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The impact of nanotechnology in achieving sustainable design

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Abstract
In light of the current energy crisis affecting the world, as it constitutes a great economic burden, and with the increase in consumption of natural environment resources, the environment has been negatively affected, which has had a negative impact on human health. Therefore, the problem is summarized in how to achieve environmental sustainability in architecture using nanotechnology. The research used the descriptive analytical approach: the theoretical study presents the concept of sustainability, sustainable design, nanotechnology, nanomaterials, applications of nanotechnology in the field of architecture. An analytical study of one of the existing administrative buildings that achieved sustainability without the use of nanomaterials. Practical study: an applied experiment for one of the thermal insulation nanomaterials, based on the study and attempts to reach accurate results. The practical experience has proven good results in achieving thermal insulation and access to thermal comfort in case of use of nanomaterials in buildings.

Keywords: sustainable design; nanotechnology; nano applications in architecture; energy consumption.

El impacto de la nanotecnología en la consecución de un diseño sostenible

Resumen
A la luz de la actual crisis energética que afecta al mundo, ya que constituye una gran carga económica, y con el aumento del consumo de recursos naturales, el medio ambiente se ha visto afectado negativamente, lo que ha tenido un impacto negativo en la salud humana. Por lo tanto, el problema se resume en cómo lograr la sostenibilidad ambiental en la arquitectura utilizando la nanotecnología. La investigación utilizó el enfoque analítico descriptivo. El estudio teórico presenta el concepto de sostenibilidad, diseño sostenible, nanotecnología, nano materiales. Un estudio analítico de uno de los edificios administrativos existentes que logró la sostenibilidad sin el uso de nano materiales. Estudio práctico: Un experimento aplicado para uno de los nano materiales de aislamiento térmico, basado en el estudio y los intentos de alcanzar resultados precisos La experiencia práctica ha demostrado buenos resultados en el logro del aislamiento térmico y el acceso al confort térmico en caso de uso de nano materiales en los edificios.

Palabras clave: diseño sostenible; nanotecnología; nano aplicaciones en arquitectura; consumo de energía.

1 Introduction

In recent years, a significant impact has emerged from man's exploitation of resources, which hurts the surrounding environment in attempts to repair the resulting damage back the Interest in the concept of sustainability [1,2].

1.1 Overview of studies of previous studies

1.1.1 Architectural studies Adam Ritchie, Randall Thomas 2009

We can design an environmental building with environmentally friendly specifications, such as achieving natural ventilation, and natural lighting, introducing high technology to reduce the heat load on the building and the city, and other things that must be followed when designing buildings, that is, to be environmentally friendly [3].

1.1.2 Architectural study Cama – 2013

She explained the importance of combining the elements of LEED and eco-friendly design. An environment that consumes less energy and adopts the use of technologies associated with instincts helps to feel comfortable and work better [4].

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1.1.3 Architect's studies 2015-Connelly & Dunier & Daniels

The importance of using green walls in architecture, especially interior architecture, as the basic elements for environmentally friendly design, and the importance of having interior architecture live through elements and ideas that depend on integrating architecture with sustainability. [5].

1.2 The concept of sustainability

Linguistic meaning: The origin of the word sustainability sustainer returns. To the origins of the Latin came from term uphold to attribution from below The community starts the foundation From the bottom in construction by its present and future occupants According to the Greek concept [6].

Sustainability: It is the exploitation of resources in the best available ways and capabilities, whether human, material, or natural, in an effective and balanced manner in the environment and urbanization to ensure continued performance without wasting the gains of future generations. [7].

The concept of sustainability at the World Conference on Development and Environment: She is filling the needs of human beings in the present without affecting future generations to meet their needs in the future.

Sustainability is indicative of maintaining operations that are specifically, permanently, and continuously different, as the world progresses and adverse effects on the environment such as global warming. [8].

Sustainability relates to several areas, including economic, social, institutional, and environmental in society, and is considered a means of organizing activities to make society, individuals, and the economy able to meet their needs and correspondence and express their extreme [9].

The most comprehensive definition of sustainability: Sustainable development: is a simple thought, balancing the economic, social and urban objectives of the environment with existing possibilities, and combining two basic principles; They are meeting the needs of the present generation and not infringing on future generations' access to their future requirements; Using natural sources without residues, protecting the natural ocean [10].

