**Table 1.** Comparing GPRS with BREEAM and LEED
Source: (Housing and Building National Research Center (HBRC), 2011; Building Research Establishment (BRE), 2016; Karmany, 2016;Doan et al., 2017; HBRC, 2017; U.S. Green Building Council (USGBC), 2019)

| **Points of Comparison** | **GPRS V2** | **BREEAM International New Construction 2016 V2** | **LEED V4** |
| --- | --- | --- | --- |
| Country | Egypt | UK | US |
| Organisations | EGGBC | BRE | USGBC |
| Flexibility | 1 country | 77 countries | 160 countries |
| First Version | 2011 | 1990 | 1998 |
| Latest Version | 2017 | 2016 (updated in 2017) | 2013 (updated in 2019) |
| Main Categories | * Management Protocols
* Indoor Environmental Quality
* Energy Efficiency
* Water Efficiency
* Materials and Resources
* Sustainable Sites
* Innovation and Added Value
 | * Management
* Health & Wellbeing
* Energy
* Transport
* Water
* Materials
* Waste
* Land Use & Ecology
* Pollution
* Innovation
 | * Integrative Process
* Indoor Environment Quality
* Energy & Atmosphere
* Location & Transportation
* Water Efficiency
* Materials & Resources
* Sustainable Sites
* Regional Priority
* Innovation
 |
| Rating approach | Additive credits | Pre-weighted categories | Additive credits |
| Rating levels | * Certified ≥ 40
* Silver Pyramid ≥ 50
* Gold Pyramid ≥ 60
* Green Pyramid ≥ 80
 | * Pass ≥ 30
* Good ≥ 45
* Very good ≥ 55
* Excellent ≥ 70
* Outstanding ≥ 85
 | * Certified ≥ 40
* Silver ≥ 50
* Gold ≥ 60
* Platinum ≥ 80
 |
| Number of Certified Buildings | 2 | 561,600 | 79,100 |

**Table 2.** Comparing the categories of GPRS, BREEAM, and LEED
Source: (BRE, 2016; HBRC, 2017; USGBC, 2019)

| **GPRS Categories** | **BREEAM Categories** | **LEED Categories** |
| --- | --- | --- |
| Management Protocols (10%) | Management (11%) | Integrative Process (≈0.91%) |
| Indoor Environmental Quality (16%) | Health & Wellbeing (19%) | Indoor Environment Quality (≈14.55%) |
| Energy Efficiency (32%) | Energy (20%) | Energy & Atmosphere (30%) |
|  | Transport (6%) | Location & Transportation (≈14.55%)  |
| Water Efficiency (20%) | Water (7%) | Water Efficiency (10%) |
| Materials and Resources (12%) | Materials (13%) | Materials & Resources (≈11.82%) |
|  | Waste (6%)  |  |
| Sustainable Sites (10%) | Land Use & Ecology (8%) | Sustainable Sites (≈9.09%) |
|  | Pollution (10%)  | Regional Priority (≈3.64%) |
| Innovation and Added Value (5% bonus)  | Innovation (10% bonus) | Innovation (≈5.45%) |

**Table 3.** New proposed weights for GPRS categories

| **Categories** | **Old weights in GPRS V1** | **Current weights in GPRS V2** | **New Proposed Weights** | **Comment** |
| --- | --- | --- | --- | --- |
| Management Protocols (MP) | 10% | 10% | 5% | The weight was modified as most of the elements in this category are included in other categories (Ismail et al., 2015). |
| Indoor Environmental Quality (IEQ) | 10% | 16% | 10% | This category is important as much as Sustainable Sites (SS) category given the importance of enhancing the TBL of sustainability. Accordingly, they were assigned similar weights. |
| Energy Efficiency (EE) | 25% | 32% | 25% | This category is important given the current electricity supply interruptions in Egypt. A careful attention has to be paid for reducing and optimising energy consumption. Accordingly, it is assigned an average weight between the new proposed weights of both WE category and M&R category. |
| Water Efficiency (WE) | 30% | 20% | 30% | A higher weight is proposed to overcome the water crisis resulting from the construction of Renaissance Dam on the Nile River. A careful attention has to be paid to save water resources and optimise their usage. |
| Materials and Resources (M&R) | 10% | 12% | 20% | A higher weight is proposed to save raw materials from depletion, avoid high project cost, and reduce CDW given the current boom of construction in Egypt. This new proposed weight takes into consideration the integration of the missing criteria, discussed in the previous section, in the future version of the GPRS. |
| Sustainable Sites (SS) | 15% | 10% | 10% | This category demonstrates the importance of protecting the agricultural land from urban sprawl (Ismail et al., 2015). |
| Innovation and Added Value (IN) | 5% (bonus) | 5% (bonus) | 5% (bonus) |  |

