

Biodynamic architecture between modern environmental and technological trends

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Abstract:

There are many challenges in the architectural field, and with each passing day the challenges facing the designer increase in order to design more quality, with the development of contemporary architectural and design ideas, many architectural trends have emerged such as sustainable architecture, green architecture that calls for caring for the environment surrounding the building and not affecting it, then smart architecture appeared that seeks to integrate intelligence with the building's environmental system in an integrated form, then kinetic architecture appeared that made the building changeable in its movement and shape.

Contemplating the creativity of the greatest designer, God Almighty, in the kinetic ability that He has bestowed upon all living beings, but it is always in response to the surrounding variables, the research deals with the study of the integration between the aforementioned architectural trends with an attempt to follow what God Almighty has created to reach a design that achieves the missing balance between buildings and the environment while benefiting from technological progress in order to propose a new architectural trend, which is the trend of biodynamic architecture for a better quality architecture.

Keywords:

Green architecture - Sustainable architecture - Smart architecture - Moving architecture – Technology

ملخص البحث:

هناك العديد من التحديات في المجال المعماري، ومع مرور كل يوم تزداد التحديات التي تواجه المصمم من أجل تصميم أكثر جودة، مع تطور الأفكار المعمارية والتصميمية المعاصرة ظهر العديد من الاتجاهات المعمارية مثل العمارة المستدامة، العمارة الخضراء التي تنادى بالاهتمام بالبيئة المحيطة بالمبنى وعدم التأثير عليها، ثم ظهرت العمارة الذكية التي تسعى إلى دمج الذكاء مع المنظومة البيئية للمبنى في شكل متكامل، ثم ظهرت العمارة المتحركة التي جعلت المبنى متغير في حركته وفي شكله.

وبالتأمل في إبداع المصمم الأكبر الله سبحانه وتعالى في القدرة الحركية التي أنعم بها على جميع الكائنات الحية ولكنها تكون دائماً إستجابة للمتغيرات المحيطة، فالبحث يتناول دراسة الدمج بين الاتجاهات المعمارية السابق ذكرها مع محاولة بإتباع ما خلقه الله سبحانه وتعالى للوصول إلى تصميم يحقق التوازن المفقود بين المبنى والبيئة مع الإستفادة من التقدم التكنولوجي من أجل إقتراح إتجاه معماري جديد هو إتجاه العمارة البيوديناميك من أجل معمار أكثر جودة.

الكلمات المفتاحية:

العمارة الخضراء-العمارة المستدامة-العمارة الذكية-العمارة المتحركة-التكنولوجيا.

Introduction:

Since the beginning of the 1960s, many trends have emerged regarding environmental protection and preservation. People began to think about the building and its architectural spaces as a miniature ecosystem that interacts and integrate with the surrounding ecosystem. This led to the emergence of many institutions interested in the environment, the idea of sustainability, and the trend towards green and sustainable buildings with smart technologies in the field of architecture. This is in addition to the pursuit of rationalizing energy, optimal use of resources, and reducing their consumption. This is in order to address the increasingly dangerous environmental threats that are now lurking around the world in several forms, such as resource depletion, rising pollution rates, and climate change.

Despite the multiplicity of architectural trends, there are those that call for environmental concern and have prioritized this, such as sustainable architecture and green architecture, but with the stability of the building. There is also smart architecture, which relies on globalization, technological techniques, and remote control. There is also kinetic architecture, which relies on the movement of the building, whether partially or completely, which has added a fourth dimension to architecture: The time dimension. However, there are some aspects of reconciliation in architectural thought that led to a state of balance between what is compatible with the environment and its capabilities, and human requirements and aspirations within the framework of modern technology and techniques. For a more qualitative human architecture that seeks to achieve the well-being of its users and responds to the changes in the surrounding environment without negatively affecting it. This is achieved through a factor that stimulates the integration of the four architectural trends, which is contemplation of the creativity of the Greatest Designer Allah.

The matter that allocating a balance with the environment, in addition to benefiting from modern technological progress that meets human aspirations within a balanced framework that does not infringe on environmental factors or affect natural resources. Therefore, the research came as a step towards a new architectural design theory, which is a step towards creating a human architectural design that is close to the laws of nature and in line with the laws of Allah in his creation of living beings, so that it would be a design trend that has the ability to adapt and interact with the environmental variables around them.

The research examines four architectural trends that are the harvest of modern science: Sustainable architecture, green architecture, smart architecture, and kinetic architecture. Combining them together to present an architectural idea that achieves a balance between all of the above, which is the trend of biodynamic architecture, is the focus of the research.

Research Problem:

- 1- The need, through modern architectural trends, each of which has its own direction and goal, to integrate more than one architectural trend to maximize the benefit from these trends during modern technological progress.
- 2- The need to introduce an architectural concept that helps preserve the environment and its resources without affecting the rights of future generations, in response to human desires and aspirations towards the use of modern technological techniques, as humans are always the focus of development.

3- The shortcomings of some attempts to benefit from modern scientific progress that has achieved a type of artificial intelligence that can be employed to serve architecture and thus humanity, and to benefit from the ability to move the building partially or completely to maximize the benefit from the previous elements and coordination between them.

Research objectives:

1- A systematic integration of three architectural trends, which are the harvest of modern science in the field of architecture, sustainable architecture, green architecture, smart architecture and its technological applications, with another architectural trend, kinetic architecture, in order to reach a more effective and high-quality architectural methodology, inspired by the creativity and creation of Allah, so that the designer can benefit from it in order to achieve a balance between meeting the requirements and aspirations of human and preserving the potential of the natural environment around him.

2- Studying the theory of biodynamic architecture is an important and vital topic in the context of the amazing progress in modern technology and the desire of designers to move towards everything new in the field of architectural and interior design, based on benefiting from modern scientific and technological developments and achieving the aspirations of humanity in this century.

Research Hypothesis:

The research will propose a new architectural trend, biodynamic architecture. If architects follow this approach, they can achieve a balance between modern technological progress and motion technology, human needs and requirements, and environmental conservation without negatively impacting the environment.

Towards a Theory of Biodynamic Architecture:

In the twenty-first century, the world has witnessed great development in various fields. Therefore, it has become necessary for architecture to interact with these variables and for the architectural product system to contain all the technological systems that can be applied to make the mechanisms of architectural work successful. However, with the interest in technology, some shortcomings have appeared in the environmental dimension of buildings and their designs, which led to the necessity of liberation from static thinking to dynamic thinking and designing flexible buildings that can respond to environmental variables and functional requirements, which gives them the ability to adapt to environmental crises and benefit from Allah creativity in his various creatures, which depends on divine technology, which is (movement).

