

# A Comparison about European Environmental Sustainability Rating Systems: BREEAM UK, DGNB, LiderA, ITACA and HQE

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## Abstract

With the arising of environmental problems from the construction sector, the sustainability issues gained more space, making sustainability assessment tools emerge. These tools are based on the global definition of sustainability that meets Environmental, Economic, and Social criteria, and each system has a different and peculiar methodology. This paper aims to analyse the structure adopted by these European sustainability assessment systems: BREAM UK, DGBN (Germany), ITACA (Italy), LiderA (Portugal), and HQE (France), showing an overview of each system assisted by the SWOT Matrix, enabling the reader to better understand their differences. There are no superior or inferior systems, but each system notably performs much better in a subject or goal.

**Author Keywords.** Sustainability Building, BREEAM UK, DGBN, LiderA, ITACA, HQE, Environmental Certification, SWOT Analysis.

**Type:** Research Article

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## 1. Introduction

In recent years, the construction industry has been affecting the environment significantly. Herewith, the concept of green construction has gained more space ([Illankoon et al. 2017](#)), due to the increased attention to sustainability, making the sector build more sustainable buildings ([Berardi 2012](#)). Based on the growth of buildings with sustainable aspects, several tools to assess sustainability and environmental performance, with different evaluation characteristics, have emerged around the world.

Building sustainability tools timeline began in 1990 with the introduction of BREEAM UK. Five years later, French HQE system emerged, and in 2000 the LEED system arises. Since then, several countries have been developing their tools based on their own characteristics about sustainability ([Reed et al. 2011](#)). By mid-2017, it was estimated that there were around 600 sustainability classification tools worldwide ([Doan et al. 2017](#)). There is considerable variation in the structure among them, as well as many meanings and definitions of “sustainability,” which is why the certification systems vary ([Zimmermann et al. 2019](#)).

Sustainability classification systems have a structure that varies from energy consumption assessment systems to life cycle analysis and complete quality assessment systems ([Berardi 2012](#)). While most of these systems assess the project life cycle, the assessment of the operating stage, is still not considered in the evaluation process ([Doan et al. 2017](#)).

Based on this issue and the evolution of the sustainability system, the purpose of this article is to present some evaluation systems from different countries, evaluating their structure and

criteria, conducting a comparison using the SWOT analysis tool. Therefore, this research will allow readers to have a greater understanding of the difference and characteristics of these tools. SWOT analysis will help to identify their strength, weakness, and significant differences among them. Helping readers to have a better understanding of each certification system, and which best adapts to a specific situation. Moreover, this will help to reduce time, cost, and effort in selecting the right tool.

## 2. Materials and Methods

Initially, five sustainability certification systems were chosen, they are from different countries in Europe, which are: BREEAM UK (United Kingdom), DGNB (Germany), ITACA (Italy), LiderA (Portugal), and HQE (France). This choice was based on location (Figure 1), as they cover different regions of Europe.

