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ORIGINAL ARTICLE

Explaining the Criteria for Sustainable Development of University Campuses with an Emphasis on Environmental Values: A Case Study of the Central Campus of Shahrood University of Technology

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ABSTRACT

Nowadays, due to increasing global environmental problems and challenges, the implementation of sustainable development concepts in various aspects related to university campuses has become critically important. In addition to their role in education and awareness, university campuses are considered small-scale cities that have significant direct and indirect effects on the environment due to their large size, multiple buildings, high population density, and complex activities. Moreover, the university, as a major educational institution, bears significant responsibility for planning and adopting effective strategies in implementing environmentally friendly programs, using renewable and sustainable resources, supporting clean energy, and preserving the environment. As awareness grows regarding the environmental impact of universities, they are expected to promote a development model that aligns with environmental safety, biodiversity, ecological balance, and intergenerational equity. The purpose of this research is to enhance the sustainability level of university campuses with an emphasis on environmental values. This study is both qualitative and quantitative, with the Central Campus of Shahrood University of Technology selected as the case study. It is a descriptive-survey in terms of nature and methodology and applied in terms of purpose. Data collection was carried out through both documentary (library) and case study methods. The theoretical framework and background information were gathered via a documentary approach, using scientific and research articles, books, and other credible domestic and international sources. In the case study phase, data were collected through questionnaires, interviews, and observations. The collected data were analyzed using SPSS 28 and AMOS 24 software. The results showed that most indicators of environmental sustainability on the central campus—including energy conservation, sustainable materials, waste separation and recycling, rainwater collection and storage, smart energy and water equipment, building greenness, bicycle use, water features, utilization of natural energy, waste reuse, and clean fuels—are currently in an unfavorable condition. Improving these indicators, based on the data analysis, can significantly enhance the environmental sustainability of the university campus. Accordingly, several solutions are proposed to develop sustainability in university campuses grounded in environmental values.

KEYWORDS

University Campuses, Sustainable Development, Environmental Sustainability.

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چکیده

امروزه، با توجه به مشکلات محیط‌زیستی و تغییرات پیش روی جهان، اجرای مفاهیم پایداری در امور مختلف مربوط به پردیس‌های دانشگاهی اهمیت بسیاری یافته است. پردیس‌های دانشگاهی علاوه بر نقش آموزشی و آگاهی‌بخشی، به دلیل وسعت زیاد، تعدد ساختمان‌ها، جمعیت فراوان و فعالیت‌های پیچیده، به‌عنوان شهرهای کوچکی در نظر گرفته می‌شوند که تأثیرات مستقیم و غیرمستقیم جدی بر محیط‌زیست دارند. پژوهش انجام‌شده از نوع مطالعه موردی بوده و پردیس مرکزی دانشگاه صنعتی شاهرود به‌عنوان محدوده موردمطالعه این پژوهش بوده است. این پژوهش با هدف شناسایی معیارهای توسعه پایدار پردیس‌های دانشگاهی با تأکید بر ارزش‌های محیط‌زیستی بر پایه روش تحقیق توصیفی- پیمایشی پایه‌گذاری شده و شامل دو بخش مطالعات اسنادی و میدانی است. تجزیه و تحلیل داده‌ها در نرم‌افزار $SPSS_{28}$ و تحلیل عاملی تأییدی در نرم‌افزار $AMOS_{24}$ صورت گرفته است. نتایج نشان داد که در محدوده موردمطالعه معیارهای پایداری محیط‌زیستی موردبررسی از جمله حفظ انرژی، مصالح پایدار، تفکیک و بازیافت زباله، جمع‌آوری و ذخیره آب باران، تجهیزات هوشمند انرژی، تجهیزات هوشمند آب، سبزینگی در ساختمان، استفاده از دوچرخه، حضور آب، بهره‌گیری از انرژی‌های پاک و استفاده مجدد از ضایعات، از وضعیت نامناسبی برخوردار است. در این راستا پیشنهادهایی در جهت بهبود وضعیت عوامل ذکرشده برای افزایش سطح پایداری محیط‌زیستی در پردیس‌های دانشگاهی ارائه شده است.