1.3 Sustainable design

- It is a design philosophy that seeks to improve the quality of the natural environment and minimize damage to the maximum extent possible in all áreas [11].
- It is a trend in the design of physical and environmental objects and services to comply with the requirements and themes of Sustainability and reducing negative damage to the environment.
- Sustainable design is the term that represents the intelligent application of sustainability principles in engineering and design. These principles apply to architecture and design.
- Maybe identification " sustainable " that is a term used to describe the use of sustainability principles in the design and development of architecture, industry, and various fields.
- It is possible to combine sustainable design and architecture through coordination between the design of buildings and the surrounding environment in a regular relationship in a manner that depends on the design integrated with nature from the environmental perspective and the least exploitation of resources and achieve the greatest benefit to achieve sustainability, which is what results in the concept of environmentally friendly architecture.

1.4 Environmentally friendly architecture

The process of designing buildings in a manner that respects the environment and reduces its energy, materials, and resources while reducing the effects of build on the environment and organizing no harmony with nature.

Principles of environmentally friendly architecture: The building is designed to achieve sustainability in the environment, taking into account all the resources contained in the building, whether materials or energy, to contribute to the needs of the building's users.

1. Energy conservation
2. Climate adaptation
3. Minimize the use of new resources
4. Respect the site
5. Respect for workers and users
6. Overall design
7. Good design

2 Materials and methods

2.1 General principles for designing environmentally friendly buildings

1. Preserving the general health of the population, the surroundings, and the globe unsatisfied in general.
2. Conservation of energy, water, and natural resources.
3. Realization of the concept of sustainability in the building economy in the construction and maintenance of these housing.
4. The use of materials that do not have a negative impact on the environment in their production, whether they are used, maintained, or disposed of.
5. Waste disposal in a way that does not have a negative impact on the environment, and waste treatment to serve the ecosystem [12].
6. Cost saving through recycling and energy production.

2.2 Sustainable building evaluation systems

1. **LEED**: Leadership in energy and Environmental Design Green Building Rating system.
2. **BREEAM**: The Building Research Establishment Environmental Assessment Method.
3. **Green Globes:** Building Environmental Assessment.

Table 1.
Shows the relative weights of the different evaluation systems

Evaluation system	Site sustainability	Energy efficiency	Water efficiency	Materials and resources	Indoor environmental quality
LEED	20%	25%	8%	19%	22%
BREEAM	10%	19%	6%	12.5%	15 %
Green Globes	11.5%	38%	8.5%	10%	20%
CASBEE	15 %	20%	2%	15%	20%
Estidama	6.7%	25%	24%	16%	21%
GPRS	5%	25%	35%	10%	10%