**Table 4.** Shortcomings in M&R category of the GPRS V2

| **Criteria** | **Status** | **Comment** | **References** |
| --- | --- | --- | --- |
| Renewable materials and materials manufactured using renewable energy. | Existing | * Lack of database for the available green materials in Egypt and their suppliers.
* Lack of green materials certification in Egypt using national or international standards.
* Lack of specification which ensures that the renewable materials should be obtained from a source which is rapidly renewable by specifying a time frame.
* For materials manufactured using renewable energy, it is not effectively applied due to high initial costs of renewable energy.
 | (Eldeeb, 2013);(Ismail et al., 2015);(HBRC, 2017); (Khalifa et al., 2018); (Ismaeel et al., 2018); (Daoud et al., 2018a) |
| Regionally procured materials and products. | Existing | * The maximum distance between the construction site and the suppliers needs to be minimised below the specified distance 500 km. This distance is specified as 160 km in the LEED. This is necessary to minimise the negative impacts of materials’ transportation on the environment.
 | (Eldeeb, 2013); (HBRC, 2017); (USGBC, 2019) |
| Reduction of overall material use. | Existing | * Not effectively applied due to lack of contractor’s awareness.
 | (HBRC, 2017); (Khalifa et al., 2018) |
| Alternative building prefabricated elements. | Existing | * Not effectively applied due to high initial costs of prefabricated elements and lack of highly qualified contractors.
 | (HBRC, 2017); (Khalifa et al., 2018) |
| Environment – friendly, sound and thermal insulation materials. | Existing | * Lack of data about life cycle costs and information of these materials.
* Not effectively applied due to lack of contractor’s awareness.
 | (BRE, 2016); (HBRC, 2017); (Khalifa et al., 2018); (USGBC, 2019) |
| Construction waste management | Missing | * Lack of requirements and instructions regarding the diversion of materials waste from landfills by applying reducing, reusing, and recovering techniques. The GPRS requires only presentation of a schedule for principal project materials. Also, it is worth mentioning that recycling industry lacks in Egypt. Accordingly, recycling is not mentioned here as a solution for CDW management.
 | (Hassan, 2012); (Elattar & Ahmed, 2014); (Ismail et al., 2015); (BRE, 2016); (HBRC, 2017); ( USGBC, 2019) |
| Building and material reuse | Missing | * Lack of requirements and instructions to indicate the reuse of an existing building structural elements (e.g., floors, roof decking), enclosure materials (e.g., skin, framing), and permanently installed interior elements (e.g., walls, doors, floor coverings, ceiling systems). This should help in reducing CDW.
 | (Elattar & Ahmed, 2014); (BRE, 2016), (HBRC, 2017); (USGBC, 2019) |
| Material efficiency | Missing | * Lack of requirements and instructions to help in reducing the amount of materials used in building design without compromising on the structural stability and other performance factors.
 | (BRE, 2016); (HBRC, 2017) |

Building Research Establishment (BRE). (2016). *BREEAM International New Construction 2016* (Issue 2.0). https://doi.org/10.1192/bjp.112.483.211-a

Daoud, A. O., Othman, A. A. E., Robinson, H., & Bayyati, A. (2018). Towards a Green Materials Procurement : Investigating the Egyptian Green Pyramid Rating System. In M. Adel, R. El Maghraby, & S. Fathi (Eds.), *Green Hiritage Conference: Chanage-Change-Challenge* (pp. 575–591). Elain Publishing House. https://www.researchgate.net/publication/323588948\_Towards\_a\_Green\_Materials\_Procurement\_Investigating\_the\_Egyptian\_Green\_Pyramid\_Rating\_System

Doan, D. T., Ghaffarianhoseini, A., Naismith, N., Zhang, T., Ghaffarianhoseini, A., & Tookey, J. (2017). A critical comparison of green building rating systems. *Building and Environment*, *123*, 243–260. https://doi.org/10.1016/j.buildenv.2017.07.007

Elattar, S. M. S., & Ahmed, E. B. (2014). Towards the Adaptation of Green Building Material Systems To the Egyptian Environment. *Journal of Asian Scientific Research*, *4*(6), 260–269.

Eldeeb, S. (2013). Environmental Performance Of Construction Materials – An Appraisal Of Sustainability Assessment Rating Systems. *International Conference on Architecture, Civil, Urban and Environmental Engineering (ICACUEE 2013)*.

Hassan, F. (2012). *LEED “materials category” a critical analysis of Applicability in Egypt*.

Housing and Building National Research Center (HBRC). (2011). *The Green Pyramid Rating System - First Version* (Vol. 2011, Issue May 2010).

Housing and Building National Research Center (HBRC). (2017). *The Green Pyramid Rating System - Second Version* (Issue 2).

Ismaeel, W. S. E., Rashed, A., & Toulibah. (2018). To Be or Not to Be: The National Green Pyramid Rating System. In M. Adel, R. El Maghraby, & S. Fathi (Eds.), *Green Heritage Conference* (Issue March, pp. L–LXII). Elain Publishing House.

Ismail, A. M., Abo Elela, M. M., & Ahmed, E. B. (2015). Localized Green Building Standards: The Anti-Globalization Thesis. *Researcher*, *7*(9), 72–82.

Karmany, H. M. (2016). *Evaluation of green building rating systems for Egypt* [The American University in Cairo]. http://dar.aucegypt.edu/handle/10526/4628

Khalifa, S. S., Abdelkader, M., Eissa, A. M., & Hamdy, A. M. (2018). Obstacles of Application of Green Pyramid Rating System (GPRS) on Local Projects in Egypt. *The 4th NZAAR International Event Series on Natural and Built Environment, Cities, Sustainability and Advanced Engineering*, 120–128. https://static1.squarespace.com/static/565bcedee4b09e25856124af/t/5a6b801a0852293fdbf7ad07/1516994747704/NZAAR+Jan+2018+Proceedings.pdf

U.S. Green Building Council (USGBC). (2019). *LEED v4 for Building Design and Construction*.