Architects are urged to search for a comprehensive theory for twenty-first-century architecture that combines sustainable, green, technological, and kinetic architecture trends. (7- P 54)

Attempting to develop a modern theory for twenty-first-century architecture that balances environmental compatibility with contemporary technologies and leverages kinetic divine technology is a real challenge. The multiplicity of sources of architectural thought makes choosing the optimal approach to developing a new architectural theory extremely complex.

This requires time and experience that may not be available to a single generation of architects to establish the foundations of a comprehensive architectural theory.

Knowing that the most recent human technologies are inspired by living organisms as design models for the architect, which have proven over the centuries their efficiency in adapting to their environment according to divine technologies that preceded what the most recent technologies of the human mind have reached, which makes the hypothesis of adopting movement in living organisms, the most important of which is man, and benefiting from it to verify a new architectural theory under the name of biodynamic architecture.(6- P 18).

Biodynamic architecture hypothesis:

Bio-Dynamic Architecture is a new architectural trend that requires architecture to interact with its surrounding environment efficiently, but using motion technology, similar to the interaction of a living organism with its flexible structure and intelligent behavior, so that the building can adapt to different environmental conditions and adapt its various parts to interact with the surrounding environment with its various natural components, making it a part of it, influencing it and being affected by it, without disturbing the environmental balance. Deriving architectural design principles from the theory of movement found in nature and the principles of sustainable green architecture, in addition to using advanced technologies in the field of kinetic architecture to create a new architectural trend that is more capable of adapting and interacting with current and future climate changes and crises. (6- P 27)

Biodynamic Architecture Reference:

Biodynamic architecture merges more than one architectural trend, namely sustainable architecture, green architecture, smart architecture, and kinetic architecture.

The following can be concluded:

First: Sustainable Architecture:

Sustainable architecture is the design of architectural spaces with environmental and sustainable development goals in mind. It seeks to reduce the negative impacts of buildings on the environment by maximizing efficiency and moderation in the use of building materials and energy and in the development of spaces.

It is an architecture that supports environmental balance by relying on ecological construction systems and reusable building materials to reduce the depletion of natural resources. The environment, culture, architecture, technology and many other elements form a comprehensive global system that requires a balanced approach. It meets the needs of the present generation without compromising the ability to meet the needs and requirements of future generations.

Sustainable architecture is the design and construction of buildings using available construction methods and materials that do not negatively impact the environment, the health of users, builders, and future generations. It addresses many considerations, including: Avoiding the depletion of resources, energy, and water.

- Studying the environmental impact assessment of buildings and their construction materials.
- Reducing reliance on non-renewable energy-waste disposal and recycle it. (8- P 41)

Principles of sustainable architecture:

- The concept of sustainability is to recycle construction materials to conserve natural resources, and to strive for technically and culturally conscious architecture that respects the environment and maintains its balance.
- Integrating nature and modern technology, making the building appear as a miniature ecosystem.
- Understanding the environmental impact of the design, by evaluating the site and its potential energy.
- Continuous communication with nature, whether the building is designed within the city or in a more natural setting.
- Reducing the consumption of non-renewable resources and using highly efficient natural resources, such as energy, water, and land.
- Harmony with the environment and understanding natural processes.
- Creating a healthy environment with scarce resources. (2- P 3,4)

Sustainable architecture goals:

- In the Biosphere: Maintaining the integrity of basic environmental processes.
- In the Made Environment: Selecting technologies with limited waste, relying on recycling of materials, and rationalizing and selecting the appropriate locations for industrial centers.
- In the Social Environment: Developing a development plan for renewable and non-renewable natural resources within a timeframe that achieves intergenerational justice and broad public participation. (10- P 163)



Image No. (1) Shows the new KEPCO headquarters, the Korea Electric Power Corporation, is intended by the government to be a model of sustainable architecture in all its aspects, helping it transition to a world that relies on renewable energy. All sustainability elements are present, such as solar panels, heating systems, and water technology. The central tower houses an atrium that acts as the "lungs" for the building, providing fresh air via ventilation shafts. (18)

Second: Green Architecture:

Green architecture is considered one of the modern trends in architectural thought, which is concerned with the relationship between the building and the environment. The green architecture trend can be defined as “an integrated design thought that aims to achieve optimal interaction with the various environmental elements and conditions, in order to create suitable conditions for human life inside the building, both health-wise and psychologically, without causing any environmental problems as much as possible, or in other words, it attempts to introduce environmental and human considerations into the design process.” (3- P 24)

It is a functional building system that is in sync with its biological environment and ecological scope through self-control in managing the inputs and outputs of this system with the least number of negative impacts on the environment and energy consumption, whether during the

construction, operation or demolition of this system, which achieves the efficiency of performing the targeted functions and activities. In an innovative architectural expression, it provides a mechanism for vital communication between human, his society and the surrounding nature. Green architecture meets people's needs and requirements for comfort, public health, and cost reduction by utilizing natural resources such as sunlight and air. It also increases human productivity in all interior architectural spaces. In doing so, it increases the use of natural building materials, conserves water consumption, reuses wastewater, and solid materials. It uses architectural methods to move and encourage air circulation in areas that would not normally enjoy this benefit. It also benefits from the sun's energy and heat for lighting and ventilation, introducing the sun's light and heat into spaces that would otherwise not be directly exposed. This contributes to reducing the need to generate electricity for environmental pollutants.

(9- P 60)

From all of the above, green architecture is the architecture that is completely in harmony with its surroundings. It was given this name to indicate understanding with nature, like plants, as green architecture borrows the properties of plants to integrate with nature.

So green architecture is:

- Flexible to accommodate expected future changes in any of the system's components, as if the building were a living organism.
- Utilizing renewable, non-polluting resources.
- Using only the materials and energy it needs without excess and without demonstrating technological capabilities.
- Exploiting the environment's resources, such as solar energy, natural light, and wind energy, and employing them to its advantage.

Green architecture principles:

1- Respecting the natural forces of the site, including:

- Ecological forces and the environmental range within which the site is located, to maintain its balance.
- Respecting natural and physical formations, including rivers, lakes, wind, sun, floods, earthquakes, and potential resources, while adapting to the climate.
- Balance with the plant and animal cover.
- Using energy sources and building materials available on the site and studying the optimal solution for withdrawing them in a balanced manner and maintaining the ecosystem.

2- Use renewable energy resources and environmentally friendly materials.

3- Reduce waste generated by the building and strive to reuse it.

4- High energy efficiency and reliance on natural energy sources.