Source: Authers.2024

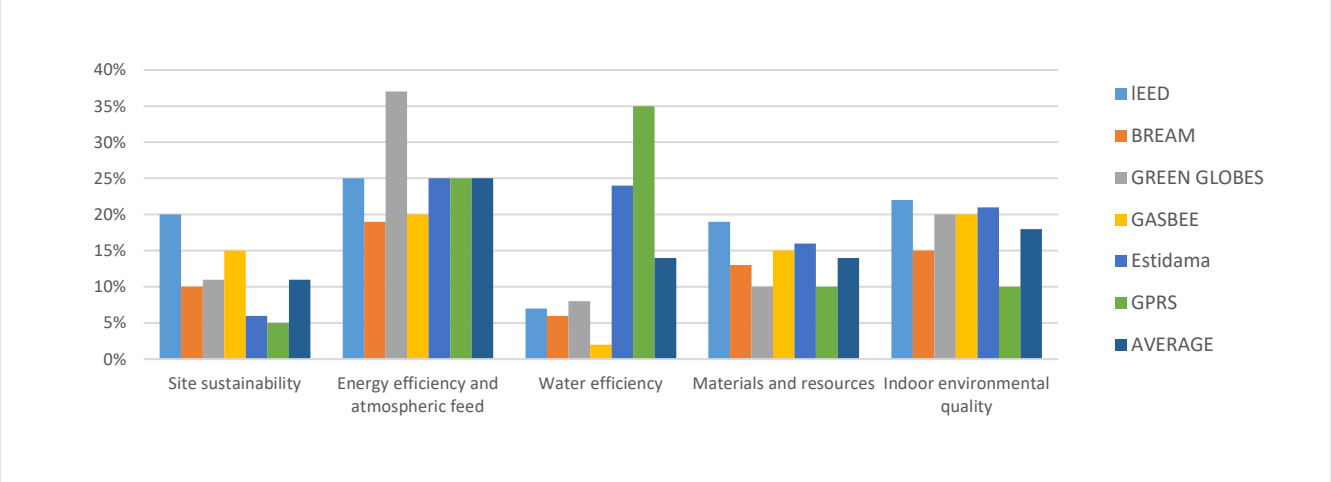

Figure 1. Shows the relative weights of the different evaluation systems.
Source: https://www.wbdg.org/design-objectives/sustainable

1. **CASBEE:** Comprehensive Aassessment System for Building Environmental Efficiency.
2. **GPRS:** The Egyption Green Rating.
3. **Estidama**

When studying the building evaluation systems, it was found that they agree with the basic criteria that must be available in buildings in order to achieve the concept of sustainable buildings: (location — energy efficiency — water efficiency — materials and resources — indoor environment quality) which it becomes clear that: Energy efficiency comes in the first place with the highest relative weights as the in Table 1 and Fig. 1 shows.

It is also followed by the quality of the internal environment in most evaluation systems. Materials and resources follow it. It was found that the water efficiency contradicts the global and local systems in terms of proportions; we find that the global systems gave it.

An evaluation of no more than 8.5%, while the regional systems gave it about 24%, while the local system gave it 35%. The sustainability of the site came at the last level.

From the foregoing, it is clear to us: that the whole world is moving towards the rationalization of energy and water for resources; to improve the indoor environment.

Nanotechnology has shown a tremendous breakthrough in improving the properties of materials and adjusting them to meet the requirements of the environment and achieving sustainability in all fields, especially in architecture, and shows through its impact on buildings to become sustainable and environmentally friendly, so we will expand the search for nanotechnology and its impact to achieve sustainability and its impact on the cost [14].

2.3 Nanotechnology

Nanomaterials:

They are very small particles with two dimensions at the bottom, containing structural components that are smaller than 1 micrometer in one of their dimensions. These materials enable us to provide solutions.

It is a modern technology that has great effects on many sciences and industries, as it adds more applications and functions than its traditional counterparts, and it reduces cost and energy consumption that controlling these properties in creating new materials to complex problems in several areas, including the problems of buildings and facilities.[15].

Goals of green nanotechnology:

1. Producing nanomaterials without harming the environment or human health, and providing solutions to environmental problems in general, and architecture in particular, by integrating the principles of green chemistry. Chemical Green with nanomaterials used in buildings, and making its products non-toxic ingredients. Using less energy, renewable inputs where possible, and using sustainable thinking in the life cycle

in all stages of designing nanomaterials, and making them have the least impact on the environment. [16].

2. It includes products that benefit both the natural and the built environment, either directly or indirectly, and have the ability to clean hazardous waste sites, desalinate water, or treat pollutants.

The impact of nanotechnology :

Nano technique depends on her job of re-ranking atoms materials and of course, whenever the arrangement atomic to the article changes its characteristics resulting in Limit big with development in the properties of materials, nanomaterials showed a significant impact on the materials [17] used in construction as Table 2 show.

Research and studies have proven that traditional buildings have a significant impact on pollution and increased energy consumption, which affects the environment clearly, Fig. 2 shows the impact section built on the environment in the United States of America as indicated by Fig 2.

We find that building nanomaterials and finishes significantly reduce the resulting pollution and contribute clearly to reducing energy consumption. We will address this through the analysis and application of nanomaterials and study their impact on achieving sustainability.

Table 2.
Area the impact of nanotechnology on buildings

Nanotechnology in Architecture	Materials	**Structural materials**	**Non-structural materials Glass**
		Concrete	Glass
		Steel	Plastic
		Wood	Drywall
		New Materials	Roofing
	Protection	Filtration, Air purification Indoor air quality - Outdoor air purification	
		Coatings Self-cleaning - Antibacterial	
		Solar Energy	Reduction of Energy consumption: Lighting; Insulation; VIPS-Aerogel-Thin-film; PCMS
		Electronics / Sensors	
		Energy Production	

Source: Ahmed, Yousra Abdel-Aziz Fadl, Mona Mostafa El-Taher. Concepts and applications of sustainability in residential areas. Sudan University of Science and Technology, 2016.