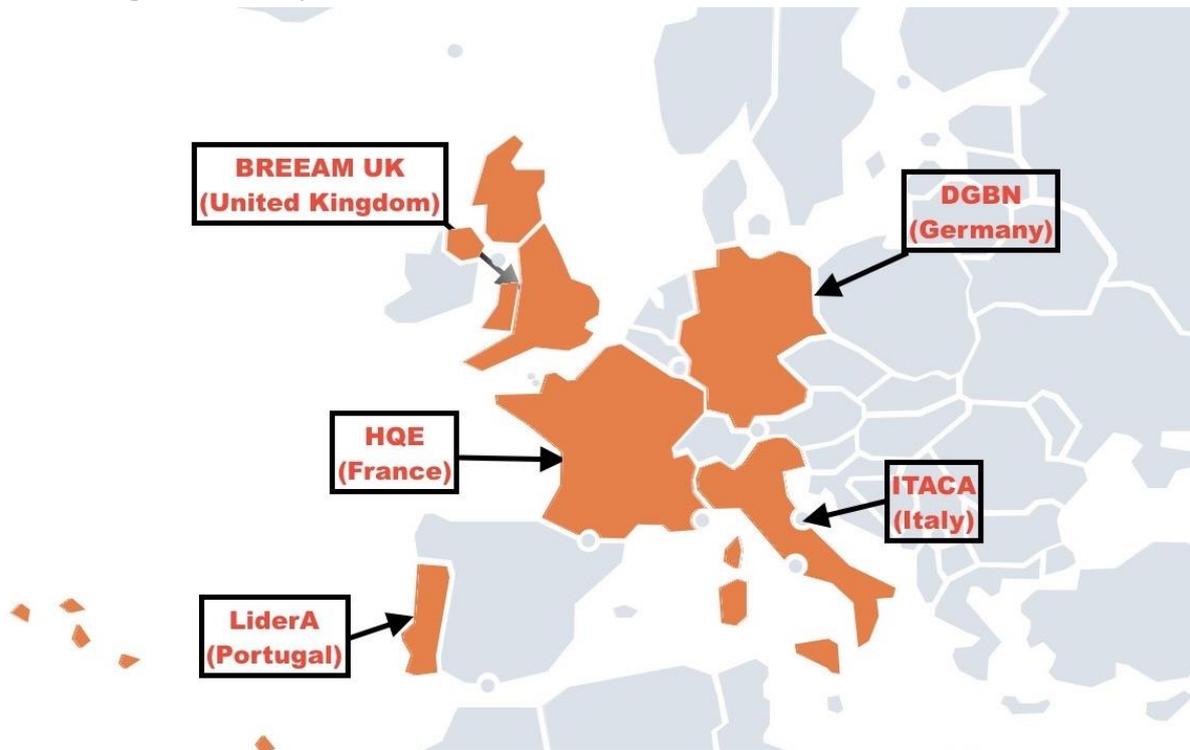


Figure 1: Sustainability certification tools (Matador, n.d.)

After choosing the sustainability certification systems, an analysis was carried out using scientific articles, system guides, and official websites. Due to this, it was possible to identify the categories and criteria of each system, allowing to examine their structures and characteristics.

Afterward, a SWOT analysis was used to classify and specify and generate meaningful information about the tools. SWOT matrix is used in the planning and marketing sectors, and it is able to evaluate and design strategies. This analysis shows how a company positions itself about other industries, helping to identify its Strengths, Weaknesses, Opportunities, and Threats (Freitas and Zhang 2018). Thus, SWOT analysis is performed to find out how these five sustainability certification systems are positioned about the sector according to their strengths, weakness, opportunities, and threats.

In the spreadsheet (Figure 2), the tools were analyzed among them; in addition, it was possible to assign weights to each item analyzed in all categories of the SWOT matrix. Weights ranged from 1 to 3; weight 1 is the worst, weight 2 is the standard, weight 3 is the best. The spreadsheet was adapted because the analysis is based on the three pillars of sustainability,

which are: environmental, economic, and social. The weight 3 was assigned to the item that meets the three pillars, 2 to those that meet two, and so on.

**STRENGTHS ANALYSIS**

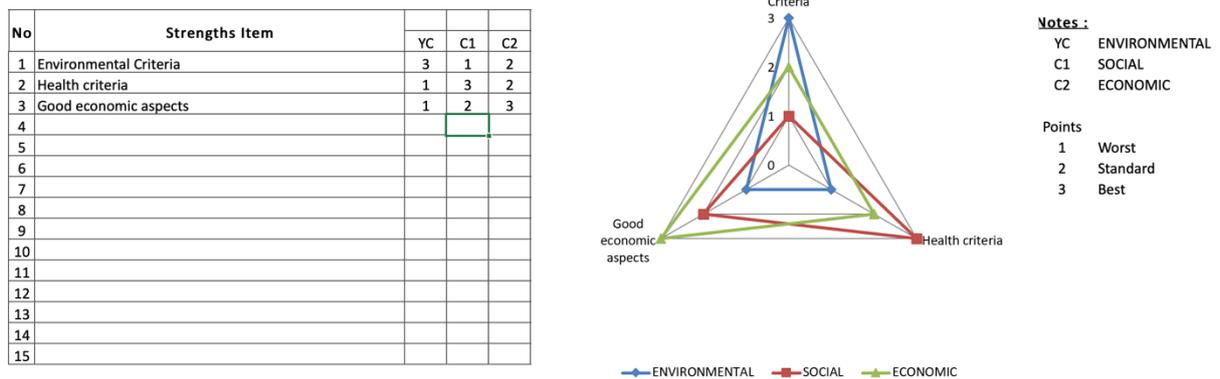


Figure 2: SWOT model (Word Templates Online, n.d.)

### 3. Sustainability Rating Systems

#### 3.1. BREEAM UK

BREEAM UK is the first sustainability assessment and certification system in the world for the built environment, being an international standard that is adapted, operated, and applied across the globe. Since its launch in 1990, up until now, 590,000 buildings have been certified, spread over more than 87 countries, and is considered the leader in the number of evaluations (BREEAM UK 2018).

The focus of this system - in terms of importance in the final calculation - is the environmental dimension of sustainability, followed by the social, and finally, the economic dimension. The main sustainable aspects of BREEAM UK are resources, environmental impact, and lastly, health (Jensen and Birgisdottir 2018). Table 1 shows the categories and criteria adopted in this structure.