واژه‌های کلیدی

پردیس‌های دانشگاهی، پایداری محیط‌زیستی، توسعه پایدار.

Introduction

The growth of the population, the expansion of cities, and the technological advances that began with the Industrial Revolution created a demand for abundant energy resources. As a result, industrial societies extensively and indiscriminately exploited fossil and natural resources to meet their needs (Dehghanmongabadi & Hoşkara, 2018). This trend has led to numerous environmental challenges, including greenhouse gas emissions, ozone layer depletion, biodiversity loss, the depletion of non-renewable energy sources, and climate change (Yılmaz & Bakış, 2015). Growing awareness of these environmental problems has given rise to new global concepts, one of which is sustainable development. The Brundtland Commission defined sustainable development as meeting the needs of the present generation without compromising the ability of future generations to meet their own (Yari Boroujeni et al., 2020). Sustainability is a multidimensional concept, typically encompassing social, economic, and environmental dimensions (Lukman et al., 2010). While the economic and social aspects are significant, the environmental dimension is often seen as more fundamental, as a sustainable environment forms the basis for both social and economic sustainability (Lei et al., 2023). Environmental sustainability refers to the conservation of resources through both tangible and intangible actions. It includes the management of environmental impacts, stakeholder participation, organizational systems, and legal compliance. It focuses on balancing human needs with the carrying capacity of the natural environment (Seydaei et al., 2018). In light of current issues such as climate change, resource depletion, and other environmental concerns, the design of sustainable environments has become a shared global responsibility (De Gaulmyn & Dupre, 2019).

With over 13,000 universities worldwide and a growing number of higher education institutions—especially in developing countries facing acute environmental problems—the impact of universities and their campuses on the environment is increasingly significant (Lukman et al., 2009). University campuses function as small urban environments and often generate substantial environmental impacts throughout their life cycle due to their size, range of activities, population density, housing, infrastructure, and resource consumption (Novieto et al., 2023), as well as their greenhouse gas emissions (Amaral et al., 2021).

At the same time, universities are recognized as key urban hubs for environmental education and innovation. They hold significant potential to shape sustainable behavior in everyday life and to train future professionals. To play this guiding role credibly, universities must first demonstrate accountability by addressing key sustainability issues such as energy and human resource management (Sonetti et al., 2016).

A review of the literature reveals a variety of university-based research on environmental sustainability. A brief overview of some of these studies is provided below.

Mohamed et al. (2020), in their research aimed at examining environmental sustainability initiatives in universities, concluded that the key factors of university environmental sustainability include environmental awareness and knowledge, green space and land use management, energy efficiency and water conservation, natural resource limitations, climate change mitigation, waste minimization, greenhouse gas emission reduction, environmental education program and research collaboration, as well as environmental sustainability guidelines and policies; with the help of these factors, the university's environmental sustainability plans can be improved.

In his study, Beringer (2006) evaluated campus sustainability at Prince Edward Island University and showed that part of the campus sustainability programs was possible through improving resource or energy efficiency, conserving non-renewable resources such as fossil fuels, minimizing gas emissions, and increasing awareness of environmental and sustainability issues through the involvement of students and faculty members.

Khoramaraie et al. (2022), in their research, which was conducted with the aim of realizing the goals of the Green University, in order to

evaluate the green management of Shahid Beheshti University, they measured the indicators of the Green Metric global university ranking system in six main areas including: environment and infrastructure, energy and climate change, recycling, water, transportation, and education. Finally, considering the pathology of the current situation and the formulation of general goals, strategies, and executive policies within the campus, they expressed the principles of designing the Green University landscape on the campus of Shahid Beheshti University.

Esmaeili et al. (2021), in their study, which aimed to identify and select appropriate strategies for integrating green management into the structure of Razi University, showed that the strategy of joining or being a member of one of the green university assessment systems at the global level, changing technology or replacing the university's current energy sources with new environmentally friendly technologies, and using the capacity of mass media to introduce the university's capabilities to the community in the field of green management has the best performance in integrating green management into the structure of Razi University, respectively.

