Humanism in Building Technology

A New Philosophical Vision for Attaining Human Aspects within the Science and Technology of Construction

Professor Dr. Abeer Samy Yousef Mohamed

Architecture Department, College of Architecture & Design, Effat University, Jeddah, Saudi Arabia.
Architecture Engineering Department, Faculty of Engineering, Tanta University, Tanta, Egypt.
PO Box 34689 Jeddah 21478 Saudi Arabia.

ORCID: 0000-0003-4415-2754

Abstract:

The technology through history is considered the important and vital index for future development especially if it associated with the field of scientific advances of the era in the context of recognizing the humanitarian needs. So, the architecture in technical side, depends mainly on construction technology in the formulation of buildings production. In the other hand the architecture in creative and artistic side is considered the most arts which influence on human. As known the application of new techniques in construction methods can impact in negative way on human being and effect on his identity and value after he was the part of an integrated social system, but these values are lost by using mass production techniques which considered the architecture as closed boxes without regard to the traditions of the society, customs, identity, and human values. Hence the search is trying to put forward a new methodology for the integration between building technology and human needs with applying positive aspects of new building technologies and techniques of current millennium.

Keywords: Humanism, Ecosystems, building technologies, technical aspect, Architecture

1. INTRODUCTION

Technological progress has taken many forms and had tremendous developments in all aspects of life from ancient ages of civilizations to the present day, innovative architects have been able to take advantage of the possibilities provided by this progress in reaching a building that reflects the needs of the times and the spirit of technology that are available through it. Architecture is influenced by what is around it and may even be one of the most affected areas because of its close association with the human being, who is the focal and center of these variables within the surrounding environment. This connection to the human being makes the profession of architecture a renewed profession suitable for the needs of the human, whether these needs are social or psychological, and the architect must understand human behavior, keep up with its requirements, needs and even desires. Today, with the intervention of technology in all aspects of our life and cross distances through means of Communication as well as a little too much via electronic information storage means and difficult to become possible, all of which makes our perceptions of many requirements change. Therefore, the new project

programming mechanism, identification, requirements of each architectural spaces of different construction formulas must be taken into account the appropriate technology of creative merging of modern technology advantages and effective traditional practices to create solutions that allow people to live in comfort. This will be with main target which is with the least harmful effects on surrounding environment, appropriate technology also aims to increase self-reliance.

1.1 Problem Definition

Architecture forms our life through architectural design by creating internal spaces that contain our activity for all aspect. Regarding to the new inventions of current millennium, new techniques have been emerged that express what have been achieved in all technologies field and that directly affected architecture. Some of these new directions & technologies didn't include social aspects as a critical part and core focal of design process especially human needs.

This lack in relationship between new building technologies in architecture and humanism considerations created architectural dilemma about the humanism needed considerations must be included in all building technologies that will be applied in architecture. Thus; social & human aspects must be linked in all design phases that in interact with structure design in a compatible way.

1.2 Research Objective

Regarding to substantial era we live through their limitless technologies that reached all life features, this paper has a particular objective that is introducing an innovative framework that devote the standard criteria of selecting and analyzing building technologies that enrich architecture design with respect and enhancement of human social, and culture to aid in design process as its main core is to create spaces that include different human activities. Also the paper will link between architecture and new liberal pioneering building technologies that to support in adding sustainability for design phase through new reading and dealing of humanitarian roles in this dilemma for the intended purpose of discovering new key scopes for additional future research.

1.3 Research Methodology

The study follows the theoretical and analytical approach in its content with the aim of exploring all the effective aspects، influences of building technology and the extent of its impact on the design process, whether positive or negative. This is through clarifying the extent of their interaction with the basic aspects as an effective realm of the design process, but rather as a primary goal that is the content of the design process. This is in the context of interacting with environmental data, passive design methodologies, sustainability and energy efficiency within the framework of different design theories and methodologies.

2. THE MAIN ENVIRONMENT ECOSYSTEMS

The environment in which the human living is formed from the interactions between the three main systems are biosphere, the social environment (sociosphere) and the technical environment (technosphere) as follow:

2.1 Biosphere

The Soviet scientist "Vernadsky" in the 20th century defined the biosphere as "that space on the planet where life of all kinds is naturally exists

(https://ec.europa.eu/environment/integration/research/newsal ert/pdf/ecosystem_services_biodiversity_IR11_en.pdf),   it provides the human being with his needs of material inputs, whether live or not, to meet his needs in the production of for food, depression, shelter, transportation and entertainment ... etc.

2.2 The Social Environment (Sociosphere)

Represents the area of human needs and immaterial aspirations of cultural values, beliefs, legislation, social structures and institutions created by man to organize relations within society and between human societies and also interactions with surrounding individuals. Contemporary thinkers have many visions of the relationship between man and the built، environment, but the most common vision is that of the environment based on behavior setting, as a framework for human activities represented below:

a) Neutral framework: i.e. man lives with the surrounding built environment within completely neutral phase.

b) Facilitating framework: If this framework is seen as a catalyst for the process of understanding stable behaviors within the community and then generates new activities.

c) Inhibiting framework: If some of the behaviors in society are characterized by the inability to express their own activities.