Categories	Criteria
<b>Management</b>	a.1) Project brief and design   a.2) Life cycle cost and service life planning a.3) Responsible Construction Practices   a.4) Commissioning and handover   a.5) Aftercare
<b>Energy</b>	b.1) Reduction of energy use and carbon emissions   b.2) Energy monitoring b.3) External lighting   b.4) Lowcarbodesign   b.5) Energy efficient cold storage   b.6) Energy efficient transportation systems   b.7) Energy efficient laboratory systems   b.8) Energy efficient equipment
<b>Water</b>	c.1) Water consumption   c.2) Water monitoring c.3) Water leak detection   c.4) Water efficient equipment
<b>Waste</b>	d.1) Construction waste management   d.2) Use of recycled and sustainably sourced aggregates   d.3) Operational waste   d.4) Speculative finishes (Offices only) d.5) Adaptation to climate change   d.6) Design for disassembly and adaptability
<b>Pollution</b>	e.1) Impact of refrigerants   e.2) Local air quality   e.3) Flood and surface water management   e.4) Reduction of nighttime light pollution   e.5) Reduction of noise pollution
<b>Health and Wellbeing</b>	f.1) Visual comfort   f.2) Indoor air quality   f.3) Thermal comfort   f.4) Acoustic performance   f.5) Security   f.6) Safe and healthy surroundings

Categories	Criteria
Transport	g.1) Transport assessment and travel plan g.2) Sustainable transport measures
Materials	h.1) Environmental impacts from construction products - Building life cycle assessment (LCA)  h.2) Environmental impacts from construction  h.3) Environmental Product Declarations (EPD)  h.4) Responsible sourcing of construction products  h.5) Designing for durability and resilience  h.6) Material efficiency
Land Use and Ecology	i.1) Siteselection  i.2) Ecological risks and opportunities  i.3) Managing impacts on ecology  i.4) Ecological change and enhancement  i.6) Long term ecological management and maintenance
Innovation	Innovation

**Table 1:** BREEAM UK structure (BREEAM UK 2018)

### 3.2. DGNB

The German certification for sustainable construction (DGNB) is based on the three pillars of sustainability. It also has two additional pillars, focusing on the aspects of the technique involved and the construction process. The location of the building is evaluated and considered as an extra note, thus, it is considered if it presents in the calculation, but if it does not, it does not interfere negatively. Finally, there are six main categories, subdivided into criteria groups (Eberl 2010).

The three main pillars each have the same weight of 22.5%, followed by Technical Quality: 22.5%, Process Quality: 10% and location quality: Extra Note (DGNB, n.d.; Gertis et al. 2008). Among the importance of weights, the DGNB is the certification system that most equalizes the pillars of sustainability. Also, the stability value, resources, and life cycle costs are some notable aspects of the system (Jensen and Birgisdottir 2018). Table 2 shows all categories and each criteria.

Categories	Criteria
Environmental quality	a.1) Building life cycle assessment  a.2) Local environmental impact  a.3) Sustainable resource extraction  a.4) Potable water demand and wastewater volume  a.5) Land use  a.6) Biodiversity at the site
Economic quality	b.1) Life cycle cost  b.2) Flexibility and adaptability  b.3) Commercial viability  b.4) Thermal comfort
Sociocultural and functional quality	b.4) Indoor air quality  b.5) Acoustic comfort  b.6) Visual comfort  b.7) User control  b.8) Quality of indoor and outdoor spaces  b.9) Safety and security  b.10) Design for all  b.11) Fire safety
Technical quality	d.1) Sound insulation  d.2) Quality of the building envelope  d.3) Use and integration of building technology  d.4) Ease of cleaning building components  d.5) Ease of recovery and recycling  d.6) Immissions control  d.7) Mobility infrastructure
Process quality	e.1) Comprehensive project brief  e.2) Sustainability aspects in tender phase  e.3) Documentation for sustainable management  e.4) Procedure for urban and design planning  e.5) Construction site / construction process  e.6) Quality assurance of the construction  e.7) Systematic commissioning  e.8) User communication  e.9) FM-compliant planning
Site quality	f.1) Local environment  f.2) Influence on the district  f.3) Transport access  f.4) Access to amenities

**Table 2:** DGNB structure (DGNB, n.d.)

### 3.3. LiderA

Considered as a Portuguese voluntary system, LiderA supports the development of a solution and assessment of sustainability in the constructions. If it meets its criteria, its certification is granted. The main goal is to support the promotion of sustainability in the built environments. It is destined for Promoters, Designers, Contractors, Enterprise Managers, Clients, and Users of the built environments (Pinheiro 2010).

