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Dilemma of green and pseudo green architecture based on LEED norms in case of developing countries

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Abstract

Achieving sustainable and eco-friendly architecture is one of the main objectives that humans for creating a better life have made as the ultimate model for all their professional activities. For this reason, moving towards a greener architecture is considered the main goal of the contemporary architecture of our time. The goal of this study is to analyse architectural projects that have been already performed in the Middle East countries in terms of their compatibility with actual concepts of sustainability and their required green criteria. Therefore, for the sake of review and study, this paper is intended to discover up to what level the sustainability rating system such as LEED (Leadership in Energy and Environmental Design) can be effective in rating contemporary architectural projects. Studies indicate three concepts for analysing contemporary architecture and have found to be descriptive: (1) green, (2) pseudo green and (3) energy-monger. The studies have also shown that some of the projects, although trying to display sustainable architecture concepts in appearance, in reality they turned out not to be sustainable enough. In latter steps, this paper intends to evaluate and examine the effectiveness of the LEED rating system. In evaluating LEED rating system, the results inferred indicate that the system is intended more for programming than actual designing purposes and is not an efficient instrument for analysing architectural design process. Analysis based on this study suggests that, for moving from pseudo green to green architecture, it is necessary to use design-oriented patterns.

Keywords: Sustainable built environment; Green architecture; Pseudo green; LEED

1. Introduction

Green building (also known as green construction or sustainable building) refers to a structure and usage processes that are environmentally responsible and resource-efficient throughout the building's life-cycle: from design to construction, operation, maintenance, renovation,

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and demolition. This requires close cooperation of the design team, the architects, the engineers, and the client at all project stages (Ji and Plainiotis, 2006). In general, green buildings conserve resources by using energy, water, and materials more efficiently during the entire life of the building, including the initial construction phase (LOHAS Dictionary, 2010). Green buildings utilize techniques, materials, and methods aimed at reducing the building's negative impact on the environment, while increasing the level of comfort, health, and productivity of its occupants (Sussman, 2008). The term green building may also refer to a sustainable or high performance building; these terms are often used interchangeably although differences do exist. Currently, green and sustainable building philosophies are merging into what may best be described as a movement founded upon "creating a healthy built environment based on ecologically sound principles" while considering the "entire life cycle of the built environment" (Montez and Olsen, 2005 and Elmualim et al., 2012). Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment (U.S. Environmental Protection Agency, 2009). Nowadays, to determine the amount of being green in the green buildings, there are some global standards and rating systems. LEED (Leadership in Energy and Environmental Design) is the most popular sustainability rating system used in the United States (Cryer et al., 2006). The Green Globes system is also popular for smaller projects because it provides online guidance with an affordable third-party verification process. Another standard less commonly used in the United States is the Building Research Establishment Energy and Environmental Assessment Model (BREEAM) (Morrison, 2012). Some cities, such as Seattle, and many countries, such as Canada, Australia, and Japan, have established their own standards. All of these systems are similar to the U.S. LEED and BREEAM ratings in that they have a certified point system for rating various sustainable features, as well as a mechanism for certifying the building (Mahdavinejad, 1998). For the purpose of this paper, developing countries' approach to green buildings was selected, so a case study on ten green buildings in the Middle Eastern countries is considered and the rate of how green these buildings are is calculated. To achieve this purpose, a checklist of eight items of green architecture is designed by us and in each item the amount of being green, pseudo green and energy-monger is recorded. On the other hand, the LEED rating system as a globally recognized standard system has been selected and based on the items on this standard, the amount of being green is calculated. Then, the obtained survey by our checklist is compared with the resulting survey from the LEED norms and the correlation between them is calculated.

2. Methodology

2.1. Conceptual framework

Climatic conditions in the Middle East, particularly in predominant desert areas of Gulf States where the temperature difference between day and night is significantly wider, and thus requiring a great deal of energy consumption to make conditions livable, together with the sharp increase in the utilization of fossil fuels which greatly contribute to air pollution and raising the air temperature have compelled the natives to find a solution to this grave problem. Luckily, the sudden surge of oil revenue has made it possible to come up with the best suitable solution of moving towards green building construction which has shown a considerable growth in combatting these unfriendly environmental conditions. But this paper assesses that the majority of these buildings can actually be categorized as pseudo-green rather than to be effectively called green constructions. To gain an understanding of how green the buildings are, a checklist consisting of eight items relating to green buildings is prepared by us in a table. This checklist is called "Designer" and is set based on design criteria. On the other hand, at the end of the case study survey, a checklist of LEED norms is also provided by which the green rating is calculated for each building. This checklist is called "Programming". This study indicates three concepts in analysing contemporary architecture that have found to be descriptive: (1) green, (2) pseudo green and (3) energy-monger. In the Designer checklist for each of the eight items the rating of being green, pseudo green and energy-monger are evaluated. "Green" signifies something that is completely natural. For example, whenever natural plants are used whether on roof, walls or structure of a building as a live organ, or natural ventilation and natural lighting are being utilized in the building, these buildings can be called green. "Pseudo green" signifies something that is artificially green and is not completely natural. For example, when the wall structure is made of lumbers cut from trees or for ventilation purposes the appearance of a funnel is used in the building, these items can be called pseudo green. "Energy-monger" refers to something that is not green and something that consumes energy. For example, when the ventilation or lighting system is used in a building without utilization of natural forces and with a greater consumption of energy, these items can be called energy-monger.

