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Research Article

Sustainability of university buildings through building standards (LEED) and how to be achieved

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Abstract

This research deals with the importance of using sustainable environmental standards of University buildings by the requirements of some LEED organizations; to have a sustainable university building which achieves the desired objectives and reduce the wrong design .The research focused on highlighting a private university that contains a large number of important faculties and conducting an analytical process to determine its ability to adapt to the environment and its sustainability according to one of the LEED standards that achieve the goals and dimensions of sustainable buildings. The research also focused on producing some results and recommendations necessary to be considered when designing the educational buildings; to reduce the negative impact on the educational buildings, make peace with the environment and make its users very comfortable.

Keywords: *LEED, sustainable environmental, University buildings, sustainability, sustainable university*

1. Introduction

There was a strong relationship between the environment and the man, due to the limited and slow changes. With the advent of great technological development, the man has significantly affected in his environment and produced changes so that he cannot rebalance the ecosystems (Mohamed, 2006).

After the escalation of the crisis between humans and the environment, the sustainability emerged in the 1990s as a contemporary environmental trend that supports buildings in favor of the quality of the environment and creates environmental standards that rationalize the consumption of natural resources and ensure the human's safety and health (Asma, 2012).

The sustainability is a result of the extreme fear of environmental degradation resulting from the traditional development method which is based on rapid growth without regard to the negative effects of this development on humans, natural resources and the environment (Ahmed, 2006).

This is due to the excessive use of materials without knowing its repercussions and the establishment of self-sufficient buildings that have nothing to do with any environmental heritage. Consequently, there was an impact on the architectural product as opposed to the industrial appearance information and construction and ignoring the environmental factor.

The old architecture was changing and developing based on the scientific discoveries of materials, methods of construction, the use of natural resources and encouraging the use of new and renewable energies (Mohamed, 2005), but at present, there is a lack of dealing with buildings, especially the educational (university) ones in respect of the environmental aspects and its relationship to the environment. Therefore, an evaluation system should be taken into account to achieve the advantages used and to activate the deficit and deficiencies through the improvement process to make the university buildings match for sustainability

Hence, the word sustainable universities comes from this matter and refers to its respect for the future and its help in the continuous progress of the educational process without upsetting the environmental balance and harmony with the environment.

2. Concepts of sustainability

In order to provide a better life for mankind , the relationship between development and the environment has emerged through several international conferences that have highlighted the interrelationship between the development and the environment , realizing the sustainable development system in its various dimensions in terms of

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(sustainable design, green architecture, green building, sustainable constructions) (Osman , 2009).

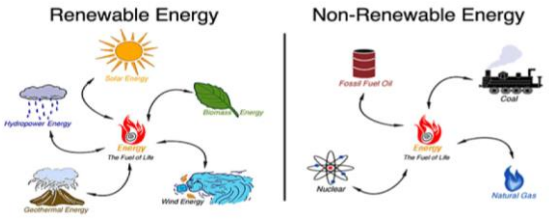
All these concepts are only new ways of design and construction that evoke the environmental and economic challenges which have overshadowed by the various sectors of this day and age; as the new buildings are designed, implemented and operated with advanced techniques and technologies that contribute to reducing the environmental impact and, at the same time, the costs, especially the Operating and Maintenance Costs (Running Costs). It also contributes to creating a safe and comfortable urban environment. Thus, the motivation for adopting the concept of sustainability in the urban sector is no different from that which led to the emergence and adoption of the sustainable development conception (Serageldin,1998).

In 1987, the Scientific and Development Committee of the United Nations held a conference on development, in which the sustainable development has been defined, by the issuance of the report entitled Our Common Future, as The development that meets the present resources requirements while retaining the rights of future generations.

