



## *Sustainability in Egyptian Universities between Reality and the Target According to Egypt Vision 2030 and COP 27*

### **Abstract**

Egypt Vision 2030 and COP 27 aim at combating the negative impact of the climate change by promoting sustainable development. Construction increases pollutants and the university sector faces many challenges related to achieving sustainable development.

The research aims to propose indicators to a reference framework, to evaluate the sustainable university campus in Egypt. in accordance with Egypt vision 2030 and (COP27) to be suitable to the reality of urbanization.

There are three parts to assess the extent to which Egyptian universities incorporate sustainability principles. The first part starts with studying the determinants and criteria for designing the university campus in Egypt. It includes the environmental determinants and the criteria for green rating system. The second part is related to exploring the university campus according to the sustainable perspective and its evaluation systems. The research ends with an applied analytical study of models from Egyptian universities: a comparative analysis between the American University in Cairo and Beni Suef National University according to the elements of the reference framework proposed; The study concluded that the A.U.C achieves 70% ,followed by B.S.N.U 50% Despite of the state's intentions, this confirms the lack of interest in applying sustainability principles in the Egyptian universities.

**Keywords:** University Campus, Egypt Vision, Sustainability.

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## 1. Introduction

The state adopts a number of national development projects, where the establishment of a new generation of sustainable universities is considered one of the most important directions for achieving sustainable development, Egypt's vision 2030, and the goals of the Climate Change Conference, and from it it is necessary to go to study the most important planning and design directions for existing universities (example: the American University in Cairo) and new ones (example). Ahlia University in Beni Suef) and assessing the extent of its implementation of developmental trends (sustainability) within the framework of local and global environmental systems and technologies as the most important ways to overcome problems in Egyptian universities and to identify the extent of urban and environmental change and its effects on the planning and design level of the campus, which is the cornerstone of the establishment of sustainable universities.

## 2. Egypt Vision 2030

Commencement of a number of initiatives mentioned in the plan 2021–2022 is to assist the State's strategy for green projects and to satisfy the governorates' development needs in the field of sustainable projects<sup>1</sup>. This is obvious in the Environmental Sustainability Standards Guide; a Framework of Environmental, Social, and Corporate Governance (ESG), Corporate Social Responsibility (CSR), and the preparation and submission of sustainability reports.

The following is an explanation of the criteria:

- Achieving SDGs through sustainable activities included in corporate social responsibility (CSR) programmes.
- Strategies for sustainable consumption<sup>23</sup>.
- The involvement and integration of workers into sustainable practices. practices.<sup>4567</sup>
- The separation and recycling of waste<sup>8910</sup>.
- Cutting back on the usage of plastic by using cloth bags and avoiding plastic drinks<sup>11 12</sup>.
- Remote working and depending on a paperless methodology.
- Using LED lighting.<sup>13141516</sup>
- Assessing the extent to which suppliers adhere to environmental sustainability criteria.
- Using windows with clear energy-saving glass<sup>171819</sup>
- Lessening of carbon footprint. Footprint.<sup>2021</sup>
- Relying on renewable energy sources to meet part of one's energy needs (i.e. installing solar panels)<sup>222324</sup>
- Supporting green fields (i.e.Clean Energy).

### **3. The Climate Conference 27 (COP 27) :**

The climate conference came out with many recommendations that must be taken into account to overcome the risks of climate change, which are as follows:

#### **3.1 Low Carbon Transport for Urban Sustainability Initiative (LcO2TUS)**

Due to the urgent need to move away from the legacy 'mode-first' mindset, this initiative was held. It aimed at activating systemic change both to improve and decarbonize the urban mobility landscape.<sup>25 26</sup> The initiative focused on enhancing access to low carbon and resilient urban mobility solutions and strengthening the foundational enablers of change as the first-order priorities. With over half of the world's population living in cities, transportation makes up 38.8% of CO<sub>2</sub> emissions from end-use sectors.<sup>27 28</sup> As urbanization accelerates in the global south, improving urban transport and mobility is becoming an increasingly salient lever to address.<sup>29</sup>

#### **3.2. The Challenge of Global Emission: Sustainable Urban Resilience for the next Generation Initiative (SURGe):**

The initiative was launched by the COP27 Presidency, in collaboration with UN-Habitat and with the facilitation of ICLEI and SURGe, to address numerous barriers limiting urban emissions reductions, adapting urban systems to climate change,<sup>30 31 32</sup> and building urban system resilience. The initiative tracked: buildings and housing, urban water, urban mobility, urban waste and consumption, and urban energy supported by partnerships and collaborations with international organizations. The COP27 Presidency spokesperson stated that "Climate change and growing urbanization are intertwined megatrends". Sustainable urbanization is a critical piece of mitigation measures in the developing world where urbanization is most rapid.<sup>33</sup>

