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"The Impact of the Concept of Sustainability on the Contemporary Construction Techniques"

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Abstract:-

The concept of sustainability is one of the most important approaches adopted to improve the reality of buildings and architectural facilities and improve their performance efficiency at all levels, and the importance of this concept becomes evident day after day with the development of human societies and the emergence of many problems that accompanied this development as well as the increasing human needs necessary to keep pace with the technology and information revolution, which has become a distinctive feature of our current era, as the concept of sustainability can, through its applications, express the architectural structure as an integrated system in which the engineering disciplines intertwine to produce a secured environment for human livelihood and movement. On the other hand, contemporary construction techniques have achieved a qualitative leap in terms of using modern materials and technologies in the construction and provided unprecedented types of sustainable structure that have contributed greatly to achieving the goals of environmentally and technically sustainable architecture, which reflected positively on the process of developing buildings and facilities and improving their performance efficiency, functionally and contextually.

The research focuses on the topic of technology facades in buildings as one of the important approaches to achieving the concept of sustainability in architecture by reviewing contemporary construction techniques within its latest technological applications and showing the effect of the concept of sustainability in it across multiple levels to produce a sustainable building that keeps pace with the times on hand and achieving the goal of establishing it on the other hand. The research method of description and analysis of contemporary urban and realistic models explaining their sustainable applications and how they are reflected on their structural techniques.

Keywords: Sustainability, Sustainable Architecture, Contemporary Construction Techniques, Buildings Elevations Technology.

Building performance characteristics within the sustainability orientation:-

It is very important to understand the building as a successful system that performs its function fully, and this is one of the most important goals of achieving sustainability, and it is necessary to delve into the performance characteristics of buildings and evaluate them within the sustainability plan, and these characteristics are not limited to successful functional aspects, but also a set of environmental, economic and social factors. As well as the technology that directly affects the desired success of the building (Environmental And Urbanization, 1992, p. 15).

There have been many opinions and proposals about these characteristics and their overlaps, and in general, the performance characteristics of the building that it is necessary to delve into and deal with are:-

The possibility of adaptation and coexistence with the surrounding environment effectively increases the performance characteristics of the building and thus works well to resist the occurrence of distortions and defects in the building elements, as the element (coexistence/adaptation) of the buildings is considered one of the factors affecting the creation of a good living environment, according to through several factors, including: (Friedman, 2007, p.44)

- Thermal expansion (expansion, conduction, and resistance)
- Not allowing moisture and water to penetrate and filter (water absorption, moisture permeability, moisture expansion, and shrinkage) (Water Absorption, Permeability, Expansion, Shrinkage)
- Provide comfort and safety Providing health and hygiene (Infestation, Toxicity, Slip Resistance, Air Infiltration) (Infestation, Toxicity, Slip Resistance, Air Infiltration)

Sustainable applications of contemporary construction techniques (building façade technology as a model):-

The sustainable applications of contemporary construction techniques have multiplied and have adopted multiple aspects through which technological features have a direct impact on architecture.

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Building façade deformation problems.	Problems of damage and collapse of installations, starting with their façades.	Facade implementation errors.	Sick building façade problems.

Building façade deformation problems:-

Building façades suffer from many problems that lead to deformation, so deterioration later, and deterioration is a natural process that may be impossible to avoid at times, despite the care in design and selection of materials, and the lack of regular maintenance of the building is one of the causes of deformations and defects in buildings, and this is usually the responsibility of the owner or The user is not responsible for the contractor or the implementer, and many aspects refer to the problems and diseases that lead to deformations and defects in buildings, caused by climatic causes and natural environmental factors, and it is important to understand their causes, causes and resulting defects to find a way to take preventive measures and avoid their occurrence, Then try to measure it if possible (Al-Qaradaghi and Siddiq, 2012, p. 3). The climatic factors that lead to the occurrence of building deformations can be divided into:-

1- Moisture movement:-

There are several causes of humidity that appear through the direction of the building and the walls that rain and little sunlight reach, which makes it more vulnerable to moisture, as well as the amounts of rainwater, surface, and groundwater, and the capillary action is the reason for the rise of moisture from the lower floors through the pores of the soil and the materials used Condensation in construction, as well as misuse and drainage, and moisture affects façades through:-

- Its effect on the materials in general and not only on the traditional materials, and on the materials it suffers from other problems related to moisture- related to leakage or penetration of water in the joints.
- The primary mechanism for the movement of moisture in materials and components is the expansion or contraction of materials.

They dissolve the water-soluble salts that are usually found in sedimentary stones (limestone, sand) and carry them to the exposed surfaces, where they crystallize in the outer layers of these surfaces when their solutions dry by evaporation and by the tremendous local pressures that accompany the crystal growth of the salts the outer surfaces of the stones are broken apart.(Al-Qaradaghi and Siddiq, 2012, p. 5).

2- Thermal movement:-

- The factors that are related to the effect of thermal motion effect through the temperature variation that leads to negative things that produce thermal inertia in general and weakens the durability and rigidity of the structures that make up the building crust and around it, which contributes to its distortion and speed of damage within a short period time (David, 2006,p. 34).

3- The effect of wind around buildings:-

- The variable nature of the wind can cause noise, and with the help of rain strikes pollute the building and provide differential pressures on the exterior of the building, but local features make it difficult to design around wind loads, and the wind speed increases at the edges of buildings and intensifies at the ends of large and high buildings in particular, and the difference values are high The pressures in these areas as the wind speed becomes most intense at the outer corners of the building that separate two areas of low and high pressure. As for how the wind contributes to the increase in damage caused by rain and snow, the wind works as a result of its constant change of direction around the building to move the pieces of falling snow In all directions, as for the wind's contribution to increasing the intensity of rainwater, it strikes rainwater severely on the outer wall surfaces.
- Wind can weigh on flat roofs.
- Trace of trees planted around the building (Trees and building)
- The proximity of trees (or other large plants) to buildings may cause soil shrinkage. This effect is usually seasonal and is frequent in clay soils (David, 2006, p. 55).

Problems of damage and collapse of installations, starting with their facades:-

The causes that lead to the occurrence of damage and collapse of the building or one of its parts vary from technical, design, construction, executive, and others due to environmental factors, and the general causes that result in problems of damage and collapse of building facades are explained through the following:-

Table (1) the causes leading to the occurrence of damage and collapse of the building

(David, 2006, 15).

