rating System for Estidama aims to address the sustainability of a given development throughout its life cycle from design through construction to operation. Assessment of performance in: Integrated Development Process, Natural Systems, Liveable Communities, Precious Water, Resourceful Energy, Stewarding Materials, Innovating Practice (Estidama, 2010).

The Cradle to Cradle (C2C) concept was developed in the beginning of the millennium by two persons, William McDonough (USA) and Michael Braungart (Germany). Since then, the concept has been formalized and national offices in several countries (e.g. Switzerland, The Netherlands, Germany and Denmark in Europe) works on a commercial basis with implementation of C2C thinking in design and development as well as managing the certification process, which for many is important because it is the only visible proof on an on-going work (Schmidt, 2012). The C2C concept rests on three pillars: Eliminate the Concept of Waste, Use Renewable Energy, Celebrate Diversity. The Cradle To Cradle Certification covers five criteria of sustainable design including: Material Health, Material Reutilization (Design for Environment), Renewable Energy and Carbon Management, Water Stewardship, Social Fairness (C2C, 2013).

The CEEQUAL Scheme (Civil Engineering Environmental Quality Assessment and Award Scheme) was developed in UK Institute of Civil Engineers. Civil engineering and public realm projects covered by CEEQUAL. The CEEQUAL Scheme rates buildings according to 15 key criteria including: Project Environmental Management, Land Use, Landscape Issues, Ecology & Biodiversity, Archaeology and Cultural Heritage, Water Issues, Energy, Material Use, Waste Management, Transport, Noisance to Neighbours, Community Relations & Joy in Use (CEEQUAL, 2007).

Even these criteria were shaped adaptable to every country's special conditions, social-economic and cultural features, environment, climate structure and standards, in time some foundations like LEED and BREEAM got institutional identities. These systems give certificate by grading the constructions according to different performances (Table 2).

Table 2: The Main Issues (Categories) Of Environmental Assessment Methods

	BREEAM	BEAM	LEED	Green Globes	Green Star	CASBEE
ISSUES	*Management *Health and Wellbeing, *Energy, *Transport, *Water, *Materials, *Waste, *Land use and ecology, *Pollution, *Innovation.	*Management, *Site Aspects, *Materials and Waste Aspects, *Energy Use, *Water Use, *Indoor Environmental Quality.	*Sustainable Sites, *Water Efficiency, *Energy And Atmosphere, *Materials And Resources *Indoor Environmental Quality, *Innovation, *Regional Priority.	*Project Management, *Site, *Energy, *Water, *Materials & Resources, *Emissions, *Indoor Environment.	*Management, *Indoor Environmental Quality, *Energy, *Transport, *Water, *Materials, *Land Use And Ecology, *Emissions *Innovation	1.Environmental Quality; -Indoor Environment, -Quality of Service, -Outdoor Environment on Site, 2.Environmental Load Reduction; -Energy, -Resources&Materials, -Off-site Environment.
	Green Mark	**CSH**	**HQE**	**DGNB**	**Estidama**	**C2C**
ISSUES	*Climatic Responsive Design, *Building Energy Performance, *Resource Stewardship, *Smart and Healthy Building, *Advanced Green Efforts.	*Energy and CO2 Emissions, *Water, *Materials, *Surface Water Run-off, *Waste, *Pollution, *Health and Wellbeing, *Management, *Ecology.	*Energy, *Site, *Components, *Worksite, *Water, *Waste, *Upkeep-Maintenance, *Hygrothermal, *Acoustic, *Visual, *Olfactory, *Quality Of Spaces, *Air Quality, *Health Quality Of Water.	*Ecological Quality, *Economical Quality, *Sociocultural and Functional Quality, *Technical Quality, *Quality of the Process, *Quality of the Location.	*Integrated Development Process, *Natural Systems, *Liveable Communities, *Precious Water, *Resourceful Energy, *Stewarding Materials, *Innovating Practice	*Material Health, *Material Reutilization (Design for Environment), *Renewable Energy Carbon Management, *Water Stewardship, *Social Fairness.

6. RESULTS AND DISCUSSION

Environmental assessment methods in the past have been seen as a driver for sustainability, however, both the methods and the context used in the assessment have been changing rapidly. All green building assessment methods indicate the results of performance measurement applications as numeric values leading to easy comprehension, assessable and comparable outcome. Table 2 and 3 shows that there are many similarities between the rating systems, differences are also seen. One of the differences is also seen in the credits given in similar categories. Due to unequal credits, universal rating system cannot be established. This study shows that differences of all assessment methods are caused by the variations of geography, socio-cultural singularity and climate. The main difference between the national assessment systems is seen as grading in environmental categories which have different significance level according to each region (Table 2, 3).

All assessment methods have determined categories. These are; Management, Land Use & Ecology /Sustainable Sites, Energy, Water, Materials and Resources, Indoor Environmental Quality / Health & Wellbeing, Waste and Recycling, Pollution and Emissions, Location, Linkages and Transport, Innovation and design. These 11 categories underlie Environmental Assessment methods. However, to evaluate the differences between regions, some assessment methods may use one or a few more from 5 categories written below in addition to others. These 4 categories are; Function and Service Quality, Technical Quality, Economic Aspects, Socio Cultural Aspects. At the same time, all assessment methods seem to be focused on the theme of conserve, reduce and maintain (Table 3).

Environmental sustainability is a global idea and practice. Determining the level of environmental sustainability is inherent in building design. However, all assessment tools are differentiating from categories to issues and parameters, and varying in both hierarchical structure and level. The main difference between the various national assessment systems is the weight they give to different environmental categories. These naturally follow the main environmental and social issues for that region, which results in rating systems tailored to account for climate and local culture. Some

systems also give credits for compliance with building regulations. To illustrate, Japan's Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) is more concerned about land use, while Estidama (Sustainability in Arabia) was developed by Abu Dhabi Urban Planning Council. Unsurprisingly, Estidama pointed out the importance of Water Conservation.

