Saudi Arabia’s LEED Projects: Recent Green Building Trends and Perspective

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Abstract. LEED (Leadership in Energy and Environmental Design) is one of the prestigious green building rating systems globally and the widely accepted international standard to evaluate green buildings. Many LEED certification building projects have already been carried out over the last few decades in the Kingdom of Saudi Arabia. Recently, many construction projects underway in the Kingdom are expected to be nominated for LEED certification over the next few years.

The paper explores the recent application of the LEED rating system in building construction projects and reviews the trends, project types, and potential challenges of the LEED certification buildings in the Kingdom. The study also investigates differences and characteristics in the types of LEED certification projects in the Kingdom and the Middle East countries, such as UAE, Qatar, Egypt, etc. The differences in the rate of adoption of the LEED categories in each country are indicated closely through the detailed analysis.

As a result, the paper presents the current trends and future perspectives based on the current status of the Kingdom's green building industry. This is a critical milestone to accelerate the development of the green building industry in the Kingdom.

1. Introduction

More countries have been focusing on environmental-friendly approaches, energy-saving and efficiency in various industries. Significantly, the construction industry is starting to focus on the green building approaches in the design and construction that could provide their countries with a more responsible way to use natural resources, which means not only does the various benefits of green buildings improve the natural environment, but also people who are working and living inside the buildings can enjoy healthier atmospheres, and improve productivity including avoiding the unnecessary pollution and waste.

In this regard, Saudi Arabia has also taken significant steps to scale up its climate action and environmental protection since Saudi Vision 2030 in 2016. Significantly, the Saudi Green Initiative is an ambitious national initiative for the Kingdom of Saudi Arabia that aims to improve the quality of life and protect future generations [1].

It now takes efforts to the next level by unifying all sustainability efforts in the Kingdom to increase reliance on clean energy, offset the impact of fossil fuels, and combat climate change. Furthermore, various green building projects have been carried out, keeping pace with the goal of Saudi green policy [2].

In this paper, firstly, the meaning of green building is defined as sustainability and high performance. Secondly, the LEED rating system by U.S. Green Building Council would be introduced as one of the
international green building standards. Thirdly, the paper explores the recent application of the LEED rating system in construction projects and reviews the trends of the last ten years and project types of the LEED-certified buildings in the Kingdom of Saudi Arabia. Additionally, the study investigates differences and characteristics in the types of LEED-certified construction projects in the Kingdom and the Middle East countries, such as UAE, Qatar, Egypt, etc. The differences in the rate of adoption of the LEED categories in each country are analyzed closely through the detailed analysis. As a specific analysis method, LEED projects registered in the U.S. Green Building Council’s website database were analyzed by period, project type, certified level, etc [3]. In conclusion, the study presents the trends and future perspectives based on the current status of the Kingdom's green building industry.

2. Green Building
What is the green building? The green building is just “Green”? There are many kinds of definitions about Green Building in the various areas, following the understanding of something meaningful of “Green” in building, such as aesthetic, economical, engineering and energy saving, global warming, environmental even including political aspect, etc. As a meaning of Green Building, the definition of the USGBC (U.S. Green Building Council) is quoted in this paper, which is “Green Building means a sustainable construction and high-performance building.” There are two essential words in this definition, which are “Sustainability” and “High-performance” [4]. The first “Sustainability” can be defined as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. It means the green building is closely connected with environmental aspects, such as protecting natural conditions, conserving cultural assets, reusing human-made environmental, and recycling materials, etc [4].

The definition of “High-performance” is the building that built and designed to reduce life cycle costs, improve environmental performance, minimize resource consumption, maximize human’s health and productivity, which explains the green building should be considered in terms of economic aspects as well as human health and productivity [4].

3. LEED Rating System
LEED (Leadership in Energy and Environmental Design) is one of the most prestigiously recognized green building ratings in the world, which the U.S. Green Building Council administers. Available for virtually all building types, LEED presents a standard for highly efficient, healthy, and cost-saving green buildings. LEED certification is a globally accepted symbol of leadership and sustainability achievement.

3.1. U.S. Green Building Council (USGBC)
The USGBC was founded in 1993 as a non-profit industry-based organization. The USGBC created LEED Rating System and it promotes sustainability in building design and construction, including operation and maintenance [3].

3.2. LEED Certification in the Green Building Rating System.
LEED certification is the point-based system to evaluate the building, which reduces stress on the environment, healthier and more productivity by encouraging resource-efficient and energy-saving, savings from higher lease rates, decreased utility costs and increased building value. The building projects registered in the LEED Rating System satisfy prerequisites and earn points to achieve different levels of certification to receive LEED certification. Prerequisites and points differ for each rating system, and the project teams choose the best fit for their project. Once a project team chooses a rating system, they will use the appropriate credits to guide design and operational decisions.
3.3. LEED Certification Types
There are five types LEED certifications as follows [5]:
- LEED Building Design and Construction (LEED BD+C)
- LEED Interior Design and Construction (LEED ID+C)
- LEED Building Operation and Maintenance (LEED O+M)
- LEED Homes Design and Construction (LEED HOMES)
- LEED Neighborhood Development (LEED ND)

Additionally, there are four levels of each certification type, which are Certified, Silver, Gold, and Platinum. The number of points that a project earns determines the LEED certification levels that the project will receive.