5- Achieve a successful and efficient internal thermal environment by ensuring internal air insulation, followed by temperature control as needed through the use of appropriate building materials in terms of thermal insulation. (4- P 181,182)

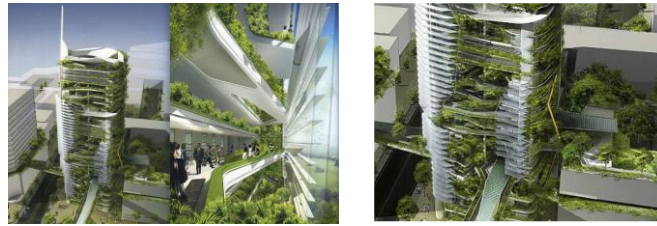


Image No. (2) The Editt Tower, designed by Yeang International & T.R. Hamzah in Singapore, integrates the plant elements with the facade, occupying nearly half of the facade's area. Natural ventilation is provided through openings, the use of photovoltaic cells, and the collection and treatment of rainwater and drainage water, reusing it to irrigate the plants. (22)

Third: Smart or Intelligent Architecture:

Intelligent architecture is a technological architecture where technology is an important tool in architecture, but not a goal in itself. Using the latest materials and technologies with the added benefit of environmental compatibility is not necessarily considered intelligent design. Therefore, smart architecture transcends and exceeds common standards of energy efficiency, achieving beauty and function, using healthy and non-toxic materials, being multifunctional and multi-purpose, resilient and sustainable, minimizing the costs of recycling and reusing materials and natural resources, and utilizing technology to integrate building systems, in addition to saving overall construction costs and operating expenses.

From the above, intelligent architecture can be defined as follows: "Intelligent architecture is architecture that integrates with everything around it, interacts with it, and responds to environmental and human requirements, through the use of modern technology and information technology, while reviving models of traditional architectural technology."

Since intelligent architecture aims to reduce natural energy consumption and utilize available resources in the environment. This trend achieves two goals:

The first is to reduce pressure on non-renewable natural resources.

The second is to increase the efficiency of using the architectural system.

What is meant by building intelligence is "the ability to recognize and perceive changing climatic conditions and respond and adapt to them, with the aim of obtaining the best use of natural resources, improving the internal environment and achieving comfort for building users and their internal spaces." (2- P 50)

Smart buildings are buildings that achieve efficiency factors, whether through cost or taking into account environmental factors, through the integration of basic elements: (construction - systems - services - management), and the mutual relationships between them are what help users of architectural spaces to realize their goals of cost, comfort, safety, suitability, maximum flexibility and achieving overall effectiveness, not only for the building itself, but also for the construction process as a whole.

The new awareness of the environment, coupled with digital capabilities, has reduced the reliance on heavy technology in air conditioning, heating, lighting, acoustics, and security, directing the design towards combining these with traditional architectural means, with software control of the integration between them. This has created what is known as intelligent architecture. These means have made it possible to automatically control the internal climate of the building with maximum energy efficiency, while quickly identifying any shortcomings or

interruptions. The outer layer of the building will be transformed into a skin that acquires new practical and technological properties. In comparison with human skin, the architectural skin in the media age has learned to see, hear, smell, taste, breathe, speak, alert with sounds, and be affected by all the sensitivity of the nervous system. In short, we are talking about intelligent, thinking architecture. Intelligent architecture is the buildings and spaces that automatically control the internal climate with minimal energy consumption by:

- Computer control of opening and closing sunshades and louvers.
- Air conditioning control based on ambient temperature, heat load, and relative humidity.
- Move with the movement of the sun and the wind, and suit the requirement day or night, summer or winter.
- Insulating upper surfaces with automatic movable umbrellas and open or covered water.
- Central monitoring of essential building services, such as elevators, sewers, water, etc...
- Automatic fire alarm and extinguishing, using electronic thermal and smoke detectors and hazardous gas detectors.
- Automatic monitoring and alarms against theft and intrusion, and planning crisis management, surveillance, and emergency alert programs.
- Automatic control of indoor lighting intensity based on daylight hours and sunlight.
- Providing databases and audio and visual communication systems. (11- P 184 ,186)

Principles of Intelligent architecture:

- The ability to achieve dynamic performance: A smart building is one that is able to monitor changes as if it were operating as a vigilant observer, and to perceive them and then respond to them in a pre-known automatic reaction, and adapt to new conditions that suit the needs of users.
- Optimizing user comfort requirements in terms of thermal, visual, auditory, and psychological comfort.
- Achieving harmony between technology and the environment, focusing on environmental protection, the use of renewable energy, and reducing energy consumption.
- Using smart materials such as photovoltaic materials, thermo-responsive materials, nano materials, and other materials that have an additional function, such as the ability to respond to external stimuli in a predictable manner and that can adapt to external appearance and ventilation in response to environmental changes. (11- P 196)



Image No. (3) The GOTZ Headquarters in Germany, designed by Webler Geisser, is a smart, responsive building capable of responding to changes in the internal and external environment, using (BMS), neural networks, and responsive artificial lighting. (17)

Fourth: Kinetic or Moving Architecture:

It is a type of architecture that has the ability to change its shape to reflect changes in the surrounding environmental conditions. It is architecture that intelligently responds to external variables and takes the form of movement. Kinetic architecture is architecture whose movement can be partially or completely controlled and responds to surrounding influences.

A movable building is a building that is managed by a system consisting of sensors and motors to be able to respond to the data it receives, and its response is in the form of movement. It is a building that changes its positions as a result of responding to the needs of its users or to respond to the surrounding environmental conditions. This response is a result of the presence of intelligent systems that can control its movement partially or completely automatically.

(1- P 63)

Features of movable buildings:

Any moving building consists of a set of materials, and the properties of the materials used vary to match the building's specific function and design considerations, in addition to the systems for entering and collecting information to reach the required levels of control, as follows: (materials – input methods – mechanical motors – control systems).

- Advantages of kinetic architecture:

- Can be used for power generation.
- Quick to implement.
- Variable facades that are far from boring.
- Energy savings in cooling or heating the space.
- Highly flexible design for horizontal projection.

Disadvantages of kinetic architecture:

- The need for high technological development in manufacturing moving parts to withstand wind and air pressure for facades and pressure loads for the weight of the parts responsible for movement and to be light, which is something that only exists in nanomaterial.
- High cost
- Requires advanced transportation and an extensive road network.
- Requires specialized technical personnel.
- Requires high precision in execution.
- Consumes significant energy for movement. (5- P 258)



Image No. (4) Shows Sharifi-Ha House, designed by Next Office in Tehran, consists of three rooms that can be rotated 90°. This movement and rotation give the house a shape-shifting facade, and also allows it to adapt to fluctuating temperatures in summer and winter by opening the rooms outwards or closing them inwards, with the facade being flexible, moving, and transforming from a two-dimensional facade to a three-dimensional facade. (15)

Sustainable architecture and green architecture are concerned with the building taking into account environmental aspects, but with the stability of the building. The intelligent building must have a group of advanced systems that rely on modern technology, and these systems must be integrated with each other in a way that allows for the exchange of information between them. Kinetic architecture aims to move the building or part of it. If we combine them, we get a movable building, but with the goal of achieving better environmental efficiency of the building, while using technology to control movement and achieve comfort and luxury for the building's users. (1- P 71)

When thinking about the creativity of the greatest architect, Allah, in his creation, we find that the human body is a manifestation of Allah's power and contains systems and organs of the utmost precision, complexity and organization. It is natural that the human body is not a building, but it can be compared to a building in several aspects. The body, like a building, is composed of many parts, and each part in the body performs specific functions, just like each part in a building. Each part has its function and use, but all the parts work together, which makes the body work smoothly and harmoniously. The body also needs energy to function, just like a building. Energy in a building, for example, comes from electricity, while in the human body; energy comes from food and oxygen.