2.2. Tools

The Designer checklist instrument involved eight items: roof, wall, structure, materials, ventilation, lighting, heating/cooling and water management. These eight items for each of the ten buildings have been prepared on a separate table. Moreover, to identify the rate of being green, pseudo green and energy-monger for each item, the data were collected from the websites of each building or the architects of those buildings. These data have been recorded

in the checklist table based on a Likert scale. The format of the proposed Likert scale has five items, which includes:

(1) lack of concept
(2) little amount of concept
(3) average amount of concept
(4) relatively large amount of concept
(5) full rating of concept

On the other hand, these data have been recorded based on the Likert scale in the programming checklist derived from twenty-five items of the LEED sustainability rating system.

Then, to identify the amount of being green in each building, the data were entered into a "Microsoft Excel database" and analysed. Finally, for the Designer and the Programming checklists, a separate chart is obtained. These charts are compared in the "SPSS statistics 19 software" and correlation coefficients between them are calculated.

3. Case studies

Nowadays, in the Middle East, we are seeing a significant growth in the use of green building technologies. This part of the world growing more and more significant in the economical era thus showed a considerable progress in building industry. The challenge of moving towards green architecture has become an effective competition in different countries. Nearly 1300 LEED certified commercial building projects can be found in the urban streetscapes in the Middle East. A recent survey of architects, engineers and construction professionals revealed that 73 percent of respondents have a new green institutional project planned in the UAE (Mo Yang, 2013). In this study, ten different cases of buildings in the Middle East countries which are known to be successful green projects have been surveyed. Efforts have been made to choose buildings which had been evaluated by the LEED rating system as green buildings, or buildings which the LEED intends to evaluate in the future.

3.1. Abu Dhabi's Aldar Market/Foster & Partners

Foster & Partners are behind the greening of Abu Dhabi's Central Shouq as well (Fig. 1). By adding a series of low rise, ecologically sensitive shops, hotel, offices, and restaurants, as well as rooftop gardens, the internationally-renowned firm has given this old world market a sustainable lift.

Table 1
Rating of green building items in Abu Dhabi Aldar Market.

Items	Green	Pseudo green	Energy-monger
Roof	4	2	1
Wall	1	5	1
Structure	1	3	3
Materials	1	4	2
Ventilation	4	1	2
Lighting	3	1	3
Heating & Cooling	1	2	4
Water management	4	2	1

The Central Market is one of the oldest areas in Abu Dhabi. Foster and Partners wanted to make a shopping complex that does not evoke the commercial banality of the shopping mall. Instead, the Aldar Central Market is a grid like new landmark, comprised of intimate balconies, alleyways and courtyards and topped with three iconic towers. The series of rooftop gardens creates a serene public park, which is a welcome retreat in the desert city. The Aldar Central Market is a city within the city. Unlike a commercial mall, the public spaces are meant for visitors to utilize as they would need a park – to relax, read, enjoy the sun, socialize – not just a place to rest tired feet from marathon shopping. The building, which occupies two city blocks, has incredible sliding walls and roofs, which cut energy costs by promoting as much natural ventilation and light as possible. The Aldar Central Market is an innovative architectural project added to the already impressive Abu Dhabi skyline – with a welcome addition of public park space (URL 01). Table 1 shows the rating of green building items based on the Designer checklist on the Abu Dhabi Aldar Market.

3.2. Abu Dhabi's Parliament Building/Ehrlich Architecture

This gorgeous lattice-domed parliament building in Abu Dhabi (Fig. 2) designed by Ehrlich Architecture can be considered as a good example of energy efficient green building. By incorporating passive solar design and unique desert architectural techniques, the firm has ensured that this super-efficient parliament building will not use too

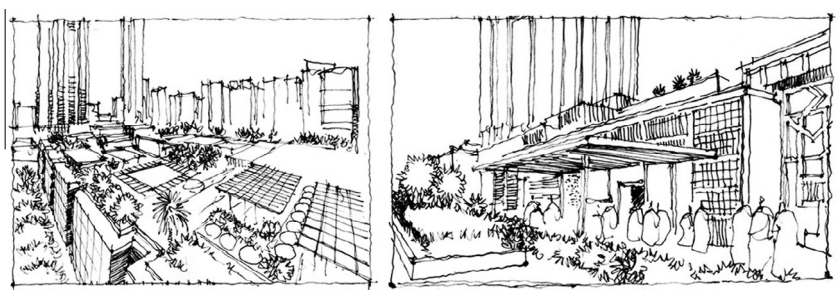

Figure 1. Abu Dhabi Aldar Market.

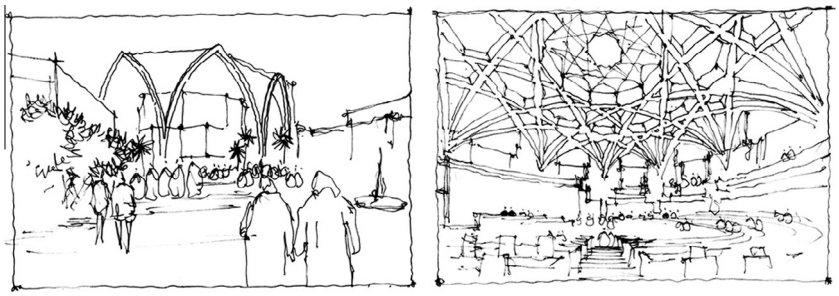

Figure 2. Abu Dhabi Parliament Building.

