GREEN BUILDING CERTIFICATION SYSTEMS: COMPARISON OF TURKEY AND BULGARIA

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ABSTRACT

Sustainability is defined as it meets the needs of present without compromising the ability of future generation's needs. Today the topic of sustainability has the urgent importance. Especially buildings consume large amount of energy and resources. Construction sector has great impact on environment. During construction process, occupancy, renovations and/or restorations and demolition, buildings consume energy, water and sources. They are also generating waste and emit harmful atmospheric emissions. Since 1990's countries had issued a series green building assessment scheme. Leadership in Energy and Environmental Design (LEED) developed by United States of America, Building Research Establishment's Assessment Method (BREEAM) developed by United Kingdom and German Sustainable Building Council (DGNB) developed by Germany are the most commonly used. There is now a proliferation of standards, rating and certification systems to assistance in order to deliver sustainable building in the marketplace. It is estimated that there are nearly 600 green certifications around the world. Green building rating programs vary in their approach with some outlining prerequisites and optional credits. Turkey and Bulgaria have some historical partnerships. So it can be useful to compare current situation of two countries in terms of green building certification. The comparison includes certification systems used in two countries. Bulgaria mainly depends on DGNB which is originally German evaluation system. Besides this some projects took LEED and BREEAM, as in Turkey. But the important difference in two countries is that Turkey has been developing its local system that is called Turkish Green Building Council (BEST). Thus in this paper the comparison mainly depends on BEST and DGNB. And also the certified projects in two countries are compared quantitatively. The benchmarks of two systems are compared in terms of similarities and differences. The characteristics of either standard system were summarized and some suggestions for improving Turkey's evaluation standard for green building were proposed.

Keywords: *green building, sustainable design, sustainability, certification, standard*

INTRODUCTION

Sustainable development contains a balance between the three dimensions of sustainability: Sociocultural, environmental and economic. This stems from the most frequent use of the term sustainability, which origins from the publication "Our Common Future" in 1987 by the Brundtland Commission [1]. In the past,

certain sustainability indicators for architecture have been proposed [2]. Some design methods, such as the biomimicry, were considered as a sustainable approach to the architectural design. Another approach that closely related with users' living quality is circular criteria of building design. Circular building (verb) is the dynamic total of associated processes, materials and stakeholders that accommodate circular flows of building materials and products at optimal rates and utilities [3]. Green building assessment systems are becoming increasingly popular worldwide. The number of different certifications has increased rapidly over the last two decades. The need for certification systems is accepted since the Brundtland Report [4]. There are number of comparison studies about certification systems. Green building certifications differ especially within social sustainability topics [5].

THE BULGARIAN GREEN BUILDING COUNCIL (BGBC) AND DGNB

BGBC is a non-profit organization with a mission to transform the built environment by changing the way buildings and communities are designed, built and operated. It serves as a central knowledge sharing platform for the construction and development market in Bulgaria. The organization offers comprehensive expertise in sustainable construction and the urban planning sector and is responsible for the implementation of internationally recognized certification systems for buildings and urban districts, and offering professional accreditation trainings for green building consultants and auditors [6].

DGNB system provides an objective description and assessment of the sustainability of buildings and urban districts. It is founded as a German Certification in 2007. This system also assertive to be the first to give equal weighting among ecology, economy and social aspects [5]. In that sense, DGNB is more of a total value sustainability assessment than the predominant environmental sustainability assessments of BREEAM and LEED. DGNB gives the DGNB certificate in bronze, silver, gold and platinum. In addition, there is the option of simple pre-certification in the planning phase.

DGNB System partners offer a system which is completely adapted to local conditions, local language and legal requirements. The DGNB System partners operate independently and carry out the conformity check locally. This partnerships are currently in place in Bulgaria, Denmark, Austria, Switzerland and Thailand [7]. The DGNB System does not evaluate individual measures but the overall performance of a building based on criteria. If these criteria are fulfilled in an outstanding way, the building receives a certificate or pre-certificate in platinum, gold, silver or bronze for existing real estate. The DGNB continues to develop its certification system and adapts it to national and international standards and legislation.

ENV. Environmental Quality; The six criteria of environmental quality allow an assessment to be made with regard to the effects of buildings on the global and local environment as well as the impact on resources and the generation of waste. The criteria are; 1.1. Building life cycle assessment, 1.2. Local environmental

impact, 1.3. Sustainable resource extraction, 2.2. Potable water demand and waste water volume, 2.3. Land use, 2.4. Biodiversity at the site.

