
# Building Sustainability according to Integral Theory and the Quadrant Analysis-Case study: Baghdad Municipality Building as an example

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ABSTRACT

The research examines the extent to which a building incorporates sustainability principles, by applying an integral theory. The research problem lies in the lack of clarity regarding the application of sustainability concepts in building design, within the framework of the proportional relationship between the building and nature. This resulted in buildings that are not compatible with nature and negatively impact the environment and climate. The research aims to study and analyze the building according to the integral theory and apply its four quadrants to the building, and to come up with indicators that determine the building's adoption of the sustainability initiative. The research process begins by examining the global trend towards sustainability, focusing on the impact of architecture on the environmental balance, and the resulting climate change, global warming, and negative effects on the environment. Then, the discussion moves on to the concept of unsustainable architecture, its depletion of resources and energy, and its negative impact on human health and well-being. Subsequently, the integral theory was applied on an administrative building in the capital city of Baghdad as an example, to determine how well the building actually implements the four quadrants of the theory in practice, and to come up with a final indicator of the building's level of sustainability.

**Keywords:** Integral Theory, Unsustainable Architecture, Sustainability.

## 1- Introduction:

Global trends toward sustainability and awareness of the importance of reducing the depletion of natural resources and minimizing pollution from manufacturing processes and environmentally unsound lifestyles have had a profound impact on architecture. Architects have thus been tasked with designing and constructing buildings that provide a suitable environment for occupants without negatively impacting the environment or human well-being, ensuring that the built environment is an integral part of the natural environment. Unfortunately, most cities are characterized by buildings isolated from the external environment, relying on industrial methods to enhance indoor environmental efficiency. Furthermore, transportation within buildings generates pollutants. It is noteworthy that the higher a city's economic level, the greater its pollution levels, negatively impacting rural areas and surrounding green spaces, and consequently harming biodiversity. This, coupled with excessive energy consumption, depletion of natural resources, and the waste and carbon emissions produced by buildings, threatens the natural environment and its ability to meet the needs of future generations and ensure the continuity of human settlements. Therefore, Ken Wilbur's Integral Theory came as a solution to test the extent to which buildings adopt sustainability requirements and

standards, and what standards must be available and conditions must be worked on in order for the building to rise to the level of integration with the ecosystem by positively taking advantage of climate data, and reducing the negative impact on the environment and biodiversity.

## 2. Research Methodology:

### 2.1 Research Problem:

The research problem lies in the lack of clarity regarding the application of sustainability concepts in building design, within the framework of the proportional relationship between the building and nature. This resulted in buildings that are not compatible with nature and negatively impact the environment and climate.

### 2.2 Research Goal:

Study and analyze the building according to the integral theory and apply its four quadrants to the building, and develop indicators that determine the building's adoption of the sustainability initiative.

### 2.3 Research Hypothesis:

Applying the integral theory on a building, to determine how well the building actually implements the four quadrants of the theory in practice, and to come up with a final indicator of the building's level of sustainability.

### 2.4 Research Method:

The research adopts an analytical, applied, and deductive approach. It presents and analyzes the reasons for the global trend toward sustainability, the proportional relationship between buildings and the environment, the concept of unsustainable architecture, and the importance of adopting sustainability concepts in buildings. It applies the integral theory on an administrative building as a model, leading to the final indicator of the building's adoption of the sustainability initiative.

### 2.5 Research Structure:

The research comprises two main axes. **The first axis** focuses on the theoretical aspects, analyzing the reasons behind the global trend towards sustainability, examining the impact of architecture on the ecological balance, and exploring the resulting climate change, global warming, and negative environmental effects. It then delves into the concept of "unsustainable architecture," its depletion of resources and energy, and its detrimental effects on human health and well-being. **The second axis** addresses the practical application of the Integral Theory on an administrative building in the capital city of Baghdad as a case study, to determine how well the building actually implements the four quadrants of the theory in practice, and to come up with a final indicator of the building's level of sustainability.

## 3. The driving forces behind the global trend towards sustainability:

Buildings and the built environment in general have an impact on the natural environment and the ecosystem. Building design often fails to consider the impact of buildings on the depletion of natural resources and energy consumption. This has led to a global trend towards sustainability, with increasing emphasis on defining its concepts and principles, and on how this sustainability approach has influenced building design, construction, and operation. Some of the most important reasons or factors behind this trend are:

### 3.1 The Impact of Architecture on Environmental Balance:

An ecosystem is defined as an environmental unit composed of living and non-living organisms that exist in a specific place and interact with each other according to a balanced and dynamic system that continues to perform its role in supporting life (**Waziri, 2003, p.74**). The environment is not constant

due to this continuous interaction, and any change in any environmental factor may lead to a change in other factors. If the change is profound, it may lead to confusion in the ecosystem and the inability to achieve balance except after a long period of time. (**Al-Hamd & Sabarini, 1979, p.83**). The ecosystem consists of four components (**Waziri, 2003, p.74**):

**First - Living (Productive) Components:** represented by plants, as they are living, productive organisms.

**Second - Living Components (Consumers):** These are living organisms that depend on other organisms for their food and are therefore classified as (consumers).

**Third - Non-living Components (Constants):** They are classified as (constants) because they represent the basic components of life (water, air, soil, sunlight, rocks, minerals, etc.).

**Fourth - Living Decomposers:** These are microscopic organisms that break down and decompose organic materials.

Humans are the ones who caused the most changes to the ecosystems as a result of (population explosion - consumption of natural resources - pollution), which caused confusion and deterioration of the ecosystem (**Al-Hamad & Sabarini,1979, p.111**). The increase in population has led to industrial progress and uncontrolled development, which has caused pollution of water, air and land, and has become a reality of life in the modern era (**Al-Talibi, 2009, p.1**). Although modern architecture has made life easier and more comfortable for humans, its construction and occupancy have caused environmental damage that threatens the suitability of planet Earth for living organisms (**Waziri, 2003, p.13**). Poverty itself has destroyed the environment, because the poor and hungry destroy their environment through their struggle for survival by cutting down forests, exhausting pastures with livestock, depleting vulnerable areas, and crowding in large numbers into crowded cities, which has made poverty in itself a global catastrophe (**World Commission on Environment and Development, 1989, p.53**).

**We conclude from the above:**

The impact of architecture on the environment is significant due to the long lifespan of the building, which ranges from 50 to 100 years. Therefore, it must be taken into consideration that a building constructed at the present time may operate in environmental conditions that differ from those of today **(Edward, 2010, p.7)**, Today's natural environment may differ from tomorrow's, and the accumulation of these buildings in a particular location may result in rising temperatures, in addition to the environmental impact of air and water pollution and resource scarcity. This will lead to the failure of the interrelationship between the built environment and the natural environment.