LiderA is divided into six major categories, which are subdivided into 22 areas, totaling 43 evaluation criteria, inside the three pillars of sustainability. To evaluate these requirements, they are classified as follows: A ++, A +, A, B, C, D, E, F, and G - G being the least efficient, A ++ being the most efficient and E being the usual practice (Ferreira, Pinheiro, and de Brito 2014). Table 3 shows all categories and each criterion.

Among the LiderA criteria, the most influential in the final calculation is energy consumption, referring to the building life, which in terms of the level of importance, shows a greater tendency towards environmental aspects (Vale 2017).

An attribute of LiderA system is that its structure of criteria evaluation has a peculiar characteristic, its application is more suitable in Portuguese-speaking countries when compared to other systems, and has good practices for new ventures (Nunes 2014).

Categories	Criteria
Local integration	a.1 Territorial enhancement  a.2 Environmental optimization of the implantation  a.3 Ecological enhancement  a.4) Interconnection of habitats  a.5) Landscape integration  a.6) Protection and enhancement of heritage
Resources	b.1) Consumption efficiency and energy certification  b.2) Passive design b.3) Carbon intensity  b.4) Drinking water consumption  b.5 Local water management  b.6) Durability  b.7) Local materials  b.8) Low impact materials  b.9) Local food production
Environmental loads	c.1) Wastewater treatment  c.2) Used water reuse rate  c.3) Air emissions flow  c.4) Waste production  c.5) Hazardous waste management  c.6)Waste recovery  c.7) Noise sources to the outside  c.8) Light-thermal pollution
Environmental comfort	d.1) Air quality levels  d.2) Thermal comfort  d.3) Lighting levels  d.4) Sound comfort
Socio-economic experience	e.1) Access to public transport  e.2) Low impact mobility  e.3) Inclusive solutions  e.4) Flexibility - adaptability to uses  e.5) Economic dynamics  e.6) Workplace  e.7) Local amenities  e.8) Interaction with the community  e.9) Control capability  e.10) Conditions for participation and governance  e.11) Control of natural risks (safety)  e.12) Control of human threats (security)  e.13) Life cycle costs
Sustainable use	f.1) Conditions of environmental use  f.2) Environmental management system  f.3) Innovations

Table 3: LiderA structure (Pinheiro 2010)

### 3.4. ITACA

ITACA is an Italian tool for buildings environmental classification, created by the association of the Council for Sustainable Construction (SBC), which allows the evaluation of different intended uses in all the phases of the life cycle. Its application can be made in different stages of the building, such as in the construction, renovation, and operation phases (Mattoni et al. 2018). Like other systems, ITACA is structured with different criteria, defined as elementary units, thus grouped into different categories and then grouped by assessment areas (Pagliaro

et al. 2015). There are usually 5 macro areas and an assessment of seven scoring levels: -1 for performance below the standard, up to 5 for advanced performance, a value of 0 corresponds to “current practice,” and a value of 3 corresponds to “best practice” (Mattoni et al. 2018). The procedures and principles adopted by ITACA are the same as those used for residential buildings. However, the number of guidelines (Table 4) is not the same for the calculation of environmental energy efficiency, being: 36 criteria for office buildings, 41 for school buildings, 36 for factories, and 33 for commercial buildings (Petrella 2016).

Categories	Criteria
Site Quality	a.1) Re-use of territory   a.2) Accessibility to public transport   a.3) Adjacent to infrastructure networks   a.4) Dispersion of the settlement   a.5) Functional mix area   a.6) External areas in common use equipped   a.7) Support for the use of bicycles   a.8) Use of local tree species   a.9) Impact on the urbanized context
Resources Consumption	b.1) Non-renewable primary energy   b.2) Primary energy total   b.3) ACS renewable energy   b.4) Renewable energy produced on the site for electrical purposes   b.5) Re-use of existing structures   b.6) Recycled/recovered materials   b.7) Materials from renewable sources   b.8) Local materials assembled on site   b.9) Recyclable or demountable materials   b.10) Certified materials   b.11) Drinking water for irrigation   b.12) Drinking water for indoor use   b.13) Thermal energy useful for heating   b.14) Thermal energy useful for cooling   b.15) Average global heat transfer coefficient   b.15) Solar radiation control
Environmental Loads	c.1) Emissions of CO2 equivalent   c.2) Solid waste produced during operation   c.3) Re-used/recycled production waste   c.4) Gray water sent to the sewed   c.5) Soil permeability   c.6) Heat island effect
Indoor Environmental Quality	d.1) Ventilation and air quality   d.2) Radon   d.3) Summer thermal comfort in air-conditioned rooms   d.4) Operating temperature in summer   d.5) Winter thermal comfort in air-conditioned rooms   d.6) Natural lighting   d.7) Acoustic quality of the building   d.8) Industrial frequency magnetic fields (50 Hertz)
Service Quality	e.1) Provision of services   e.2) Home automation systems   e.3) Integration of building automation systems   e.4) Availability of technical documentation buildings   e.5) Design for all

Table 4: ITACA structure (ITACA 2015)

### 3.5. HQE

After ECO 92 conference in Rio de Janeiro, instigating several countries to reflect about the environment, led to the creation of HQE (Haute Qualité Environnementale), by the Center Scientifique et Technique du Bâtiment (CSTB) in France (Vazquez et al. 2011).