ECO. Economic Quality; The three criteria of economic quality serve to assess the long-term economic viability (life cycle costs) and economic development. 1.1. Life cycle cost, 2.1. Flexibility and adaptability, 2.2. Commercial viability.

SOC. Sociocultural and Functional Quality; The eight criteria of sociocultural and functional quality help to assess buildings with regard to health, comfort and user satisfaction as well as the essential aspects of functionality. 1.1. Thermal comfort, 1.2. Indoor air quality, 1.3. Acoustic comfort, 1.4. Visual comfort, 1.5. User control, 1.6. Quality of indoor and outdoor spaces, 1.7. Safety and security, 2.1. Design for all.

TEC. Technical Quality; The seven criteria of technical quality provide a scale for evaluating the technical quality in view of relevant sustainability aspects. 1.2. Sound insulation, 1.3. Quality of the building envelope, 1.4. Use and integration of building technology, 1.5. Ease of cleaning building components, 1.6. Ease of recovery and recycling, 1.7. Emissions control, 3.1. Mobility infrastructure.

PRO. Process Quality; The nine criteria of process quality aim to increase the planning quality and the construction quality assurance. 1.1. Comprehensive project brief, 1.4. Sustainability aspects in tender phase, 1.5. Documentation for sustainable management, 1.6. Urban planning and design procedure, 2.1. Construction site/construction process, 2.2. Quality assurance of the construction, 2.3. Systematic commissioning, 2.4. User communication, 2.5. FM-compliant planning.

SITE. Site Quality; The four criteria of site quality assess the impact of the project on its environment and vice versa. 1.1. Local environment, 1.2. Influence on the district, 1.3. Transport access, 1.4. Access to amenities.

THE TURKISH GREEN BUILDING COUNCIL (ÇEDBİK) AND BEST

The Turkish Green Building Council is a non-governmental organization. ÇEDBİK aims to contribute to the building industry's development by means of the spread of principles of sustainability, established in 2007. It conducts its activities with the belief that buildings and settlements designed and constructed with an ecological sensibility allow us to live and work in healthier places and lead healthier lives. ÇEDBİK organizes educational programs, develops pilot projects with government and universities to increase public awareness about the necessity of green building while also encouraging the building industry to develop along with principles of sustainability.

ÇEDBİK has created BEST Residential certification system that is appropriate to be implemented to new residential projects in Turkey. Within the scope of BEST-Residential Certificate, houses are evaluated under 9 headings.

1. Integrated Green Project Management; Integrated design (precondition), 1.1. Integrated design, 1.2. Environmentally friendly contractor, 1.3. Construction waste management, 1.4. Noise pollution.

2. Land Use; 2.1. Land location, 2.2. Disaster risk, 2.3. Relationship between density and housing, 2.4. Land reuse, 2.5. Access to urban amenities.

3. Water Use; Reducing water use (precondition), 3.1. Reducing water use, 3.2. Preventing water losses, 3.3. Waste water treatment and evaluation, 3.4. Surface water flow.

4. Energy Use; Control/Start-up/Acceptance process of building energy systems (precondition), Energy efficiency (precondition), 4.1. Energy efficiency, 4.2. Renewable energy use, 4.3. Outdoor lighting, 4.4. Energy efficient white goods, 4.5. Lifts.

5. Health and Comfort; 5.1. Thermal comfort, 5.2. Visual comfort, 5.3. Fresh air, 5.4. Contamination control, 5.5. Audio comfort

6. Material and Resource Use; 6.1. Environmentally Friendly Material Use, 6.2. Using the Existing Building Elements, 6.3. Re-Use of The Material, 6.4. Local Material Use, 6.5. Durable Material.

7. Life in Residence; 7.1. Universal And Inclusive Design, 7.2. Security, 7.3. Sports and Resting Areas, 7.4. Art, 7.5. Transportation, 7.6. Parking Area, 7.7. Working at Home

8. Operation and Maintenance; 8.1. Waste Discrimination and User Access, 8.2. Waste Technology, 8.3. Building Use and Maintenance Manual, 8.4. Follow-Up of Consumption Values

9. Innovation; 9.1. Innovation, 9.2. Certified consultant.

METHODOLOGY

It can be said that the building certification systems have their individual nature. Therefore, it is a kind of challenge to understand the whole content of the criterions of certifications. And so it is quite difficult to determine how they are different from each other. A common definition of sustainable buildings is therefore used to analyse certification systems in order to get a better understanding of the certifications in the light of sustainability aspects [8]. Ecologic quality, economic quality and sociocultural quality. These are also triple pillars of sustainable development.