3. Sustainable development

There are many definitions of sustainable development, as follows:

- In 1993, Rosenbaum & Vieira defined sustainable development as It is all that meets the present and future needs, using the renewable resources and not harming the natural and human systems of the site (air, water, earth, energy, vital system)(Osman, 2009).
- The World Resource Institute has defined it as The exploitation of natural resources for future generations through conservation of stocks.
- The sustainable development is defined as the development that does not pollute the surrounding environment and does not drain its resources fig.1. It is based on the optimal human management of natural resources and supports the popular participation at all stages of sustainable development fig.2, giving all generations equal rights in benefiting from natural resources. In this sense, the development can be sustainable only if a perspective that considers the intergenerational relationship is adopted (Tariq,1995).
- Concluded from these definitions that the concept the more comprehensive of sustainable development is using the new and renewable resources while preserving the rights of future generations.



(**Fig.1** renewable and non-renewable resources (1

[1]www.schoolworkhelper.net2018

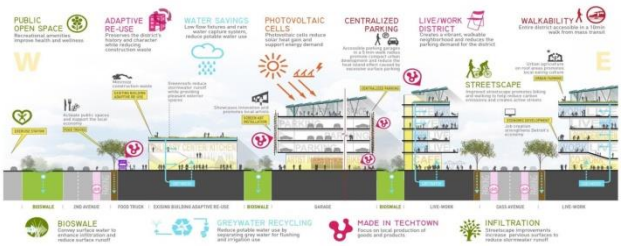


Fig.2 Demonstrates the utilization of natural resources ((2

[2]https://www.pinterest.co.uk

2.1 Sustainable development axes

The sustainable development process makes an overlap and complementarity in environmental, economic and social dimensions to create the idea of sustainability to preserve the rights of future generations without polluting fig.3, corrupting the ecosystems or depleting its resources (Osman, 2009).

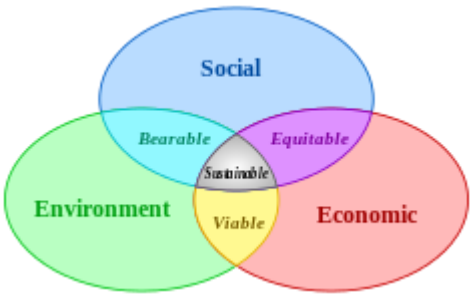


Fig.3 Corrupting the ecosystems or depleting its resources

The sustainable development system consists of three axes (www. arch.hku.hk/research/ BEER/sustain.com By.Sam

2.1.1. Environmental development

The environmental sustainability is achieved by protecting the components of the local ecosystem and maintaining the global environmental balance by reducing waste and harmful emissions to the environment, mitigating the negative impacts on human health, eliminating the toxic substances and

using the natural resources but at rates commensurate with its ability to regenerate and continue. So, it is better to use renewable energy sources so as not to pollute the environmental area (Essam, 2001).

There are some issues necessary to be taken into consideration to achieve the environmental development, as follows:

a) The weather changes.
b) The erosion of the ozone layer.
c) The pollution.
d) The energy consumption.
e) The human health.
f) The loss of biodiversity.

2.1.2. Economic development

This can be achieved by markets & opportunities of development, reducing the costs, improving the performance and using the energy and materials from renewable sources.

The economic development is concerned with several basic topics such as the construction, the materials used and the infrastructure. It is also concerned with studying all related assets, profits, employment and the production level, by achieving a stable level of economic growth rates and enhancing the efficiency and economic capacity to contribute to the job creation and the increased production. This results in the need to generate the highest production of economic well-being, in addition to preserving the resources stock, including the environmental ones(Ahmed, 2006).

2.1.3 Social development

The social sustainability is manifested in taking care of human health, the safety of occupants, control of impact on local communities, impact on quality of life and special considerations for people with special needs and the poor; as neglecting this aspect leads to the failure of many development programs and projects.(www. Sustainability.com. What is Sustainable Development.ed)

3. New environmental standards of construction

The advent of green architecture and sustainable buildings has origins related to the energy crisis of the 1970s. Architects then began to wonder about the wisdom of box buildings surrounded by glass and steel which requires massive heating and costly cooling systems. In this sense, The enthusiastic architects suggested the most energy-efficient architecture (Energy Planning Authority,1998).