#### **3.3. Global Waste Initiative 50 by 2050:**

The target of this initiative was to treat and recycle a minimum of 50% of the solid waste produced in Africa by 2050.<sup>34</sup>

#### **3.4. Energy:**

The Draft recognizes that the unprecedented global energy crisis highlights the need for quick changes to energy systems to make them more dependable, secure, and resilient during this crucial decade of action. In addition, it emphasizes the importance of increasing the proportion of renewable energy<sup>35</sup> in the energy mix at all levels as part of diversifying energy mixes and systems,<sup>36</sup> in keeping with national conditions and recognizing the need for support towards equitable transitions.<sup>37 38</sup>

#### **4. The Criteria for the Egyptian Green Evaluation Systems:**

Green pyramid (GPRS) has a set of general and fixed domains and elements for all types of buildings; as it does not target certain segments or categories of buildings. Furthermore, there is no difference between the areas and elements of evaluation from one category to another in this system; as the case in international evaluation systems such as GREEN STAR, LEED, and BREEAM.<sup>39</sup>

The evaluation domains and elements of this system are the result of the merger between the evaluation domains used in the LEED and BREEAM systems taking into account the employment of the domains in an appropriate manner to buildings in Egypt<sup>40</sup>.

This includes the following criteria: sustainable sites, energy efficiency, water efficiency, materials and resources, indoor environmental quality, management, innovation and added value.<sup>41</sup>

#### **5. ISCN International Sustainable Campus Network**

The Sustainable Campus Design Guidelines aim at clarifying sustainability principles and indicate a dedication to sustainable campus construction.

Higher education institutions are obligated, under the ISCN Charter, to follow the following sustainability criteria: scale, quality design, participation, education, handling of resources, life cycle costs, efficiency of sustainability process, change management, monitoring, and controlling<sup>42</sup>. (see Table1).

Table 1. Elements of the Proposed Reference Frame / Source (By Researchers)

Source	Element	principle
Green City Index( EUI) <sup>43</sup>	Energy: (Operational	1. Clean Energy Policies to Reduce Energy Consumption in Buildings
Egypt vision 2030	- embodied	2. Applying energy saving techniques in spaces and buildings, such as using solar panels.
Green Pyramid <sup>44</sup>	- renewable)	3. Rationalizing the use of energy in heat expulsion equipment (i.e. cooling towers).
		4. Designing the heating, ventilation and cooling systems.
		5. Designing heating systems that use gas or liquid fuel.
		6. Use energy-saving lighting.
		7. Using central air conditioning units and not a number of small appliances.
		8. Observing the climatic conditions directed by the sun and wind.
		9. Achieving a maximum air speed.
Green Pyramid1	Site Sustainability	1. Choosing a project site in the city center on the outskirts of the city.
		2. Choosing a location near to mass transit.
		3. Choosing a site that does not contribute to urban sprawl.
		4. Choose a site near good landscaping
		5. Selecting a site according to its regional importance.
The National Authority for Education Quality Assurance and Accreditation - Norms Planning Guideline for Standards of Areas, Human Resources, Equipment and General Specifications for Buildings and Facilities for	Land Uses	1. the green areas are more than 15% of the total site
		2. The cafeteria, in terms of space, is more than 1m <sup>2</sup> .
		3. The Central Library area in the University for each student is 1.5 square meters
		4. Student housing is 25% of the university land.
		5. Museums and galleries capacity is more than 100 m2
		6. The theatres area is more than 1 m2.

Higher Education Institutions		
Neufert <sup>45</sup>		7. University planning patterns: Central Design Decentralized Design (DISPERSED) Nucleus Design (NUCLEUS) Grid Design (GRID) and Cross Design (BY-LINEAR) Stripe Design (LINEAR)
Greening Universities Toolkit-v20		8. Mixed land use. 9. Depending on a planning unit that is suitable to addition and future expansion when achieved; flexibility, privacy, diversity and social interaction.
Metrobits <sup>1</sup> Egypt Vision 2030	Transportation and Mobility	1. Mass transit usage.
Bike-Sharing World Map		2. General use of bicycles. 3. Adopting pedestrian paths to achieve comfortable movement.
Green City Index( EUI) Kekez,2022).		4. Policies to promote sustainable transportation (i.e. use of sustainable alternative fuels) <sup>46</sup>
Greening Universities Toolkit-v20		5. Separation of pedestrian and car paths 6. Improving parking efficiency and fencing borders by placing plants and trees for shade 7. Reducing the entry, path and parking of cars on campus.
The National Authority for Education Quality Assurance and Accreditation		8. The presence of a clear interconnected traffic network of main and secondary roads. 9. Discrimination in the use of colors and paving materials
		10. The number of car garages to the number of cars is 5: 1.
Green City Index	Waste	1. Existence of a waste collection and disposal policy (Zero-Max).Waste storage and separation.
Green City Index( EUI)		2. Recycling waste and disposal.