Table 2
Rating of green building items in Abu Dhabi Parliament Building.

Items	Green	Pseudo green	Energy-monger
Roof	1	2	4
Wall	1	2	4
Structure	1	2	4
Materials	1	3	3
Ventilation	4	2	1
Lighting	4	1	2
Heating & Cooling	1	1	5
Water management	4	2	1

Table 3
Rating of green building items in Kuwait International Airport.

Items	Green	Pseudo green	Energy-monger
Roof	1	1	5
Wall	1	1	5
Structure	1	2	4
Materials	1	3	3
Ventilation	3	3	1
Lighting	4	1	2
Heating & Cooling	2	2	3
Water management	5	1	1

much energy (URL 02). Table 2 shows the rating of green building items based on the Designer checklist in Abu Dhabi Parliament Building.

3.3. Kuwait's LEED Gold Certified International Airport/ Foster & Partners

Lo and behold, Foster & Partners are behind yet another green project in the Middle East. This time they have unveiled plans to build a massive solar-powered international airport in Kuwait (Fig. 3). Although that country does not have its own green building standard, the firm is shooting to bring this crazy-shaped project in line with LEED Gold standards.

Inhabitant favourite Foster + Partners just announced they will be designing the new Kuwait International Airport – and they are aiming to make it the world's first LEED gold certified passenger terminal! The stunning design is sure to be an eye-catcher from both the ground and the sky, and it will raise the environmental bar for airports everywhere with a smart set of green features that will reduce the building's energy use and keep it cool in one of the hottest places on earth (URL 03). Table 3 shows the rating of green building items based on the Designer checklist at the Kuwait International Airport.

3.4. Masdar's zero carbon, zero emissions city/Foster & Partners

Masdar City is one of the most well know projects in the Middle East (Fig. 4). Touted as the world's first zero carbon and zero emission city, but beset with economic troubles, Foster & Partner's sustainable terracotta-coloured buildings are nonetheless very impressive to look at.

Foster and Partner's carbon-neutral Masdar City is springing to life in Abu Dhabi. Checking out the city's first Eco street fair and Organic Market, a family affair complete with cotton candy, clowns, and princess fairies that also gave locals and visitors their first glimpse of some of the world's most advanced architecture and clean tech

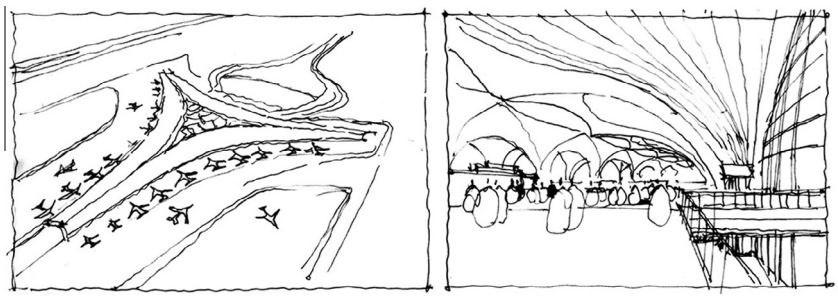

Figure 3. Kuwait International Airport.

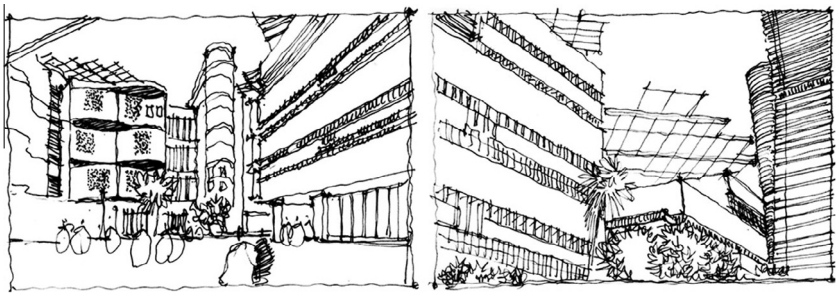

Figure 4. Masdar City in Abu Dhabi.

Table 4
Rating of green building items in Abu Dhabi Masdar City.

Items	Green	Pseudo green	Energy-monger
Roof	1	3	3
Wall	1	1	5
Structure	1	2	4
Materials	1	3	3
Ventilation	3	1	3
Lighting	3	2	2
Heating & Cooling	4	2	1
Water management	4	2	1

developments has been very impressive. It also gave eco-businesses and organizations, such as the Land Art Generator Initiative, an opportunity to strut their good green stuff – read on for a first look (URL 04). Table 4 shows the rating of green building items based on the Designer checklist in the Abu Dhabi Masdar City.

3.5. Morocco's Dazzling Domed Bank/Foster & Partners

Technically Morocco is in Africa, but most people think of this mysterious country as being in the Middle East. This is Foster & Partners' first project in that country, and maybe one of their most beautiful. This dramatic domed bank features several ancient Arabic design techniques and a unique geothermal system that keeps it cool in summers (Fig. 5).

Foster & Partners have built sustainable projects all over the world. But the internationally-renowned architectural firm has never before completed a project in Africa, until now. The first two of three projects commissioned by Morocco's BMCE (Banque Marocaine du Commerce Exterieur), were built in Rabat and Casablanca and feature plenty of sustainable goodness: energy efficiency, locally-sourced materials, and even an electricity-free cooling system. Step on in for more glimpses of this unbelievably beautiful building based on traditional Arabic design.