The aim of the present study is to identify the key criteria influencing the sustainable development of university campuses, with a specific focus on environmental values. The research is intended to reduce the environmental impact of human activity and move toward global sustainability. Accordingly, the study seeks to answer the following research questions:

- How can environmental sustainability be achieved on university campuses?
- What are the environmental sustainability criteria on university campuses?
- What are the solutions for sustainable development of university campuses with an emphasis on environmental values?

A growing number of universities, realizing their environmental responsibility, are incorporating aspects of environmental management into their policies, curriculum, research projects, building design, technology, and other campus activities, and are engaged in environmental declarations (Anwar et al., 2020). In order to ensure optimal efficiency in reducing resource use and the environmental impacts of university campus operations, a wide range of aspects must be considered, including carbon emissions, energy and water efficiency, wastewater discharge and treatment, waste management, as well as indirect impacts related to other activities such as the provision of food for university dining centers (Gu et al., 2019). In the following, environmental sustainability criteria on university campuses were extracted from several domestic and foreign studies. Table (1) presents the extracted criteria.

Table 1. Criteria Related to Environmental Sustainability on University Campuses

Research title	Criteria	Reference
Planning a Sustainable University Model Based on the Researches in Iran	Architectural and environmental design considerations - Energy - Waste and waste recycling - Sustainable transportation system - Environmental principles Health and safety - Procurement and purchasing of materials - Nutrition	(Rad et al., 2018)
Carbon footprint assessment at Universitas Pertamina from the scope of electricity, transportation, and waste generation: toward a green campus and promotion of environmental sustainability	Site management and planning - Energy efficiency - Waste management - Water efficiency and conservation - Sustainable transportation - Material and resource management - Indoor environmental quality - Green innovation - Green education	(Ridhosari & Rahman, 2020)
Environmental performance of universities: Proposal for implementing	Infrastructure (buildings, morphological design, energy, food, consumables) -	(Marrone et al., 2018)

Research title	Criteria	Reference
campus urban morphology as an evaluation parameter in Green Metric	Society (governance, leadership, responsibility, investment, capital, health, fitness, services) - (Curriculum)	
Developing an integrated participatory methodology framework for campus sustainability assessment tools (CSAT): A case study of a sino-foreign university in China	Buildings - Waste - Water - Land Use - Transportation - Nutrition - Health	(Dawodu et al., 2024)
Key Performance Indicators to optimize the environmental performance of Higher Education Institutions with environmental management system–A case study of Universitat Politècnica de València	Energy management - Biodiversity - Sustainable transportation - Waste and wastewater management - Water management - Green economy - Infrastructure - Land use - Air pollution - Materials and resources - Climate change - Environmental scenarios - Nutrition	(LoIaconoFerreira et al., 2018)
Exploring the coverage of environmental-dimension indicators in existing campus sustainability appraisal tools	Energy efficiency - Clean transportation - Water efficiency - Green construction - Waste management - Biodiversity - Materials	(Adenle et al., 2020)
Prioritising performance indicators for sustainable construction and development of university campuses using an integrated assessment approach	Water - Energy - Waste - Population Management - Land Use - Noise - Green Space and Climate	(Li et al., 2018)

Achieving sustainability, especially environmental sustainability, will be possible through a set of components. Accordingly, the components of environmental sustainability are examined as operational elements, public and political awareness of environmental issues and their management, measuring sustainability, and creating a balance between development and the environment (Mirsanjari & Mohammadyari, 2019; Dehghanmongabadi, and Tahmasbnia, 2025). From the summary of research related to environmental sustainability on university campuses by various researchers in Table (1), six components of biodiversity conservation, architectural and design considerations, energy management, waste management, transportation management, and water management have been examined in this research.

In order to examine and analyze the main components of the research, the criteria associated with each component are shown in Table (2).