Green Pyramid	Infrastructure	1. The quality of sanitary works for rain drainage and rainwater management.
Green City Index( EUI)		2. Gray water reuse.
		3. Sustainable Sanitation Policies.
The National Authority for Education Quality Assurance and Accreditation	In door Quality	1. Windows is 15% of the floor area.
European Environmental Agency		2. Architectural elements such as awnings, umbrellas, etc., and shading buildings are reducing the effect of islands heat.
Green Pyramid		3. Extent, detailing and shape of openings to achieve air quality.
		4. The negative effects of noise are diminished to some extent.
		5. The quality of flooring and its coverings.
		6. The quality of environmental and sustainable handling of paints.
		7. There is an interest in plants and coordination of the surrounding site.
		8. Using local heat and drought tolerant plants.
		9. The social and local dimensions are taken into account by designing urban spaces and buildings based on the local character.
		10. Considering the visual dimension by applying optical image elements and dazzling control of solar radiation.
		11. Linking functional relationships to achieve unity , diversity , gradation, and inclusion.
Greening Universities Toolkit-v20	Environmental Management	1. Cultivating organic food, plants and flowering trees on campus.
Green Pyramid		2. Innovation and environmental uniqueness of design.
		3. Applying any patents in implementation or designing.
		4. Using comfort standards for the disabled
Green Pyramid	Resources and	1. Using local building materials with high efficiency, high resistance to erosion, and less maintenance.

Building Materials	2. Using finishing materials that are highly resistant to moisture, water and environmentally friendly.
	3. Choosing wood fixtures from wood waste.
	4. Selecting and using of prefabricated modules.
	5. Anti-bacterial materials.

## 6. Evaluation Systems:

Through an analytical study that was carried out and a reference framework for the sustainability of the campus in Egyptian universities was reached. This is done through designing elements for a sustainable campus, which include (see Fig. 1):

1. Energy: (operational - embodied - renewable)
2. Site Sustainability
3. Land Uses
4. Transportation and Mobility
5. Waste
6. Infrastructure
7. In door Quality
8. Environmental Management
9. Resources and Building Materials



Fig. 1. The reference frame / Source (By Researchers)



The reference frame is a detailed outline that defines the components of the university campus and links them to the content of the standards through a table with two dimensions. The first dimension demonstrates the main standards with detailed elements. The second dimension demonstrates the comprehensiveness of the campus including the detailed elements of each standard, the appropriate weight, the degree of application of each standard on campus, and the overall degree of application. The real weight was given to each criterion and the relative weight as well in accordance with the size of its requirements and the elements of its application. (see Table2 , Fig. 2)

Table 2. Evaluation Ratios according to the Measurement Matrix / Source (By Researchers)

Standard	Application Ratio	Total Application Standards
Element	The percentage based on the available information.	The percentage of application of standards ÷ the number of elements of the total standards