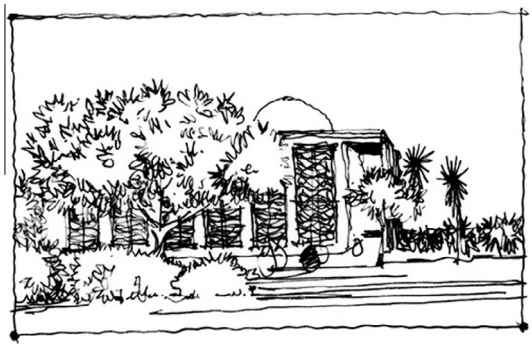

Figure 5. Morocco's Dazzling bank.

The contemporary interior (streaming with light) is wrapped in an energy efficient exterior modelled after traditional, geometric design. In order to keep down the heat, the latticed, almost tangled screens were made from low-iron stainless steel. This maintains high energy efficiency, and the building requires very little cooling as a result. In addition to using local craftsmanship during construction, local materials such as black granite and grey limestone feature heavily in the design. Iconic in recent Turkish architecture, the dome occurs in each of the three BMCE buildings. The interior is rendered in tadelakt, a local plaster technique, while the exterior is clad in zellige, which are traditional ceramic tiles. Notice how the dome slides down into the banking hall to create a stunning, functional bench.

Finally, F&P installed an electricity-free cooling system called the "earth tube." This uses fresh air drawn into an empty pipe that encircles the building underground, where it is naturally cooled by the earth and released into the branch, a first for Africa, but just another in a long series of incredible F&P projects (URL 05). Table 5 shows the rating of green building items based on the Designer checklist in Morocco's Dazzling Domed Bank.

3.6. Qatar World Cup Al Wakrah Stadium/Zaha Hadid

Qatar's controversial 2022 World Cup planning got a burst of star power when renowned Iraqi architect Zaha Hadid, who was one of Time Magazine's top 100 most influential people in 2010, was appointed to join AECOM to design the Al Wakrah Stadium (Fig. 6). The modular 45,000 seat stadium will incorporate Islamic architectural elements to match one of the oldest inhabited settlements in Qatar – just south of Doha. A design that embraces the city's cultural heritage, the stadium will act as an urban

Table 5
Rating of green building items in Morocco's Dazzling Domed Bank.

Items	Green	Pseudo green	Energy-monger
Roof	1	2	4
Wall	3	3	1
Structure	1	2	4
Materials	1	3	3
Ventilation	4	1	2
Lighting	4	1	2
Heating & Cooling	3	1	3
Water management	4	2	1

oasis complete with an aquatics centre, a spa and commercial space.

Believe it or not, countries are already bidding to host the World Cup as far out as 2022, and Qatar has submitted their bid, which includes a slew of solar powered stadiums as well as significant upgrades to their public transportation network. If they win the bid, Qatar would build three brand new green stadiums and update to existing ones in order to host the games (URL 06). Table 6 shows the rating of green building items based on the Designer checklist in Qatar World Cup Al Wakrah Stadium.

3.7. Sustainable Bamboo Dome in Iran/Pouya Khazaeli Parsa

Made from fast-growing bamboo and finished with bunches of dry rice plants, this organic dome near the forests of Katalom, Iran, was designed by Pouya Khazaeli Parsa (Fig. 7). Inspired by one of his students who was struggling to make a dome model at the university, this real-life shelter was used as a model to develop a resort in the area. Biodegradable, economical, and made from natural local materials, this sustainable shelter can also be raised in no time.

It takes three people two days to build this shelter, which is made from seventy bamboo canes. The base of the self-standing shelter was made from gas pipes from a local shop, ensuring the structure can move to another location if required. The fast growing renewable plant is

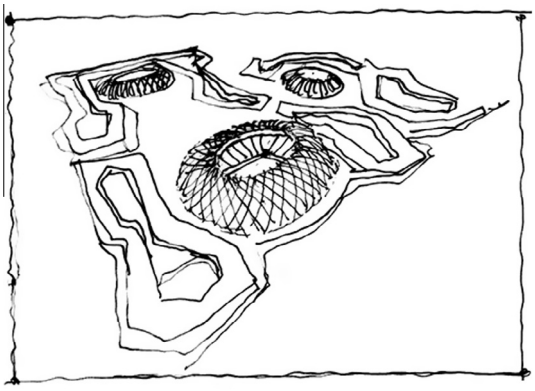

Figure 6. Qatar, Al Warkah Stadium.

Table 6
Rating of green building items in Qatar World Cup Al Wakrah Stadium.

Items	Green	Pseudo green	Energy-monger
Roof	1	1	5
Wall	1	1	5
Structure	1	1	5
Materials	1	3	3
Ventilation	5	1	1
Lighting	4	1	2
Heating & Cooling	5	1	1
Water management	4	2	1

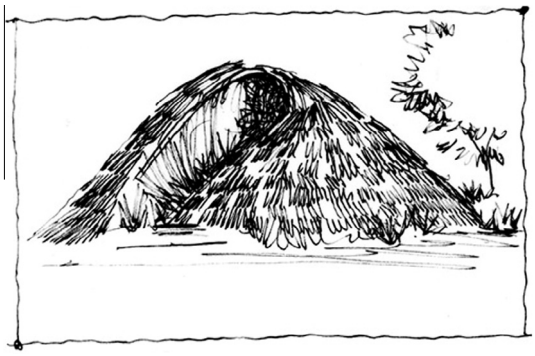

Figure 7. Sustainable Bamboo Dome.

left to try for two days after it is cut in order to keep it flexible and soft. The dome bamboo structure was finished with bunches of dry rice plants that were found locally and are biodegradable and also weatherproof. When it rains the plants expand, keeping the shelter dry. When it is sunny and warm, breezes can blow through them to provide natural cooling and ventilation. Because of their shape, these domes can be pretty resistant to winds or earthquakes, making them highly cost-effective as emergency housing (URL 07). Table 7 shows the rating of green building items based on the Designer checklist in Iran's Sustainable Bamboo Dome.