Table 2. Research Components and Criteria

Components	Criteria	Reference
Preserving biodiversity (protecting flora and fauna)	Green space Presence of water	(Ha & Kim, 2021) (Kumar et al., 2024)
Architectural and design considerations	Natural light Natural ventilation Sustainable materials Reducing noise pollution Reducing air pollution Greenery in the building	(Ahadi & Khanmohammadi, 2015) (Mojtabavi & Izadpanah, 2022) (Akrami & Alipour,2016) (Aliabadi et al., 2013) (Ramírez et al., 2023) (de Oliveira Santos et al., 2024)
Energy	Natural energies (solar, wind, geothermal) Energy conservation Smart energy equipment	(Luo et al., 2017) (Dehghanmongabadi, and Tahmasbnia, 2025)
Garbage and waste	Waste separation and recycling Reuse of waste	(Ugwu et al., 2021)
Transportation	Public transportation	(Nematchoua et al., 2020)

Components	Criteria	Reference
	Clean fuel	
	Using a bicycle	
	Walkability	
Water	Rainwater collection and storage	(Amr et al., 2016)
	Smart water equipment	
	Drip irrigation	

Research Methodology

Shahrood University of Technology was established as the first university in Semnan province in 1973 and currently has 14 faculties and 4 campuses: Central Campus, Industry and New Technologies Campus, Agricultural Engineering Campus, and Educational Mining Campus. The present study focuses exclusively on the Central Campus, as shown in Figure 1.

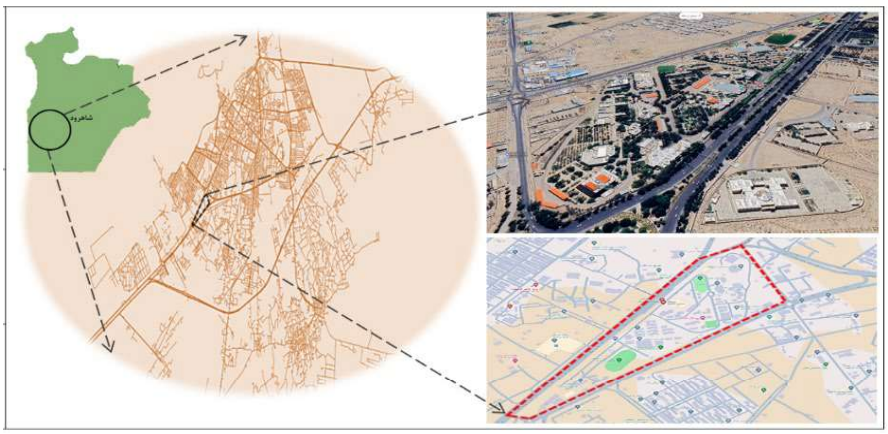

Figure 1. Location of the Central Campus of Shahrood University of Technology at the County Level

The present study is applied in terms of purpose and descriptive-survey research in terms of nature and method. In the present study, information related to theoretical foundations and research background was collected through documentary method, and in the field method, in addition to interviews and observations, a questionnaire was used as the main tool for collecting information. The validity of the questionnaire was confirmed by experts and its reliability was confirmed through Cronbach's alpha with a reliability coefficient of 0.821. The statistical population of the study was all members of the central campus of Shahrood University of Technology, which is about 4,000 people. The Cochran formula was used to determine the sample size of this study. Assuming maximum dispersion, the p value was set to 0.5 and q was set to 0.5. With a confidence level of 95% and a permissible error rate of d= 0.06, the sample size was 250 people; therefore, 270 people responded to the questionnaire. SPSS version 28 and AMOS version 24 software were used to analyze the data.

In order to determine the extent to which the model measurement items were correctly selected, confirmatory factor analysis was used in AMOS version 24 software. Figure (2)

To confirm the factor loading, attention is paid to the level of significance. If the significance level is less than 0.05, the effect of the factor loading will be significant. The significance level (p) obtained for the research variables is less than 0.05, so all dimensions have explained their constructs well. After confirming the factor loadings, attention is paid to the model estimation indices. The $\chi 2/df$ index (chi-square per degree of freedom) is acceptable at a value less than 3 (Kakizadeh et al 2022); in this study, the value of this index was 2.527. The GFI (Goodness of Fit index) should preferably be between 0.5 and 1, which is the obtained value of 0.811. The RMSEA

(root mean square error of estimation) index is considered to be less than 0.09, and the value obtained in this study is 0.087. The SRMR index (standard root mean square residual) is considered to be less than 0.8, which was obtained as 0.052, indicating a good fit of the model. The CFI (Comparative Fit Index) is 0.836; since this value is close to 1, it indicates an acceptable fit of the model. In general, based on the aforementioned fit indices, it can be said that the model considered by the researchers is approved.