Not taking technical precautions and following engineering standards when establishing.	1- Establishing on loamy soils without making soil substitution and not being careful about the presence of chemicals in the soil that may lead to erosion and reactions to concrete and reinforcing steel. This happens whenever the building is near factories and waste sites. 2- Neglecting soil tests 3 - The problem of founding on ruins, landfills or archaeological sites.
Building in areas prone to collapse without taking this into account during design.	Some areas may be prone to earthquakes where earthquakes and tremors should be taken into account when designing concrete works.
Inappropriateness of structural and architectural design	1- Negligence in the design of the concrete mixture 2 - Structural design inaccuracy and negligence in adopting standards and code and making wrong calculations for loads of various kinds. 3- Lack of relying on good reports from reliable sources regarding soil and foundations works.
Failure to comply with specifications and plans during implementation or improper implementation.	
Using bad materials that do not fit and do not comply with specifications.	

Also, foundations may be exposed to corrosion, which leads to the interaction of various chemical substances due to the presence of water under the building that leads to reactions with iron and concrete, and the presence of water alone causes rust and corrosion of iron, as well as what is caused by groundwater, sewage or water resulting from leakage due to damage to the plumbing, and in general their Several reasons can lead to damage and collapse of the facades of buildings, namely: (David, 2006, 35).

(dust - humidity - rain - heat and extreme expansion - variable atmospheric pressure)

Facade implementation errors problems:-

Many errors may be committed during the implementation, especially about dealing with concrete, and lead to the occurrence of many problems, for example: - (Macdonald, 2001, p. 89)

- The concrete breaks off during casting and results from delayed mixing vehicles and pumps.
- Lack of good follow-up and correct receipt of rebar and its sectors.
- Water, moisture, and neglect of thermal and water insulation.
- Modifications and changes in the use of buildings: There is a wide difference between the loads, whether live or dead, between the activities for each type of building, so the school differs from the library and the hospital differs from the educational buildings ... etc.
- The leakage of rainwater from the roofs is not well insulated, which results in a separation between the iron and the concrete as a result of corrosion of the iron due to rust.

- Negligence in cladding facades, which exposes concrete to weather conditions.
- Renovations and expansion without study.
- Unconscious restoration and use of materials that cause damage to iron.
- Make additional supports in sizes that cannot be tolerated by the foundations or the soil.
- Restoration by a non-specialist team and inappropriate materials.
- Not taking into account any consideration during the restoration of weight, stress, and safety factors.
- Careless maintenance.

The visual chaos caused by common construction errors can affect the development and rehabilitation of buildings as well as their tangible impact on the context and public taste, and one of the most important causes of it is the lack of a uniform formal system for adjacent buildings within the urban system, and consequently it will result in the absence of the distinctive identity of the region or body Urbanism through its buildings, that identity that architects focus on a lot in their products and work to achieve it by integrating the general context of the facades and the architectural elements in them, as well as the nature of the local materials used, and visual chaos can result from structural errors, whether in design or implementation, the matter that is generated from it Chaos in the formal system of the building, and the absence of prior planning and thoughtful design of the basic plans and façades in many of our local buildings has caused our cities to lose the unity of form and the common context between their buildings (David, 2006, 45).

The problems of sick buildings façades:-

The problems of the façades of the diseased buildings may appear totally or partially, meaning that there are problems that afflict the building as a whole and others afflict one part of the building, and this is explained through the following table:-

Table (2) the problems of sick building façades (Walter & Linda, 2004, p. 48)

Factors affecting the structure of the building as a whole, and their effect appears in the facades.	Factors affecting the entity of the building.
Weakness of the structural structure.	Defects of water leakage, for example, that may affect water pipes or drainage, or both.
Weak bearing walls.	Damaged internal and external finishing work.
Weak foundations.	Damage to floors and joints adjacent to the facades.
The chassis bears more weight than the design safety load.	Damage to reinforced concrete and mortar on facades.
The structural unbalanced geometrically.	Salting of walls, floors and ceilings.
Landing of the soil under the structure.	Spoilage and bending of used wood.
The occurrence of disproportionate landing in the parts of the hull	Damaged internal and external finishing work.
The occurrence of non-measured expansion horizontally or vertically.	The iron used has been rust.
Weakness of the structural structure.	Factors affecting the entity of the building.

Cracks are among the most important types of defects in concrete buildings that are described as sick and most widespread and cause collapses and disasters, despite the development in the field of construction and attention to the quality of design and good implementation, and how cracks are diagnosed in buildings subject to cracks may not be accurate enough, especially when done according to a traditional approach, which often relies on personal guesswork for ostensible reasons only (NPCA, 2006, p. 32).

Through all the previous problems, it is possible to attach several characteristics to the characteristics of architecture prevailing in a particular environment under the name (formal chaos of architecture) as an inevitable result of the defect and distortion that affects the facades in particular and buildings in general, and these chaotic characteristics are:-

(Disorder - randomness - confusion - immorality - lack of formal pattern - confusion in perception).

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The concept of formal chaos of architecture:-

This concept is one of the concepts circulating in the architectural arena that tries to stand against the trends of sustainability as a result of the aforementioned influences, and chaos, in general, is a disruption in the performance of organic and social functions, and in architecture it means not achieving functional and formal goals in a way that serves the direction of architecture, and it may result from Chaos has several negative aspects that affect architecture, and add to its confusion (Charleson, 2005, p. 37). The effect of the concept of chaos in architecture appears through the distortion of facades in the following tables within the aforementioned characteristics (disorganization - randomness - confusion - immorality - lack of a formal pattern - confusion in perception):-

Table (3) the concept of disorder and its details (the researchers)

Irregularity.	System disruption. Contrast system parts. Difficulty distinguishing parts of the system.	Elements.
	Different. Undefined.	Relations.
	Clear lines. Blurred lines.	The interfaces are articulated.

Table (4) The concept of randomness and its details (the researchers)

Random	Formal characteristics	the size.	Sizes are similar
		Texture.	Different sizes
		Materials Used.	Coarse / fine / mixed.

Table (5) The concept of interference and its details (the researchers)

Opposite.	Interface.	Compatible.
	Colors.	Chromatic rhythm.
	Horizontal chart.	The clarity of the scheme.
	The relationship of mass to open space.	Space is unclear.

Table (6) the concept of non-conformism and its details (the researchers)

Immobility.	In the shapes of projections, openings, and windows.	Similar patterns. Various styles.	Are similar. Not the same.
		Space of blocks.	Having a rhythm. Lack of rhythm.
		Dimensions of the elements.	Uniform dimensions. Dimensions are not uniform.
		Horizontal extension.	Fixed or variable.
		The relationship of a block with a block.	Compatible. Scattered. Undefined.