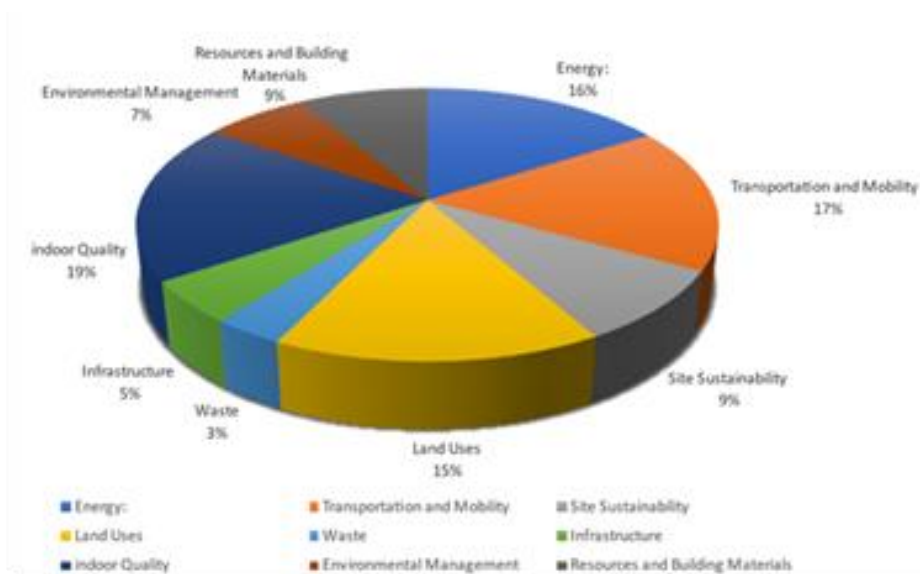


Fig. 2 The reference frame / Source (By Researchers)

## 7. applied analytical study

The research ends with an applied analytical study of models from Egyptian universities: a comparative analysis according to the elements of the proposed frame of reference between the American University in which represents the current reality, and Beni Suef National University, which represents the target model for Egyptian universities. . (see Table3 , Fig.5)

### 7.1.American University in Cairo 2008AD:

The university moved to the new campus in New Cairo, which extends over an area of 260 acres, Energy consumption decreased at the university level by about a third, and the total water consumption on campus decreased to more than 7%. The university ranked 101 out of 300 universities participating in the evaluation of green universities.<sup>47</sup> . (see Fig. 3)