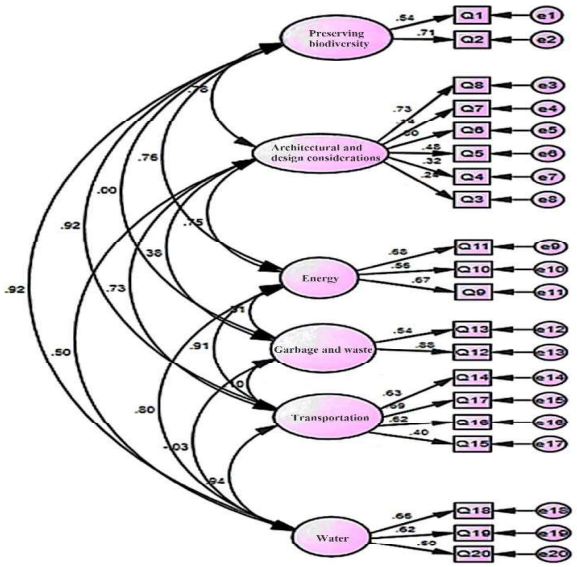

Figure 2. Confirmatory Factor Analysis Model with Standard Coefficients

Research Findings

To analyze the current status of the criteria influencing the sustainable development of university campuses, with an emphasis on environmental values, descriptive statistics were employed. This section examines the mean and standard deviation of each variable and evaluates their condition relative to the neutral value (3) on the Likert scale used in the research questionnaire.

Table 3. Descriptive Statistics of Research Variables

Variable	Average	Standard deviation	Standard error
Green space	3.57	0.690	0.042
Presence of water	1.72	0.657	0.040
Natural light	3.24	0.677	0.041
Natural ventilation	2.94	0.727	0.044
Sustainable materials	2.19	0.779	0.047
Reducing noise pollution	3.01	0.781	0.048
Reducing air pollution	3.87	0.595	0.036
Greenery in the building	1.79	0.724	0.044
Natural energies (solar, wind, geothermal)	1.66	0.676	0.041
Energy conservation	2.27	0.725	0.044
Smart energy equipment	1.97	0.659	0.040
Waste separation and recycling	2.07	0.855	0.052
Reuse of waste	1.59	0.596	0.036
Public transportation	3.53	0.927	0.056
Clean fuel	1.23	0.463	0.028
Using a bicycle	1.70	0.737	0.045

Variable	Average	Standard deviation	Standard error
Walkability	3.32	0.999	0.061
Rainwater collection and storage	1.94	0.737	0.045
Smart water equipment	1.89	0.677	0.041
Drip irrigation	3.87	0.863	0.053

The results of Table (3) show that in the central campus of Shahrood University of Technology, the current status of 7 environmental sustainability criteria including: air pollution reduction with an average of 3.87, drip irrigation with an average of 3.87, green space with an average of 3.57, public transportation with an average of 3.53, Walkability with an average of 3.32, natural light with an average of 3.24, and noise pollution with an average of 3.01 are above average and are in a good condition. On the other hand, 13 other indicators including natural ventilation with an average of 2.94, energy conservation with an average of 2.27, sustainable materials with an average of 2.19, waste separation and recycling with an average of 2.07, smart energy equipment with an average of 1.97, rainwater collection and storage with an average of 1.94, smart water equipment with an average of 1.89, greenery in the building with an average of 1.79, water presence with an average of 1.72, bicycle use with an average of 1.70, utilization of natural energies with an average of 1.66, waste reuse with an average of 1.59, and clean fuel with an average of 1.23 are below average and are in an inappropriate state.

To examine the impact of environmental sustainability criteria on the sustainable development of university campuses (Shahrood University of Technology Central Campus), a one-sample t-test was used. The results of the one-sample t-test are summarized in Table (4).