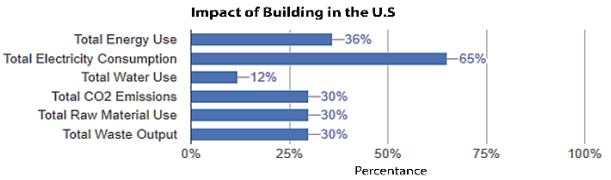

Figure 2. Shows impact of build on the environment USA
Source: [13] https://www.wbdg.org/design-objectives/sustainable

Table 3
The criteria and points of sustainability assessment show the buildings of the study cases.

Evaluation score	Evaluation points	Sustainability standards	
	The basic building system is energy efficient. Reducing emissions of carbon compounds and polluting gases. Reliance on renewable energy. the total	Energy and atmosphere 25%	Environmental criteria 82.5%
	Reliance on recyclable materials. Reuse of resources. Reliance on locally manufactured materials Use of materials with lower emissions the total	Building materials and resources 14%	
	Ventilation quality. Reducing the use of chemicals and sources of pollution Use daylight for flats Thermal comfort the total	Indoor environmental quality 18%	
	Water treatment technologies Waste water recycling Reduce water use the total	Water efficiency 14%	
	No negative impact on the external environment Waste management Rain water management the total	Site sustainability 11.5%	
	Rational consumption of ores and materials Reduce energy cost Reduce maintenance costs. Increasing the life span of the building the total	Standards economical 10%	
	Observance of aesthetic standards Provide convenience to the user Compatibility with modern architecture the total	The standards the social 7.5%	
	Total summation		

Source: Authors.2024

2.4 Analytical studies

Study methodology:

The research aims to: Clarify the impact and effectiveness of the integration of nanotechnology with sustainable architecture.

The application of green Nano architecture in buildings, which in turn leads to raising the efficiency and sustainability of buildings, through an analytical study of some proposed buildings that represent the architecture of the future, taking into account the principles of sustainable design using green nanotechnology.

Analysis and evaluation of selected projects through several points:

1. Building site.
2. Building activity.
3. Description of the building.
4. used nano applications.
5. Investigation unless Sustainability.
6. Evaluate the building using evaluation criteria.

Sustainability Assessment Criteria and Points Study Case Buildings

The Table 3 is the main table based on which the analysis and evaluation of the buildings selected.

Evaluation method:

Buildings will be evaluated with a sign indicating the average percentage to achieve each of the assessment points drawn from the building's description. The conclusion of the average percentage achievement of each standard; access to the final valuation of the building, according to Table 4.

Tablet 4.
Indcates levels of assessment of study case buildings

Unavailable	Weak	Good	Very good	Scales
—	○	◑	●	Code
0 %	1: 30%	30: 60%	60: 90%	Class

Source: Authors.2024.

A sustainable building without the use of nanomaterials

Bahrain Tower-Abu Dhabi

Building analysis:

Building site: Abu Dhabi city.

Construction activity: Administrative building.

Construction activity: Administrative building.

Architect: Aedas Architec.

Category: A building with a sustainable design without the use of nanotechnology.

Description of the building: Each tower contains 29 floors.

The first contains the headquarters of the Abu Dhabi Investment Council, and the second contains the main offices of Al Hilal Bank.

The designer was inspired by the design of the towers from the traditional "mashrabiya" that adorned the windows of traditional Arab houses since the century the14 as Fig. 3 shows.

This clever, geometric design of the mashrabiya provides both shade and privacy, while at the same time allowing for an enclosure external all the time.