Although the human body can be compared to a building, it is more amazing than any building because it is Allah's creation and because it can do special things. For example, the body can grow. The body begins as a single cell, and over time, this tiny cell develops into a body made up of billions of cells. The human body can replace certain worn-out parts. Every day, about two billion of the body's cells wear out and are replaced. Thus, the body is constantly rebuilding itself. For example, the human body replaces the outer layer of skin every 15-30 days.

The human body can defend itself against hundreds of diseases and can repair itself after most minor injuries. Many body parts, such as the heart and kidneys, work nonstop. For example, the heart of a 70-year-old person will have pumped at least 174 million liters of blood during that time, and that same person's kidneys will have removed waste from more than 3.8 million liters of blood.

Using the senses, humans can detect changes in their surroundings, such as changes in temperature, light, or sounds, and can adapt to these changes immediately. (2- P 58,60)

The body's senses are among the most important blessings that Allah has bestowed upon man. People can distinguish thousands of smells, yet the sense of smell is one of the least developed senses in humans. The human body can also detect changes that occur within it, such as changes in body temperature and the adaptation of different parts of the body to constant activity to keep the internal organs in their natural state. These adaptations extend to a system of nerves that transmit messages from one part of the body to another.

Despite the amazing technological progress achieved by humanity, we are still panting to catch up with technology, but through nature. When looking at any technological development achieved by man, we find that nature preceded him by stages thousands of years ago. The airplane, for example, is a model imitated from nature, but with reliance on human technology (energy, materials, and construction systems). As for nature, which Allah created, it relies on divine technology, which is (movement). (11- P 192)

Movement is one of the characteristics that indicate life, so the technology related to it is the focus of the attention of researchers and students of living organisms, as superior technologies

appear that support and enable them to perform their functions in a way that ensures their continuity and survival.

Movement is defined as the ability of a living organism to change its place in the environment in which it lives. It is one of the characteristics that distinguishes a living organism from inanimate objects. So, it is one of the most prominent aspects of life that a living being uses to move from one place to another in pursuit of benefit or avoiding harm. The movement is done with the participation and integration of specialized systems and organs such as the skeletal system, the muscular system, and the nervous system, which organizes and coordinates the required movement pattern through the work of the muscles and bones together, enabling the body to move. (1- P 77)

The types of movement in living organisms are divided into two types: Either relative motion or translational motion:

- 1- Relative "positional" movement is the movement of the body while the origin remains constant, such as the movement of plant stems and the movements of the heart.
- 2- Translational movement: This is the movement of the entire body from one place to another, such as the movement of humans and animals. However, they agree that this movement results from a response to a stimulus, whether internal or external.

Living organisms respond to stimuli, whether these stimuli are physical or chemical in the internal and external environment. The stimuli that cause a response in most organisms include several variables, including changes in the color, direction, and intensity of light, changes in temperature, pressure, and sound, and changes in the chemical composition of the environment, such as the surrounding soil, air, or water.

In general, moving technology is one of the most prominent biotechnologies that has provided humanity with ideas for many mechanical solutions. (2- P 67)

- From all of the above, we can extract a definition of biodynamic architecture.

Definition of Bio-Dynamic Architecture:

Biodynamic architecture is an architectural thesis that combines trends in green and sustainable architecture, intelligent architecture, and kinetic architecture. The building is embodied as a living entity that has the ability to interact positively with its surrounding environment, being affected by it and influencing it, but the effect does not harm its nature, but rather is in harmony with it, as if the building has senses that enable it to sense the environmental changes around it, and it gives a signal to some of its parts to move in response to those changes, depending on the technological techniques that were achieved during the twenty-first century.(16)

Bio-Dynamic Architecture Goals:

- 1- Raising the level of the architectural product and making it more capable of achieving some steps on the path to progress to simulate some moving creatures.
- 2- Freedom of movement and raising the ceiling of ambitions for the designer.
- 3- Adding a new aesthetic and formative dimension to the building, transforming the design from static rhythms to dynamic rhythms.
- 4- Reducing the depletion of natural resources and averting environmental crises.

5- Meeting the needs of users for diverse buildings equipped with technologies that meet their current and future requirements.

The research attempts to establish a theory and general framework for biodynamic architecture, while leaving the details to the imagination of each designer to develop his own vision, as it is a newly emerging architectural trend. (12- P 84,85)

The importance of Bio-Dynamic Architecture:

Environmentally:

- Preserving the environment from waste from the construction materials used in traditional architecture.
- Reducing the consumption of natural resources through recycling construction materials and operational waste.
- Reducing energy consumption, as energy can be generated through the movement of the building and saved.
- Reducing pollution, the increasing rates of which threaten the future of current and future generations.
- Considering environmental loads, such as wind and ice, through the fluidity of the building's shape.
- Conserving natural resources, which helps leave a better world for future generations.
- The ability to produce enough electrical energy to operate the building by using wind turbines among floors and solar cells on the roofs of floors.

Functionally:

- Creating an environment more suitable for human needs and meeting various social requirements.
- Taking into account the compatibility between the moving form of the building and its desired function.
- Multiple uses of the building by transforming and replacing the building's internal elements to suit different activities.
- Meeting users' needs for diverse buildings equipped with technologies that meet their current and future requirements.
- Use appropriate materials for the required purpose according to their properties. (6- P 101,104)

In terms of spaces:

- Adding a new formative dimension to the building, as the format is no longer limited to static rhythms, but rather moving formative rhythms have been added to it.
- Providing various formations with changing functional requirements.
- Flexibility and spaciousness of spaces to allow for future changes.
- Ease of maintenance and avoiding problems resulting from conflicting service paths of plumbing and electrical installations due to the centralization of services (in the fixed part of the building).
- Integration between different disciplines, including architecture, construction and mechanics, to achieve an ideal movable building.
- The possibility of future expansion in some architectural spaces.

- Taking into account the aesthetic and symbolic aspects of the architectural formation.
(12- P 98)

In terms of Technology:

- Using computers to monitor and control movement and the presence of control units within each unit.
- Using prefabricated construction technology to reduce construction time and workforce.
- Using smart systems in home components (doors, windows, fire systems, etc....).
- Keeping pace with modern technological developments.
- The ability to comprehend future developments that are taking leaps in the information age.
(16)

Analytical and applied examples that illustrate the vision of the future of Bio-Dynamic Architecture theory:

1- Kine tower Metamorphic Skyscraper :

Architect: Kinetura

Location: Belgium.