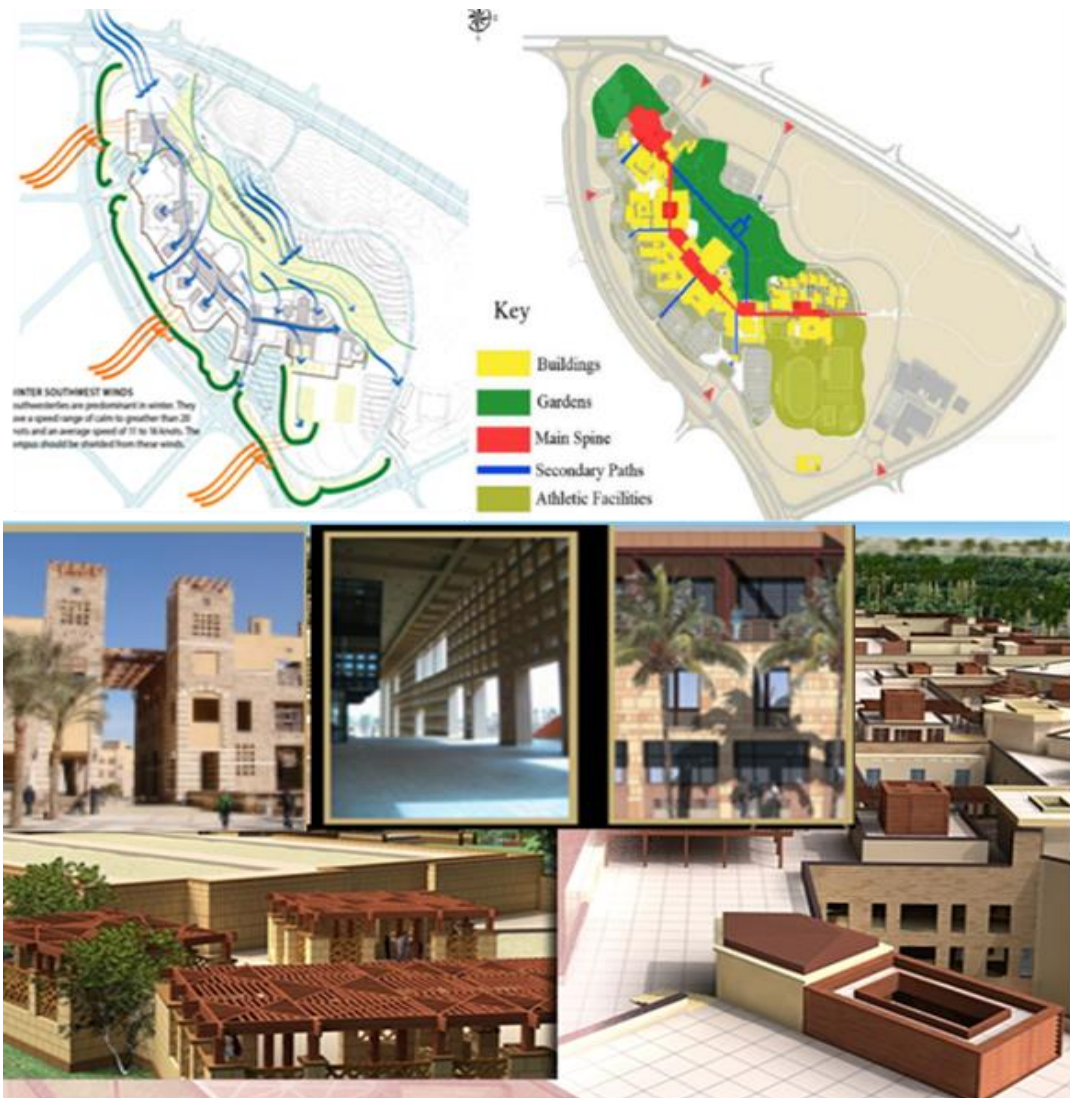


Fig.3 American University in Cairo / Source ([www.aucegypt.edu/ar](http://www.aucegypt.edu/ar))

## 7.2 Beni Suf National University 2022 AD :

42 acres have been allocated for the establishment of Beni Suf National University in a 330-acre complex in the university complex in the east of the Nile. One of the most important systems used is the rainwater storage system in addition to groundwater for irrigation of the campus gardens, The percentage of openings for the facades is 55.6%, in addition to the use of double glazing in the windows to reduce thermal conductivity<sup>48</sup>. (see Fig. 4)



Fig. 4 Beni Suf National University / Source ([www.nu.bsu.edu.eg](http://www.nu.bsu.edu.eg))

Table3. Evaluation universities Elements of the Proposed Reference Frame / Source (By Researchers)

the Elements	Indicators Measuring the Elements of Planning and Environmental Sustainability									
Energy	1	2	3	4	5	6	7	8	9	
American University	100%	100%	100%	100%	50%	100%	100%	100%	100%	90%
Beni Suef National University	0%	0%	0%	50%	0%	50%	80%	80%	80%	50%
Site Sustainability	1	2	3	4	5					
American University	100%	100%	100%	0%	50%					
Beni Suef National University	100%	100%	100%	100%	0%					
Land Uses	1	2	3	4	5	6	7	8	9	
American University	100%	100%	100%	70%	0%	0%	100%	100%	100%	100%
Beni Suef National University	50%	0%	0%	0%	0%	100%	75%	75%	75%	0%
Transportation and Mobility	1	2	3	4	5	6	7	8	9	10
American University	0%	0%	100%	0%	100%	100%	100%	100%	70%	100%
Beni Suef National University	100%	50%	100%	0%	100%	25%	100%	100%	100%	75%
Waste	1						2			
American University	0%						0%			
Beni Suef National University	0%						0%			
Infrastructure	1	2	3							
American University	0%	100%	100%							
Beni Suef National University	100%	75%	75%							

In door Quality	1	2	3	4	5	6	7	8	9	10	11
American University	100%	100%	100%	0%	50%	50%	75%	75%	100%	50%	100%
Beni Suef National University	100%	75%	100%	75%	50%	50%	50%	50%	75%	75%	75%
Environment Management	1			2			3			4	
American University	0%			100%			0%			100%	
Beni Suef National University	0%			0%			0%			50%	
Resources and Building Materials	1			2			3			4	5
American University	100%			75%			50%			0%	25%
Beni Suef National University	50%			50%			0%			0%	25%
Reference Frame application ratio Measuring sustainability standards at American University in Cairo = Total ratios of sustainability criteria / their number = 58/3980 = 70%						Reference Frame application ratio Measuring sustainability standards at Beni Suef National University = Total ratios of sustainability criteria / their number = 58/2885 = 50%					