**3-2 Climate Change:**

Building accumulation leads to climate change (**Smith, 2005, p.2**), One of the most important challenges facing the modern world is the rise in the Earth's surface temperature due to the negative impact of buildings and human activities, which leads to a group of natural phenomena that have repercussions on the built environment and humans (**AlMaktoum, 2008, p.2**).

This growing awareness of the negative impact of human and built environment on climate change has put pressure on high-carbon producing sectors to reduce their greenhouse gas emissions **(Al-Sayyid & Fayyad, 2011, p.114)**, After the increase in the amount of carbon dioxide in the atmosphere during the last century as a result of the use of fossil fuels in addition to other factors related to the increase in population numbers, increased consumption and change in land use (**Wong&Chan, 2005, p.1064**). Therefore, reducing carbon dioxide emissions is an inevitable trend to avoid a major disruption in the global climate, especially after the latest forecasts that indicated an increase in temperatures by (1.8 - 4.0 °C) by the end of the current century (**AlMaktoum, 2008, p.2)** Which could cause devastating climate change in some parts of the world (**Wong&Chan, 2005, p.1064**).

**We conclude from the above:**

To avoid potentially dire consequences, governments around the world have sought to develop ambitious plans to address climate change and reduce the damage caused by the built environment to the ecosystem and the natural environment **(Al-Sayyid & Fayyad, 2011, p.114)**, This is achieved by reducing the negative impact of buildings on nature by reducing energy consumption, lowering carbon emissions, and making positive use of climate data.

**3-3 Unsustainable Architecture:**

We must reconsider the design style of buildings and the modern city, and take a careful look to understand the impact of the built environment on both human health and the natural environment and its biological system. Human society needs awareness to open the fields of perception and understanding of how the natural ecosystem supports human settlements. If we want to continue to benefit from this environment and its vital role in serving humanity, it must be cared for, maintained, and work must be done to raise its efficiency and capacity to ensure its sustainability. In general, it is noted that unsustainable architecture is characterized by three characteristics (**Waziri, 2003, p.35-36**):

**First** - Waste in energy use and consumption of natural resources.

**Second** - The negative impact on the ecosystem.

**Third:** Negative impact on human health.

**First - Waste in energy use and consumption of natural resources:**

One of the biggest problems facing our contemporary world is the misuse of natural resources, the waste of their basic components, and the impact this has on the environment. (**World Commission on Environment and Development, 1989, p.7**). Misuse of natural resources can be defined as: reducing the resource or its disappearance from performing its functional role in the system of life and the environment (**Khurufa, 2006, p.152**).

The consumption of natural resources is a major factor in influencing the environment, as development in technology depends primarily on the depletion of raw materials and energy, which in turn causes a large percentage of pollution (**World Commission on Environment and Development, 1989, p.57**) Which causes tremendous pressure on the environment and a negative impact on the ecosystem due to the depletion and disappearance of these materials from nature (**Talbi & Sahel, 2008, p. 202**).

The process of consuming resources from nature is characterized by being a linear process that takes resources from one place and invests them in another place without taking into account the recycling of these materials, and the resulting side effects are represented by pollution and the reduction of vegetation cover, which leads to desertification (**Waziri, 2003, p.38**), Soil erosion, impact on terrestrial and marine organisms, and depletion of energy resources (**Talbi & Sahel, 2008, p.202**), Reducing the ozone layer in the atmosphere, which causes exposure to a large percentage of radiation and an increase in temperature (**Waziri, 2003, p.38**).

These materials are used in the construction of the building, and the building's efficiency and impact on the surrounding environment are reflected through the materials from which it was constructed, and the energy allocated to extracting, transporting, shaping, manufacturing, and using these materials in construction. The use of some building materials consumes more energy than other materials, which is a form of energy depletion and waste, and thus negatively impacts the environment (**Binggeli, 2003, p.19-20**).

**Second: The Negative Impact on the Ecosystem:**

Humans are one of the most important creatures living on the surface of the Earth and consuming resources in nature. If they interfere with the environmental balance without awareness or thought, this balance will be disturbed. The Stockholm Conference in 1972 AD pointed to the relationship between human activities and changes occurring in the natural environment, and environmental

pollution was defined as: the interference of human activity with the resources and energies present in nature, which negatively affects its sustainability (**Islam, 1990, p.12**).

Recent progress in the fields of industry, transportation, communications and construction has relied primarily on the depletion of natural resources and the rapid consumption of energy, which has also led to the emergence of new chemical substances that did not exist in nature (**Islam, 1990, p.14**), Gases emitted from inside buildings, in addition to those emitted by factories, cause air pollution and acid rain, in addition to waste that pollutes the water cover (**Table 1**), (**Vallero&Brasier, 2008, p.272**).

**Table 1:** Global Building Pollution Estimation Table (Built Environment)
**(Reference: Edwards, 2010, p.ix)**

| No. | Global Building Pollution Estimation | |
|---|---|---|
| | Pollution | Percentage (%) |
| 1 | Air Quality | 23 |
| 2 | Greenhouse Gases | 50 |
| 3 | Drinking Water Pollution | 40 |
| 4 | Landfill | 50 |
| 5 | Ozone Layer Thinning | 50 |

Man's immersion in modern technology has caused an imbalance in the environment, resulting in air, water and soil pollution (**Islam, 1990, p.15**), This was facilitated by the increase in population and the growth of the built environment represented by cities at the expense of the natural environment, which led to a reduction in vegetation cover, air pollution, and an increase in waste. Human life has begun to affect the environment, which requires the development of strategies and solutions that reduce this impact and direct it in the desired direction (**Sebestyen, 2003, p.131**).

**Third: Negative Impact on Human Health:**

Humanity's efforts to create more efficient and thermally comfortable buildings have resulted in buildings that do not breathe and that do not allow air to flow from the outside due to the use of central heating systems, double glazing on facades, and tightly closed doors. Due to these improvements, pollutants have accumulated inside buildings, negatively affecting human health (**Emmit, 2002, p.101**).

Pollution may be caused by interior finishing materials or furniture, in addition to air conditioning units that cause people to breathe the same air for hours on end without interruption. Recent studies have also proven that exposure to artificial lighting for long periods and the lack of natural lighting negatively affects human health and comfort (**Al-Sawat, 2005, p.3**), As a result, the occupants of these buildings began to feel uncomfortable, tired and sick, which in turn had an economic impact due to decreased production and increased treatment costs (**Emmit, 2002, p.100**).