Project Type: Skyscraper

Construction Date: Future Design 2008-2011.

Building description:

The building is a parallelogram-shaped skyscraper and is a sustainable and intelligent building that mimics nature. This is in the building's outer shell, which contains a group of simple elements that open or close according to sunlight, responding to nature and the surrounding environment in order to form the building's facade. It is a building whose facade elements respond and move to sunlight or to the user inside. (23)

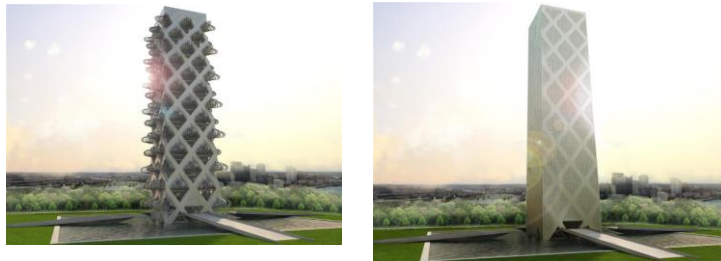


Image No. (5) shows the Kinetower Metamorphic Skyscraper opening and closing the elements
Components of the outer shell. (23)

Sustainable and green environmental systems used in the building:

- The building's exterior envelope controls the amount of natural light from the sun and the amount of air that can penetrate the building through openings, based on the needs of the users of the interior spaces.
- The building interacts with external climatic conditions and the internal environment, controlling the amount of natural light that can penetrate the building through openings. At the same time, the building's movable envelope efficiently regulates solar energy and natural ventilation in the internal spaces. (13)

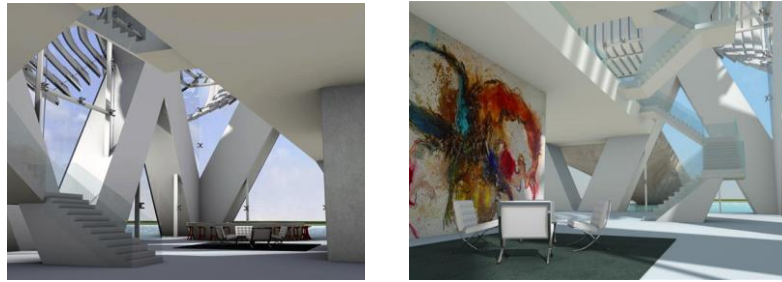


Image No. (6) Shows the interior design of one of the interior spaces of the Kinetower Metamorphic Skyscraper. (23)

Intelligent systems used in the building and the use of modern technology:

- The Window Shutters movable cover is designed from unique strips of flexible, easy-to-shape material called the Deformable Salt System, which works in integration with motion-based technologies and is computer controlled.
 - Data is transferred to computers via sensor systems distributed inside and outside the building, thus completing the communication circuit that directs and maps movement in the outer shell.
- (24)

Nature of movement:

- The movement of the building imitates nature, as the movement of the building's facade imitates the movement of flower leaves opening or blossoming in the sunlight, as they change from a closed state to an open state, but in a slow and imperceptible manner. The fixed facade responds to the first appearance of sunlight to begin to transform into a moving facade characterized by flexibility, so that the elements of the openings open like the opening process in flowers, but in a slow and imperceptible manner. (19)



Image No. (7) shows the opening and closing of the interface. (23)

2- Al Bahar Office Towers in Abu Dhabi:

Designed by Aedas Architects

Project Type: Administrative Building

Location: Abu Dhabi, UAE

Completion Date: 2009-2012

Building description:

The building consists of 27 floors and two basements, with a height of 145 meters. It consists of two twin towers designed in the shape of a cylinder with an area of 56 m² on a plot of 100 m². The design of the building's outer shell is based on an ancient technique but reused in a modern way, emulating Islamic architecture through the concept of the mashrabiya, but with a modern twist. (11-P 125)



Image No. (8) shows Al Bahr Towers Building in Abu Dhabi

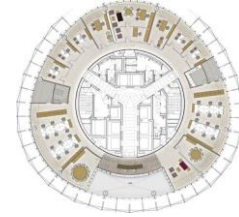
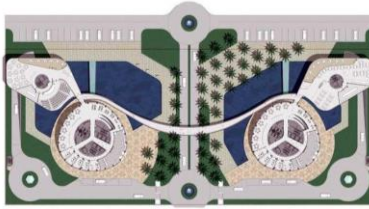


Image No. (9) shows layout and plan of the Al Bahr Towers building. (14)

The movable cover consists of 1000 solar-responsive movable shading screens called Masharabiys Shading System which act as a secondary cover operating within an independent framework. It consists of a hexagonal shape divided into foldable triangular screens that form the building cover, covered with glass fibers programmed with computer technology to respond quickly to the movement of the sun, and focus light and heat on any of the building's facades during daylight hours, to reduce the entry of glare and heat of the sun during the day, while it is folded at night to provide a view and interaction with the outside through the glass facades. (14)

Sustainable and green environmental systems used in the building:

- The facade's movement is achieved by the use of a solar-responsive dynamic shading screen system, which mimics the ancient mashrabiya. This system effectively reduces heat gain, as the facade units move according to the amount of solar radiation, which changes along with its angle of incidence during different days of the year. It also helps reduce cooling loads by more than 20%, thus increasing the efficiency of reducing energy consumption and carbon emissions.
- Movement practices reduce glare by 50%, which reduces the need for indoor air conditioning and energy consumption, in addition to allowing natural light to enter spaces, which reduces the need for artificial light and works to save energy, but ensures good use of natural lighting for the building's interior spaces.
- The idea of the Responsive Dynamic Shading Screen, which mimics the Mashrabiya but with a redesign using technological capabilities, is that during the night, a large percentage of the main facade is exposed, and with the first appearance of sunlight, the shading systems begin to close, starting from the east. As the sun moves, the units turn and begin to close along the strip perpendicular to the sun's rays. (15)

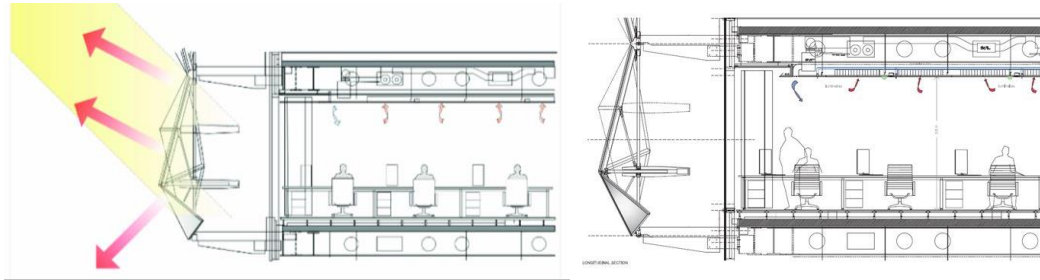


Image No. (10) shows facade movement and use of natural lighting in interior spaces. (14)