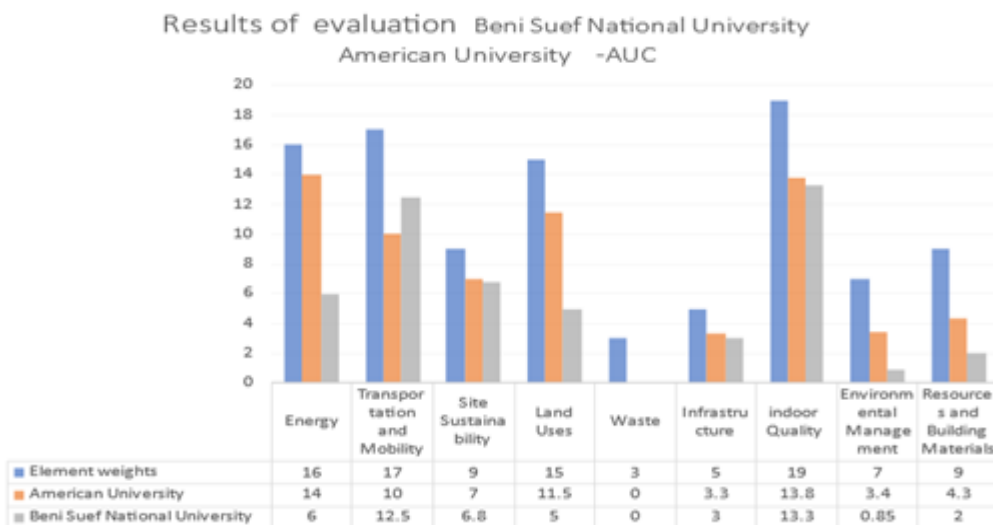


Fig. 5 result of evaluation Beni Suef National University and American University -AUC / Source (By Researchers)

### 7.3. The strengths and weaknesses of the case studies:

Consequently, of the evaluation, there are some of strengths and Weaknesses of American University in Cairo and Beni Suef National University, it is as follows:

#### 7.3.1 strengths of American University in Cairo:

- 1.Design The university is a pioneering experience for development in the desert, and to be an example to be followed in the urban development of a city
- 2.New Cairo, and this necessitated the introduction of many developments on the master plan for many uses
- 3.Renewable energy, taking advantage of the principle of reuse, and it is worth noting that the main concept
- 4.The general plan is inspired by the traditional Egyptian architecture and planning patterns, which are in line with its nature local environment.
- 5.Choose a location near mass transit . It is bordered to the north by Southern Teseen Street, and to the west by the American University axis
- 6.Choosing a site that does not contribute to urban sprawl The general site represents part of the eastern plateau, which is part of the Mokattam plateau, which extends to the Suez road
- 7.The university succeeded in reducing energy consumption by a third in two years, as the attempt to rationalize energy consumption in the American University buildings was taken into account through environmental efficiency Inside the building

- through architectural treatment systems and the use of passive control systems in addition to the use of cogeneration system 60% of the energy used in the university.
8. Using solar energy to get natural lighting, and wind catchers for natural ventilation.
  9. The optimum level of comfort has been reached Thermal without the use of mechanical systems This is done through thermal interactions between A group of spaces or elements represented by:-1 squares.- 2 inner courtyards -3 tunnels. And the choice of an environmentally friendly cooling system where the pure water cooling method was used, and the coolant fluids do not use harmful substances
  10. The designer adopted the idea of directing the inner courtyards with water fountains To adjust and humidify indoor air.It was also surrounded by shaded, roofed passages, with the apertures protected by canopies wooden simulating traditional mashrabiya,
  11. For hot water There is a central station for hot water heaters that supply water to all university buildings
  12. Hot water through storage heaters, which are located in the basement of each building.
  13. Use LED lights that consume less energy
  14. The air conditioning system is controlled by a BMS system.
  15. The surrounding natural light has been taken advantage of Through external windows and patios
  16. internal.
  17. Similar shading techniques were used Mashrabiyas to control lighting, ventilation, energy and thermal comfort
  18. Achieve maximum air speed Through the northern orientation of the external windows and courtyards Interior and air locks.
  19. University planning patterns: The campus is characterized by its traditional local architectural designs, "Islamic planning." The designer was keen to have the library in the heart of the campus, which ensures connectivity and flexibility in design.)
  20. Mixed land use: The university chose a scheme that groups all activities around a group of courtyards
  21. The university's plan is simply a pedestrian city organized around the interior and a group of squares, A group of spaces and internal spaces, and each space bears its own character, and the groove was formed
  22. As an external garden, with its outer border designated as a fence to protect the site
  23. The general outline is In response to the changing environmental conditions of the site on the one hand, an extrapolation of what can be developed in the site .The future is a future extension of the university's facilities and buildings.
  24. Building openings, squares, courtyards, and entrances in the campus buildings, all in the direction of the north-eastern wind
  25. The use of water and green spaces contribute to cooling the air naturally.
  26. Taking care of shading the squares and courtyards to reduce the thermal effect, as well as providing a large number of corridors next to the buildings and shaded passages that connect the blocks
  27. Use of local building materials suitable for the environment and climate.
  28. Paying attention to afforestation, green spaces, and landscaping the surrounding site.
  29. Plant a lot of palms to use less water

30. The green interior spaces are designed sequentially in spaces from linear spaces to central spaces beside the green spaces completely surrounding the campus from all sides.
31. Both the interior and exterior walls are made of bricks and typical cement tiles
32. 80% of the outer walls of the sanctuary were made of sandstone, which helps to make the rooms cool during the day and warm during the night.
33. The use of local building materials such as sandstone, which is characterized by its efficiency in thermal insulation. It was extracted from local quarries in Aswan, and cut and prepared on site.