Table 4. T-test Output for Research Variables

Variable	Test Value = 3					
	T-status	Degree of freedom	Significance level	Average difference	Confidence interval 0.95	
					Lower limit	Upper limit
Green space	25.583	269	0.000	1.074	0.99	1.16
Presence of water	-19.448	269	0.000	-0.778	-0.86	-0.70
Natural light	17.974	269	0.000	0.741	0.66	0.82
Natural ventilation	10.046	269	0.000	0.444	0.36	0.53
Sustainable materials	-6.560	269	0.000	-0.311	-0.40	-0.22
Reducing noise pollution	10.679	269	0.000	0.507	0.41	0.60
Reducing air pollution	37.749	269	0.000	1.367	1.30	1.44
Greenery in the building	-16.141	269	0.000	-0.711	-0.80	-0.62
Natural energies (solar, wind, geothermal)	-20.523	269	0.000	-0.844	-0.93	-0.76
Energy conservation	-5.207	269	0.000	-0.230	-0.32	-0.14
Smart energy equipment	-13.305	269	0.000	-0.533	-0.61	-0.45
Waste separation and recycling	-8.325	269	0.000	-0.433	-0.54	-0.33
Reuse of waste	-25.223	269	0.000	-0.915	-0.99	-0.84
Public transportation	18.179	269	0.000	1.026	0.91	1.14
Clean fuel	-45.047	269	0.000	-1.270	-1.33	-1.21
Using a bicycle	-17.743	269	0.000	-0.796	-0.88	-0.71
Walkability	13.459	269	0.000	0.819	0.70	0.94
Rainwater collection and storage	-12.384	269	0.000	-0.556	-0.64	-0.47
Smart water equipment	-14.913	269	0.000	-0.615	-0.70	-0.53
Drip irrigation	26.084	269	0.000	1.370	1.27	1.47

Based on Table (4), the significance level obtained for all variables is less than 0.05. This means that the average of each criterion is significantly different from the hypothetical

average, and therefore, all of these criteria significantly affect the sustainable development of university campuses with an emphasis on environmental values. Some variables including: presence of water, sustainable materials, greenery in the building, use of natural energy, energy conservation, smart energy equipment, waste separation and recycling, waste reuse, clean fuel, bicycle use, rainwater collection and storage, and smart water equipment have negative t-statistics; these factors have a more unfavorable status due to having a negative t-statistic and require more requirements.

Conclusion

Sustainability-related discussions consistently emphasize the well-being of future generations and the protection of the global environment. In the era of sustainable development, university campuses play a critical role in addressing environmental challenges and promoting a healthier environment. As influential educational centers, campuses can foster a culture of sustainability in society and raise public awareness about the importance of environmental protection. At the same time, the design and operational practices of these institutions can have long-lasting environmental consequences. Given the growing urgency of environmental crises, it is essential to adopt sustainable approaches in the planning and physical development of university campuses.

Campuses that have embedded environmental sustainability in their institutional agenda typically take action across multiple areas, including biodiversity conservation, design and construction, energy, waste and recycling, transportation, and water management. By integrating environmental sustainability principles into all aspects of campus operations, universities can serve as effective models for other institutions and organizations in preventing environmental crises. Fostering sustainable thinking and behavior within academic environments not only enhances the quality of life for current generations but also safeguards the well-being and health of future generations.

Descriptive statistics from this study revealed that 13 environmental sustainability criteria at the Central Campus of Shahrood University of Technology—including natural ventilation, energy conservation, sustainable materials, waste separation and recycling, smart energy equipment, rainwater collection and storage, smart water equipment, greenery in buildings, presence of water, bicycle usage, natural energy utilization, waste reuse, and clean fuel, scored below the midpoint average and are currently in an inadequate state. Improving these factors can help enhance the university campus's overall environmental sustainability, contributing to environmental protection and the global pursuit of sustainable development.

Based on the results of the one-sample t-test at the 95% confidence level, all designed variables were found to be statistically significant. Thus, all criteria examined in this study are recognized as influential factors in the sustainable development of university campuses, particularly in relation to environmental values. However, some variables showed negative t-statistics, indicating a more unfavorable status and the need for additional improvement. These include:

- Clean fuel (T-status: -45.047)
- Reuse of waste (T-status: -25.223)
- Natural energies (T-status: -20.523)
- Presence of water (T-status: -19.448)
- Using a bicycle (T-status: -17.743)
- Greenery in the building (T-status: -16.141)
- Smart water equipment (T-status: -14.913)
- Smart energy equipment (T-status: -13.305)
- Rainwater collection and storage (T-status: -12.384)
- Waste separation and recycling (T-status: -8.325)
- Sustainable materials (T-status: -6.560)
- Energy conservation (T-status: -5.207)

Providing sustainable environmental solutions in the development of university campuses can help in selecting the best options to solve environmental problems. In this regard, solutions have been proposed in Table (5) for the sustainable development of university campuses with an emphasis on environmental values.