Since then, this perspective has been greatly used in some building appraisal systems applied in Britain in 1990 and the standards of the Energy and Environmental Design Presidency of the United States of America which developed by the United States Green Building Council (USGBC) and was introduced in 2000. Now, certificates are granted to produce a greener environment and buildings with better economic performance. These standards - given to engineers, developers, and investors- consist of a simple list of criteria used to judge how well the building has complied with green controls. According to these criteria, the points are granted to the building in different aspects.

The evaluation of buildings reveals to us the inefficient buildings, and therefore we identify the reasons for this in the methods used in its design, construction, and operation. It's not just energy use, but a materials use the waste of water and inappropriate strategies that we use to choose the sub-systems of our buildings, said Philippe Bernstein, an architect, and professor at Yale University, when talking about the problem of the inefficient building. He argues that the buildings inefficiency is due to what he called the rupture or fragmentation in the construction works; as he sees that the architects, engineers, developers and construction contractors adopt each one of the decisions that serve only their interests. Thus, a large deficit and a total lack of quality and efficiency are happened in general in the building (Haidar,2009).

4. Sustainable building assessment systems

With the increase awareness of the importance of sustainable buildings in the achievement of various economic, social and environmental development goals focused on long-term environmental impact during the lifetime of the complete building, many systems have developed evaluation criteria for sustainable buildings to illustrate the buildings aspects and requirements necessary to be met in order to achieve the sustainable development dimensions; as the building is only a group of materials that consume a range of energies from the beginning of extraction to operating stage. With the passage of time, technological advances, the emergence of new materials and the massive expansion of energy use, there was very necessary to have a clear mechanism for assessing the performance of all buildings and adjusting the relationship between the building and the environment throughout the lifetime of the building.

These programs and systems aim to achieve many environmental objectives such as (energy management - water - resources - location - the quality of the internal environment) according to the environmental factors (http://www.green-rating.com/green-rating/what-is-green-rating1)

Many developed countries have succeeded in developing new building standards that correspond to the environment and develop a set of requirements and conditions necessary to achieve a sustainable green building, including:

1) Leadership in Energy and Environmental Design Green Building Rating System (LEEDTM)- Unites States of America.
   a. Stainable Building Assessment Systems - United States of America:

4.1 Leadership in Energy and Environmental Design Green Building Rating System (LEEDTM)

It is a system developed by the United States Green Building Council (USGBC), a non-governmental voluntary organization that aims to develop the standardization systems and sustainable building efficiency standards. The LEED system presents a complete approach to assessing the building efficiency that meets the sustainability objectives. The assessment includes site planning strategies, water consumption rationalization, energy efficiency, selecting materials and environment internal quality. The following standards were developed:

4.1.1 Assessment methodology of LEED system

Buildings are assessed through a checklist that includes a group of standards to judge the building's commitment to the conditions of sustainability, which are:

- Sustainable site: to study and evaluate the potential change and the available pollution deterrents, transportation within and outside the site and processing rainwater.
- Water efficiency: reducing the consumption, managing liquefied wastes and recycling it.
- Energy and atmosphere: evaluating energy performance efficiency within the building and strategies of renewable energy use.
- Material and resources: represented in the reuse of concrete structure and basic components of the building, recycling it and setting strategies for waste disposal in addition to the search for sustainable renewable resources.
- Quality of internal environment: the possibility to control temperatures, ventilation efficiency, natural light and relative moisture through good designs.
- Design and management: the possibility to manage design processes in a way that achieve project and site sustainability, guaranteeing economic performance, selecting building materials and controlling the amount of consumed energy(Ross *et al*. 2006).

4.1.2 Buildings targeted by (LEED)

Sustainable buildings assessment authority (LEEDS) issued several specialized versions to evaluate the effectiveness of some building types:

- Educational buildings.
- Residential buildings.
- Shell buildings.
- Interior spaces of commercial centers.
- Development of neighborhoods.

LEED system achieved several achievements represented in spreading awareness in the field of sustainable building and providing an integrated system to evaluate projects, granting specialized authorization certificates and training on strategies of sustainable buildings (Bauer, *et al*., 2010).