### **7.3.2 Weaknesses of American University in Cairo:**

1. A site close to good landscaping is not chosen
2. not used Policies to promote sustainable transportation (i.e. use of sustainable alternative fuels)
3. Non-user policy for waste collection and disposal or storage and separation of waste.
4. No waste recycling and disposal policy is used.
5. Rainwater harvesting systems are not clear
6. It is not clear policy to avoid the negative effects of noise
7. No organic food, plants and flowering trees are grown on campus.
8. No patents have been applied in implementation or design.
9. Pre-assembled units have not been used
10. It is not clear the use of antibacterial materials

### **7.3.3 strengths of Beni Suef National University:**

1. Taking into account the climatic conditions by directing the buildings internally to protect from the sun and benefit from the wind
2. The selection of the project site is located on the regional road
3. Choose a location near mass transit on major traffic axes
4. Choosing a site that does not contribute to urban sprawl and increases urban development
5. The percentage of green areas of the total site is more than 15%
6. Follow one of the university planning patterns (central design)
7. Architectural elements such as inner courtyards, building shading, and reducing the heat island effect
8. The percentage of openings for the facades is 55.6%, in addition to the use of double glazing in the windows to reduce thermal conductivity
9. Reducing the negative effects of noise by using double glazing in windows
10. Taking into account the social and local dimension
11. Building design based on the architectural character of Beni Suef University
12. Relying on the inner squares, directing the interior, and creating clear visual axes
13. Connecting buildings and their entrances with traffic axes and urban spaces to achieve unity and diversity
14. Mixed land uses and reliance on a planning unit that can be replicated and accept future addition and expansion



15. Use of indoor mass transit on campus
16. Adopting pedestrian paths to achieve ease of movement
17. Separation of pedestrian and vehicle lanes with a clear, interconnected traffic network of main and secondary roads
18. Reducing entry, paths and parking spaces within the university campus
19. The number of car parks is suitable for users
20. Sanitary quality stormwater management works and Gray water reuse

#### 7.3.4 Weaknesses of Beni Suf National University:

1. Clean energy policies have not been used to reduce energy consumption in buildings
2. energy saving techniques have not been applied in spaces and buildings, such as using solar panels
3. No heat removal equipment (cooling towers) was used.
4. Heating systems are not designed to use gas or liquid fuels.
5. not apply Policies to promote sustainable transportation
6. not apply Existence of a waste collection and disposal policy
7. not apply Waste recycling and disposal
8. not apply Sustainable Sanitation Policies
9. Organic food is not grown on campus
10. Environmental innovation of design is not done
11. None of the patents applied in implementation or design
12. No waste wood formulations were used
13. No prefabricated units used
14. Using paints and finishes that are medium resistant to bacteria

Table 4. Results of evaluation Beni Suf National University and American University -AUC

<b>Elements</b>	<b>Element weights</b>	<b>American University AUC</b>	<b>Beni Suf National University</b>
Energy	16	14	6
Transportation and Mobility	17	10	12.5
Site Sustainability	9	7	6.8
Land Uses	15	11.5	5
Waste	3	0	0
Infrastructure	5	3.3	3
indoor Quality	19	13.8	13.3
Environmental Management	7	3.4	0.85
Resources and Building		4.3	2
Materials	9		
Total about	100	70	49