Table (7) The concept of lack of a formal pattern and its details (the researchers)

Lack of formality pattern.	Horizontal chart.	Uniform style. Random pattern.
	Interface.	Uniform morphology Lack of structure Uniform morphology.

Table (8) The concept of perceptual confusion and its details (the researchers)

Confusion in Perception.	In the interface.	the shape. the color. Subject. Texture.
	Horizontal chart.	The shape of the base diagram. The relationship of mass to open space.

Treatments with some contemporary sustainable materials used in building façades:-

Sustainable treatments can appear in contemporary building facades by taking into account several things that can be summarized as follows:-

- Adopting the consistent formal characteristics of the facades at the level of parts and details on the level of color, texture, size, and structural material to avoid visual chaos that may result from their inconsistency.

- The need to adopt a formal, communicative language with the neighborhood when designing the facades in line with the considerations of achieving sustainability.

- Extending bridges of communication with the past and not interrupting it, not by blind unexamined imitation, but by adopting the principle of benefiting from successful experiences that have proven their efficiency through years or even centuries of application.

Figure (1): Connecting with the past with a contemporary touch as a sustainable application of architecture (Halliday, 2008, p. 78)

In general, building materials and those used in finishes, in particular, have the effective effect through which sustainable applications appear on building facades, and from contemporary sustainable materials used in building facades, those materials most commonly used in our local environments stand out for many reasons such as (stone / natural and factory) - Packaging with different metals - packaging with glass), as the levels of achieving the goal of sustainability vary between these materials according to their characteristics and the nature of their use in terms of the types of interfaces used in them, and within this framework, the facades of buildings can be classified by reference to the purpose of their treatments and their implementation and the nature of the buildings belonging to them to:-

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- Interfaces with an environmental purpose.
- Interfaces have a functional purpose.
- Interfaces whose purpose is to show the nature of their structure.
- Interfaces whose purpose is to show symbolic aspects.

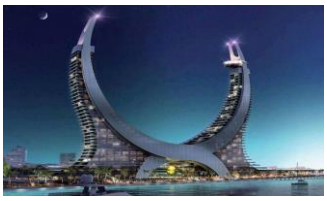


Figure (2): Various formal values to achieve sustainability on architectural facades
(http://www.eiburs-ascimer.transyt-project.com)

Within the previous specific types of façades, contemporary sustainable finishing materials are applied to achieve the goal of sustainability in architecture, and it is imperative here to identify the nature of each material, its characteristics, methods, and methods of its implementation, as follows: (Al-Qaradaghi and Siddiq, 2012, p.8).

(1) Stone material:-

One of the important and well-known building materials commonly used in building facades since ancient times and still to this day is considered a sustainable material due to its distinctive properties, and within contemporary applications of stone there are two types:

- **Natural stone (limestone):-**

It is a type of sedimentary rock and often contains varying amounts of silica in an image. Impurities, as well as varying amounts of clay, silt, and sand, and pure limestone is often white, but impurities such as silt, sand, and iron oxides make it color in different colors, and it is found in the earth's crust in abundance.

- **Factory stone:-**

An industrial type of stone that resists weathering, insulates heat and humidity while providing a wide possibility of color and decoration, as it is characterized by a high hardness, colorfastness, and water absorption rate of 2%. The following table shows a comparison between the two previous types of stone in terms of their characteristics and general distinguishing characteristics:

Table (9) comparison between the two previous types of stone
(Al-Qaradaghi and Siddiq, 2012, p.9)

Natural stone (limestone)	Factory stone
The breaking strength depends on the type of rock of origin.	**The breaking strength depends on the type of concrete mixture.**
Its shape depends on the method of engraving or cutting the stone, and its moisture absorption rate depends on the type of the original rock.	**Its shape depends on the shape of the mold it is pouring into and the percentage of moisture absorption depends on the type Concrete may be like natural stone or less.**
Its dimensions are not completely uniform.	**Its dimensions are standardized according to the mold, and molds can be made upon request.**
Its color is completely uniform being natural.	**Its color is completely uniform, being industrial, with the possibility of coloring.**
The high cost of it is the way to extract natural stone from the ground and the process of dividing and refining it.	**Its cost is approximately 50% of natural stone.**
The weight of natural stone is greater.	**The weight of artificial stone is equivalent to one third of the weight of natural stone**
The distance between the rows of stones is from (5-8) mm.	**The distance between the rows of the stone is slightly larger than (8-10) mm**
The effort is large compared to the artificial stone manufacturing method.	**The effort is less compared to the method of extracting the stone natural.**
Melamont cannot be added to it.	**Melamont (the super plasticizer) can be added to the mixture and the absorption rate becomes 2% of the total weight.**
The strong bond between stone and adhesive is (water + cement + lime dust).	**The back side is not smooth to aid the bonding process between the stone and the adhesive.**
The natural stone changes color due to time, dust and car smoke, so the carving process is performed after a period of time to restore its luster.	**The artificial stone has a distinctive and wonderful shine, especially when the rays of the sun fall on it and does not lose it due to rain or long exposure to the sun or when it is affected by the smoke of external pollutants.**

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Figure (3): The presence of natural stone in the environment and the method of extracting it (www.dw-afterplasticity.com)


Figure (4): Various models for sustainable stone facades
(www.dw-afterplasticity.com)

(2) Encapsulating with different metals:-

There is no doubt that minerals are among the building materials that have revolutionized the structural and architectural forms, and modern technology has affected the methods and means of using different metals in the facades of buildings, especially after the qualitative leap that has been achieved in the field of manufacturing and treating different types of metals to produce alloys resistant to building stresses For the different external conditions and factors, and within this context, the minerals (iron - aluminum - copper - titanium) emerge through their use in the facades and the various techniques applied with them, and the following are some of the characteristics and features of these minerals through their use in building facades: (ISBN, 2002, p. 79).

- **Iron:-**

Iron metal is one of the oldest metals used by man in his various life fields, but the use of iron in the field of building and construction in its contemporary form did not become clear until the industrial revolution in Europe, and despite the great criticism directed at the use of this material architecturally and constructively due to its weak resistance, However, modern technology through its advanced technologies have provided distinct applications to avoid and overcome this negativity and try to make iron material with sustainable qualities that serve the achievement of this goal in the field of architecture, and in general, iron as a building material has been used in both types (cast iron and Al-Mutawa) as well as (Al-Fouladh), which has special features.

- **Aluminum:-**

It is one of the relatively important modern materials in terms of its use in the building and construction sector, and the reason for this may be due to its limited use to the facades' packaging works as well as some other supporting uses such as doors and windows, and this material has special features that qualify it to be sustainable par excellence through its resistance to external conditions (Climatic, specifically) and its distinctive aesthetic considerations.