**We conclude from the above:**

Building construction consumes natural resources and depletes the energy needed to extract, transport, and utilize these resources for construction. Humans' obsession with technology and their interference with natural energies and resources negatively impacts their sustainability. Modern buildings that lack natural lighting and ventilation negatively impact human health and comfort.

## 4- Integral Theory:

### 4-1 The concept of the Integral Theory:

It is a theory developed by Ken Wilber to unify a large number of theories and fields into a single integrative theory that aims to shed light on how different branches of human knowledge can

complement and support each other (**Visser&Wilber, 2003, p.229**). Wilber presents this theory within a four-quadrant framework within the context of sustainability. These four quadrants represent lenses that help us better understand any occurrence and reveal the dynamics and forces in the interiors and exteriors of individuals and collectives, ultimately providing a comprehensive map of psychology, behavior, culture, and systems. The quadrants can be used in three key ways for sustainability (**Brown, 2009, p.2)**:

- Organizing sustainability information.
- Diagnosing the challenges facing sustainability initiatives.
- Prescribe an integrated solution that accounts all the major dynamics at play.

**4-2 The Quadrants: Four Perspectives for Better Understanding Sustainability:**

The four quadrants are essentially four lenses (**Fig.1**), and each quadrant represents one global perspective. When combined, they help us look holistically at a sustainability initiative and identify most, if not all, of the key forces that influence the success or failure of that initiative. This reflects the importance of conducting a SWOT analysis of a building, in order to get a very comprehensive picture of all the dynamics that play a role in the success or failure of this project (**Brown, 2009, p.4**).

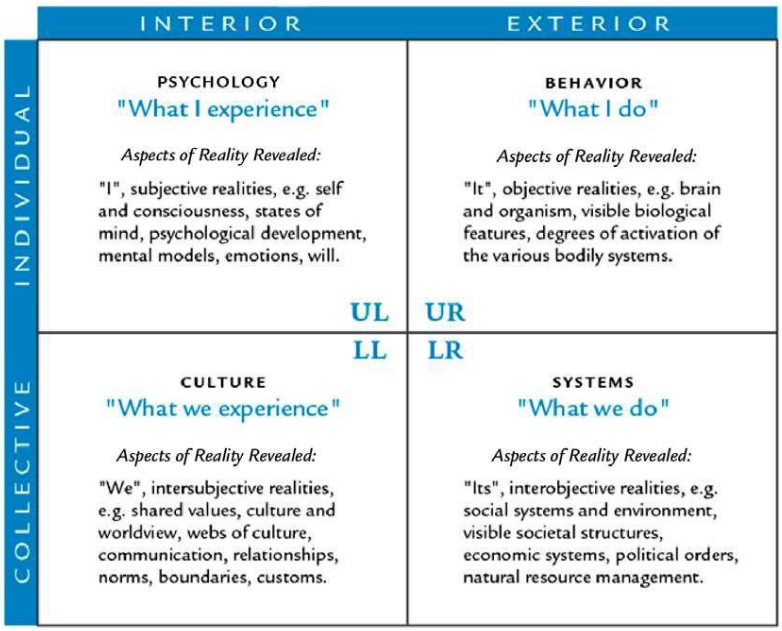


**Figure 1:** The four quadrants map represents universal lenses through which you can analyze and evaluate a building. (**Reference: Brown, 2009, p.5**)

In **Figure (1):** The first quadrant (top left) refers to the perspective of "**I**", the perspective of (**Experience and Expertise**), the second quadrant (top right) refers to the perspective of "**It**", the perspective of (**Behavior**), the third quadrant (bottom right) refers to what "**It has**", the systems surrounding us, and the fourth quadrant (bottom left) refers to the perspective of "**We**", the perspective of (**Relations and Culture**) (**Brown, 2009, p.10**). By applying these four quadrants to a specific building and highlighting the workforce that contributes to the sustainability initiative in that building, we can determine whether the building is adopting sustainability or not.

**4-3 Applying the Integral Theory to one of the administrative buildings (Baghdad Municipality building as a model):**

**4-3-1 UL "I" Quadrant (Experience and Expertise):**

In this quarter, the C.V. of the architect who designed the building will be reviewed (which will constitute the largest proportion of the first quarter and will be evaluated at 70%), and his design idea will be discussed (which will constitute the smallest proportion and will be evaluated at 30%) through analyzing the facade of the building mentioned above, arriving at the final conclusion and determining

the final percentage of the extent to which the first quarter (**I**) which represents (**Experience & Expertise**) has been achieved.

**4-3-1-1 Biography of architect Hisham Munir:**

Hisham Munir is an Iraqi architect born in 1930. After completing his studies at the American University of Beirut, he studied architecture at the University of Texas (Austin, Texas), graduating in 1953. He founded Hisham Munir and Partners in 1959 and collaborated with the TAC office, founded by Walter Gropius. The office has won numerous awards and designed and implemented numerous important buildings in Iraq and the Gulf states. These projects ranged in scope, including administrative, residential, educational, healthcare, and recreational buildings, as well as transportation facilities (**Fig.2**), among others. Urban development and urban planning projects have also been featured in the office's projects. Hisham Munir is one of the founders of the Department of Architecture at the University of Baghdad in 1959, becoming a professor there since its inception and head between 1968 and 1972. He has also participated in international consulting firms and currently resides in the United States (**Al Chalabi, 2018, p.309**).

**Figure 2:** Shows part of the works of architect Hisham Munir in Baghdad.
**(Photographed by the researcher)**

**<u>We conclude from the above:</u>**

The first indicator, which represents the architect's CV, was achieved at a rate of (**60/70**) because it covered the academic and professional aspects of the architect and did not cover all aspects of life.

**4-3-1-2 The design concept of the Baghdad Municipality building:**

The building gives us an expression of postmodernism, borrowing traditional treatment forms to give an authoritarian touch of identity and legitimacy to the building, as well as being surrounded by a complete set of protruding partitions that are decorated with an abstract arch inspired by the Abbasid arch (**Fig.3**), (**Al-Jalabi,2018, p.406**).