4.1.3 Evaluation criteria of used buildings by LEED system

It was applied starting from 2000; now LEED certificate is awarded to distinctive projects in the application of sustainable green architecture in USA table1(Lawrence,2014).

Table.1 Illustrating the criteria for evaluating used buildings by LEED system (Lawrence,2014)

Category	
1	Site sustainability
2	Water efficiency
3	**Outer cover energy**
4	Resources and sources
5	Quality of internal environment
6	**Creativity and innovation**

Table 2 Measurement Test (LEED Checklist) (Adam, 2009)

Corrosion and erosion factors resistance
Site selection
Land Reuse
Transportation how to reach the site.
Transportation non-vehicles areas.
Transportation using alternative fuel.
Transportation cars capacity and waiting areas.
Site's validity open and closed areas.
Site's validity development potential.
Site's validity development potential.
Site's validity development potential.
Rainwater management how to treat it.
Site formatting and open exterior design
Site formatting and closed exterior design
Site formatting and closed external design
Pollution reduction
Reducing irrigation water by 50%
Non-use of drinking water for irrigation
Water treatment technology
Reducing water usage by 20%
Reducing water usage by 30%
Basic construction systems
Improving energy performance
Renewable energy 5%
Renewable energy 10%
Renewable energy 20%
Additional costs
Affecting ozone layer
Follow-up and verification
Green energy
Building materials and resources
Storing and assembling recyclable materials
Building reuse and maintaining 75% of the basic structure

Building reuse and maintaining 100% of the basic structure
Building reuse and maintaining 75% of the basic structure ad 50% of the sub-structures
Waste management and conversion by 50%
Waste management and conversion by 75%
Resources reuse 5%
Resources reuse 10%
Recycled content 10%
Recycled content 20%
Using locally manufactured resources more than 20%
Fast replenished materials
Wood usage
Quality of interior environment
Minimum performance of internal air quality
Smoke percentage monitoring
CO2 percentage monitoring
Ventilation efficiency
Air performance management plan during construction
Air performance management plan after construction
Low emissions materials (adhesives)
Low emissions materials (paints)
Low emissions materials (carpets)
Chemicals and pollution sources monitoring
System control within the perimeter
System control outside the perimeter
Thermal comfort
Using daylight in 75% of surfaces
Using daylight in 90% of surfaces
Innovation and design process
Inserting specific subject in the design
Adoption of LEED condition

5. About the University

- October 6 university is located in 6 October city – Giza governorate, as the location of the university, was chosen since the inception of the city and it is located in the most distinguished location, and it is considered as a distinctive landmark of the city and expressing it.
- The university was established on space of 40 acres approximately 168000 m2 as it constitutes 40% of the total space and the remaining are green spaces according to laws and regulations applicable in the city.
- Main important axes were established around the university to facilitate the vehicles' movement, and internal pedestrian movement was coordinated.
- The university is advantaged by the existence of the main station in Al-Hossary Square. This station serves the university to facilitate the students' access and the adjacent places.
- The University contains several buildings of the different colleges besides a private hospital and administrative building to serve the university. It also includes several playgrounds.
- The university buildings take angular shape overlooking the general location of the university to make use of site's formation elements with the existence of internal courtyards overlooking the internal spaces to assist the ventilation process.
- Buildings benefit from the natural elements partially so that they are harmonized and balances with the local climate and environment.
- Complete separation between pedestrian movement and vehicles movement with providing parking spaces for each building.
- The following is an analytical review of the application of measurement tests (LEED checklist) campus of the university and put suggestions to have a sustainable academic building that greatly improves the comfort of its users.