Figure 3. Shows Bahrain Towers in Abu Dhabi.
Source: https://content.iospress.com/articles/journal-of-facade-design-and-engineering/fde0040

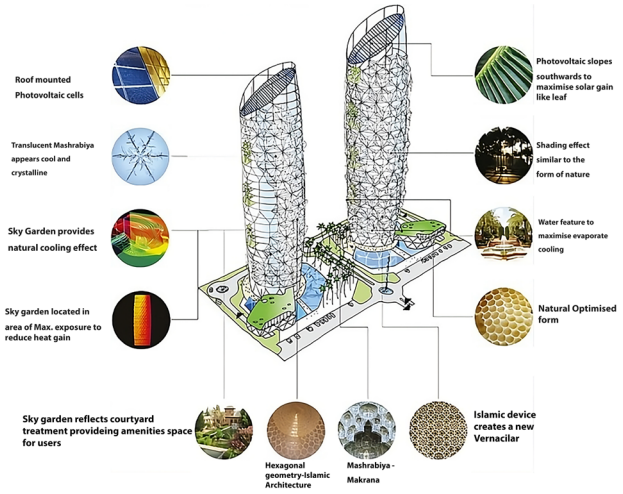

Figure 4: Demonstrates a dynamic Mashrabiya - inspired by the past is an adaptive natural system -Bahrain Towers in Abu Dhabi.
Source: https://content.iospress.com/articles/journal-of-facade-design-and-engineering/fde0040

- The external façade consists of 2,000 elements, all of which resemble the cells of palm tres as Fig. 5 shows.
- This dynamic mashrabiya opens and closes depending on the movement of the sun; which helps reduce heat inside the tower by 50% almost, thus saving a lot of electrical energy consumed by the air conditioner in the hot weather.

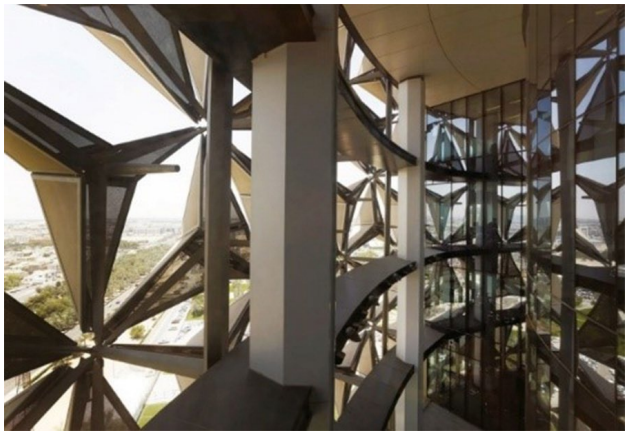

Figure 5: Shows the shape of the mashrabiya from the outside and the inside Source: https://content.iospress.com/articles/journal-of-facade-design-and-engineering/fde0040.

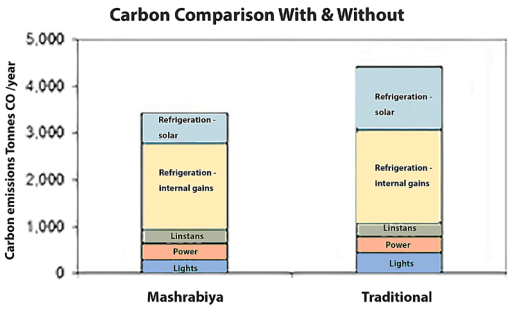

Figure 6. It shows a comparison between the percentage of carbon emissions and waste in the traditional case and the case of using the mashrabiya. Source: MUTEB ALAYAFI, Ahmed Mostafa. "Trends and challenges of smart facades technologies in buildings and the reality of their application in Saudi Arabia (Riyadh as a model) JES. Journal of Engineering Sciences, 50, 5, 2022, 263-283. DOI: 10.21608/jesaun.2022.136177.1134

Table 5.
The evaluation criteria and points are recommended for a Sustainability Bahrain Towers building–Abu Dhabi, Source: researche