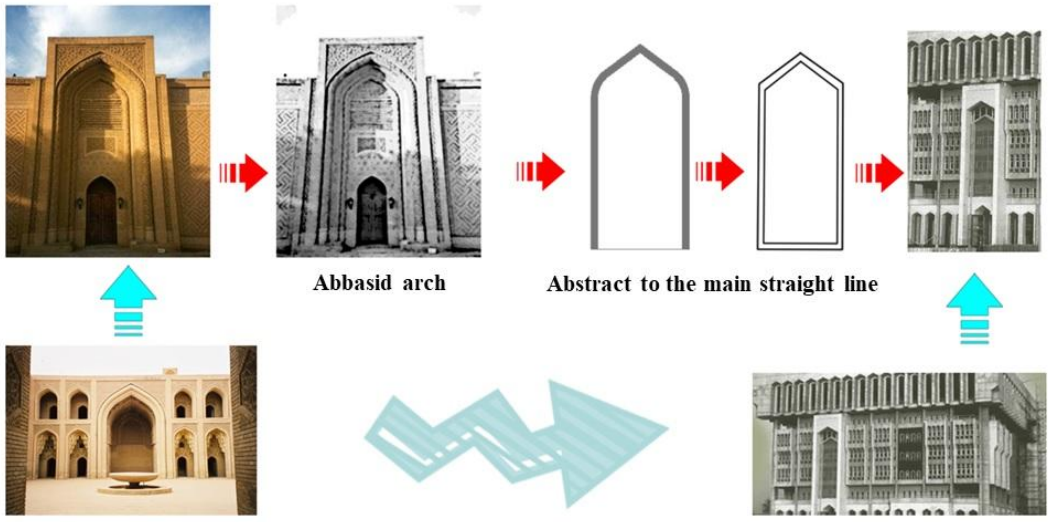

**Figure 3:** The basic idea of designing the facade details. **(Researcher's analysis)**

The building consists horizontally of three main parts (**Al-Jalabi,2018, p.406**):

**First - The base:** A corridor around the base of the building rises to two floors, and is built of local bricks, reflecting the aesthetics of heritage.

**Second - The building's body:** An architectural block consisting of five floors. The first and fifth floors appear as a partition, separating the building's body from the base and crown.

**Third - The Crown:** It was built from grey concrete, and appears as a dominant mass engraved with arches to give us a stunning finish (**Fig.4**).

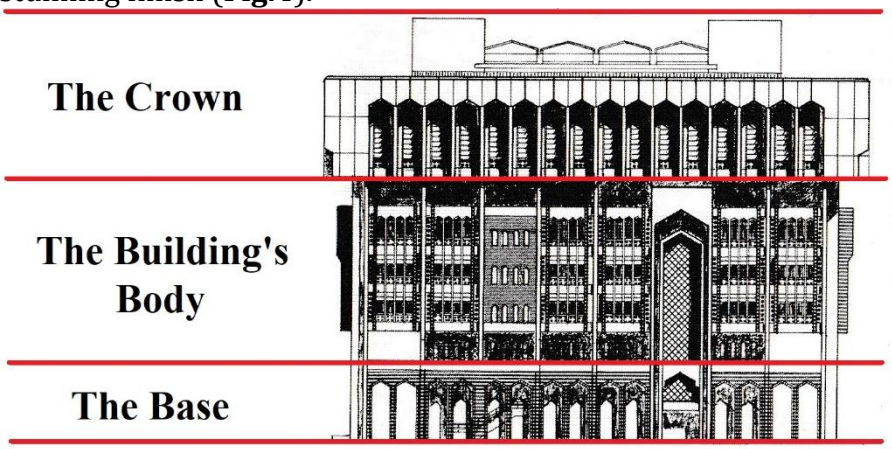


**Figure 4:** The vertical division shows us the main entrance to the building shown in elevation, clear and dominant from base to crown. **(Reference: Al-Jalabi, 2018, p.406)**

**We conclude from the above:**

The second indicator, representing the architect's design concept, was achieved at a rate of (**27/30**), as it covered the formal aspect of the building and did not fully cover the operational and functional aspects.

By combining the percentages for the first and second indicators (architect's biography and design concept), we conclude that the first quadrant (**I**), representing (**Experience & Expertise**), was achieved at a rate of **87%** (**Table 2**).

**Table 2:** The percentage of achievement of the first and second indicators and the total and final percentage of achievement of the first quarter **(I). (By the researcher)**

| No. | Integral Theory | | | Percentage | Per% |
|---|---|---|---|---|---|
| 1 | "I" 100% | 70% | Architect's C.V. | 60% | 87% |
| | | 30% | The Design Concept | 27% | |

**4-3-2 UR "It" Quadrant (Behavior):**

In this quarter, everything related to the building will be reviewed, from design and planning (which will be evaluated at 40%), to the efficiency of using building materials (which will be evaluated at 30%), and the efficiency of using water (which will be evaluated at 30%), through a complete analysis of the building and determining the final percentage of the extent to which the second quarter (It) which represents (Behavior) has been achieved.

**4-3-2-1 Design of the Baghdad Municipality building, Al-Uwayna, Baghdad, 1978:**

The building remains intact despite not undergoing full maintenance for decades. The choice of building materials has proven to be sound despite the successive effects of climate throughout the year. The location within the green space was a comprehensive design model for what sustainable

architecture can be, in addition to the effort to coordinate open spaces. The Baghdad Municipality building presents the recipient with the concept of identity and heritage through the modest size of the building mass (the ground floor is for commercial purposes, and three upper floors are for offices). The building employed well-known and widespread local building materials, such as brick and concrete, which facilitated the translation of the designer's ideas into reality. This can be seen through the simplicity of the design treatments in the building, the use of arches in the facade, and the lack of cladding of concrete blocks (**Fig.5**). The building is one of the buildings that demonstrates the architect's ability to reinvent the urban landscape of Baghdad and enrich it with prominent design models (**Baghdad Municipality, 2018**).

**Figure 5:** Shows the design treatments and the concrete display on the façade.
**(Photographed by the researcher)**

**4-3-2-2 Building plans:**

Regarding the building's floor plan design, we note a high degree of flexibility. The structure is distributed in a way that ensures a free distribution of functions between the different floors, accommodating all employees and internal activities (**Fig.6**). This is in addition to the spaces surrounding the central courtyard, which is surrounded by a corridor, the gathering area, vertical movement, and openness to the outside. Furthermore, the secondary internal openings, the facade design style, and the width of the corridors add vitality to the user experience and the spacing of the spaces (**By the researcher**).