Sustainability of the site	
Current situation	Improvement (suggestion)
▪ The university has large open areas with no umbrella for the pedestrians. ▪ The public station serves the university to facilitate the transportation of the students and serving the city. ▪ Movement paths of the pedestrians are exposed with no shaded places to facilitate the pedestrians 'movement. ▪ The site has not been greatly utilized in raising the efficiency of the building and adopting artificial sources. ▪ Using traditional openings in the buildings that are exposed to sunrays, therefore, the existence of a relative increase in loads.  Use traditional materials to reduce reflections ▪ Providing service areas for parking with capacity for some buildings users but partially not totally that is not enough for faculty members and their assistants. Also providing freight cars for transportation of faculty members and their assistants.	▪ Reduce the number of places that are exposed to the sun rays directly and reducing open areas by using plants and umbrellas that are used in site format process. ▪ Provide parking areas for bikes with capacity enough for 5% of the total users of the buildings to encourage the users to reduce the use of cars and reduce harmful emissions.   Providing electric parking spaces and places for grades ▪ Using shaded corridors in relative terms and using the idea of wooden tents and pergolas to avoid direct sunrays. ▪ Using negative ventilation and wind towers. ▪ Using openings looking like oriels to prevent sunrays and reducing thermal loads. ▪ It is suggested to provide

Providing parking spaces for electric vehicles to transport faculty members and their assistants.

- There is no possibility that development process of the site could include expansion.
- Achieving the minimum required ratio of open spaces that constitute approximately 25% of the space as it was employed in the form of courtyards that help in the natural ventilation process.

The use of Courtyard helps in natural ventilation

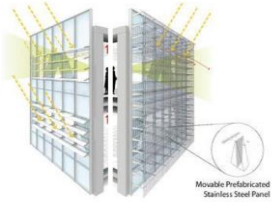
- there is no possibility to benefit from rain waters because there is no method to gather the rainwater and recycling it to be used within the project.
- There is partial weakness concerning the reduction of light pollution as the block is divided into two parts, which makes it difficult to reduce light pollution because of its location on the main road directly that sees nothing but congestion and lack of traffic and other road polluters. While the other part overlooks the general site of the project where trees, plants, and green spaces were used that helped in the reduction of light pollution process.
- Using materials that help non-strong reflection of sunrays and making use of its light with the increase of light penetration ration (glass – finishing materials) (traditional materials), to reduce the optical waste.
- Using traditional insulation methods to cover the roofs (thermal insulation).

parking areas for electric vehicles with 5% of the total surface of the parking areas and moving by it to reduce the exhaust.

- It is suggested to build fountains and water elements within the open areas to help in air humidification, feeding the spaces and providing thermal comfort for the users. It is also suggested to plant palm trees for shading.

Use fountains and water inside the patio to moisten the air

- It is suggested to make reflexive openings with light cells to avoid thermal effect within the building beside the optimal use of materials that help in reducing reflections within the building.
- Using a reinforced glass to reduce the excessive rays falling on students (treating materials). Using sunrays reflecting and heat preserving glass within the building along with increasing light permeability at night.



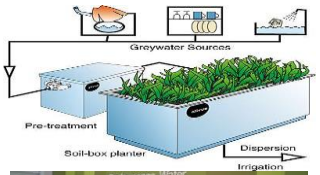
The use of reflective glass for the sun and the preservation of the heat inside the building, as well as increase the effectiveness of light at night.

Use traditional methods to isolate surfaces

- It is suggested to use reflexive roofs to cover roofs with solar cells above the project's blocks to reduce the effect of heat within the building.

Use the reflective roof to cover the surface by optical cells

- It is also suggested to calculate the potential rain quantity in the area and how to deal with its effects on the building beside how to reuse it.
- Using tanks to gather rainwaters.
- Recycling the water and using it for irrigation.

Water efficiency	
Current situation	Improvement (suggestion)
▪ There is no possibility to reduce the efficiency of water use because of building's dependence on water directly without any use of treated or recycled water.	▪ Using tanks to collect rainwater. ▪ Recycling water and using it for irrigation. ▪ Providing space for performing water purification process and existing purification plants then reusing it.
	