3.8. The Grand Stade de Casablanca Stadium in Morocco/ Scau Team

Scau from France collaborated with Moroccan-based Archi Design to give the national football team a brand new, sustainable stadium (Fig. 8). Concrete fin-like struc-

Table 7
Rating of green building items in Iran's Sustainable Bamboo Dome.

Items	Green	Pseudo green	Energy-monger
Roof	1	5	1
Wall	1	5	1
Structure	1	5	1
Materials	1	5	1
Ventilation	5	1	1
Lighting	5	1	1
Heating & Cooling	5	1	1
Water management	1	5	1

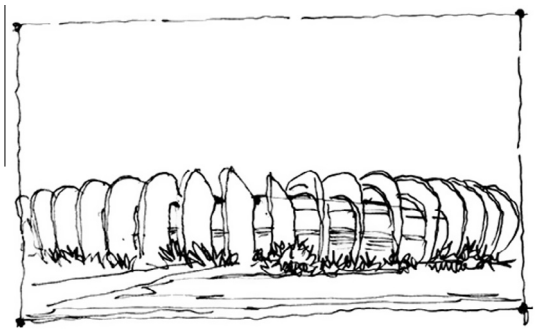

Figure 8. The Casablanca Stadium.

Table 8
Rating of green building items in Morocco's The Grand Stade de Casablanca Stadium.

Items	Green	Pseudo green	Energy-monger
Roof	1	2	4
Wall	1	2	4
Structure	1	1	5
Materials	1	2	4
Ventilation	5	1	1
Lighting	4	1	2
Heating & Cooling	4	1	2
Water management	4	1	2

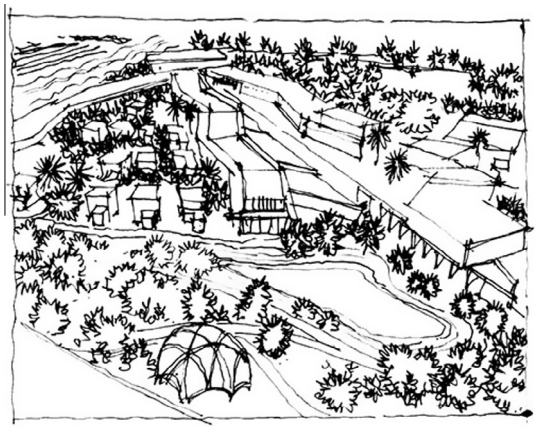

Figure 9. Dubai Sustainability City.

tures promote natural ventilation and passive design keeps the building nice and cool.

The Grand Stade de Casablanca built in an old quarry features passive solar design with concrete fin-like blades that promotes natural ventilation. The 100 ha site was formerly a quarry and the plans for the new stadium take advantage of the sunken and abandoned sites. Inspired by the quarry site itself, the Grand Stade de Casablanca is designed to resemble a mineral. The open air stadium is surrounded by large, perforated concrete blades, which act as a sunshade and encourage natural ventilation. In between the envelope of the blades and the interior stadium is a garden that serves as a thermal buffer and an oasis for the spectators to enjoy. Natural day lighting is allowed through the lattice-like blades, which were carefully oriented to allow an optimum amount of sunlight to enter. The blades extend up and over to provide shade for the spectators, leaving a large hole for day lighting of the playing field (URL 08). Table 8 shows the rating of green building items based on the Designer checklist in Morocco's The Grand Stade de Casablanca Stadium.

Table 9
Rating of green building items in Dubai Sustainability City.

Items	Green	Pseudo green	Energy-monger
Roof	4	2	1
Wall	2	2	3
Structure	1	2	4
Materials	1	2	4
Ventilation	4	1	2
Lighting	4	1	2
Heating & Cooling	2	1	4
Water management	3	1	3

3.9. Dubai Sustainability City/Baharash Architecture

Diamond Developers selected Baharash Architecture to plan the second of four phases of Dubai Sustainable City – a 46 ha, 500 villa eco-development slated for construction at the junction of Al Qudra and Emirates Roads in Dubai (Fig. 9). "The vision of the city encompasses three main pillars of sustainability: environmental, economic and social," Diamond Developers said in a recent statement. They added that the Baharash proposal exceeds best practices in environmental building technologies while maintaining a reasonable price tag.

Phase two of the project involves building a mixed-use zone for occupants of the 100 energy efficient, solar-powered villas and townhouses. This zone includes a Juma Mosque, an Institute for Ecological Engineering, a museum & planetarium, a "Green" School for K-6, an Eco-Resort, Country Club and Equestrian Center.