The kinetic part of the building:

- The building's geometric shape is based on the mashrabiya. The circular movement of the towers' cover helps maximize the use of the land area and benefit from the view from all directions through the walls.
- Responsive Dynamic Shading Screen is a movable element that has been installed as an external part of the double envelope of the building. It moves in a folding manner but in a radial formation. (11-P127)

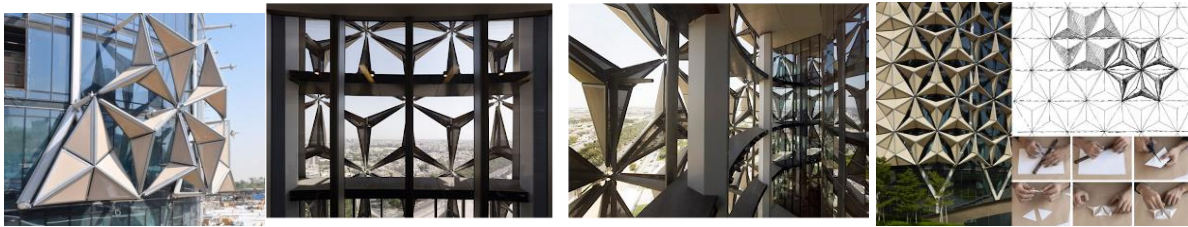


Image No. (11) shows movable shading units for the Al Bahr Towers building. (14)

Intelligent systems used in the building and the use of modern technology:

- The building's movable facade intelligently works in conjunction with solar thermal panels that heat the water, as well as photovoltaic panels on the roof, completely reducing total carbon dioxide emissions by more than 1,750 tons annually.
- The shading units are programmed by computer in a sequential manner, with the opening angle calculated in advance to control solar radiation and prevent it from reaching the main facade of the building. Through a variety of sensors, the command is given to open or close according to the climatic conditions outside the building.
- Connection among the computer, sensors, shading units and the motor so that it can operate in response to the sun's position and different angles of inclination. (11- P130)



Image No. (12) the movement of the movable shading units of the building. Its design adopts the idea of the mashrabiya, which opens and closes its openings automatically. (15)

Nature of movement:

The movement of the building mimics nature, as the facade of the building mimics the movement of the eye, opening and closing in sunlight through the building's responsive dynamic shading screen. During the night, a large percentage of the main facade is visible, and

with the first appearance of sunlight, the shading systems begin to close, starting from the east. With the movement of the sun, the units turn and begin to close along the vertical strip of the secondary cover. (14)

3- Floating Observatories Building (Tree Tower):

Project Name: Tree Tower

Designer: DSBA Group and Romanian architect Stefan Dorin, 2011

Location: Near Tai Chong City, on the Taiwan-China border

Project Type: Administrative and Entertainment Building

Implementation date: Not Completed

Building description:

The structure is a design proposal that won first place in an international design competition to reflect Taiwanese culture. It will have a maximum height of 300 m and an area of 10,000 m². The project was scheduled to be completed in 2012 with funding from the Taiwanese government.

The project includes the Taichung Museum and the Administrative Projects Center, in addition to being a tourist attraction for the city. (21)

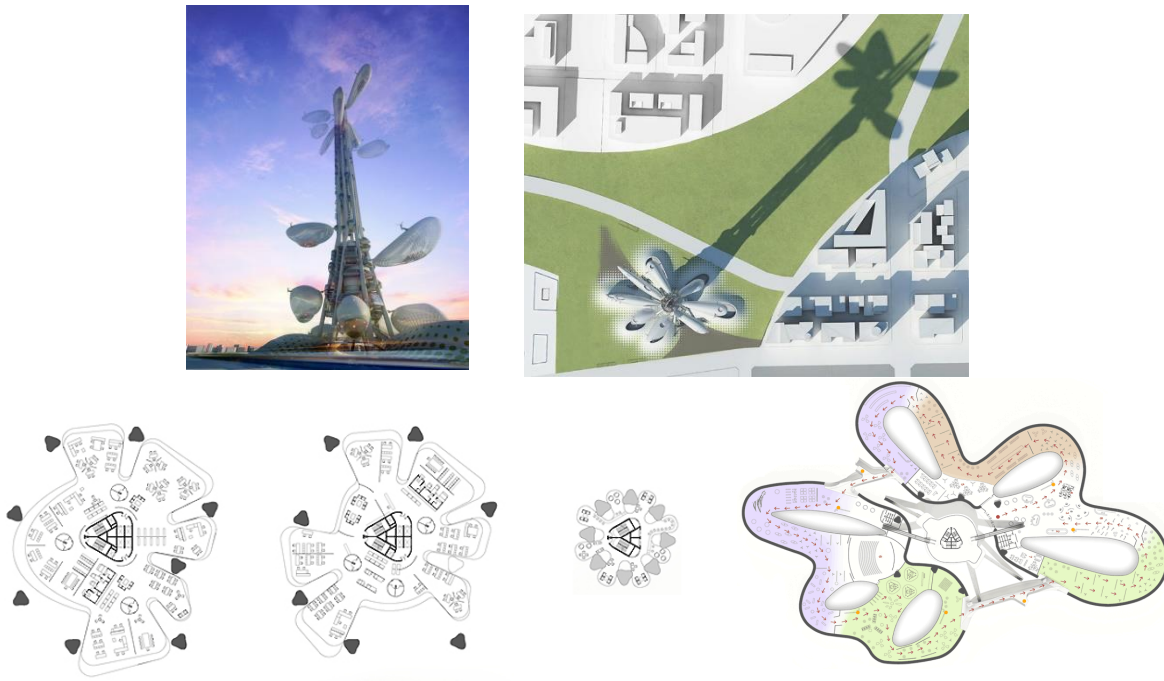


Image No. (13) shows floating observatories building, layout and its plan. (19)

Sustainable and green environmental systems used in the building:

- The ability to generate electricity due to horizontally mounted wind turbines located along the vertical axis. The dimensions of the horizontal turbines are designed according to wind speeds at different altitudes, so that they will produce sufficient energy for the building's needs.
- The building uses a self-contained solar energy system, as it contains large external glass surfaces that allow sunlight to pass into the building's interior spaces, which provides natural

heating in the winter, in addition to providing natural lighting for the building throughout the day.