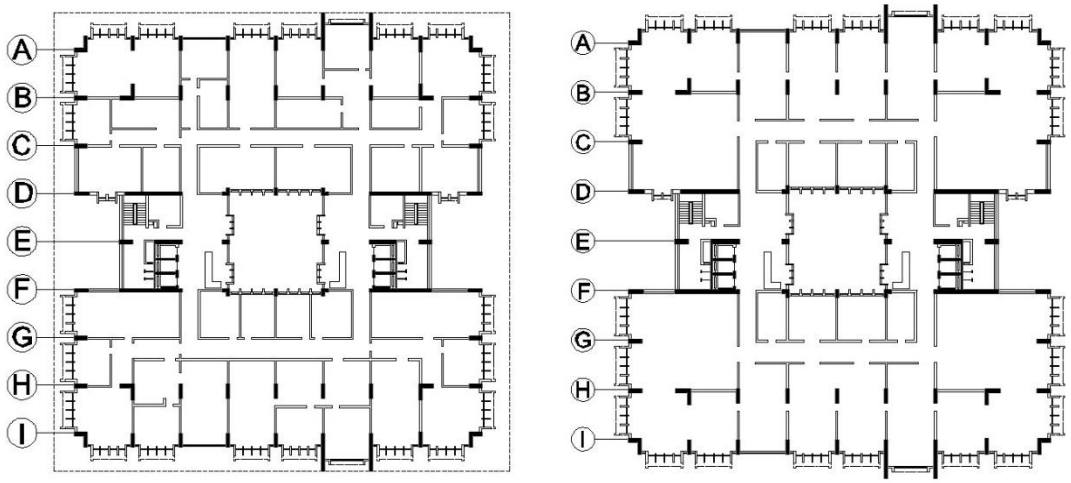


**Figure 6:** The third (left) and fourth (right) floor plans show the flexibility of distributing the structural system to accommodate all internal functions and activities**. (By the researcher)**

The section of the building also shows us complete integration with the plans, and careful attention to the openness between the inner courtyard and the outer facade, in addition to the vertical movement axes (**Fig.7**). The upper part of the building is surrounded by a crown-shaped concrete curtain, which enhances the shading of the lower floors and provides protection from direct solar radiation (**By the researcher**).

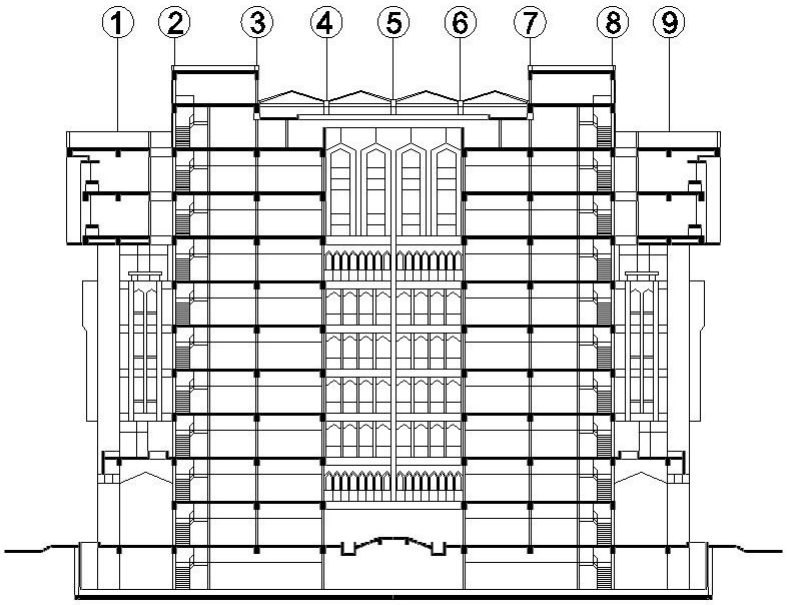


**Figure 7:** A section of the building showing the axes of vertical movement and openness between the interior and exterior, and details of the concrete curtain**. (By the researcher)**

**4-3-2-3 Material and water use efficiency:**

Environmentally available local materials were adopted, using local bricks and concrete to form the facades and frame the glass windows. We also note the optimal use of local materials aesthetically and functionally, as they work through their high quality as sound and heat insulating materials that work to disperse direct sunlight, allowing only the required light to enter the building to achieve internal thermal comfort (**Fig.8**). As for the efficiency of water use only, it was limited to using water as a fountain in the central courtyard of the building, which contributes to moderating and raising the efficiency of the indoor air (**Fig.9**). However, no initiative was observed in the building design to use rainwater, recycle water use in the building, or reuse water to irrigate crops (**By the researcher**).

**Figure 8:** (Left) Employing local materials aesthetically and functionally. Figure 9: (Right) Efficient water utilization in the central courtyard of the building. **(By the researcher)**

**We conclude from the above:**

The first indicator, which represents the design and planning of the Capital Municipality building, was achieved at a rate of (**35/40**) as it covered design, planning, aesthetic and functional aspects. The second indicator, which represents the efficiency of using materials, was achieved at a rate of (**28/30**), and the third indicator, which represents the efficiency of using water, was achieved at a rate of (**15/30**) as it was limited to a fountain in the central courtyard without covering other functional aspects of water. By adding the percentages of the three indicators (design, planning, efficiency of using materials and water), we conclude that the second quarter (**It**), which represents (**Behavior**), was achieved at a rate of **78%** (**Table 3**).

**Table 3:** The percentage of achievement of the three indicators and the total and final percentage of achievement of the second quarter (it). **(By the researcher)**

| No. | Integral Theory | | | Percentage | Per% |
|---|---|---|---|---|---|
| 2 | "It" 100% | 40% | Design & Planning | 35% | 78% |
| | | 30% | Materials Efficiency | 28% | |
| | | 30% | Water Efficiency | 15% | |

**4-3-3 LR "It's" Quadrant (Systems Surrounding Us):**

In this quarter, the building's suitability to the site and surrounding fabric will be discussed (which will be evaluated at 30%), the building's internal environmental efficiency (which will be evaluated at 40%), the building's analysis as an ecosystem (which will be evaluated at 15%), and the building's evaluation as a living building (which will be evaluated at 15%), leading to the final percentage of the achievement of the third quarter (**It has**), which represents (**Systems Surrounding Us**).

**4-3-3-1 The building's suitability to the site and the surrounding fabric:**

If we look at the design model for the Capital Municipality building site and what was actually implemented, we notice a significant gap between planning and implementation (**Fig.10**). In the proposed model, we find an integrated design for several buildings, while most of these buildings were never built. Rather, implementation was limited to only three buildings, one of which was the Baghdad Municipality building. It can be noted that the site is surrounded by a traditional fabric, with the municipality building appearing as a massive block amidst this fabric. However, the design takes into account the spaciousness of the site's floor area to accommodate the building's massiveness. (**Baghdad Municipality, 2018**).