Each residence is equipped with solar panels that are expected to produce at least 60 percent of their energy needs, and smart water systems will slash water consumption by 30 percent. Once complete, the Dubai Sustainability City will have 550 solar-powered villas, solar-powered elec-

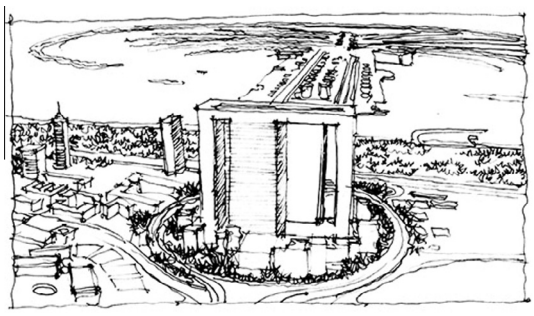

Figure 10. Dubai Pearl.

Table 10
Rating of green building items in Dubai Pearl.

Items	Green	Pseudo green	Energy-monger
Roof	4	2	1
Wall	1	2	4
Structure	1	1	5
Materials	1	2	4
Ventilation	4	1	2
Lighting	3	1	3
Heating & Cooling	2	1	4
Water management	3	3	1

Table 11
A rating of ten green buildings in the Middle East based on Designer checklists.

Buildings	Green	Pseudo green	Energy-monger
Abu Dhabi Aldar Market	2	3	2
Abu Dhabi Parliament Building	2	2	3
Kuwait International Airport	2	2	3
Masdar City	3	2	3
Dazzling Domed Bank	3	2	3
Wakrah Stadium	3	1	3
Sustainable Bamboo Structure	2	4	1
de Casablanca Stadium	3	2	3
Dubai Sustainability City	3	2	3
Dubai Pearl	3	2	3

tric vehicles for an emission-free zone, organic farms, and a sophisticated waste management system. Additionally, all grey and black water will be treated and recycled for irrigation purposes. Diamond Developers strive to ensure that 50 percent of the city will be comprised of green spaces complete with shade and nitrogen fixing for superior soil quality (URL 09). Table 9 shows the rating of green building items based on the Designer checklist in the Dubai Sustainability City.

3.10. Dubai Pearl/Schweger Associated Architects

The Dubai Pearl is being planned for an area near Dubai's new business centres, and according to the developers, the programme will boost energy efficiency, "smart technology", a column-free design, and a walkable environment that will enable community living (Fig. 10). According to Dubai Pearl's press office, the 40 acres (16 ha) site will include 1 million square feet of open spaces and landscaped areas, with 15,500 parking spaces, 1500 residential units, 1400 offices and a retail zone that will eventually support a population of 30,000 people.

So how will this be a sustainable development? Dubai Pearl's contractors have designed a master plan to ensure energy efficiency that they hope will score the complex LEED Gold certification. Recycling facilities for paper, glass and food waste will be part of the complex's guarantee for effective waste diversion. Smart lighting features and water conservation will also supposedly minimize Dubai Pearl's impact on the local environment (URL 10). Table 10 shows the rating of green building items based on the Designer checklist in Dubai Pearl.

4. Discussion

4.1. Design-Oriented Analysis

Through summarizing the results of the Designer checklists, we can estimate the green rating for each one of the case studies based on the design process. Table 11 shows the rate of being green, pseudo green and energy-monger for ten green buildings in the Middle East based on data of the Designer checklists.

Fig. 11 obtained from the data results, shows the percentage of being green, pseudo green and energy-monger for each of the ten green buildings of the Middle East. We can find that the Sustainable Bamboo Dome building has the highest green factor of 45%. Also, this building

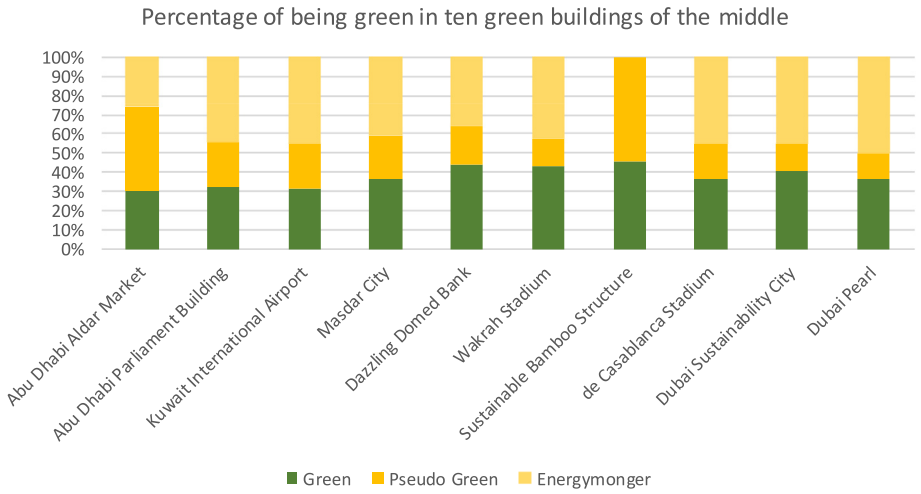

Figure 11. Percentage of being green, pseudo green and energy-monger in ten green buildings of the Middle East based on Designer checklist.

Table 12
Rating practical strategies of the LEED norms in ten green buildings of the Middle East.