- The building uses solar cells to cover its outer shell, generating electricity from sunlight and meeting the building's energy needs.
- Rainwater will be collected and treated.
- The heat from the ground is used to heat the interior spaces of the building in the winter. Air passes through ventilation pipes through the ground due to the ventilation openings in the spaces used in the building. The energy from the ground's heat is also used to maintain the temperature of the water being heated. (19)

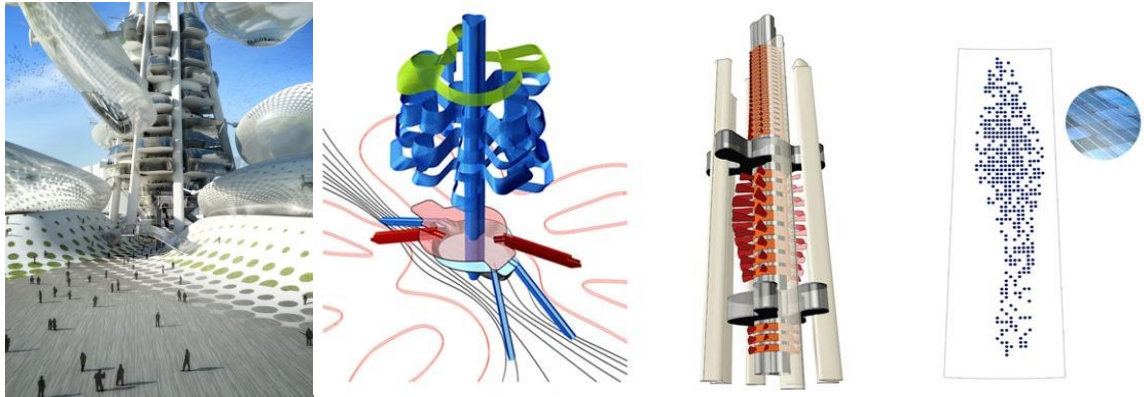


Image No. (14) shows (left) access to the office floors is through three escalators (blue); two other escalators connect the 'wings' of the museum (red) (center), 3D detail of the axial wind turbines (right) unfolded skin, showing the distribution of adjustable photovoltaic panels.

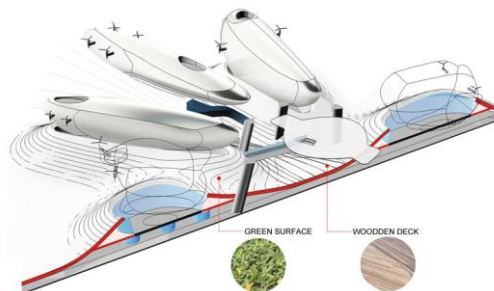


Image No. (15) shows cross section of museum with surface materiality. (18)

Intelligent systems used in the building and the use of modern technology:

- The building is based on the concept of prefabricated parts, as all floating units will be manufactured in the factory and then installed on site, except for the foundations and the middle concrete core, which will be manufactured on site, which will lead to: Energy saving - Reducing construction time.
- Reducing costs
- A clean and green construction site free of noise, dust, smoke, or waste.
- The solar cells are connected to the observatory units that comprise the building, along with the computer, to determine the difference in energy generated by the solar cells and the internal consumption of the users. Government electricity coming from abroad is used up if the amount of energy stored in the solar cells is exhausted.
- The central core contains eight elevators as follows: Two elevators to reach the observation space, two others to serve the office space, four for offices, in addition to two emergency stairs. (21)

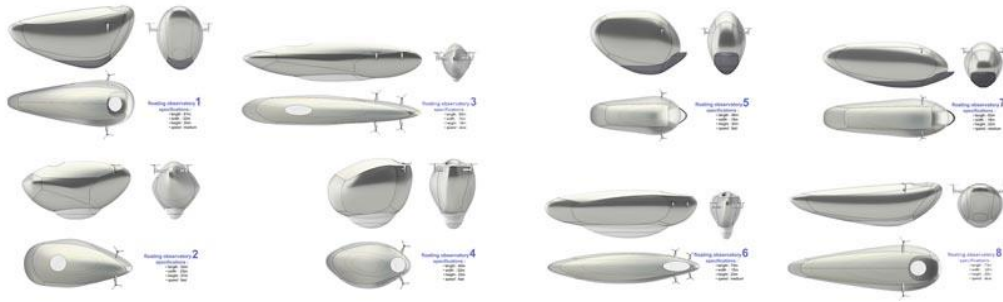


Image No. (16) shows Prefabricated parts of the floating observatory building
floating observatories – typologies and dimensions

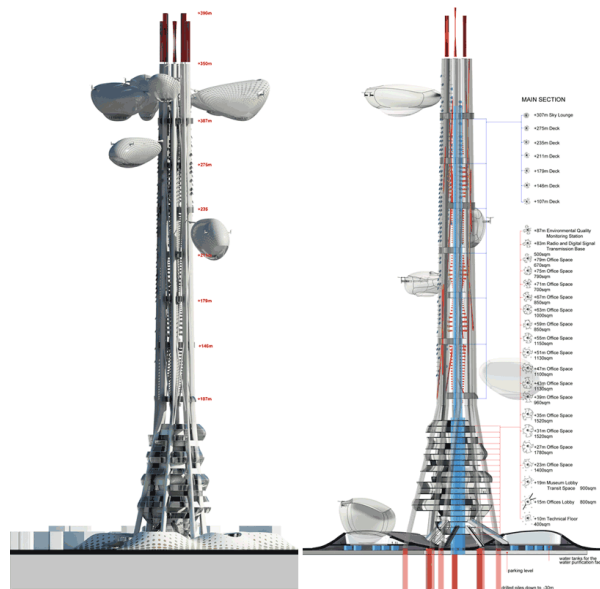


Image No. (17) shows (left) tower elevation (right) tower section. (21)

The kinetic part of the building:

- The tree-shaped building contains 8 platforms (floating observatories) that move vertically along a central concrete column (the tree trunk) up and down. Each platform can accommodate 50 to 80 people, enabling them to get an exceptional view of Taiwan from above.
- The movement is linear movement by electromagnetic field to lift the platforms in the middle column. (17)

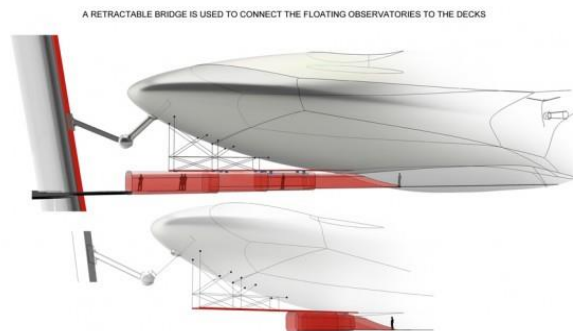


Image No. (18) shows the shape of the floating observatories used in the building. (21)

Nature of movement:

- These observatories are designed in the shape of a leaf because Taiwan is also a leaf-shaped island, and they will be made of very lightweight materials inspired by the spacecraft industry.
- The single platform resembles a balloon filled with helium, and is designed to slide on a vertical track where it is used as an elevator, which resulted in the building having a small area on the ground and large green spaces. (17)