Three aspects of sustainability have been defined for the analysis as well as a total number of 13 subcategories [9]. Subcategories;

- Ecologic quality; Environmental impacts, resources, biodiversity, recycle, toxicity
- Economic quality; Life cycle costing, area use, value stability
- Sociocultural quality; Safety and access, well-being, architecture, transport, social responsibility

The criterion of the certification systems is then categorised within these subcategories. So, the analysis is limited to the “theme” within the criteria in the certification system and does not include the ambition of the criteria. It should be

noted that categorising has some subjective interpretation of the criteria [10]. The categorisation of criteria is based on the descriptions in the certifications' manual. If there is a direct relation with the category and the criteria, it is categorised directly. But generally, the criteria can be related more than one category and, in some cases, where the subject of the criteria has been multidisciplinary design of the building or has to do with documentation or process, the criteria has been equally divided on all categories. This choice in method means that categories that have otherwise not been included in a certification becomes visible in the results because it is included in this equal distribution [9].Although there are 13 subcategories, it is sometimes hard to categorise criterions. There will also exist some subjective interpretation of the criteria consequently.

RESULTS AND DISCUSSION

Table 1. shows a distribution in percent of DGNB certification criterion into three aspects. It can be claim that from this analyse, criterion of DGNB has approximately equal weight on three aspects of sustainability. Area use is the most represented category and environmental impacts category is the second. Another important result is the two categories share the weightiest percentage. Environmental impacts and area use.

Table 1. DGNB certification criterions categorise into three sustainability aspects

	Ecologic Quality					Economic Quality			Sociocultural Quality				
	Environmental impacts	Resources	Biodiversity	Recycle	Toxicity	Life cycle costing	Area use	Value stability	Safety and access	Well-being	Architecture	Transport	Social Responsibility
ENV1.1	1,4	1,4	1,3	1,3	1,3	1,3							
ENV1.2	0,7	0,7	0,7	0,6	0,6		0,7						
ENV1.3	0,4	0,4	0,3	0,3	0,3	0,3							
ENV2.2	0,4	0,4	0,4	0,4	0,4								
ENV2.3	0,4	0,4	0,4			0,4	0,4						
ENV2.4	0,1	0,1	0,1		0,1	0,1	0,1	0,1		0,1	0,1		0,1
ECO1.1	0,7	0,6		0,6		0,8	0,7	0,6					
ECO2.1	0,3	0,3				0,3	0,4	0,3	0,3	0,4	0,3		0,4
ECO2.2						1		1					
SOC1.1	0,5	0,5	0,5			0,5	0,5			0,5	0,5		0,5
SOC1.2					0,9	0,7	0,8			0,9	0,7		0,8
SOC1.3							0,4	0,4		0,4	0,4		0,4
SOC1.4	0,3	0,4		0,3		0,3	0,3	0,3		0,4	0,3		0,4
SOC1.5	0,2	0,2				0,2	0,2	0,2	0,2	0,3	0,3		0,2
SOC1.6	0,2	0,2			0,2	0,2	0,2	0,2	0,2	0,2	0,2		0,2
SOC1.7							0,2		0,3	0,2	0,1	0,1	0,1
SOC2.1						0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
TEC1.2							0,6	0,6		0,6	0,6		0,6
TEC1.3	0,5	0,5	0,5			0,5	0,5	0,5		0,5	0,5		
TEC1.4	0,3	0,3	0,3	0,3		0,3		0,3	0,3	0,3	0,3		0,3
TEC1.5	0,1	0,2	0,1		0,2	0,2	0,2	0,2	0,2	0,2	0,2		0,2
TEC1.6	0,4	0,4	0,4	0,4		0,4	0,4	0,4			0,4	0,4	0,4
TEC1.7	0,1	0,1					0,1	0,1		0,3	0,1		0,2
TEC3.1	0,3	0,3			0,3			0,3	0,3	0,4	0,3	0,5	0,3
PRO1.1							0,5	0,5	0,5	0,5	0,5		0,5
PRO1.4	0,4	0,4	0,2	0,2	0,2	0,3	0,3	0,2	0,2			0,3	0,3
PRO1.5	0,2	0,2	0,2	0,2		0,2	0,2	0,2	0,2			0,2	0,2
PRO1.6	0,6						0,6				0,6	0,6	0,6
PRO2.1	0,25	0,25	0,25	0,25	0,25		0,25	0,25	0,25	0,25	0,25	0,25	0,25
PRO2.2	0,4	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3
PRO2.3	0,5	0,5	0,5	0,5		0,5		0,5					
PRO2.4	0,25	0,25	0,25	0,25		0,25	0,25	0,25					0,25
PRO2.5	0,2	0,2	0,1			0,1	0,1	0,1					0,2
SITE1.1	0,2		0,1		0,2	0,2	0,2	0,1	0,2	0,2	0,2	0,2	0,2
SITE1.2						0,5	0,5	0,5					0,5
SITE1.3	0,2	0,2			0,1	0,2	0,2	0,2	0,2	0,2	0,1	0,2	0,2
SITE1.4	0,3	0,3	0,3		0,3		0,3	0,3	0,3	0,3		0,3	0,3
	10,8	10	7,1	5,8	5,55	10,45	10,8	9,3	4,35	7,85	7,65	3,75	9,4