HQE Certification was created in 1994, is based on four categories: environmental construction, environmental management, comfort, and health, and is subdivided into 14 criteria. In the process of product choosing and construction materials, environmental product declarations are used, including LCA data (Giama and Papadopoulos 2012).

A characteristic of this certification is that the health category is responsible for more than half of all importance weight, meaning that this tool has little focus on the economic dimension of sustainability (Jensen and Birgisdottir 2018). Table 5 shows the required criteria for each category. Another feature of HQE is that in the criteria description schemes, in terms of final classification for HQE levels, it is not sufficiently clear what will be preferably evaluated (Approved, Good, Very Good, Excellent, Exceptional) (Oviir 2016).

Categories	Criteria
Energy	a.1) Energy management
Environment	b.1) Relation of the building with its immediate environment   b.2) Integrated choice of construction products, systems and processes   b.3) Site with low environmental impact   b.4) Water Management   b.5) Waste management b.6) Maintenance - Sustainability of environmental performance
Comfort	c.1) Hygrothermal comfort   c.2) Acoustic comfort   c.3) Visual comfort   c.4) Olfactory comfort
Health	d.1) Sanitary quality of spaces   d.2) Sanitary air quality   d.3) Sanitary quality of water

Table 5: HQE structure (Certification NF HQE 2015)

#### 4. SWOT Analysis

All systems show unique characteristics; this makes them have their strengths, weaknesses, and optimization point.

##### 4.1. SWOT BREEAM UK

The first of them, BREEAM UK has great international recognition in this sector and great weight in the energy items, contributing to energy improvement, an important factor, due to the fact that buildings account for 40% of the world's energy consumption (Buyle, Braet, and Audenaert 2013).

However, this higher weight for energetic/environmental factors makes the economic and social pillars less critical, as shown in the SWOT analysis in Figure 3. Social aspects are not explored by an all in all, compared to the environmental pillar, being one of its weaknesses. Then, this can be an opportunity to better explore the social and economic aspects, to make sustainability more balanced. Finally, BREEAM UK presents a complex system; this can cause loss of space for other more direct tools, mainly in Europe, where there is a high competition.

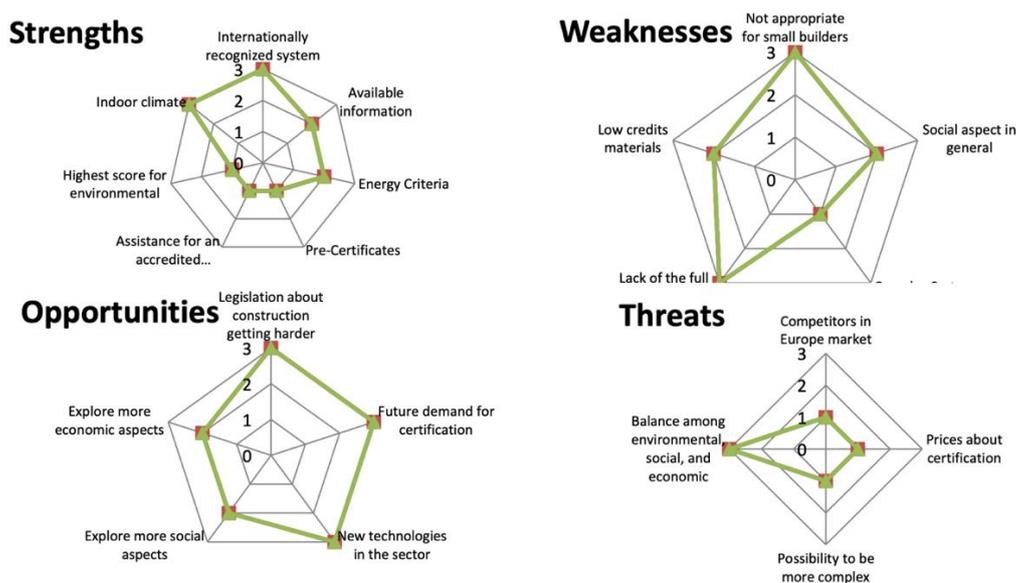


Figure 3: SWOT BREEAM UK

#### 4.2. SWOT DGNB

Another system with unique characteristics is the DGNB, considered to have the best definition of sustainability. Also, it has several influential factors, such as clear structure, assistance from an auditor, and an English version, that can expand the market. The environmental pillar stands out for its criteria; there are good items for toxicity, impacts, and life cycle costs.