- **Copper:-**

As is the case with iron metal, copper has been known to man since ancient times, but its contemporary use within the construction sector has proven its efficiency as a sustainable metal despite the need for this material for special treatment when used on architectural facades and surfaces, through the aesthetic considerations provided by this material, specially

when They are used in buildings that bear expressive features of an aesthetic character, and that the use of copper is in the form of sheets, as is the case with aluminum when covering buildings and facades.

- **Titanium:-**

The use of this material has emerged in recent times with the emergence of architectural currents that adopt technology to the farthest limits and try to highlight the technological strength through the material used in the encapsulation of architectural, and titanium metal is not economical if it is compared with precious metals, but its characteristics and characteristics made it a strong competitor in Use if we take into account the characteristic of the building's durability and durability, which makes it a sustainable material in this aspect.

Figure (5): The use of titanium on facades by the architect (Frank Gehry)
(Addington & Dniel, 2005, p, 44)

In general, some of the drawbacks that appear when using different types of metals in the construction and packaging work of the facades have been avoided through the development of manufacturing techniques and the successful handling of material engineering technology, which has produced various alloys with high-efficiency, sustainable specifications, and successful economic considerations.

Figure (6): Models of contemporary architecture showing the sustainable technical and aesthetic characteristics of using metal types in façade cladding (Macdonald, 2001, p.57)

(3) Packaging by the glass:-

Glass is frequently used in contemporary architecture in the packaging of facades with the aim of achieving aesthetic, technical and environmental considerations towards achieving the sustainability of architecture, and modern technology has provided tremendous possibilities for using glass in different ways on the facades, so the multiple colors that serve the goals of aesthetic design have become accessible to designers, and perhaps the information revolution and what it has provided Smart architecture applications have produced glass facades with distinctive technical specifications in some private buildings, with the importance of the environmental aspect, which has proven modern glass as a sustainable material on the façades, its importance through the use of types of shaded, insulating, reflective and reinforced glass ... etc., and if the glass architecture was promised yesterday The relative is a kind of achieving transparency for the building, because today it represents a stand-alone science with its dimensions, objectives, and pioneers, and the use of glass is not limited to the work of wrapping the facades, although most of the uses have been directed towards this application, as the glass may be combined with the structure or the glass spaces may occupy large parts From the mass of the building the service of considerations towards achieving the goal of sustainability (SB05 Tokyo, 2005, p.12).

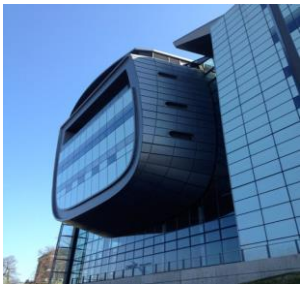

Figure (7): Models for sustainable applications that use glass on building facades, from the inside and outside (SB05 Tokyo, 2005, p.18).

The relationship of sustainable structures to building façade technology:-

The nature of building facades and the sustainable solutions used in them depend on several factors, including:-

- The shape of the building from the outside and the direction of its projection on the site (X1)
- Architectural design prowess inside and out (X2)
- Selection of appropriate building materials (X3)
- External building angles, their joints, and their relationship with neighborhoods (X4)

The aforementioned factors show the relationship of sustainable structural structures to building façade technology, as the impact of the concept of sustainability in contemporary construction techniques is evident through distinct applications of architecture based on the previous factors in whole or in part through realistic examples that will be discussed during the application.

Application to discuss real examples that illustrate the impact of the concept of sustainability on contemporary construction techniques:-

The theoretical aspect that was presented highlighted the importance of some contemporary sustainable applications that serve the trends of architecture in today's world that is governed by technological implications at all levels, and although the contemporary architecture has adopted sustainability in its simplest form, it showed the importance of some applications without others despite their importance all together, The technological feature overshadows those more technical uses. The methods of applying the concept of sustainability to building facades are shown through several formulas:

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Figure (8): Implementing sustainability in simple formulas in contemporary architecture (www.archdaily.com)

(A)Show structure for expressive purposes:

However, the analysis of models of contemporary architecture that prevailed during the twentieth century and the new millennium showed that the use of technical applications in architecture may be carried out outside the declared traditional framework, whether for environmental, aesthetic, or service purposes in pursuit of other things that architecture is intended to achieve, and the purpose may be Contrary to the traditional view, instead of encapsulating the metal of the building as a crust, it is projected to the outside as a clear structure (that is, it is the core and not the crust) as in the Center Pompidou, as the purpose was to highlight the machine element through the air tubes to show the element of the machine and the machine. It is an abstraction of the form, its purity, and its sincerity in its expression of its function, and although (the Eiffel Tower) may not be included in our classification of contemporary architectural facilities due to the time difference from it, its adoption of a certain idea applied in some contemporary architectural models about regard to metal structures makes it a suitable topic For discussion, it was based on the principle of making the metal structure a person or a symbol of the city by highlighting the strength of the material with the splendor of design.

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Figure (9): The Pompidou Center in France
(www.castractesmaterialfacades.com)

Figure (10): The Eiffel Tower in Paris (www.castractesmaterialfacades.com)

(B)Respect for context and function:

As an application of the principle of communicating with neighborhoods contextually and functionally towards achieving the goal of sustainability, the style of designing the public urban space appears necessary in any urban environment, as the wide space between buildings connects buildings and surrounds them through walkways, which are considered a physical and functional element in facilitating pedestrian movement and separating them from movement For clients on the ground, the role of successful design of sustainable façades is to achieve enhanced communication and integration at the urban level.