Table 2. shows a distribution in percent of BEST certification criterion into three aspects.

This analyse shows that unlike Table 1 there is no equal distribution between three aspects. It is clear that ecologic quality has the power both represented categories and criterion weightings. The most represented and weightiest category is environmental impact. On the other hand, the least represented and scored category is transport. Economic quality aspect is least scored and represented. However, we can say the other aspects are generally related with economic quality.

Table 2. BEST certification criterions categorise into three sustainability aspects

	Ecologic Quality					Economic Quality			Sociocultural Quality				
	Environmental impacts	Resources	Biodiversity	Recycle	Toxicity	Life cycle costing	Area use	Value stability	Safety and access	Well-being	Architecture	Transport	Social Responsibility
1.1	0,2	0,2	0,2			0,2	0,2		0,2	0,2	0,2	0,2	0,2
1.2	0,4	0,4	0,4	0,4	0,4								
1.3	0,5		0,5	0,5	0,5								
1.4	1									1			
2.1	1	1	1										
2.2	0,75								0,75	0,75			0,75
2.3	0,5					0,5				0,5			0,5
2.4	0,5	0,5	0,5	0,5			0,5						0,5
2.5	0,4							0,4	0,4			0,4	0,4
3.1	1,5	1,5		1,5		1,5							
3.2	0,8	0,8				0,4							
3.3	0,4	0,4	0,4	0,4		0,4							
3.4	1		1										
4.1	3	3		3		3		3					
4.2	1,5	1,5	1,5	1,5		1,5		1					
4.3	0,25	0,25		0,25		0,25							
4.4	0,25	0,25		0,25		0,25							
4.5	0,25	0,25		0,25		0,25							
5.1	0,4	0,4	0,4			0,4	0,4	0,2		0,4			0,4
5.2	0,3	0,4	0,3			0,3	0,4	0,3		0,4	0,3		0,3
5.3	0,3	0,3	0,3		0,3	0,3	0,3	0,3		0,3	0,3		0,3
5.4	0,3	0,3			0,4					0,4	0,3		0,3
5.5							0,4	0,4		0,4	0,4		0,4
6.1	0,5	0,5	0,5					0,5			0,5		0,5
6.2	0,3	0,4	0,3	0,4		0,3	0,3	0,3			0,3		0,3
6.3	0,3	0,4	0,3	0,4		0,3	0,3	0,3			0,3		0,3
6.4	0,3	0,3	0,3	0,3		0,3	0,3	0,3			0,3	0,3	0,3
6.5						0,6			0,7				0,7
7.1							0,3	0,3	0,4	0,3	0,3		0,4
7.2	0,2				0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
7.3					0,2	0,3		0,3	0,3	0,3		0,3	0,3
7.4						0,1	0,2	0,1	0,1	0,2	0,1		0,2
7.5	0,3	0,3			0,3	0,3	0,3	0,3	0,3	0,3		0,3	0,3
7.6	0,2	0,2			0,2	0,1	0,2	0,1	0,2	0,2	0,2	0,2	0,2
7.7						0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
8.1	0,2	0,2	0,2	0,2	0,2	0,1	0,2	0,2	0,2		0,1		0,2
8.2	0,2	0,1	0,1	0,1	0,1	0,1	0,1						0,2
8.3	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1				0,1
8.4	0,4	0,4				0,3	0,3	0,3					0,3
9.1	0,2	0,2	0,1	0,2		0,1	0,1	0,1					
9.2	0,2	0,2	0,1	0,2		0,1	0,1	0,1					
	18,9	14,75	8,5	10,5	2,9	12,8	5,45	9,35	4,1	6,1	4,05	2,15	8,8

Table 3. shows a comparison of DGNB and BEST certifications score weighting according to three aspects and 13 subcategories. It can be concluded about scoring distribution that both systems give mostly close scores. Four subcategories have different score weightings. Environmental impacts, resources, recycle and area use categories. Like DGNB, the BEST system's least represented and scored category is transport. Sociocultural aspect is the least scored. However economic quality is the least represented.