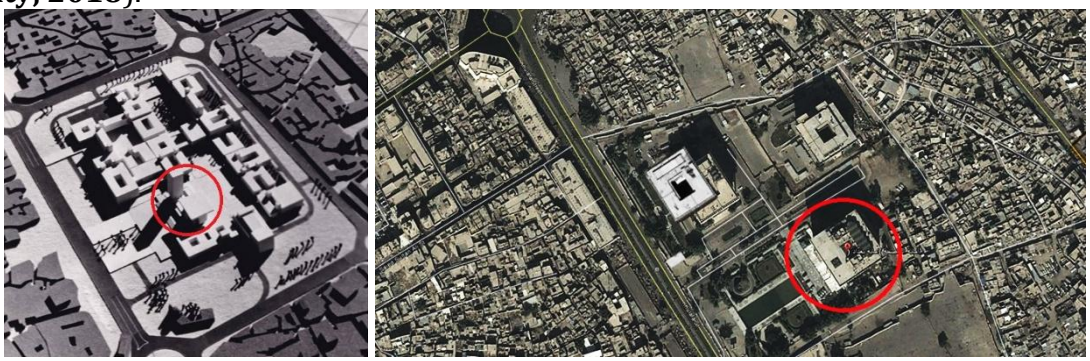

**Figure 10:** (on the left) a design model for the Baghdad Municipality building site, and (on the right) what was implemented on the ground**. (Al Chalabi, 2018, p.407)**

The three-building complex is aligned with the design of the green spaces, providing each building with a wonderful view. The site was also planned (**Fig.11**) to ensure that all means of transportation can reach any point closest to the building (**Baghdad Municipality, 2018**).

**Figure 11:** Landscape design and site planning. **(Al Chalabi, 2018, p. 407)**

The building's high efficiency is also attributed to its correct orientation towards the northwest of the horizon (**Fig.12**), which made the building oriented towards the prevailing winds, thus achieving the highest level of natural ventilation in addition to achieving appropriate lighting for the interior spaces (**By the researcher**).

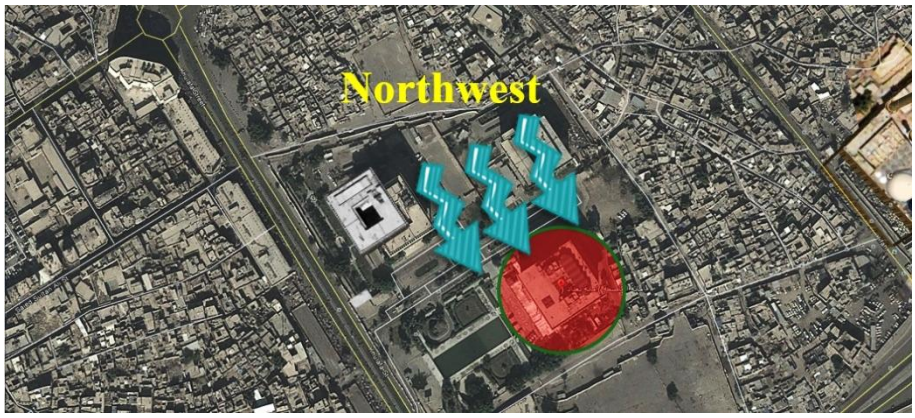


**Figure 12:** Orientation of the Baghdad Municipality building and wind movement. **(By the researcher)**

**4-3-3-2 Efficiency of the building's internal environment:**

We notice from the building plans (**Fig.13**) a high degree of clarity in defining the entrances and the distribution between the spaces with clear and direct passages, which leads to the presence of a type of nodes that represent joints for placing the vertical movement (elevators and stairs) that connect the floors. We can also notice that the largest part of the functional spaces opens with views to the outside, while the smaller functional spaces open with views of the building's inner courtyard (**By the researcher**).

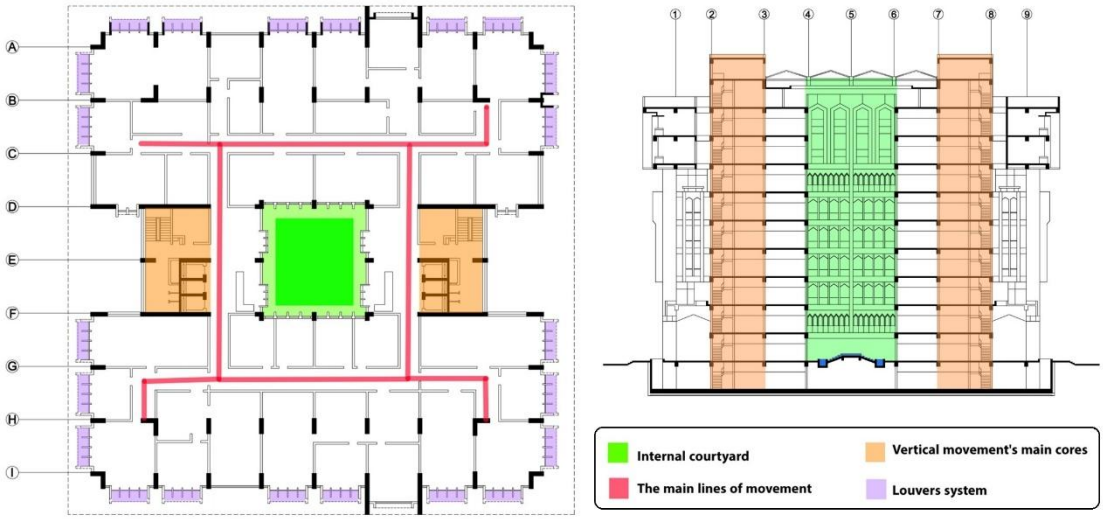


**Figure 13:** A plan and section of the Baghdad Municipality building showing the orientation of the building spaces and the vertical movement nodes for moving between floors. **(By the researcher)**

**4-3-3-3 The building as an ecosystem:**

It was also noted that there was an integrated structural system resembling a shell that enveloped the building and treated the facades in a way that reduced the impact of direct solar radiation, thus giving the building's exterior a local character and an ideal fit with the site's climatic conditions (**Fig.14**). As for the building's internal ventilation system, it was never rehabilitated, and this was the main reason for using air conditioning units instead of distorting the building's appearance (**By the researcher**).

**Figure 14:** Treatment of external facades, reducing the effect of direct solar radiation, and the internal ventilation system**. (By the researcher)**

**4-3-3-4 Evaluating the building as a living building:**

Inside the building, there is a central courtyard open to the top, with a fountain in the middle and surrounded by internal spaces. It acts as a lung for the building, constantly renewing the internal air (**Fig.9**). It also provides suitable lighting for the spaces overlooking it (**Fig.15**) in order to create better internal thermal comfort (**By the researcher**).