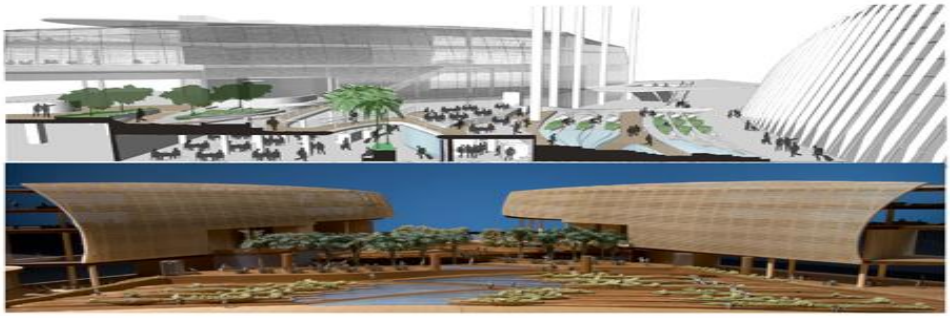

Figure (11): the contextual and functional communication of sustainable urban interfaces through their connecting spaces within the site. (Giffinger, 2007, p. 65)

(C)The strength of the material and its technological properties:

As for glass façades, after the glass was a secondary element in architecture, the machine came to help people to highlight their transparency and provide us with a new material that varies in thickness, dimensions, colors, and texture, and large areas of the external façades have become in the form of transparent walls attached to the general structural structure and this is done using double layers They are formed for these walls or increase their thickness so that they are linked with metal hooks, and the purpose of such an interface is to achieve a beautiful reflection of the surrounding scenery, especially in open areas and tall buildings where clouds and trees reflect during the day and the lights reflected at night, and the glass used is of the reflective type that is made by coating a layer of metal and provides The required properties also reduces the heat delivered to the building.


Figure (12): Important details for using glass in sustainable façades (www.nationalgeography.com)

The glass panels may be vertical or horizontal or wide or wide or thin, as well as they may be thick or thin depending on the function of the building, and there are techniques in how to clean the glass of tall towers using electronic robots that clean according to micro-sensors related to the city's climate.


Figure (13): Glass panels and methods of cleaning them on the facades (www.nationalgeography.com)

On the other hand, the purpose of the glass façades may be to show the strength of the structure, or to show the transparency of the building, or for the glass to act as a windbreak ... etc.

Figure (14): Transparency while resisting climatic conditions and highlighting the strength of the structure is among the most important characteristics of glass on sustainable facades (www.typesoffacadesbuildings.com)

Also, a combination of glass and metal structures may occur when a building is coated with a double film With environmentally friendly materials that allow light to enter indoors by solar radiation.

Figure (15): The use of double-film (glass / metal) in contemporary sustainable buildings packaging (www.typesoffacadesbuildings.com)

Glass or metal may be used when covering the facades of buildings to create a kind of respect for the site and to communicate with it visually and functionally within the objectives of achieving green design compatible with nature, especially if the site itself is qualified for this purpose.

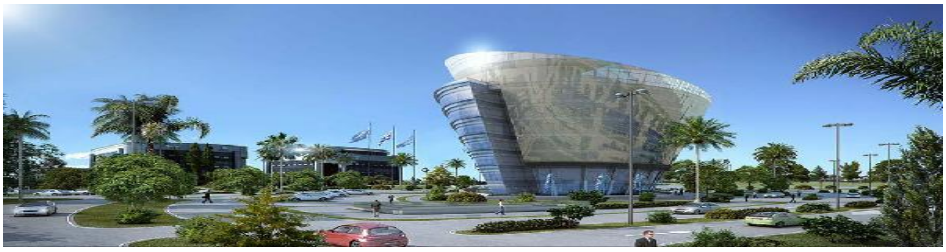

Figure (16): Respecting the site and communicating with it through sustainable technologies for the interface (www.m3mar.com)

At the urban level, too, the uses of glass appear when furnishing urban facades and spaces through advanced technologies that respect people and take into account the environment and achieve the optimal purpose (sustainable) through their function. As for the formulas to achieve sustainability, functional sustainability can be shown by using a structure that highlights its structural strength with its high technical and functional potential, and this is applied in the business of (Norman Foster) as well as in the London airport and train station.

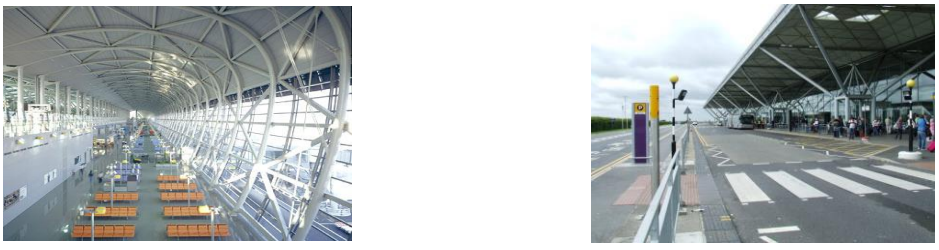

Figure (17): Functional Sustainability of Structure Strength with Job Integration (www.habitedmaterial.com)

(D)Recycling applications:

The concept of sustainability has influenced contemporary construction techniques through distinct applications in the use of structures, packaging materials, and finishing of facades, in addition to all of the above, the process of recycling materials had a presence in this field, for example, recycled water bottles were used in the construction and construction of some buildings as a technology. Contemporary sustainable construction with influential economic dimensions with its positive effects on the environment. In contemporary sustainable construction techniques, the building must be environmentally friendly, and environmental awareness is one of the most important goals of this trend, and an important example of this is (Taipei International Plants Exhibition) as it requires a design with Its distinctive environmental features provide special transparency for the growth of plants on natural light. Empty water bottles have been used here as an effective, insulating, and resistant material to loads of the nine-story building.

Figure (18): A sustainable application for the use of empty water bottles in construction

(www.e-bookdoubleskinbuildingtech.com)

(E)The architectural form of the mass:

The process of sustaining the architectural form comes to represent a contemporary sustainable technology with a clear impact on construction techniques, and this is clearly evident in the architecture of contemporary Islamic mosques, including the building (Cologne Central Mosque in Germany), which is one of the largest mosques in Europe, in which large glass areas are used in harmony with the nature of the solid mass It is built in the Ottoman style with two minarets and a central dome, as it consists of 5 floors with an open dome up to a height of 36.5 meters and two minarets with a height of 55 meters each and accommodates about 1,200 worshipers, in addition to the prayer hall that includes the complex extending over an area of 16,000 square meters A large hall for events, as well as a library and classrooms, the architecture innovated in the design of the structure of the building by making vertical walls on the direction of the qibla so that they are suspended and separated by transparent glass to enter natural light into the main prayer space.