2.3 Technosphere

Is a technological system used by man and used within the biosphere (housing, public buildings, farms, pastures, factories, mines, fisheries, roads, bridges, dams, archways, power plants, vehicles etc...) (Mikellides, B., 1980). In this area, the techniques used and technology provide the means to establish these products, structural formulations and their operating systems. However, it should be taken into considerations that the way in which the technologies are applied to create these "all man-made" products within the biosphere is formed within the social context.

3. CONSTRUCTION TECHNOLOGY AND TECHNICAL ASPECT OF ARCHITECTURE

Technology has an important role in determining what architecture produced, and perhaps the comparison between architecture in its different eras and architecture in the current century (in particular) reveals to us what is the big difference in the development of architecture from the impact of construction technology application provided by scientific advances in the design and implementation of buildings (Parsaee, M., et al., 2015), particularly in pioneers' work of the high-tech architecture and the pioneers of modern deconstruction movement. Thus, a concept could be reached about what technological architecture means; it can be defined as the architecture that applies available technologies in current era, both in the design and model of such architecture or in the ways and methods of its implementation.

3.1 The Impact of Technological Change on Architecture:

At the end of the twentieth Architecture has undergone changes at all levels, also the industrial and technological boom supported these changes. Architecture was influenced by these technological developments in the methods of design, construction and building materials as follows:

3.1.1 Development in Building Materials:

Technology has made it possible to improve the properties of certain materials such as reinforced concrete, wood or steel, which are old and long-used materials, giving these materials new features & uses, this is in addition to the emergence of several tangible developments in building materials (Hatherley, O., 2007), including:

1. Manufactured materials such as elastomers with different compositions, with their flexibility in forming and coloring as in fig (1).

Figure 1: (Left) Plastics that added more flexibility in shaping, transparency and multicolor in the architecture,

(https://www.shutterstock.com/es/image-illustration/3d-colorful-sheets-transparent-plastic-93191074) / (Right) ETFE foil cushions Saurierpark Bautzen, Germany,(https://architizer.com/blog/inspiration/collections/etfe/)

2. Development of glass to show modern types of heat treatment, noise proof and self-cleaning types.

3. Development of thermal and acoustic insulation materials not only to ensure a comfortable indoor environment but also to maintain the internal energy of the building, which in turn is in alignment with the principles of sustainability and energy conservation.

4. Development of intelligent building materials and sensors based on the use of mini-triggers in managing and control systems, including energy-efficient technology by controlling air conditioning systems, lighting, heating and cooling at strategic points and energy control through the use of sensors that continuously feed information, it leads to a significant reduction in energy consumption, such as interactive walls capable of identifying a person and his psychological state using biological models and energy maps of the human body, fig (2).

5. The development of materials and fiber that added to the concrete mixtures to improve their properties on the loading, operating and shaping.

Figure 2: (Left) special digital ad for a Berlin Metro Station, (https://mindsparklemag.com/video/digital-interactive-wall-in-berlin/), (Right) ESI Design Installs Interactive Wall Display in Washington DC Office Building

(https://www.urdesignmag.com/design/2016/07/12/esi-design-installs-interactive-wall-display-washington-dc-office-building/)

3.1.2. Technological Development in Construction Systems:

Structural systems have evolved in such a way that the architects to launch their imagination to create shapes and voids that were not achieved before, where it became possible for them to create different masses and the possibility of strengthening the building with modern construction systems based on the overlap between the system Structural with steel sectors and modern designs of buildings emerged fig (3), such as skyscrapers, enormous covered halls and buildings that follow the deconstructive style.

Figure 3: The development of structural systems allows architects to release their imagination to invent shapes and voids that were not hammered, as in the development of skyscrapers and deconstructive architecture.

3.1.3 Technological Development in Designs Preparation:

The process of architectural design and proposal preparation has perceived a huge innovation using computer applications and its competences to support architectural designs, generate shapes and analyze structural loads of complex forms. Also, communication technology has contributed to connecting architectural offices to sites around the world (Siegel, C., 2008), the most important results of these developments.

- Architecture Globalization:

The possibility of remote design as it became available to the architectural offices around the world to design works in other countries among the entire world through the use of communications technology. Also, they can follow the implementation of the building remotely with the same technology, and thus have been affected by the architectural spaces and elements of computing and digital communication.

- The use of virtual reality and simulation:

Digital modelling has become a very vital in the early stages of design process in both architectural and structural phases. In manual model, the information is static while in the digital model is dynamic, the digital model provides us with infinite images of the project, so architectural and structural elements could be modifying and seeing their direct impact not only on the designs but also on the cost of the building ...etc., fig (4) and simulate climatic effects from heat, light and wind movement.