Practical Strategies of LEED in green buildings		Abu Dhabi Aldar Market	Abu Dhabi Parliament Building	Kuwait International Airport	Madder's Zero carbon, zero emissions city	Morocco's Dazzling Domed Bank	Qatar World Cup Al Wakrah Stadium	Sustainable Bamboo Dome	The Grand Stade de Casablanca Stadium	Dubai Sustainability City	Dubai Pearl
Sustainable Sites	Reflective and open grid paving	3	4	1	3	3	1	1	4	1	1
	Green roof	3	1	1	1	1	1	1	1	4	3
	Green wall	1	1	1	1	2	1	1	1	1	1
	Alternative transportation	3	1	5	3	1	5	1	5	3	4
	Reduce site disturbance	1	1	1	3	4	3	5	3	3	2
Water Efficiency	Efficient plumbing fixtures	2	3	2	2	3	1	1	1	1	2
	Native landscaping	4	1	1	4	5	4	5	4	4	3
	Overall water use reduction	3	4	4	4	4	4	1	1	1	3
	Fixture and fitting upgrades	2	1	1	3	1	1	1	1	1	1
Energy and Atmosphere	Solar-heated hot water	1	3	4	3	4	1	1	1	1	1
	Efficient HVAC system	4	4	3	4	5	5	5	4	2	4
	Improve equipment efficiency	2	3	1	1	1	3	1	4	1	1
	Renewable heat and energy	3	5	3	4	3	3	1	1	4	3
Materials and Resources	Construction waste diversion	1	1	1	1	1	1	1	1	1	1
	Sustainable building materials	3	1	1	2	4	1	5	1	1	1
	Sustainable purchasing	1	1	1	1	1	1	1	1	1	1
	Building waste management	3	2	4	4	2	3	1	3	3	3
Indoor Environmental Quality	Daylight and views	4	4	1	3	5	5	5	5	3	3
	Low-emitting paints	3	1	4	2	1	1	1	1	1	1
	Green cleaning	3	1	3	1	1	2	1	1	1	1
	Healthy indoor environment	4	4	5	3	5	4	5	5	3	3
Innovation in Operations	Public and staff education	2	1	3	1	1	1	1	3	1	2
	Sustainable operating policies	4	1	5	4	5	4	1	3	3	1
	Eco team	1	3	3	4	1	4	1	1	1	1
	Innovative cooling tower design	1	1	1	4	1	1	1	1	1	1

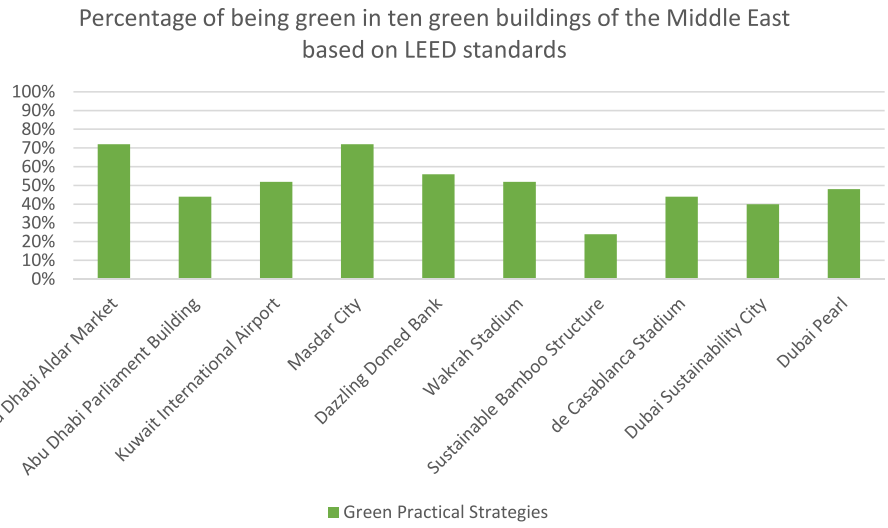

Figure 12. Percentage of being green in ten green buildings of the Middle East based on the LEED rating system.

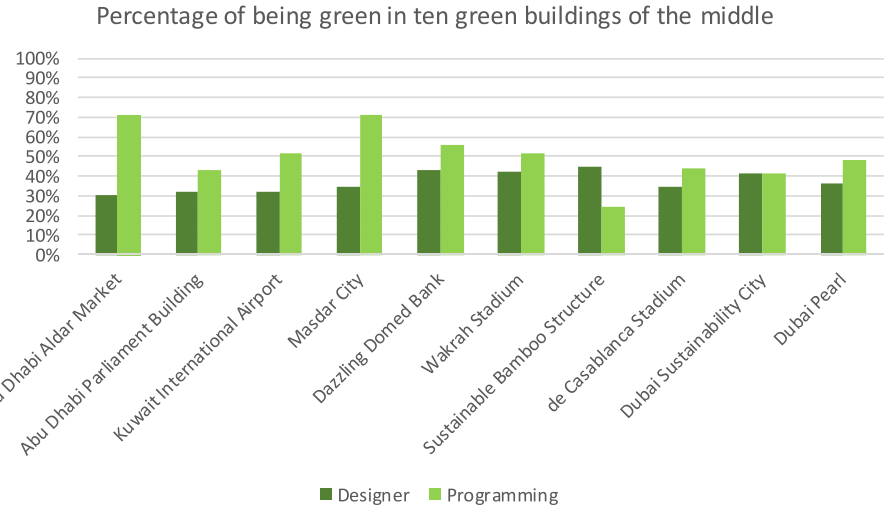

Figure 13. Comparison between results of Designer and Programming checklists.

has the highest pseudo green factor of 55%. The Dubai Pearl building has the highest energy-monger factor of 52%. Therefore, through Fig. 11 we can conclude that the rate of being green based on design criteria in these buildings is between 30% and 45%.