Evaluation score	Evaluation points	Sustainability standards	
●	The basic building system is energy efficient.		
◑	Reducing emissions of carbon compounds and polluting gases.	Energy and atmosphere 25%	
◑	Reliance on renewable energy.		
◑	The total		
○	Reliance on recyclable materials.		
○	Reuse of resources.		
○	Reliance on locally manufactured materials	Building materials and resources 14%	
◑	Use of materials with lower emissions		
○	The total		
◑	Ventilation quality.		
◑	Reducing the use of chemicals and sources of pollution		
●	Use daylight for flats	Indoor environmental quality 18%	
●	Thermal comfort		
●	The total		
—	— Water treatment technologies		
—	Waste water recycling	Water efficiency 14%	
—	Reduce water use		
○	The total		
◑	No negative impact on the external environment		
○	Waste management	Site sustainability 11.5%	
—	Rainwater management		
○	the total		
◑	Rational consumption of ores and materials		
●	Reduce energy cost		
○	Reduce maintenance costs.	Standards economical 10%	
○	Increasing the life span of the building		
○	The total		
●	Observance of aesthetic standards		
●	Provide convenience to the user		
●	Compatibility with modern architecture	The standards the social 7.5%	
●	The total		
◑	**Total summation**		

Environmental criteria 82.5%

Source: Authors 2024.

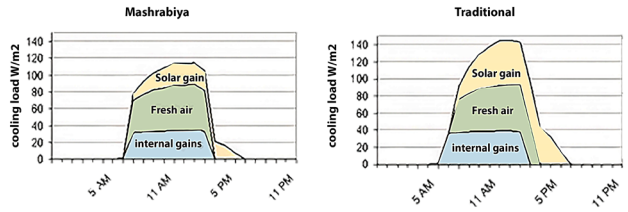

Figure 7. It shows a comparison between cooling in the traditional case and in the case of using the Mashrabiya.
Source: MUTEB ALAYAFI, Ahmed Mostafa. "Trends and challenges of smart facades technologies in buildings and the reality of their application in Saudi Arabia (Riyadh as a model) JES. Journal of Engineering Sciences, 50, 5, 2022, 263-283. DOI: 10.21608/jesaun.2022.136177.1134.

- The ability to provide shade for the building prompted the architects to dispense with the dark glass that obscures external light in all areas at times, and this.
- Worked to save the electricity consumed by lighting during the day.
- It will use a group of Solar panels on the roof to heat the water as Fig. 4 explain.

Nanotechnologies used:
There is no use of nanotechnologies.

Achievements the sustainability: The use of natural materials helped reduce material waste where the Reach rate waste to 30% about buildings, but the team managed the design from scale down level Waste by a large percentage where it came from 3% to 5% in this project as Fig. 6 shows.

Office workspaces have been isolated from the rest of the building, as the use of mashrabia has reduced the energy consumption of those spaces from both lighting loads and cooling loads by up to 50% which has helped to maintain thermal comfort within the building as Fig. 7 shows.

Use solar panels to participate in getting energy in the building, which is used for several purposes, including heating water.

Building evaluation criteria and points: The Table 5 is the main table to evaluation of the building.

<u>Commercial Bank headquarters–Comers Bank Headquarters - Germany</u>:

Building analysis:
Building site: Germany.
Construction activity: Office administrative building.
Architectural: a company Foster + Partners.
Category: A building with a sustainable design without the use of nanotechnology as Fig. 8 shows.

Description of the building: The horizontal projection of the tower in the form of a triangle contains three pillars; they are the office floors and a "trunk" formed by the full-height central courtyard a Fig. 9 shows.

- It applied the idea of gardens in the sky, and these gardens graduated in a spiral form along the tower.
- The gardens will be used to provide natural air to offices overlooking the central courtyard.

The gardens have trees from different vegetation areas, and the type of plants depends on the orientation of the garden where there are 5 gardens in each building.

Figure 8. Building Commercial Bank headquarters- Germany.
Source: Saad Fadi, Adel Al-Kurdi, Commercial Bank headquarters as one of the sustainable buildings, Arab Journal for Scientific Publishing, fourth issue, 2018.

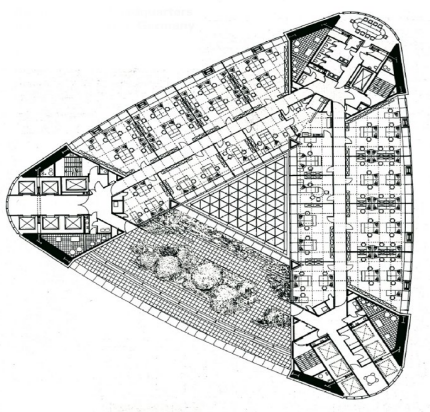

Figure 9. Shows a horizontal projection of the Commercial Bank - Germany
Source: Manghutay, Jalil Ghazaei. "The Design of Administrative Building Based on Climate Considerations: A Case Study in Khuzestan Engineering Systems Buildings." *European Online Journal of Natural and Social Sciences* 4 (2015): 397-407.