Use of potable water in fountains ▪ Complete dependence on drinking water for irrigation process within the campus as there is no possibility to use rain and recycled waters to irrigate trees and plants. ▪ There is a total waste in the water used to irrigate the green landscapes, because of lack or using modern irrigation methods such as drip irrigation and depending on spray irrigation.	 The possibility of recirculation of rainwater and wastewater ▪ Depending on rainwaters and underground water with the limiting of using drinking water to the human process only. ▪ Depending on using rain and wells water. ▪ Using gel balls to irrigate plants by dew. ▪ Using toilets with modern technologies for water saving. ▪ Recycling water and using it. ▪ It is suggested to use the rain, grey, black water and the water coming from water treating and recycling plants (used as fountains).
 Use of irrigation methods (spray irrigation) ▪ Non-dependence on recycling wastewater and	

using it to irrigate gardens and plants. ▪ The ability to reduce water usage is not activated due to lack of possibility to reduce the dependence on the natural water directly and non-use of treated water. ▪ There is no way to maintain rainwaters nor depending on using treated water such as wastewater. ▪ The majority of the plants used within the campus are greatly consumed by water.  Use of plants consumed for water	 Reuse of gray water in fountains ▪ It is suggested to use the majority of plants of the campus from local and non-local plants that save water, requires large quantity for irrigation and then reduces the total water consumption.  Use of water-consuming plants

Outer cover energy	
Current situation	Improvement (suggestion)
▪ Complete dependence on artificial energy within buildings, therefore there is no possibility to reduce large energy consumption. ▪ Using some systems and strategies to reduce energy demand, so that it comes in the shape of the glass used in the facades to induce the natural lighting beside using power-saving fluorescent lamps.  Use glass for natural lighting ▪ University administration depends on continuous maintenance and follow-up process, but there was no system followed for training the workers who perform maintenance, measurement and monitoring process of the systems within the building. ▪ The university did not care about the performance measurement regarding reducing the harmful emissions resulting from the building nor writing reports about it. ▪ Buildings do not depend on renewable energy sources within site, as there is a huge free area that could be	▪ It is suggested to use smart systems to reduce energy consumption beside using photovoltaic power and cells with the large surface on roofs.  ▪ It is suggested to use power-producing systems and improving its performance in the project.  ▪ Using thermal solar energy system to provide hot water for the project.  ▪ Producing large ratio of the energy used in the project from renewable energy sources.

used.  Unused spaces in the production of new and renewable energies	▪ It is suggested to use modern systems within the buildings and following-up the continuous operation process for it and measuring its efficiency level. ▪ It is suggested to depend on renewable energy resources regarding: ▪ Finding architectural solutions to benefit from the surfaces by distributing solar cells.  ▪ Putting windmills in the vast spaces. Permanent reliance on alternative energy.

Resources and sources	
Current situation	Improvement (suggestion)
▪ Shades and colors play a vital role in giving the facade its character. ▪ There was no method applied to reduce and manage waste sources except in the university's hospital that comes in the shape of an incinerator for the disposal of hospital waste. ▪ There was no interest in storing and collecting recyclable wastes and making use of it in many various fields. ▪ The university did not depend on reducing used toxic materials source as it was used directly with no treatment. ▪ Using traditional methods in waste management through construction, demolition, and renovation phase. ▪ The university did not depend on using alternative and recyclable materials to reduce harmful emissions resulting from non-innovative materials. ▪ Non-reliance on using available materials within the building to raise the performance of the building regarding internal air quality and other to achieve users' comfort. ▪ Using traditional materials for internal finishing (gypsum boards – paint materials by the direct way. ▪ Using materials to create a contrast between shades and lights and making use of sun movement but in the	▪ Activate some means to manage, get benefit from and recycle the waste at the university level, also, to activate the recycled materials system. ▪ It is proposed to use the recycled materials with less harmful emissions. ▪ Improving the internal finishes that must compose from the organic compounds and generated by the recycled materials, next to the timber used from the resources available of the site. ▪ It is proposed to use the first external materials to create a contradiction between the lights and shadows and take full advantage of the sun's movement. ▪ Using the resistant (stone-glass) materials