Table 13
Descriptive Statistics for Designer and Programming data.

Variables	Mean	Std. Deviation	*N*
Designer	37.10	5.259	10
Programming	50.10	14.106	10

4.2. Programming-Oriented Analysis

Leadership in Energy and Environmental Design (LEED) is a voluntary green building rating system. LEED-certified buildings have implemented strategies intended to reduce building's operating costs, environmental footprint, and resource consumption such as water and energy use. LEED projects are designed, built and operated to cut CO_2 emissions while encouraging strategies to help create healthier indoor environmental quality (Reed et al., 2009). As new technologies emerge, policies change, and the built environment evolves, LEED will respond through an ongoing, consensus based refinement process. There are six principal LEED categories, including: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality and Innovation in Operations with four possible levels of certification (certified, silver, gold and platinum). Each of the six credit categories within LEED includes four different examples of LEED strategies utilized and the associated credits or prerequisites (Mahdavinejad, 1998). In this paper, the LEED rating system is selected as a globally recognized standard and according to the items of this

Table 14
Correlation coefficient between items of Designer and Programming.

Variables			Designer	Programming
Spearman's rho	Designer	Correlation coefficient	1.000	−3.74
		Sig. (2-tailed)		.287
		N	10	10
	Programming	Correlation coefficient	−3.74	1.000
		Sig. (2-tailed)	.287	
		N	10	10

standard, the rate of being green is estimated. So, programming analysis in this paper is based on the items of the LEED rating system. According to data collected from case studies, we have recorded the rate of being green for each strategy of LEED in the Programming checklist. Table 12 shows the green rating for ten green buildings in the Middle East based on data of the Programming checklist. The obtained data were recorded using the Likert scale.

Fig. 12 obtained from the data of programming checklist, shows the percentage of being green for each of the ten green buildings of the Middle East. We can find that the Abu Dhabi Aldar Market and Masdar city buildings have the highest green factor of 71%. Also Sustainable Bamboo Dome has the lowest green factor of 24%. Additionally, through Fig. 12 we can conclude that the rate of being green in these buildings based on the programming of LEED is between 24% and 71% and the mean between them is about 50%.

4.3. Comparative analysis

According to the findings from the Design-Oriented and Programming-Oriented Analysis, we can make a comparison between them. Fig. 13 shows the comparison between results of Designer and Programming data. From this comparison, it can be found that the results of Designer and Programming data do not match and there is only one adaptation in "Dubai Sustainability City complex". The results for Abu Dhabi Aldar Market building and Masdar city are very different. The rate of being green in Abu Dhabi Aldar Market building based on Design-Oriented Analysis is 30%; while this amount for building based on Programming-Oriented Analysis is 70%. This mismatch between the two variables indicates that the LEED rating system is focused more on programming than design. This rating system also recognizes pseudo green and green as similar concepts and in many cases, both of them are accounted in its assessment; while in the design criteria, these items are not considered as similar. Therefore, in the Design-Oriented Analysis, we only considered those items which are completely green and natural.

Table 13 shows the descriptive statistics for Designer and Programming data. Mean data for Designer variable is 37.1% and for Programming variable is 50.1%. It shows the mean for rate of being green based on the strategies of the LEED rating system to be higher. So, it seems The LEED rating system evaluates some factors which are relevant to the programming and these factors may not have a good effect on the building design process. Standard Deviation for Designer variable is 5.2% and for Programming variable is 14.1%. It is clear that the results of Programming-Oriented Analysis are more diverse than the results of the Design-Oriented Analysis.

According to statistics obtained from the analysis of Designer and Programming variables, we can calculate the correlation between these two variables. Table 14 shows the Spearman's correlation between Designer and Programming variables. The correlation coefficient between them is −0.374. It can be found that there is no good correlation between Designer variable based on our checklist and Programming variable based on programme and strategies of LEED. This correlation coefficient also shows that there are some unknown variables in this assessment.

5. Conclusion

Sustainability is increasingly becoming a key consideration of building practitioners, policy makers, and industry alike, since the world is moving towards green construction. When buildings have green consumption, the effect of embodied energy and greenhouse gas emissions becomes important. A green building can be built with different materials and construction methods that create a different cumulative carbon footprint. Green products can have very low energy consumption and also can be helpful to the environment and nature. Therefore, the utilization of green materials, as the most important renewable materials, in all aspects of human existence appears to be the most effective way to optimize the use of resources and to reduce the environmental impact associated with mankind's activities. Advancement towards a real green architecture which means the efficient utilization of all live natural elements and the existing energies in nature is an imperative requirement in contemporary architecture. The concept of green is very different from the concept of pseudo green , but many mistakenly believe the two are similar. Because of that, some of the projects, although trying to display sustainable architecture concepts in appearance, in reality they turned out not to be sustainable and green enough. Also the LEED rating system in some cases introduces the green

and pseudo green in similar concepts. The correct orientation that is necessary for moving towards , is "Green" concept; for this reason, moving towards a greener architecture is considered the main goal of the contemporary architecture. Based on information obtained from the analysis of results, it can be found that the LEED rating system, considered many items that they may not have a good effect on the architectural design process of green buildings. This rating system tool is not design-oriented, but many of its items are considered in programming criteria. Also, the results showed that there are some unknown interfering issues in analysing the grade of sustainability in building construction.

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