However, there are some weakness factors; for example, the guide for new construction needs to be requested and is not available on the website. The price for certification can be a barrier to this system, depending on the work, it can be a costly lift, instigating the decision-makers to choose another certification system.

Besides, there is a high competition in the European market that alienates new users, but the good point is that it is located in a country - Germany, that has construction legislation and it gives it an opportunity to grow. In Figure 4 it is possible to follow the SWOT analysis for this tool.

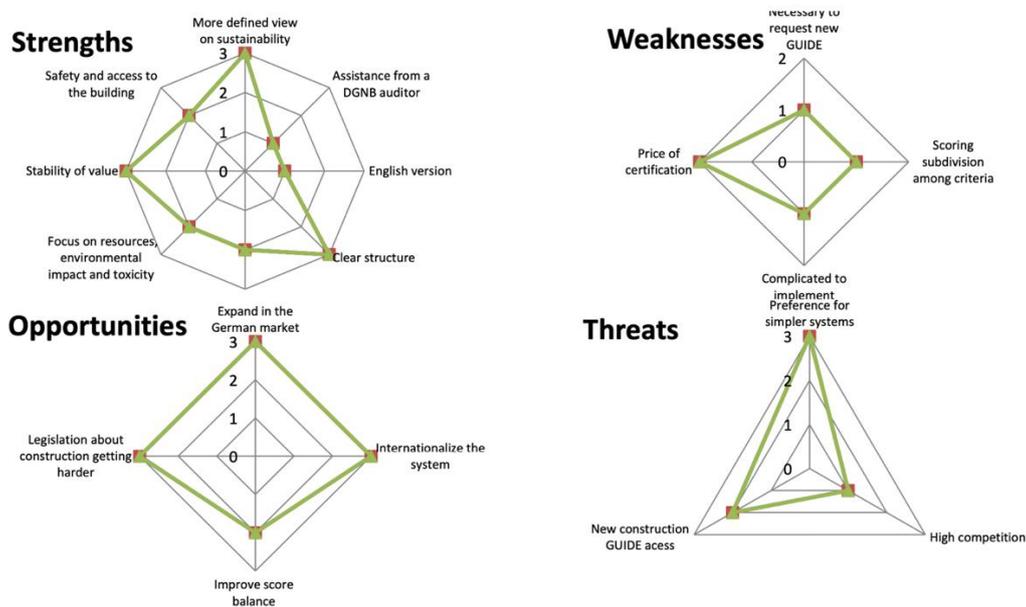


Figure 4: SWOT DGNB

#### 4.3. SWOT LiderA

LiderA, the Portuguese system, can be seen in Figure 5, presented good strengths and improvement opportunities in the SWOT analysis. This system has unique criteria, such as safety and security, in addition to having a certification process in the design phase, a factor that contributes to good planning. Its language and structure facilitate its growth in Portuguese-speaking countries. However, the lack of English versions may hinder its growth in the European market, and also of being inserted in a region (Europe), that has a high level of competition with other systems.

Another item noted is the imbalance of importance between the environmental, social, and economic pillars, which can be a point of improvement. Specifically, the economic aspects, which are rarely discussed.