Figure 10. It shows the ventilation and lighting openings of the tower, the commercial headquarters bank –in Germany.
Source: Saad Fadi, Adel Al-Kurdi, Commercial Bank headquarters as one of the sustainable buildings, Arab Journal for Scientific Publishing, fourth issue, 2018.

- Building composed of 53 floors It is the tallest building in Europe.
- The design of the building was based on natural ventilation, with the use of mechanical assistance from air conditioners,

used only in harsh conditions. Ventilation and natural lighting are achieved through existing windows located in the perimeter of the building and are controlled using a central computer [22] as Fig. 10 shows.

Principles of green architecture realized in the building: The building was outstanding by applying the principles of green architecture.

1. The building was adopted in its design So that it responds to the direction of wind and solar energy, to ensure optimal ventilation and benefit from the maximum amount of daylight.
2. The triangle shape and central courtyard are designed to help create an area of negative pressure, which drives natural ventilation through the building.
3. The building is designed to be naturally ventilated for 60% of the year, with "sky gardens" allowing natural ventilation during seasons. This approach was expected to reduce energy consumption by up to 50% [23].
4. Provide cooling by cooled ceilings, while heating from ambient heat. The windows are connected to a system BMS to ensure that mechanical ventilation only operates when windows are closed. Where artificial lighting was connected to motion sensors and timers.
5. All wood used in the building is from managed sources. Facilities were provided to separate operational waste and compost waste.
6. Building performance: Studies have shown that the tower actually consumes 20% less energy than expected, and there has been an annual decrease in energy consumption. This is because building users have extended the period of natural ventilation to 85% compared to the 60% designed for i. [24].

Nanotechnologies used: It does not use nanotechnology.

Building Evaluation criteria and points: The Table 6 is the main table to evaluation of the building.

Table 6.
Showing the sustainability evaluation criteria and points of the headquarters building of the Commercial Bank – Germany.

Evaluation score	Evaluation points	Sustainability standards	
◑	The basic building system is energy efficient.	Energy and atmosphere 25%	Environmental criteria 82.5%
●	Reducing emissions of carbon compounds and polluting gases.		
●	Reliance on renewable energy.		
●	The total		
◑	Reliance on recyclable materials.	Building materials and resources 14%	
◑	Reuse of resources.		
○	Reliance on locally manufactured materials		
◑	Use of materials with lower emissions		
◑	The total		
●	Ventilation quality.	Indoor environmental quality 18%	
●	Reducing the use of chemicals and sources of pollution		
●	Use daylight for flats		
◑	Thermal comfort		
●	The total		
○	Water treatment technologies	Water efficiency 14%	
◑	Waste water recycling		
○	Reduce water use		
○	The total		
●	No negative impact on the external environment	Site sustainability 11.5%	
●	Waste management		
◑	Rainwater management		
●	The total		
●	Rational consumption of ores and materials	Standards economical 10%	
●	Reduce energy cost		
◑	Reduce maintenance costs.		
◑	Increasing the life span of the building		
◑	The total		
●	Observance of aesthetic standards	The standards the social 7.5%	
◑	Provide convenience to the user		
●	Compatibility with modern architecture		
●	The total		
◑	**Total summation**		

Source: Authers.2022.

So, the administrative buildings (the subject of the study) that achieve sustainability take a good evaluation in reaching a clean environment with less pollution and achieving comfort for users. Through study and research, we seek to increase production and save energy consumption in accordance with the aforementioned criteria.

As a result, and with the completion of research and studies that appeared recently and were conducted on nanomaterials, which showed their impact on architecture and construction significantly, some materials were tested in the laboratory and applied practically to see the extent of their impact on buildings and their impact on the surrounding environment to prove the validity of the hypothesis search.

Practical experience

Elements of the experiment:

Building bricks - Source of light and heat– Tin oxide nano powder – Resinous substance – Thermal imaging camera.