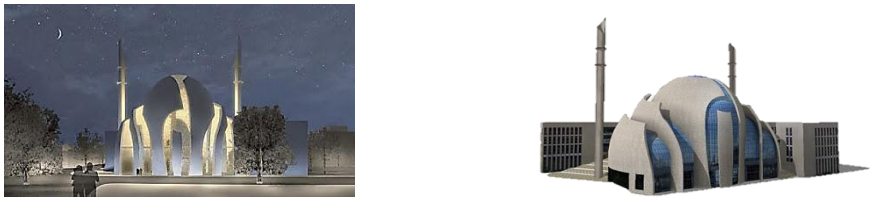

Figure (19): Cologne Central Mosque in Germany / The sustainability of the architectural form within the influences of the concept of sustainability on contemporary construction techniques (www.constructionfacadesbuilding.com)

(F)The memorial side of the architecture:

The symbolic memorial dimension had its presence in contemporary applications that reflected the impact of the concept of sustainability in construction techniques, and the building (King Abdullah Mosque in the Kingdom of Saudi Arabia) is one of the distinctive examples of this, as it was in its plan to refer to the shape of the Mosque of the Prophet Muhammad (may God bless him Salaam) at the beginning of its establishment, then he used the square projection with the cubic block to simulate the shape of the Kaaba in the Grand Mosque in Makah while preserving the Qibla wall and this unique harmony between the shape of the plan and the mass was represented by simulating the dimensions and spiritual values inherent in Muslims's minds as a distinctive application of the concept of sustainability In its human meaning in architecture, it is noticed that there are no openings in the walls, but there are decorations that allow the entry of lighting into the space of prayer, also the simplicity of the design reflects the values of the spiritual transparency of Islam with the spirit of tolerance, dignity, simplicity, and non-extravagance. Islamic architecture, such as the presence of the water floor that suggests illumination, and

within the general design notes the disappearance of the dome, which was replaced in the interior design of the prayer space by the dim lighting of the shape The beautiful carousel that inspired the feeling of the dome, the sustainable influence also appeared through the refinement of the luminescent and the shape of the minaret.

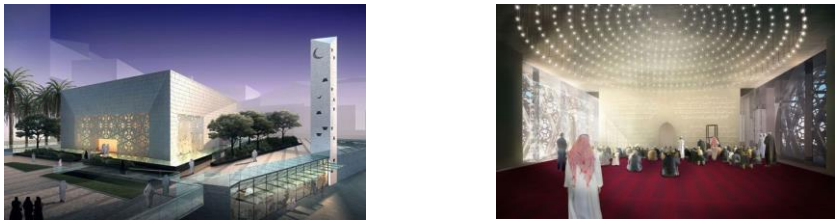

Figure (20): The King Abdullah Mosque in the Kingdom of Saudi Arabia that is visually and environmentally sustainable (www.m3mar.com)

(G)Architecture decorating considerations:

The focus on the use of daylight through the formally sustainable mass was evident as a sustainable application in contemporary mosque buildings, as in the previous example and also in the Yasil Vadi Mosque in Istanbul, Turkey, where the split dome and the longitudinal openings were used to introduce natural lighting while providing creativity in decoration and art. And the artificial lighting, then the structural structure, and preserving the solid qibla wall, to avoid distraction.

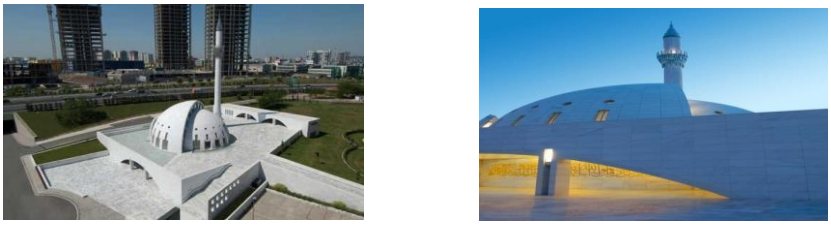

Figure (21): Yasil Vadi Mosque in Istanbul, Turkey, as a sustainable form with other environmental and structural technologies (www.intelligentmaterial.com)

(H)Symbol concept:

And in the Dubai Mosque, which carried a touch of contemporary with the fragrance of heritage, the sustainable influence of shape techniques appeared through deep symbols and connotations through the use of three main elements that make up the mosque in Islamic architecture: the dome with its structural dimensions, the cube that represents most of the shapes of the prayer hall in mosques as well as the shape of the Kaaba, with The minaret, which has become a characteristic symbol of the contemporary mosque), and this building required a huge amount of research into how to implement its details, including the shadows of the mass from the sun and the reflection of "In the Name of God, the Most Gracious, the Most Merciful" in the water or the pool surrounding the floating mosque, as well as changing the entrance to the mosque from The bridge path crossed by the portico, with the use of creative forms of the bridge and the art of carving the dome.

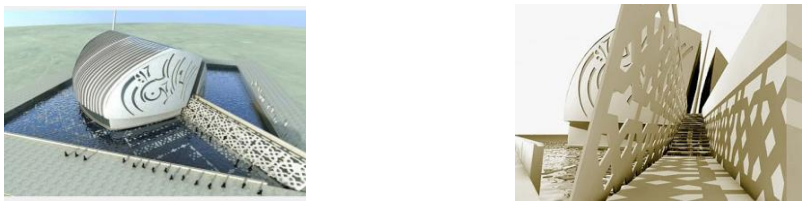

Figure (22): Dubai Mosque and distinct applications for the sustainability of architecture

(www.high-techbuilding.com)

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(I)The privacy of the place:

And in the Umm al-Qura Mosque in Baghdad, which was completed in (2001), the symbolic dimension of sustainable architecture emerged through elements that draw inspiration from history to document the specificity of the place and the site. The lake on which the mosque's building blocks float with its unique design takes the shape of a map of the Arab world with an architectural abstraction that achieves a balance between sincere expression and the underlying meaning. The profound connotations and the library block appears over Baghdad, where the House of Wisdom is, and the prayer hall is centered at the heart of the map with eight minarets of symbolic design dimensions and a giant central dome covering the prayer hall, & the sustainable effect here is in the far-influencing sent blades achieved by merging the design idea with history and geography as well as Construction and implementation techniques.

Figure (23): Umm Al-Qura Mosque in Baghdad showing the linking of sustainable architectural form with history and geography of the place (www.m3mar.com)

(J)The concept of edifice in architecture:

In a shift to other types of sustainable buildings in which the impact of the concept of sustainability on contemporary construction techniques, specifically on blocks and facades, is evident, in the building (The Great Decade) in Paris, the effective use of distinctive finishing and packaging materials on the facades, with the simple block design with a symbolic dimension to its connotations The purpose of the building was to find the main landmark at the end of the long line of perspective that runs through the city of Paris from east to west, starting with the Arc de Triomphe and passing through the Champs-Elysées gardens, and that this landmark is at the end of that axis, and indeed it has become a wonderful architectural work As the symbolic gateway to the French capital and the beginning of new architectural art, the building, in general, is distinguished by its enormous size with the simplicity of using the system of symbols and signs.