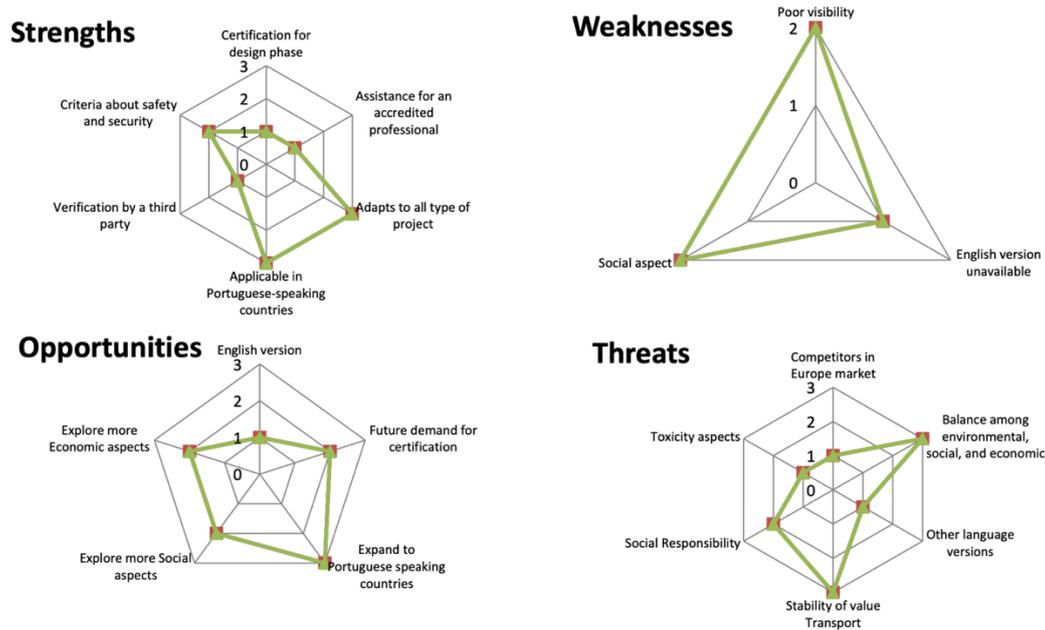


Figure 5: SWOT LiderA

#### 4.4. SWOT ITACA

ITACA, an Italian tool, very similar to LiderA, does not have an English version, and it is limited only to the Italian language market. Unlike the previous tool, this fact can be harmful since Italian is not an official language of large regions. Also, it presents a complex system, which can make the tool lose market to other simpler system tools. Economic and social aspects are not well explored; however, the environmental pillar is very detailed, has high criteria for environmental loads and resource consumption, and is a tool that can be adjusted for different types of projects. Figure 6 presents the SWOT analysis of this system.

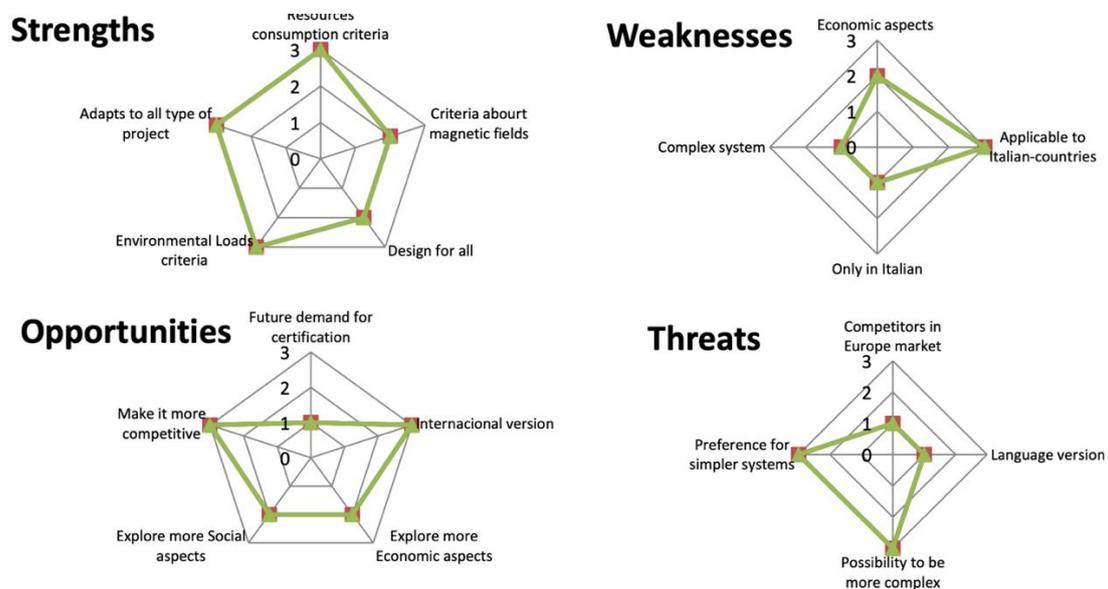


Figure 6: SWOT ITACA

#### 4.5. SWOT HQE

Among all the tools discussed in this paper, HQE is the one that gives to social dimension greater value; this makes this tool different from the others. However, it can cause an imbalance among the three pillars of sustainability, as shown in the SWOT analysis in Figure 7. Moreover, it gives less weight to economical importance, as well as few economic criteria. However, the health criteria are widespread, which is a strong point of this tool. As it is one of the first tools in this area to be launched, it has excellent visibility, allowing many opportunities for improvement, for example, better development of the English version and the optimization of the environmental and economic aspects.