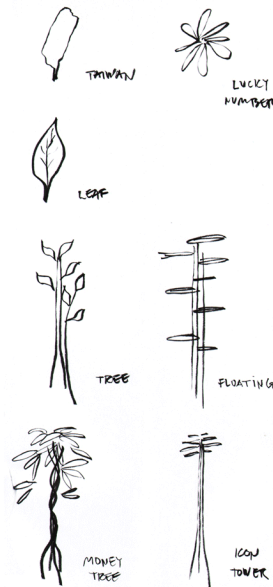


Image No. (19) shows the design concept of the floating observatory building. (21)

From the above it is clear that Biodynamic architecture is an architectural thesis that combines trends in green and sustainable architecture, intelligent architecture, and kinetic architecture. The building is embodied as a living entity that has the ability to interact positively with its surrounding environment, being affected by it and influencing it, but the effect does not harm its nature, but rather is in harmony with it, as if the building has senses that enable it to sense the environmental changes around it, and it gives a signal to some of its parts to move in response to those changes, depending on the technological techniques that were achieved during the twenty-first century. The reference of biodynamic architecture goes back to the combination of basic elements: Sustainable architecture, green architecture, smart architecture, kinetic architecture, and contemplation of the ability of the greatest architect, Allah, and the use of nature and his ability in his creation, which results in biodynamic architecture.

A questionnaire directed to specialists for the research entitled " Biodynamic architecture between modern environmental and technological trends" :

The survey aims to obtain the opinion of specialists in modern design trends from the integration of more than one architectural trend to obtain new comprehensive architectural trends that combine many characteristics and advantages to obtain the maximum benefit in design and their opinion on the extent of benefit from applying the trend of biodynamic architecture.

The questionnaire was directed to a number of faculty members in the Department of Interior Design and Furniture and the Department of Architecture in the Faculties of Applied Arts, Engineering and Fine Arts, and a number of architects and interior designers.

The results of the questionnaire were as follows:

Questions	Agree	Slightly agree	Disagree
1- With the multiplicity of architectural trends and the emergence of many modern technologies, it has become necessary to integrate and combine more than one design trend and technology in a systematic and thoughtful manner to maximize the benefits of both.	90 %	5 %	90 %
2- By researching the universe, nature, living organisms, and Allah ability in his creation, and attempting to analyze them, we can benefit from them in the field of design in increasing the design background of designers with characteristics, forms, and capabilities, and arriving at a design direction and theory capable of achieving a balance between the environment's right over man to preserve it and his changing requirements and needs.	90 %	10 %	_____
3- From modern trends in design, the integration of more than one design trend or the combination of more than one specialization will benefit people, the environment, and design learning.	80 %	20 %	_____
4- Research in the field of alternative and renewable energy must be supported, just as industrialized countries are concerned with their commitments to supporting environmental studies and taking them into consideration.	95 %	5 %	_____
5- From the current environmental problems, the designer must expand the use of clean and renewable energy to reduce heat emissions and use technology that leads to no increase in global temperature.	100 %	_____	_____
6- The theory of biodynamic architecture as a comprehensive theory that combines the main goals of the theory of sustainable architecture, green architecture, smart architecture, and kinetic architecture. If the designer follows it, he can achieve a balance between the environment and the requirements of the users of the spaces.	85 %	15 %	_____
7- Do you think that biodynamic architecture will be a balanced architecture that may contribute to finding solutions to many of the current environmental crises.	85 %	15 %	_____
8- Do you think that the biodynamic trend might work to achieve a balance between the environment's right to be preserved by humans and their requirements.	80 %	20 %	_____

9- The biodynamic trend will be able to adapt and interact with current and future climate changes and crises in light of the modern technology used.	85 %	15 %	_____
10- The culture of biodynamic architecture must be disseminated as an integrative and comprehensive architecture, as it is the basis for stimulating public thought so that society becomes aware of the type of work that meets human needs and aspirations as a fundamental axis for development.	80 %	20 %	_____

By analyzing the opinions of the individuals participating in the survey from the specialists, the survey results showed the following:

- It has become necessary to integrate and combine more than one design trend and technology in a systematic and thoughtful manner to make the most of the advantages of both.
- By researching the universe, nature, living organisms, and Allah's ability in His creation, and trying to analyze them, we can benefit from them in the field of design in increasing the design background of designers with characteristics, forms, and capabilities.
- Integration between more than one design trend or combination of more than one specialization will benefit people, the environment, and design learning.
- Research in the field of alternative and renewable energy must be supported, as industrialized countries pay attention to their commitments to supporting environmental studies and taking them into consideration.
- The designer must expand the use of clean and renewable energy to reduce heat emissions and use technology that prevents an increase in global temperature.
- The theory of biodynamic architecture as a comprehensive theory that combines the main goals of the theory of sustainable, green, smart and movable architecture. If the designer follows it, he can achieve a balance between the environment and the requirements of the users of the spaces.
- Biodynamic architecture will be a balanced architecture that may contribute to finding solutions to many of the current environmental crises.
- The biodynamic trend will work to achieve a balance between the environment's right to be preserved by humans and their requirements.
- The biodynamic trend will be able to adapt and interact with current and future climate changes and crises, in light of the modern technology used.
- The culture of biodynamic architecture must be disseminated as an integrative and comprehensive architecture, as it is the basis for stimulating public thought so that society becomes aware of the type of work that meets human needs and aspirations.

Results:

- Formulating the theory of biodynamic architecture as a comprehensive theory that combines the main objectives of the theory of sustainable architecture, green architecture, smart architecture, and kinetic architecture during the twenty-first century.
- Explaining the importance of biodynamic architecture to achieve balanced architecture that contributes to finding solutions to many of the environmental crises that have begun to appear and have led to the doubling of energy consumption rates and the excessive exploitation of natural resources, in addition to many environmental problems such as global warming and water, air and land pollution due to the increase in industrialization rates and the emission of toxic gases, which has negatively affected the environment and its natural balance.
- Searching for an alternative architecture capable of achieving a balance between the environment's right over man to preserve it and man's changing requirements and needs. This is what biodynamic architecture derived from natural engineering as applied models that were able to adapt over the years. Therefore, the theory of biodynamic architecture came from the design of the human body.

Recommendations:

- Delving into the universe, God's power and creativity in all of His creation, and trying to analyze the living examples that exist for us in nature and benefit from them in the architectural field and all other fields.
- Using technology, but taking into account what meets the needs of the building user, without forgetting the environment's right to be preserved.
- Expanding the design background of designers with the characteristics, forms and capabilities of the biodynamic architecture trend by creating study curricula and creating research groups so that the designer becomes familiar with how to benefit from this trend.
- Expanding the use of clean and renewable energy to reduce greenhouse gas emissions and using low-carbon technology that prevents global warming.
- Supporting research in the field of alternative energy as Industrialized countries are also concerned with their commitments to supporting environmental studies and taking them into consideration.

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