Figure (24): Building (Unique Contract) in the French capital, Paris (www.urbanfacadesbuilding.com)

(K)Consideration environment climate:

Among the distinctive architectural works that illustrate the impact of the environmental sustainability of architecture on the shape and mass is a building (National Commercial Bank in Jeddah) in the Kingdom of Saudi Arabia. The building is in its V-shaped plan and there are several large losses on the block and facades that have become a source for the introduction of natural lighting for administrative offices in the building And with the presence of a giant middle cavity on the block, the possibility of creating a sheltered shaded area was provided to form a green semi-internal environment that affected the temperatures that are about ten degrees below the ocean.

Figure (25): The National Commercial Bank Building in Jeddah, Kingdom of Saudi Arabia (www.m3mar.com)

(L)Considerations physical structure:

Sustainable buildings may be designed formally and technically to achieve a sustainable constructive goal as in some modern installations, including inflated ones, where the manipulation of blocks to achieve the laws of mass physics in the blown bubbles and these small-unit designs allow the formation of internal space for natural ventilation by the effect of raising the deflected air and outside the building through Gaps in the bubbles, as natural sunlight enters the space through windows in the ceiling.

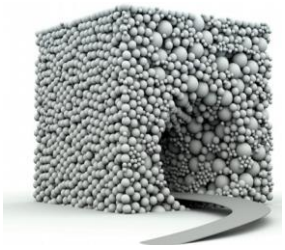


Figure (26): Blown Origin as a Contemporary Sustainable Technology
(www.sustainableskinfacadesbuildings.com)

(M)Formats unfamiliar architecture:

Within this framework, the concept of sustainability influenced contemporary construction techniques within structural and formal applications that showed interfaces that may appear unfamiliar but bear distinctive sustainable applications. They are interconnected, and their uses have appeared in housing buildings and parks, as well as relatively large facilities such as stadiums and halls.

Figure (27): Types of single and multi-lobed balloon inflatable installations
(www.sustainableskinfacadesbuildings.com)

(N)Considerations visual and technical:

The formulas of formal sustainability expand on contemporary architectural facades to include achieving visual, sensory, and aesthetic aspects, including the system of color harmony and its impact on the formality and context, on the multiplicity and diversity of the uses and functions of buildings.


Figure (28): sustainable applications of the contemporary architectural form using colors on the façades (www.lowenergyfacades.com)

(O)Psychology architecture:

Colors may be used in architecture not only to achieve cosmetic and apparent aesthetic aspects, but their effect may extend to include the function with the expressive values associated with it, to impart a spirit of joy and pleasure to the users, as well as the psychological aspects achieved by the colors in their various physical dimensions, for example the use of colors at the level Facade, section and scheme for a kindergarten in Malaysia.

Figure (29): the use of colors in harmony with the function and the user's psychology towards achieving sustainable formulas for architecture (www.lowenergyfacades.com)

(P) Architecture and animation:

Among the sustainable formal aspects affected by contemporary construction techniques are the applications of dynamic installations and their high-tech technological formulas.


Figure (30): Dynamic Architecture with its sustainable, high-tech applications

(www.e-bookglassesfacadesbuildingtech.com)

(Q)Applications of green architecture:

And since green architecture represents one of the most important sustainable trends in the world today, its impact has been evident on the architectural form of the facades and blocks, so that green buildings have become morally, environmentally, visually, and organically sustainable, and technology has influenced by making environmentally unfriendly materials sustainable, including the use of concrete facades that breathe By its ability to absorb plants away

from the traditional methods of vertical gardens and the details they need, the new living concrete includes three layers, one of which is to absorb and store rainwater and air humidity, and the other to provide a suitable environment for plant growth, with a third insulation layer to prevent the negative effects of humidity on the building.


Figure (31): New sustainable green technologies on building façades (www.lowenergyfacades.com)

(R)The design of urban green:

As an extension of the theme of green architecture with its sustainable applications and its impact on contemporary construction techniques, types of new buildings have emerged formally dispersed and harmoniously with the traditional green cover, including an underground building in Germany that contains an entire city of museums, trains, restaurants and parks, and the roof of the building contains structures similar to transparent lenses. These lenses are like resting places from the top and lighting enters the underground city. This project was implemented in (2013).


Figure (32): New formulas of green architecture that adopt the concept of sustainability (www.nationalgeography.com)

(S)The achieve the goals of private architecture:

Contemporary building shapes have been affected by other aspects towards achieving the goal of sustainability that may not depend on the nature of the building material or the type of structure, but on the method of decorative formation of the building within what is known as the orientation of decorative buildings, and this type of building is operated and implemented with advanced technologies to achieve environmental, aesthetic and economic aspects. Through that, the shape of the building scattered or lobed ornamental to achieve these goals.


Figure (33): Decorative buildings with special formal values (www.nationalgeography.com)

(T) Advertising and media in architecture:

Within the same sustainable context for contemporary installations, there is a tendency to simulate the advertising and informational aspects for commercial purposes, and this is one of the aspects of the interaction of architecture with other matters to achieve sustainability and communication.

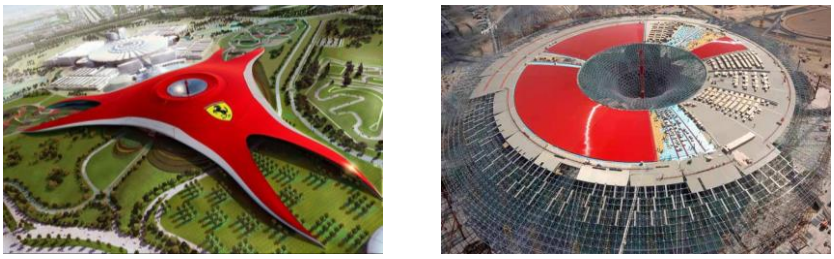


Figure (34): The (Ferrari World) project in Abu Dhabi as a distinctive form with media dimensions (www.nationalgeography.com)

Through the formulas previous to apply the sustainability and show the relationship of these formulas factors sustainability facades through the views of elite architects jurisdiction is as follows:

Table (10) Relationship formats achieving sustainability in buildings and factors sustainability on facades through the application (the researchers)

Formats achieving sustainability in buildings	Levels of factors sustainability on facades			
	Level one (1)	Level two (2)	Level three (3)	Level four (4)
(A)	X4	X1	X2	X3
(B)	X3	X4	X1	X2
(C)	X3	X2	X1	X4
(D)	X2	X3	X1	X4
(E)	X1	X2	X4	X3
(F)	X2	X1	X3	X4
(G)	X1	X2	X4	X3
(H)	X2	X4	X1	-
(I)	X1	X4	X2	-
(J)	X2	X1	X4	-
(K)	X2	X1	X4	-
(L)	X3	X2	X4	X1
(M)	X1	X2	X3	X4
(N)	X3	X2	X1	X4
(O)	X2	X1	X3	X4
(P)	X2	X1	X4	X3
(Q)	X3	X1	X2	X4