3.4. LEED Certification Structure
Within each of the point structures, there are specific prerequisites the project team must satisfy, and a variety of credits can pursue to earn points. There are eight representative structure categories; Location and Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation, and Regional Priority. Additionally, there are three categories in LEED-ND: Smart Location & Linkage, Neighborhood Pattern & Design, and Green Infrastructure & Buildings [3].

4. LEED Projects in the Kingdom

4.1. LEED Project Status
The first LEED-certified project in KSA is the KAUST (King Abdullah University of Science and Technology) Campus Project in 2009, which was the largest LEED Platinum certification project (5.337 Million sq ft) in the world. Since then, 1,543 projects have been registered as green building candidates in various LEED certification types. Nine hundred of the total registered projects have been certified successfully in December 2021. (Table 1)

| Waiting for Certified or Failed | Completed Certified | Total Registered Projects |
|---------------------------------|--------------------|--------------------------|
| Project No.                     | Percentage         |                          |
| 642                             | 41.6%              | 901                      | 1,543                      |
| Percentage                      | 58.4%              | 100%                     |

In this regard, the percentage of the LEED-certified projects in the Kingdom is 58.4%, higher than 55.8%, the percentage of the world average certified projects. (Table 2)

| Waiting for Certified or Failed | Completed Certified | Total Registered Projects |
|---------------------------------|--------------------|--------------------------|
| Project No.                     | Percentage         |                          |
| 73,062                          | 44.2%              | 92,338                   | 165,400                    |
| Percentage                      | 55.8%              | 100%                     |

Since 2009, 78,700 LEED projects have been certified in the world. During the same period, the LEED-certified projects in KSA reached 901 projects. When viewed as a percentage of the LEED-certified project in the Kingdom, it accounts for only 1.2%. The result shows relatively low compared to other countries.
4.2. LEED Certified Projects Types
As shown in Table 3, five all project types of the LEED certification have been achieved for the last 12 years since the KAUST project was certified successfully in 2009. Among the 901 LEED-certified projects, the LEED Homes projects account for most of the certified projects in the Kingdom, which are 807 (89.6%). The LEED BD+C projects are the most significant project types, which are 83 projects, 9.2%.

|               | LEED certified projects | %     | Remarks          |
|---------------|------------------------|-------|------------------|
| **LEED BD+C** |                        |       |                  |
| New Construction | 73                    | 8.1 (75.3) |                  |
| Core & Shell   | 9                      | 1.0 (9.3)   |                  |
| School         | 1                      | 0.1 (1.0)    |                  |
| Sub Total      | 83                     | 9.2 (85.6)   |                  |
| **LEED HOMES** |                        |       |                  |
| Low-Rising House | 807 (3)               | 89.6 (3.1) * | Al Waseel Hills: 615 |
|                |                        |       | KAPSARC: 191 *   |
|                |                        |       | Confidential: 1 * |
| **LEED ID+C** |                        |       |                  |
| Interior Design | 5                      | 0.5 (5.2)    |                  |
| **LEED O+M**  |                        |       |                  |
| Existing Building | 4                    | 0.5 (4.1)    |                  |
| **LEED ND**   |                        |       |                  |
| Neighborhood  | 2                      | 0.2 (2.0)    |                  |
| **Total**     | 901 (97)               | 100 (100)   |                  |

However, the LEED Homes projects are usually counted on an individual unit, meaning that a house construction project consists of many housing units. Therefore, the 807 LEED-certified housing units belong to three house construction projects, which are the Al Waseel Hills project (615 units), KAPSARC project (191 units), and a personal project (1 unit) so that the LEED Homes projects in the Kingdom would be able to count on three single-construction projects. As a result, a total of 97 LEED-certified projects have been performed since 2009.

Figure 1. LEED-Certified Projects Yearly Trends
4.3. **LEED Certified Projects Trends**

The LEED-certified projects in the Kingdom have been gradually increased since 2018. Primarily, the numbers of the project registration and the LEED-certified projects have been dramatically raised in 2021 (Figure 1). According to the USGBC's database, the certified projects in 2021 consist of mainly LEED BD+C New Construction projects which are 19 projects, and 2 LEED ID+C projects, 3 LEED O+M projects. Lastly, there are two LEED-ND projects certified.

4.4. **LEED Project Certification Levels**

In the LEED Rating System, there are four certification levels, Certified, Silver, Gold, and Platinum, which are based on the number of points a project achieves. The levels can be used as a criterion for evaluating how responsive the proposed project meets the LEED certification standards and an indicator to show the quality level of the registered projects. As in the following table 4, the Silver certification level accounts for the most certified projects with 70.7%. Next, the Gold certification level is 24%, showing the second-highest rate in the Kingdom.

| Certification Level | Points | Project No. | %    |
|---------------------|--------|-------------|------|
| Certified           | 40-49  | 37          | 4.1  |
| Silver              | 50-59  | 637         | 70.7 |
| Gold                | 60-79  | 216         | 24.0 |
| Platinum            | 80+    | 11          | 1.2  |
| Total               |        | 901         | 100  |

Based on the same standards, each certification level of the world LEED-certified projects can be analyzed as 26.5% in the Certified Level, 32.9% in the Silver Level, 29.8% in the Gold Level, and 10.8% in the Platinum Level. As a result, the LEED-certified projects in the Kingdom account for more than 95% of the projects with Silver Level or higher, indicating that the projects of relatively high quality have been progressed.