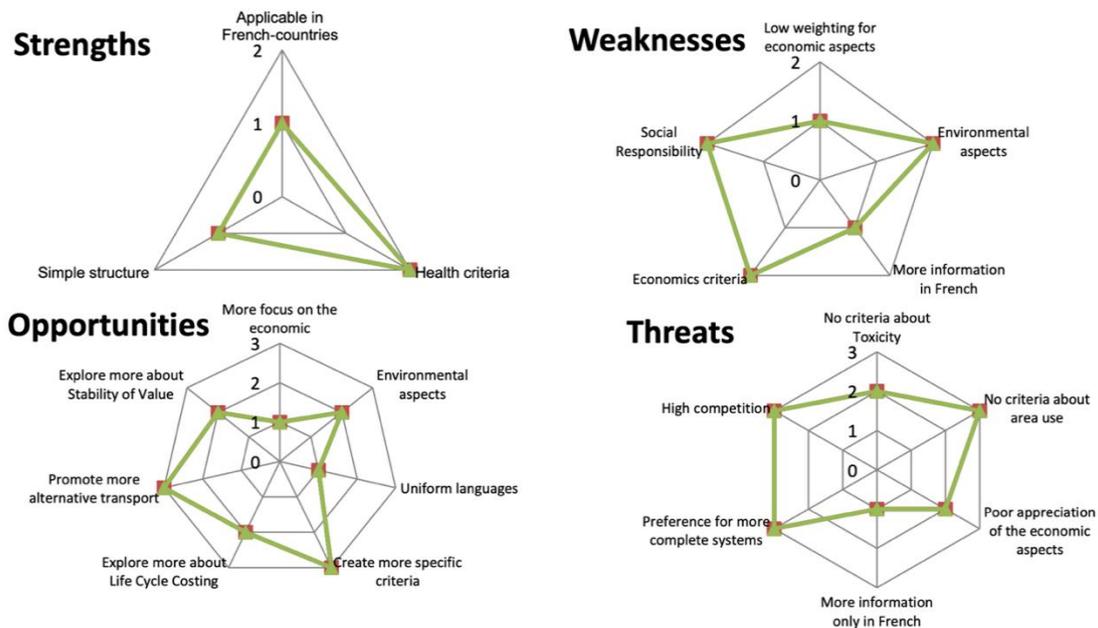


Figure 7: SWOT HQE

#### 5. Discussions & Conclusions

The global definition of sustainability includes the union of three pillars, the economic, environmental, and social dimensions. When the three dimensions are effectively achieved, sustainability is guaranteed. To evaluate the sustainability, different tools are used, and each system makes use of different categories, so social, environmental, and economic pillars are not used directly. This difference in the number of categories and the information to be assessed by each category, within sustainability, has been the subject of the study of several authors (Braulio-Gonzalo, Bovea, and Ruá 2015).

Each of the certification systems has its peculiarities. Based on this, it is necessary to identify what the user's objective is, before the certification process, so the certification system will contribute in the best way to what the user wants.

BREEAM UK has the characteristic of being the system with the most certifications in the world, this fact contributes positively to its marketing, and it is considered one of the most comprehensive system tools in this area. It is appropriate if the user is looking to meet sustainability objectives with more commercial visibility.

On the other hand, the DGNB system proved to be a certification system that tries to consider more outstanding balance in terms of importance among the three pillars of sustainability,

when equally distributes their weights. In general, it is recommended for users looking for buildings that achieve these three aspects as equally as possible.

LiderA, the Portuguese system, is notable for having a greater focus on environmental issues when compared to social and environmental aspects. It also has unique characteristics, being the only model that considers the control of natural risks (safety) and control of human threats (security). In addition, it is accessible to Portuguese-speaking users, facilitating the understanding, and includes criteria that are best applied to Portuguese-speaking regions.

The structure of the Italian model ITACA, has the most detailed criterion in comparison to the other tools. The Design, will help the buildings certified by this system; it follows a standard process that facilitates the mobility among all users. Its structure is well distributed and within the quality category in the environment indoor. Moreover, it is the only model that evaluated the criterion of electromagnetic pollution. There is little research about the presented criterion, which could indicate an interesting subject of study.

HQE, the French system, being one of the oldest in existence, has an international model and a French model. Comparing to others, it is visually a simpler model, which is divided into categories and different criteria. This system gives greater importance to user comfort on health aspects. This can be recommended for users who have a greater need for environmental comfort. This approach exists in other systems, however, this system is more widespread in this area.

It is important to point out that this article does not aim to indicate which system is the best, since each system is developed based on the definition of sustainability according to the country's regional reality. An important factor identified, is the difficulty in directly weighing the criteria inside the three pillars of sustainability, no matter how much one criterion has a greater influence on one pillar, it indirectly affects others - making it impossible to estimate the exact level of importance between the pillars. This topic could, therefore, be the subject of further study.

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