(R)	X4	X1	X2	X3
(S)	X1	X4	X3	X2
(T)	X4	X1	X2	X3

Figure (35) Listed repetitive relationship formats sustainability levels of agents the sustainability of facades through the application (The researchers)

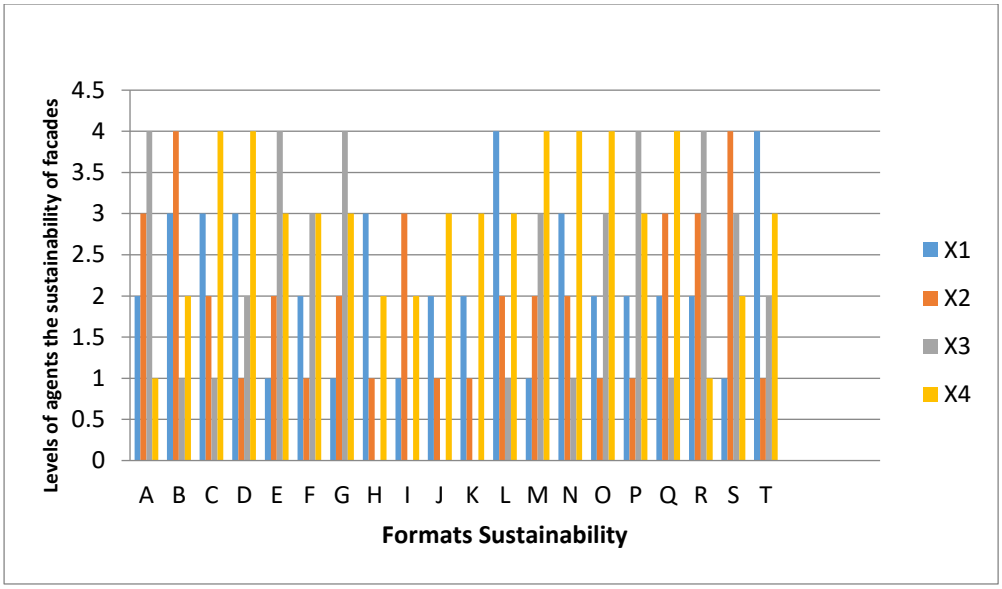
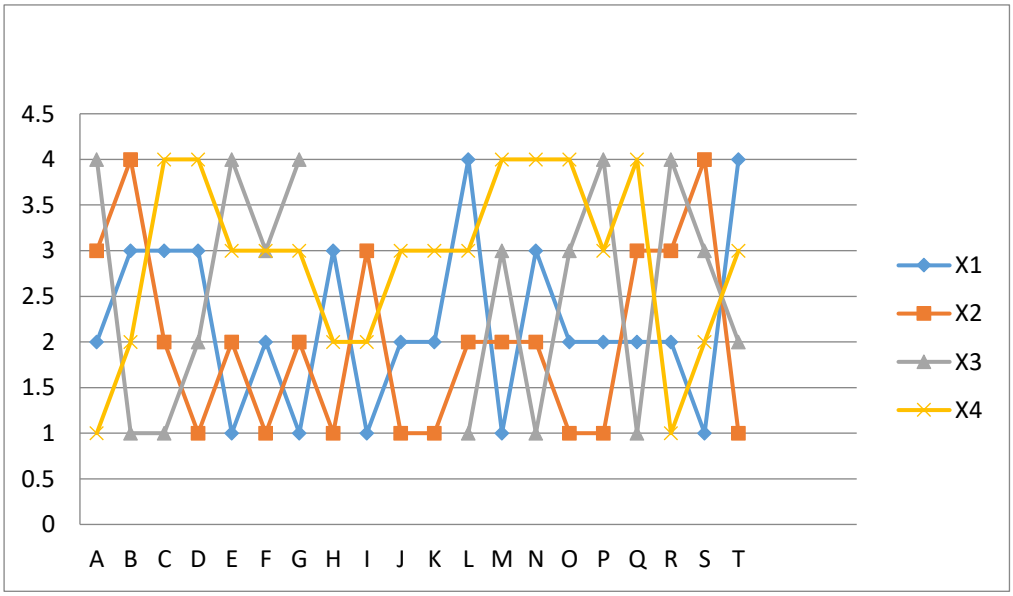


Figure (36) Scheme graph relationship formats sustainability levels of agents the sustainability of facades through the application (The researchers)



Conclusions:-

1- Irregularity at the level of the façades may result in visual chaos, which leads to a disturbance in the building system, and thus the building loses many considerations that qualify it to perform its function properly, which will negatively affect the sustainability approach and prevent its achievement in the near term.
2- Visually distorting the building for the recipient results in another contextual distortion that appears by looking at the building as part of the urban system by integrating it with its neighborhoods. The causes of this contextual distortion are often due to the loss of aesthetic considerations as an inevitable consequence of the difference in the architectural language between adjacent buildings through finishes, colors, heights, and the relationship with External spaces, which requires attention to these aspects when implementing the sustainability plan.
3- The effect of the concept of sustainability in contemporary construction techniques can be demonstrated by analyzing the relationship of buildings with the spaces adjacent to them or those confined to them, that relationship that may carry with it many functions and uses that support architecture and whose neglect may result in negative aspects that harm the buildings and their users And impede the process of achieving sustainability.
4- There is no doubt that the green trend of contemporary architecture has left its mark while we are talking about the goal of sustainability of architecture, and the influence of plants and trees as well as green spaces, appear as complementary factors to architecture not only from an environmental point of view of its importance but also as a visual and functional aesthetic system towards achieving the goal of sustainability of architecture.
5- From the formal aspect of the façades, it is important to adopt the forms that are accepted in taste, context, and function at the level of local architecture prevailing in a certain environment away from those external influences that adopt technology in its propositions on the one hand, but it may negatively affect unintentionally distorting the architecture with the implications it leaves Intellectual, aesthetic and impressionistic public recipients as well as specialists.
6- Also, by considering the building as an integrated system in which all engineering disciplines are compatible with the multiplicity and diversity of their orientations, this close relationship between design techniques and implementation techniques appears, as well as the techniques used at the level of engineering services to achieve the desired goal of directing the sustainability of architecture through its construction techniques.

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