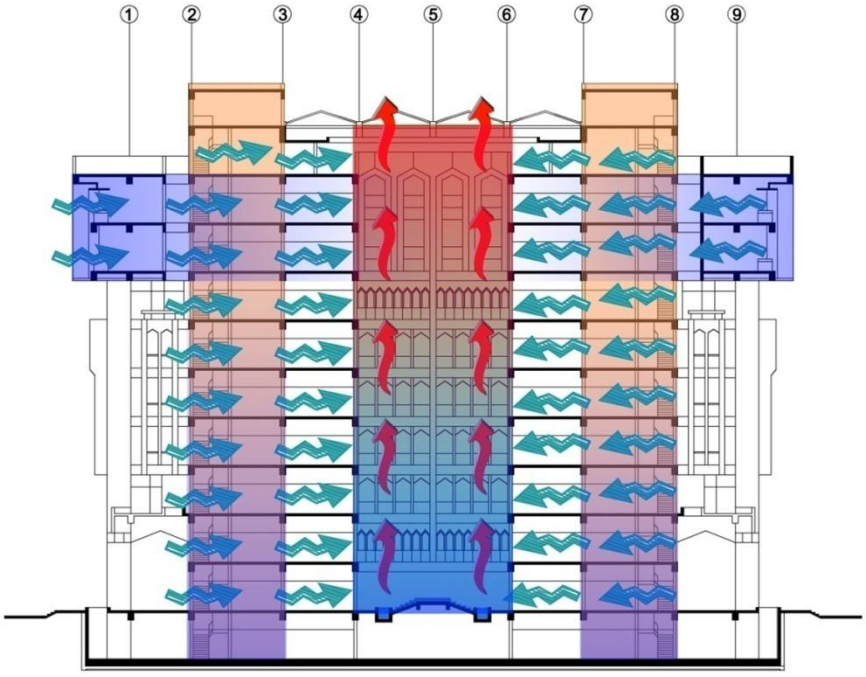


**Figure 15:** The central courtyard and its role in activating internal ventilation and achieving thermal comfort in the building. **(By the researcher)**

**We conclude from the above:**

The **first** indicator, which represents the building's suitability to the site and the surrounding fabric, was achieved at a rate of (**25/30**) due to the massiveness of the building's mass, which was reduced by the site's area capacity. This massiveness came as a result of the fact that the proposed basic design for the site included several buildings of the same scale, most of which were not implemented on the ground, except for three buildings, one of which was the Baghdad Municipality building. The **second** indicator, which represents the efficiency of the building's internal environment, was achieved at a rate of (**38/40**) due to the superiority of the plans in distributing the structural system and spaces and achieving equal views of all spaces towards the inside and outside. The **third** indicator, which represents the building as an environmental system, was achieved at a rate of (**11/15**) due to the lack of rehabilitation of the building's internal ventilation system and the use of air conditioning units as an alternative solution, despite the building being protected from the outside with a shell that reduces the effect of direct solar radiation. The **fourth** indicator, which represents the building's evaluation as a living building, was achieved at a rate of (**8/15**) due to the fact that the central courtyard of the building was designed to work as a lung that supplies the building with the necessary natural lighting and ventilation, but it was not rehabilitated to function as required, and the use of air conditioning units and artificial lighting continues as an alternative solution (**By the researcher**).

By adding the percentages of the four indicators, we conclude that the third quarter (**It has**), which represents (**Systems Surrounding Us**), was achieved at a rate of 82% (**Table 4**).

**Table 4:** The percentage of achievement of the four indicators and the total and final percentage of achievement of the third quarter (It has). **(By the researcher)**

| No. | Integral Theory | | | Percentage | Per % |
|---|---|---|---|---|---|
| 3 | "It has" 100% | 30 % | Fitness to site & context | 25% | 82% |
| | | 40 % | Efficiency of internal environment | 38% | |

| | | | | | |
|---|---|---|---|---|---|
| | | 15 % | Building as an ecosystem | 11% | |
| | | 15 % | Living building | 8% | |

**4-3-4 LL "We" Quadrant (Relations & Culture):**

In the fourth quarter, a questionnaire will be prepared that includes twenty questions to obtain the public opinion of the building's reviewers or users. Each question will be evaluated at (5%) if it is fully achieved, at (2%) if it is partially achieved, and at (0%) if it is not achieved. The evaluations will be collected to conclude the final percentage of the extent to which the fourth quarter (**We**) has been achieved, which represents (**Relations & Culture**). The questionnaire's evaluations were generally as in (**Table 5**).

**Table 3:** The percentage of achievement of the three indicators and the total and final percentage of achievement of the second quarter (it). **(By the researcher)**

| No. | Variables | Status | | | Points 5% |
|---|---|---|---|---|---|
| | | Achieved | Semi-Achieved | Not Achieved | |
| 1 | Harmony with the climatic environment | ✓ | | | 5 |
| 2 | Harmony with the social environment | ✓ | | | 5 |
| 3 | Easy access to the project site | ✓ | | | 5 |
| 4 | Responding to cultural and social influences | ✓ | | | 5 |
| 5 | Creativity and design aesthetics | ✓ | | | 5 |
| 6 | Efficiency of service systems & infrastructure | | | ✓ | 0 |
| 7 | Meeting functional requirements of the users | | ✓ | | 2 |
| 8 | Efficiency of solar radiation & ventilation | | ✓ | | 2 |
| 9 | Compatibility with the spirit of the times | | | ✓ | 0 |
| 10 | Energy efficiency | | | ✓ | 0 |
| 11 | Expression and building function | ✓ | | | 5 |
| 12 | The use of local materials | ✓ | | | 5 |
| 13 | Efficiency of the internal environment | | ✓ | | 2 |
| 14 | Water efficiency | | | ✓ | 0 |
| 15 | Use of renewable energy technologies | | | ✓ | 0 |
| 16 | Harmony with the site | | ✓ | | 2 |
| 17 | Considering construction's economic aspect | | | ✓ | 0 |
| 18 | Building ability to resist the time factor | | | ✓ | 0 |

| | | | | | |
|---|---|---|---|---|---|
| **19** | Compatibility for increasing variable needs | | | ✓ | 0 |
| **20** | Functionality modification & materials recycling | | ✓ | | 2 |
| **Final evaluation** | | | | | **45%** |

**We conclude from the above:**

The overall responses to the questionnaire were fully achieved regarding the items related to the building's harmony with the climate and social fabric, ease of access to the site, response to cultural and social influence, creativity and achieving aesthetic design, and the use of local materials (with total ratings of **35%**). The overall responses were partially achieved regarding meeting the functional requirements of users, solar radiation efficiency, ventilation, the indoor environment, harmony with the site, modifying functions, and recycling materials (with ratings totaling **10%**). As for infrastructure, energy and water efficiency, the use of renewable technologies, resistance to the time factor, and compatibility with increasing changing needs, the responses were neither fully nor partially achieved due to the failure to meet these items. By combining the percentages of full and partial achievement, we conclude that the fourth quarter (**We**), which represents (**Relations & Culture**), was achieved by **45%** (**Table 6**).