Table 3: The Themes And Main Issues (Categories) Of Environmental Assessment Methods

THEMES	MAIN ISSUES	BREEAM	BEAM	LEED	GREEN Globes	GREEN Star	CASBEE	GREEN Mark	CSH	HQE	DGNB	ESTIDAMA	C2C
Reduce	Energy	O	O	O	O	O	O	O	O	O	O	O	O
	Water	O	O	O	O	O	O	O	O	O	O	O	O
	Materials & Resources	O	O	O	O	O	O	O	O	O	O	O	O
	Land Use & Ecology/ Sustainable Sites	O	O	O	O	O	O	O	O	O	O	O	O
	Waste & Recycling,	O	O				O	O	O	O	O		
Conserve	Land Use & Ecology/ Sustainable Sites	O	O	O	O	O	O	O	O	O	O	O	O
	Pollution & Emissions	O		O	O	O	O	O	O		O		
Maintain	Indoor Environmental Quality, Health & Well.	O	O	O	O	O	O	O	O	O	O		
	Location & Linkages & Transport	O				O	O	O		O	O		
	Materials & Resources	O	O	O	O	O	O	O	O	O		O	O
	Innovation And Design	O		O		O						O	
	Function & Service Quality						O				O		
	Technical Quality										O		
Socio-Cultur & Economy	Management	O	O		O	O			O		O		
	Economic Aspects						O				O		
	Socio Cultural Aspects						O				O		O

However, The DGNB and the HQE schemes seem to follow the provisions in the upcoming European standards EN 15804 and EN 15978 as close as possible and they are therefore well suited describe the material and building impacts during building lifetime. The US-based LEED scheme and the Cradle-to-Cradle concept do not use any kind of quantitative information about the life cycle environmental performance of materials and products. LEED, however, gives a small credit if EPDs are available. Green Star & BEAM are like LEED and BREEAM, a large amount of points are applied to energy conservation and improved indoor air quality. Green Star also includes an innovation section like LEED, although the points do not have as great of an impact. In all building certification schemes, the direct environmental life cycle performance of the selected building materials and products appears to be less important for the final rating than commonly thought, accounting at most for about 5% of the total score. The building materials and products may, however, also have a significant indirect influence on how the building performs in energy - related categories that are accounted for separately. In some countries the assessment of a building cannot be separated from its local environment. For example, a building will be marked down on its sustainability if local health and educational systems are weak or non-existent.

While the rating systems are typically designed with one country in mind they are often applied to other areas as a means of gaining increased exposure to the worldwide building industry. However, these rating systems are not adjusted to take into account the local climate, geographic or cultural differences. Construction materials and technology, thermal comfort levels, water availability and electricity demands are all major site-specific factors that are not included. New green technologies and materials are always being developed and entering into the marketplace to complement current

practices in creating greener environments. Many of these technologies and materials have not been tested long enough in the built environment in order to fully verify their performance. Seek extensive testing and performance data before incorporating new technologies and materials into a project. Over the last several years there has also been a shift away from a prescriptive approach to sustainable design toward the scientific evaluation of actual performance through Life Cycle Assessments (LCA). While LCAs are not yet a consistent requirement of green building rating systems and codes, there is a trend toward requiring LCAs and improving the methods for conducting them.

7. CONCLUSIONS

It is observed that there is a clear and linear relationship between Sustainability, Sustainable Development, Sustainable Construction and Environmental Assessment Methods. It is clear that environmental assessment systems are the trigger of sustainable development. However, the approaches of sustainable building in under- developed countries and in developed countries cannot be compared. It is seen that sustainable urban development has progressed very much in developed countries in the context of architecture, construction and house and legal, managerial, technical structure is founded and improved. In this sense, many countries develop certification programmes and green building assessment systems in order to put forward the environmental effects of constructions and buildings objectively. It can be said that these systems help the countries improving in architectural and structure sectors and making important progresses in service sector. But since every system is shaped according to their national regional and local conditions of the country it is produced, the assessment systems like LEED, BREEAM, CASBEE, HQE, DGNB, Green Star, etc. make it hard to do a realistic assessment in another country than its own, it can be even said that it make assessment impossible in a country where the conditions are very different. Instead of this, especially for under-developed countries it could be suitable to shape a global and flexible assessment framework which could be used adaptable to every country's national regional and local conditions. These general assessment framework which could be a guide for under-developed countries, can be adapted to different national conditions and can be helpful for regional and local conditions which are not similar. Beside environmental assessment, the assessment of social-economic and cultural sustainability should be developed and implemented more effectively. Environmental assessment methods have in the past been seen as a driver for sustainability, however, both the methods and the context in which they operate, are changing rapidly. Some methods are more future proofed and appropriate than others for wide application in the future and have greater potential to deliver future requirements and to assist in the delivery of life cycle evaluated environmental, social and economic sustainability. It has been expected that in All Countries the effort for sustainable city, environment and society will be done by public authority, and the parties of architecture and construction should both take the necessary steps in this field and supported and encouraged by public authority. In order to increase implementation in this field, investors, building owners, users and renters should be informed. Since the foundation and operation of an assessment system suitable to national conditions needs a process the studies related to this issue should be done immediately. It would be proper to make "national environmental performance systems" for single constructions, houses and urban development. It would be proper to underline that in order to say what criterias a green building assessment system which will be done for All Countries have needs more advanced researches. This article has focused on the general understanding of the problem.

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