Table 3. Comparison the certification systems score weightings according to three aspects

Three Aspects	Subcategories	DGNB	BEST
Ecologic Quality	Environmental impacts	10,8	18,9
	Resources	10	14,75
	Biodiversity	7,1	8,5
	Recycle	5,8	10,5
	Toxicity	5,55	2,9
Economic Quality	Life cycle costing	10,45	12,8
	Area use	10,08	5,45
	Value stability	9,3	9,35
Sociocultural Quality	Safety and access	4,35	4,1
	Well-being	7,85	6,1
	Architecture	7,65	4,05
	Transport	3,75	2,15
	Social Responsibility	9,4	8,8

In both systems it is evident that the ecologic quality aspect is valued most. While DGNB gives second place to sociocultural and third place to economy, BEST gives to economy the second place.

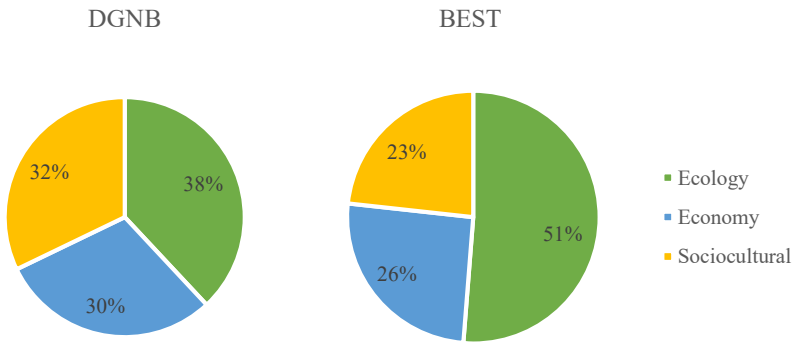

Figure 1. Percentage comparison of DGNB and BEST systems scorings according to sustainability aspect

There is an equal distribution among three aspects, when we look over DGNB. However, at BEST system ecology has the half.

CONCLUSION

Two certification systems that are used in two countries are compared. The analysis gives an overview of two building certification systems in relation to the sustainable building aspects and categories. Because of subjective interpretation of criteria, there is uncertainty in the results. However, the results still give a good

indication of the sustainability aspects in the certification systems. And also, it represents overall tendencies and differences.

In both systems it is evident that the ecologic quality aspect is valued most. While DGNB gives second place to sociocultural and third place to economy, BEST gives to economy the second place. On the other hand, BEST gives the weightiest scoring to environmental impact, DGNB gives the weightiest scoring to two categories which are environmental impacts and area use.

The ecologic quality aspect is valued most in both systems. While DGNB gives second place to sociocultural and third place to economy, BEST gives to economy the second place. DGNB gives the equal distribution among three aspects. But BEST gives the weightiness to ecologic quality.

REFERENCES

[1] Brundtland, G.H., et al., Our common future. New York, vol. /issue, pp 8, 1987.

[2] Liu, T.-Y., P.-H. Chen, and N.N. Chou, Comparison of Assessment Systems for Green Building and Green Civil Infrastructure. Sustainability, vol. 11/issue 7, pp 2117, 2019.

[3] Geldermans, B., M. Tenpierik, and P. Luscuere, Circular and flexible infill concepts: Integration of the residential user perspective. Sustainability, vol. 11/issue 1, pp 261, 2019.

[4] Reed, R., et al., International comparison of sustainable rating tools. Journal of sustainable real estate, vol. 1/issue 1, pp 1-22, 2009.

[5] Rohde, L., et al., Comparison of Five Leading Sustainable Building Certifications Concerning Indoor Environmental Assessment Content. 2019, Aalborg: Aalborg University.

[6] BGBC. Bulgarian Green Building Council: About us. 2012; Available from: https://www.bgbc.bg/en/pages/Aboutus/.

[7] DGNB. The DGNB System: Global Benchmark for Sustainability. 2020; Available from: https://www.dgnb-system.de/en/.

[8] Ebert, T., N. Essig, and G. Hauser, Green building certification systems. Detail Green, vol. /issue, 2011.

[9] Zimmermann, R.K., et al. Categorizing Building certification systems according to the definition of sustainable building. in IOP Conference Series: Materials Science and Engineering. IOP Publishing,2019.

[10] Yuce, M., Sustainability Evaluation of Green Building Certification Systems. Master of Science Florida International University, Construction Management. 2012.