Experience Goal:

The main objective is to reach a highly transparent heat-insulating material and to conduct the tests necessary to ensure its health and to convert it into liquid material to facilitate its painting on the walls and to study its impact.

Equipment needed for the experiment:

1. Processing of brick molds and start making layers of whiteness (oysters) and paste (such as a founding plate) before placing the final paint of the material as Fig. 11 show.
2. The paint material was prepared in the laboratory by mixing both tin oxide powder and the resin using laboratory mixing devices, and making sure that the powder dissolved completely and turned into a liquid substance that is easy to Paint.
3. Ensure that the surface used to apply the material is clean to ensure correct results.

Steps of the experiment:

1. It was Applied a layer of insulating material for the external faces of the simulation room wall.
2. Using an ordinary lamp as a source of light and heat (simulated natural heat source).
3. Use the heat source to expose the external destination of the room for 6 hours continuously to ensure exposure to a large amount of heat.
4. Using a thermometer to measure from the heat emitted from the used source, measuring the temperature of the destination exposed to the source, and measuring the internal temperature of the wall as Fig. 12 shows.

Figure 11. Explain the stages of preparing the templates used in the experiment.
Source: Authors 2024.

The result of the experiment:

After several experiments and in different ways to use the material and paint it on the model used, and when measuring, it was found that there is a difference in degrees Celsius between the inside and the outside Fig. 13 shows the method of measuring temperature so, it can be used as a heat-insulating paint material, and it achieves good results in reducing energy consumption and achieving thermal comfort. Therefore, it can be used in the exterior paints of the building to give the highest thermal efficiency.

Figure 12. Shows exposing a room sample to lamp heat
Source: Authers .2024

Figure 13. Demonstrates the method of measuring temperature by practical experiment
Source: Authors .2024

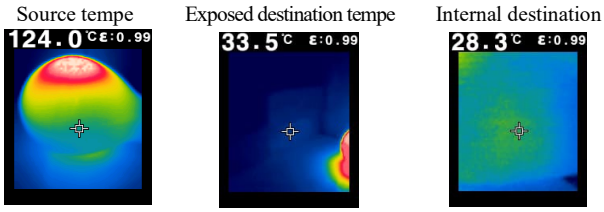

Figure 14: Show the temperature measurements resulting from the experiment.
Source: Authors 2024.

Measurements obtained from the experiment:

The temperatures were measured in the experiment as in Fig. 14. And by analyzing and studying the aforementioned buildings in

the research, when applying the heat insulating material (the subject of the experiment) on the external aspects of the building, it is expected to reduce the amount of heat entering and improve the internal environment of the building by 5.15%, according to the results of the preliminary experiment that was proven according to the mathematical equations calculated from the average temperatures external and internal / number of hours %, which helps greatly in reducing energy consumption in the building.

3 Results and discussions

Therefore, administrative buildings (the subject of the study) that achieve sustainability using nanomaterials are the best ever at reaching a pristine environment with less pollution and convenience for users, helping to increase production and save energy consumption.

The analytical study, according to the proposed assessment of sustainability criteria, showed that nanomaterials greatly improved the property of the building, giving an excellent assessment according to the standards, but that the building used for conventional materials that can preserve the environment has achieved a good assessment according to the standards, which demonstrates the validity of the research hypothesis.

4 Conclusion

Through a theoretical and analytical study of previous buildings, we have come up with:

1. Nanotechnology can be used to develop green architecture avoiding its side effects sunless human and environment; to achieve an integrated framework Sustainability from design, through the use of these materials in construction, to the safe disposal of Nano waste.
2. Nanotechnology has succeeded in showing impressive results practically and theoretically in achieving the principles of sustainability in buildings especially in the field of energy efficiency, material resource utilization, and air purification.
3. Nanotechnology is characterized by adding new properties to materials that help raise energy efficiency and extend the life span of the virtual building. It also works to increase durability and contributes significantly to the application of sustainable design principles.
4. The use of nanotechnology applications in the design process is a radical change in architectural thought, and it helps in the development of architecture and its compatibility with the requirements of the environment significantly.
5. Paying attention to the design of buildings using materials that preserve the health of the users of the building and achieving the concept of sustainability and economy in construction and maintenance.
6. The costs allocated to the building can be saved by recycling some materials or elements and increasing energy production instead of consuming it.

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