## 8. Research results:

1. The analytical and applied studies of a number of case studies represented in two local experiences showed several results at the level of: The study experiments participated in strengths that mainly affected the extent of their success, and they were represented in the elements of the sustainability of the site and the quality of the internal environment at the highest rates, then followed by the elements of transportation according to the idea of design.
2. It was concluded that the application of the terms of reference for the sustainability of the campus for the case study that is recognized for success (the American University in Cairo) increased to 70%, which indicates the extent of comprehensiveness and the success of the terms of reference for the application of standards of sustainability at the local level
3. The American University got 14% in evaluating the energy component, while Beni Suef National University got 1%, due to the interest in reduce Energy Consumption in Buildings, designing ventilation systems. and applying energy saving techniques in spaces and buildings, such as using solar panels. While Beni Suef National University excelled in transportation, due to its use of bicycles, and Mass transit usage. So, the AUC received 10% while Beni Suef National University has 12.5%.
4. Regarding the element of site sustainability, Infrastructure, and indoor Quality, both colleges were rated nearly equally. Both universities neglect their waste
5. the AUC performed exceptionally well on the Land Uses component, earning 11.5% from 15% for the purpose of using Commitment to design standards by providing services from a cafeteria and theater, Central Library area the green areas, Student housing, and Museums and galleries, in addition to Depending on a planning unit that is suitable for addition and future expansion when achieved; Flexibility, privacy, diversity and social interaction.
6. In the Environmental Management component, Beni Suef scored 0.85% while Americans scored 3.4%. because of Innovation and environmental uniqueness of design, and using comfort standards for the disabled.
7. Beni Suef National University neglected the Resources and Building Materials element, as it obtains 2%, while the American University obtains 4.3%, due to its interest in Choosing wood fixtures from wood waste, and using local building materials with high efficiency, high resistance to erosion, and less maintenance.
8. The university campus is constantly changing and evolving as a result of the new needs and future requirements that must be accommodated, which emphasize the necessity of the phased construction of universities and relying on the possibility of future expansion.
9. Attention to the environmental and urban needs is no less important than the physical and functional needs of the university campus.
10. Structural systems should be used that allow for modification and flexibility to change the spaces and furnish them easily with the exploitation of the roofs and planting them as green environmental and social spaces for users that contain solar energy collection units.
11. .
  - The integrated planning of buildings, the high percentage of green spaces, afforestation, taking into account the orientation of buildings and openings,

- following the principles of solar design, the use of local and environmentally friendly building materials and finishes, and the provision of environmentally friendly transportation alternatives help to achieve a sustainable university campus.
12. Sustainability standards must be applied at the building level to be awarded a green building certification as part of a sustainable campus.
  13. The proposed vision for the sustainability of universities in Egypt depends on the application of a sustainable university campus as a university model that achieves the future vision of Egypt 2050 AD.
  14. The proposed frame of reference is considered one of the mechanisms for the development of university campuses in Egypt and the applications of university sustainability, through which it is possible to apply and measure the extent of comprehensiveness of existing and developed universities on sustainable standards and their keeping pace with future life changes. Through analysis using the frame of reference on local universities, the research hypothesis was proven that the university campus in Egypt It contains many environmental and urban problems and lacks a general orientation towards sustainable development, in particular the standards for waste recycling as one of the pillars of university sustainability. It addresses previous negative effects and takes into account future visions and developments.
  15. The proposed Reference Frame (criteria for a sustainable university campus) includes 9 main criteria that contain sub-elements
  16. The provision of a sustainable university campus represents the key components of a sustainable growth program that supports universities of different types and achieves the environmental aspects through multiple principles represented in the following: mixed use - compact buildings - adopting pedestrian paths - supporting distinctive and attractive urban areas and creating a sense of place - preserving space Open spaces and environmental lands - Strengthening existing communities - Providing multiple transportation options - Forecasting development options - Encouraging community participation
  17. The orientations of the preparation of environmental sustainable inclusive plans include taking into account climate determinants and their treatment, exploitation of natural resources, compact planning, internal courtyards, attention to social relations, human standards, ease of perception, priority of pedestrian paths and green areas therein.

## **9.Recommendations:**

1. The state should encourage the provision of inclusive basics, involve the user in defining his future needs, and encourage community participation and belonging.
2. Solutions and the possibility of changing and modifying buildings must be proposed in a way that does not harm the general plan of the university campus and does not conflict with the environment and safety.
3. Orientation to create a specific model for future horizontal expansion that preserves the urban characteristics and the mental image of a sustainable university campus and achieves functional flexibility

4. Providing a media network for the site and dividing it in stages in terms of providing it with facilities, services, construction, maintenance and follow-up.
5. Working with the advanced and extended smart building system according to future needs within a unified architectural and urban framework.
6. Providing an infrastructure that can bear the current and future needs.
7. The need to rely on energy-saving and energy-generating buildings and their resistance to the surrounding factors and response to climatic conditions by forming an architecture that expresses the local identity.
8. Take advantage of strengths and avoid weaknesses in universities and work on developing them.
9. Rationalizing the consumption of natural resources and non-renewable energy sources, using highly efficient systems, and recycling waste and water.
10. Educating individuals and institutions about the principles and standards of sustainability and their importance.
11. Providing mechanisms for applying sustainability at the urban and architectural level using digital systems and technologies.
12. Developing architectural education curricula to mainly include sustainable technical developments and how to integrate and benefit from them at the level of architectural and urban design in various projects.
13. Estimating the environmental impact of projects before and during construction and reducing the negative impact and waste of resources.

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## 11.References

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