Table 5. Sustainable Development Strategies for University Campuses with an Emphasis on Environmental Values

Criteria	Solutions
Green space	- Creating university parks and gardens - Creating diverse habitats in green space design such as rock gardens, meadows, and nesting spaces for birds and small mammals - Planting diverse native plants
Presence of water	- Development of water spaces in the form of ponds, water features, wetlands, and small natural ponds - Creation of structures similar to natural habitats in the water, such as rock piles, depth differences, and native aquatic plants
Natural light	- Proper orientation of the building relative to the sun's path for maximum use of daylight - Using large windows on the southern facade and taking advantage of the desired southern light - Using roof skylights for spaces that do not receive light
Natural ventilation	- Using windows that can be opened and closed and windows facing each other - Creating openings in the ceiling and walls - Using the windbreak technique
Sustainable materials	- Maximum use of local and natural materials such as wood, stone, straw and soil
Reducing noise pollution	- Use of sound walls and vegetation - Planting trees in front of the source of noise pollution - Multi-walled walls and windows
Reducing air pollution	- Preventing the accumulation of waste - Developing green spaces and planting native trees - Allowing air circulation in open and semi-open spaces
Greenery in the building	- Implementation of green roofs, green walls and vertical gardens in buildings - Use of plants in the interior design of buildings
Natural energies (solar, wind, geothermal)	- Installation of solar panels, use of solar water heaters and solar lights outdoors - Installation of wind turbines and fans - Use of geothermal heat pumps
Energy conservation	- Installation of multi-glazed windows and facades - Use of building components with high thermal capacity such as stone, brick and concrete - Effective insulation of walls, ceilings and floors
Smart energy equipment	- Smart lighting, such as using motion sensors and LED lighting that can automatically dim and increase based on the amount of natural light - Using smart heating and cooling systems - Using smart air conditioning systems
Waste separation and recycling	- Establishing waste separation bins with clear signs and at appropriate intervals - Separating organic waste and reusing it
Reuse of waste	- Scrap metal for making artwork and decorations such as sculptures or making lamp bases, patio tables and chairs, etc. - Plastic waste such as bottles can be turned into pots or storage containers or used to make recycled bricks, benches and patio tables - Construction waste such as concrete, bricks and stones can be used to make walkways or outdoor furniture - Wood waste for making tables, shelves and artwork
Public transportation	- Establishing bus stops at key locations - Allocating special bus routes - Providing free or affordable public transportation - Establishing shared stations between the university and the city

Criteria	Solutions
Clean fuel	- Use of electric scooters or bicycles - Installation of electric charging stations in various locations - Design of parking lots for clean vehicles - Use of electric buses and minibuses
Using a bicycle	- Creating specific and safe cycling routes and connecting them to urban routes - Suitable parking lots or sturdy bike racks near high-traffic areas - Creating simple stations for minor repairs and maintenance - Affordable bike rental and sharing programs
Walkability	- Creating safe and comfortable walking paths - Walking paths with appropriate flooring and without obstacles - Appropriate lighting along the walking path at night - Using green space and appropriate furniture along the path - Connected walking paths without cuts to access different points
Rainwater collection and storage	- Installing water storage tanks above or below ground - Creating large pools or ponds in the area - Using roof systems to collect rainwater
Smart water equipment	- Use of smart faucets - Motion sensors to reduce water consumption in bathrooms - Installation of soil and water sensors to control irrigation amount - Smart irrigation controls
Drip irrigation	- Identifying different green areas such as gardens, lawns and orchards that consume a large amount of water for irrigation - Designing appropriate piping networks that can deliver water uniformly and over a long period to different points - Using different types of drip irrigation in the form of spot and sprinkler irrigation

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