traditional way. ▪ Blocks shades and colors used play an important role; as it gives the facade its architectural character.	
Quality of internal environment	
Current situation	Improvement (suggestion)
▪ Relying largely on artificial ventilation through energy-consuming air-conditioning systems. ▪ All campus buildings have proper ventilation ratios to guarantee the sustainability of supplying pure air for the building's users through: ▪ the building does not rely on highly efficient sources throughout the building. ▪ Relying on manual keys to turn on/off the lights ▪ Benefiting from daylight partially. ▪ There is no possibility to monitor CO2 ratio. ▪ Using prominent protrusions and external stationary ventilation openings and courtyards. ▪ There is a plan to manage air performance during construction to protect the used materials in the building whether during storage or installation and preserving it from moisture. ▪ There is a plan to manage air performance after establishing the buildings as (building flash out process) begins, which is the process of airflow taking into account the polluted air resulting from the effects of used materials and to remove any organic compounds from the finishing used within the internal space. Using materials with volatile organic compounds with low emissions, as it included reducing the use of air-polluting materials in closed areas by using weather-resisting materials	▪ Dependence on the natural ventilation significantly through the inner courtyard, which contains a fountain to soften the atmosphere surrounding it ▪ Possibility to control systems by integrating technology with environmental factors to achieve the thermal comfort of users. ▪ It is suggested to depend on high-efficiency materials in all building's areas. ▪ It is suggested to depend on automatic control in turning on and shutting lights and specifying the required light intensity to reduce light consumption. ▪ Complete use of daylight through the opening existing in the spaces not partially. ▪ use sensors to monitor carbon dioxide to ensure appropriate levels of clean air and ventilation for building users, and reduce the health effects resulting from it ▪ Use solar crushers to move on the façade to minimize sunlight within the vacuum to ensure efficient indoor air.

Creativity and innovation	
Current situation	Improvement (suggestion)
▪ Creativity and innovation in this building were done in consistency with its period as the building was established in 1990 with no additional burdens or debts incurred in the construction. ▪ The university is considered a central project that was opened in 1991 representing a distinctive landmark of the city.	▪ Development and improvement to keep up with the times regarding innovation process by adding some architectural processing to compete and match other universities of this age. ▪ Using green spaces on the outside of buildings to improve the aesthetic shape of the building and benefiting from it to achieve users' comfort. ▪ Covering the exterior walls by smart processing covers through which there could be a functional benefit in generating energy and improving the general shape of the building. ▪ Using smart materials and systems to provide complete comfort without any human intervention for the users. ▪ Putting into consideration the future improvement of the buildings to cope with the future regarding the possibility to add some changes to cope with the future.

Through the proposed improvement process, the requirements and conditions of the LEED that are available for sustainability in the university have been met

Conclusions and Recommendations

According to this analysis of the university, I recommend

1) The research, through previous studies, has highlighted the importance of applying sustainability on university buildings, where it aims to reduce energy consumption and negative reduction on the environment.
2) Through study and analysis of October 6 University, it became clear that it does not perform the optimal performance of sustainability that was included in the assessment systems.
3) Encouraging to conduct development process in desert areas and avoiding slums that have a negative impact on the environment, in addition to easy access to the site to reduce pollution, traffic congestion and environmental balance to reduce the environmental impact of the project on the site and protecting natural systems.
4) The correct orientation of the buildings achieves internal efficiency and benefit from the directing process in the halls as well as directing the openings toward the courtyards which lead to significant decrease in temperatures within the building.
5) The possibility of eliminating harmful effects and providing an adequate building to support the entertainment and comfort of users through adequate ventilation, air quality and achieving thermal and optical comfort for the users.
6) Encouraging the use of local and renewable resources with low effect on the building and the environment in addition to inducing the use of high-efficiency materials.
7) Using new and renewable energy to reduce the artificial energy consumption and carbon emissions resulting from consumed energy by devices.

8) Reducing the use of drinking water for plants irrigation and using recycled water instead to reduce water consumption with the possibility to employ it.
9) Innovation, good design, applying comfort standards for the disabled, showing heritage and architectural character.

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