5. **Comparative Analysis between KSA and other Middle East Countries**

5.1. **LEED Registered and Certified Projects**

Figure 2 shows the registration status of the LEED projects that have been or are in progress in the Middle East countries as of December 2021 and the status of LEED projects that have received LEED certification. As of December 2012, UAE has the highest number of LEED registered projects with 2,072 projects. Subsequently, Saudi Arabia and Turkey can find 1,543 and 1,122 LEED registered projects, respectively. In terms of the country's overall size, it can show that the relatively small UAE currently has the most significant number of LEED registered projects. It may be based on the active drive and policy of the government and the market for green projects.

On the other hand, KSA has a success rate of 58.4% (901/1,542) in terms of having received LEED certification compared to LEED project registration. This result can be significantly higher compared to other Middle East countries. When it is considered that the success of a LEED project depends on sufficient preparation and consideration in the early stages, it represents that LEED projects in KSA have been relatively well managed.
5.2. LEED Projects Certification Levels.
Table 5 shows the LEED project certification level of 8 countries in the Middle East. Comparing the LEED projects in three countries, namely KSA, UAE, and Turkey, where a relatively large number of projects, have been carried out, it could be analyzed that LEED-certified projects with high-quality certifications above the Silver Level are relatively distributed in KSA, which is above 96% in the Silver, Gold and Platinum Level, on the other side, 70% in UAE and 93% in Turkey.
As previously analyzed from these results, the LEED-certified projects in KSA were relatively well prepared and managed at the beginning of the project stage.

Table 5. LEED Project Certification Levels in the Middle East Countries

| Level   | KSA | UAE | Turkey | Qatar | Egypt | Oman | Kuwait | Jordan |
|---------|-----|-----|--------|-------|-------|------|--------|--------|
| Certified | 37  | 142 | 32     | 1     | 4     | 1    | 1      | 0      |
| Silver  | 637 | 76  | 320    | 7     | 7     | 4    | 3      | 3      |
| Gold    | 216 | 190 | 69     | 50    | 10    | 8    | 5      | 5      |
| Platinum| 11  | 76  | 65     | 60    | 1     | 7    | 1      | 2      |
| Total   | 901 | 484 | 486    | 118   | 20    | 20   | 10     | 10     |

5.3. LEED Certified Project Types
If one aspect can be mentioned as one of the most significant differences between LEED projects in other Middle East countries and KSA, it is the type of LEED projects that have been certified. As shown in Figure 3 below, the critical feature of KSA’s LEED-certified projects is that out of 901 LEED-certified projects, LEED Homes type accounts for the majority with 807 projects.
Figure 3. LEED-Certified Project Types in the Middle East Countries

It is entirely different from other Middle East countries where the LEED BD+C certified projects are the main focus, including commercial and office building projects, core & shell, retail, healthcare, hospitality, and warehouses projects, etc.

On the other hand, in KSA, it indicates that the LEED-certified project has focused on housing for residential purposes. It means that KSA's government has continued to carry out housing construction projects based on its large-scale housing supply policy.

6. Conclusion
Currently, under the strong policy support based on the Saudi Vision 2030, numerous development projects are being carried out on a large scale throughout the Kingdom of Saudi Arabia. All projects in KSA should be progressing on the principle of eco-friendly and sustainable development as mentioned in the Saudi Green Initiative, which requires international standards to manage and operate projects in the future systematically. In this respect, the LEED Rating System has presented international standards for green building projects through long experiences and numerous LEED-certified projects worldwide.

This paper first analyzed the trend and characteristics of LEED-certified projects conducted in KSA by year, type, and certification level. As a result, the LEED-certified projects in KSA account for more than 95% of the projects with Silver Level or higher, indicating that the projects of relatively high quality have been progressed. Additionally, the LEED-certified projects have gradually increased since 2018. The numbers of the project registration and the LEED-certified projects have been rapidly raised in 2021. This increase is expected to continue in the future with the progress of large-scale development projects in KSA.

Next, the characteristics of the LEED-certified projects were analyzed compared with the status of LEED projects in the Middle East countries. The most striking feature of KSA’s LEED-certified projects is that compared to other Middle East countries, LEED Homes type’s projects are predominant, that has focused on providing housing for residential purposes. It is in line with the government’s large-scale housing supply policy until recently.

Through this study, the LEED-certified projects in KSA show rapid growth in qualitative, scale and number recently compared to any other Middle East countries. It is expected to continue to develop along with the current national policies in the Saudi Green Initiative and strong leadership in the Saudi Vision 2030.
7. References
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