**Table 6:** Total and partial verification ratios for the fourth quarter (We). **(By the researcher)**

| No. | Integral Theory | | | Percentage | Per % |
|---|---|---|---|---|---|
| **4** | **"We" 100%** | 100 % | Perspective of Cultures & Relations | 45% | 45% |

**5- Summary of applying the four quadrants of Integral Theory to the case study (Baghdad Municipality Building):**

The **first** quadrant (the "**I**" perspective), which refers to (**Experience & Expertise**), was achieved by (**87%**), and by taking the evaluation as (1/4), it achieved (**21.75%**). The **second** quadrant (the "**It**" perspective), which refers to (**Behavior**), was achieved by (**78%**), and by taking the evaluation as (1/4), it achieved (**19.5%**). The **third** quadrant (the "**It has**" perspective), which refers to (**Systems Surrounding Us**), was achieved by (**82%**), and by taking the evaluation as (1/4), it achieved (**20.5%**). The **fourth** quadrant (the "**We**" perspective), which refers to (**Relations & Culture**), was achieved by (**45%**), and by taking the evaluation as (1/4), it achieved (**11.25%**). By adding the percentages of the four quadrants, we arrive at the final percentage (73%), which indicates that the Baghdad Municipality building has adopted sustainability standards by (73%) Table (**7**), Figure (**16**) (**By the Researcher**).

**Table 7:** The four quadrants percentage and the final percentage of building adoption of sustainability standards.

**(By the researcher)**

| No. | Integral Theory | | | Percentage | Per % | Per 25 % | Final Result |
|---|---|---|---|---|---|---|---|
| **1** | **"I" 100%** | 70% | Architect's C.V. | 60% | 87% | 21.75% | |
| | | 30% | The Design Concept | 27% | | | |
| **2** | **"It" 100%** | 40% | Design & Planning | 35% | 78% | 19.5 % | |
| | | 30% | Materials Efficiency | 28% | | | |
| | | 30% | Water Efficiency | 15% | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **3** | **"It has" 100%** | 30% | Fitness to site & context | 25% | 82% | 20.5 % | 73% |
| | | 40% | Efficiency of internal environment | 38% | | | |
| | | 15% | Building as an ecosystem | 11% | | | |
| | | 15% | Living building | 8% | | | |
| **4** | **"We" 100%** | 100 % | Perspective of Cultures & Relations | 45% | 45% | 11.25% | |

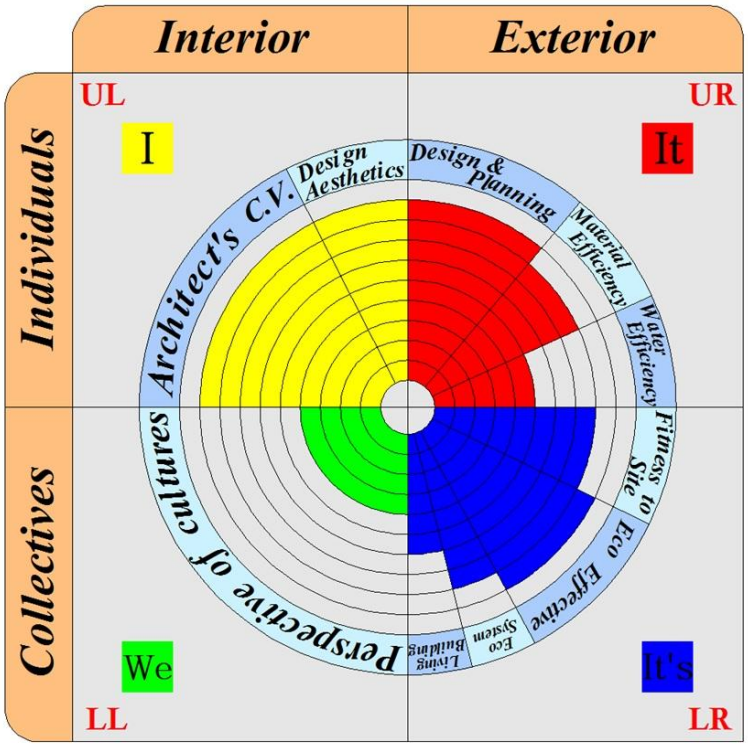


**Figure 16:** Applying the Integral Theory to the study model according to the plan.
**(By the Researcher)**

## 6- Final conclusions of the study:

- Architecture generally impacts nature and the ecosystem, and buildings do not take into account the depletion of natural resources and energy consumption, resulting in a global trend towards sustainability.
- The impact of architecture on the environment is significant due to the long lifespan of the building, which ranges from (50-100 years). Therefore, we must take into consideration that the constructed building may operate in environmental conditions that differ from those of today, and the accumulation of buildings in one place may result in an increase in temperatures and a negative impact on the environment.
- Governments around the world have sought to develop ambitious plans to reduce the negative impact of buildings on the environment, reduce energy consumption, lower carbon emissions, and take positive advantage of climate data.
- Building construction consumes resources from nature and drains the energy needed to extract, transport and use these resources for construction.
- Man's involvement in technology and his interference with the energies and resources found in nature negatively affects its sustainability.
- Modern buildings lack lighting and ventilation, which negatively impacts human health and comfort.

## 7- Recommendations:

- The building's design must be compatible with the climate of the surrounding area, taking full advantage of the positives and being isolated from negative climate impacts.
- Employing technological solutions that are appropriate to the building's internal environment and according to the nature of the climate (solutions balanced with environmental solutions).
- Exploiting renewable energy sources to generate a portion of the building's energy and enhancing it through appropriate orientation and shaping of the building according to the climate, which reflects on the efficiency and effectiveness of the building's energy output.
- Technological solutions in buildings must be compatible with environmental solutions, starting from the initial concept of the project, so that any expected shortcomings are overcome when the building is put into operation.
- Employing central service systems (Heating and air conditioning) that are efficient with low energy consumption, compatible with the building's internal requirements, and integrated with its ventilation systems.
- Employing light sensor systems so that artificial lighting integrates with the building's natural lighting in an efficient way with low energy consumption.
- Employing and applying the Integral Theory to evaluate existing buildings and knowing the extent to which it adopts sustainability standards and trends. Working to enhance the efficiency of their internal environment so that it integrates with positive climate data and reduces the negative impact of the building on the surrounding environment by reducing energy consumption, lowering carbon emissions, and employing technological solutions that are compatible with available environmental solutions.

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