Figure 4. (Thiago, V. C., 2018): (left) Immersive 4D VR – intelligent linking of construction elements with time / (right) Interactive Virtual visit in Real estate.

4. HUMAN NEEDS AND SOCIAL ASPECT OF ARCHITECTURE:

Food, shelter, and clothing are the three things that necessary for human existence. All kinds of Structural formulations represent spaces that contain human and his own or social activities according to building's type. Human is influenced by the building he lives or uses for work, worship, etc., (Scholl, M. B., et al, 2012). Also, buildings outside form must represent the surrounding environment. For example, housing affects individuals psychologically and socially, the quality of housing, general design of its interior spaces, privacy, open spaces and the extent to which each family's personal needs are met. It may affect health, psychological, and interpersonal relationships.

The Maslow theory (David, W., Marta, L., 2009) is one of the best theories of human needs analysis, which states that; "the minimum basic needs in the hierarchy must be met before the required needs at the higher levels". These needs are as described in Fig. (5)
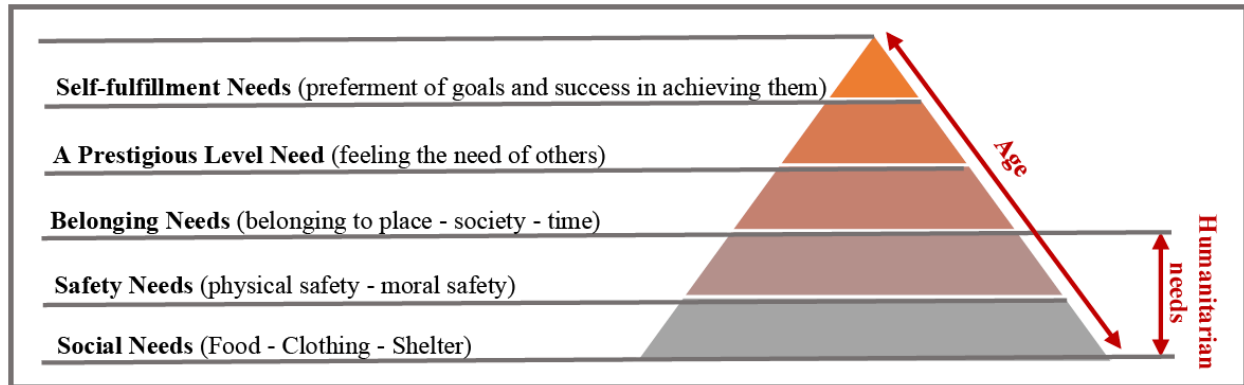

Figure 5. Humanitarian needs according to priorities – upgrading from Maslow' Model (David, W., Marta, L., 2009)

- Social needs: The necessary needs for the individual to live within the community,

- Safety and reassurance: whether essentially perceptible through securing the surrounding environment and building formulations from any external or moral threats by satisfying the need for safety and a sense of stability.

- Feel one's self: belong whether the individual belongs to a place or society or a time.

All of these previous needs represent psychological needs that depend on the social needs of both the individual and the community, while the physiological needs that depend on the vital living needs are:

- Physical needs: these are the basic needs that all human beings participate in such as eating, breathing, sleeping and protection from enemies...... etc.

- Climatic needs 'thermal and environmental comfort: is one of the main objectives of architectural design, protecting against climatic effects (March, L., 1998) (Zhang, L., 2015), so the absence of thermal comfort negatively affects Human behavior.

- Aesthetic needs: where architectural beauty is represented in the good use of construction types, techniques, how to use vocabularies of formation and visual architectural composition achieving the fundamentals principles of arrangement of composition (Megan S., Matthew E. L., 2014)(Zhang, L., 2015), that expressing the functional, social and cultural content and achieving the requirements of the individual psychological and environmental and representative of the technology of the era to which he belongs.

5. THE INFLUENCE OF HUMAN BEHAVIOR REQUIREMENTS ON MODERN BUILDING TECHNOLOGY

5. 1 The Inclination Towards Sustainable Architecture

In the 1970s, architects began to enquiry about the wisdom of creating buildings box that surrounded by glass and steel, requiring enormous heating and expensive cooling systems, hence the demands of the ardent architects, (Schaumann, D., et al., 2016) who proposed the most energy-efficient architecture came from Thomas Herzog of Germany, Norman Foster and Richard Rogers of Britain (Scholl, et al, 2014). These architects began to explore and develop architectural designs that focused on the long-term environmental impact during the operation and maintenance of buildings. At its 1986 conference, the United Nations Environment Committee defined the concept of social sustainability as; a way of social, economic and political progress that meet local needs without sacrificing the ability of future generations to meet their needs, and one of the most important principles of sustainability is Making the most of the use of natural resources of water, raw materials and energy, fig (6).
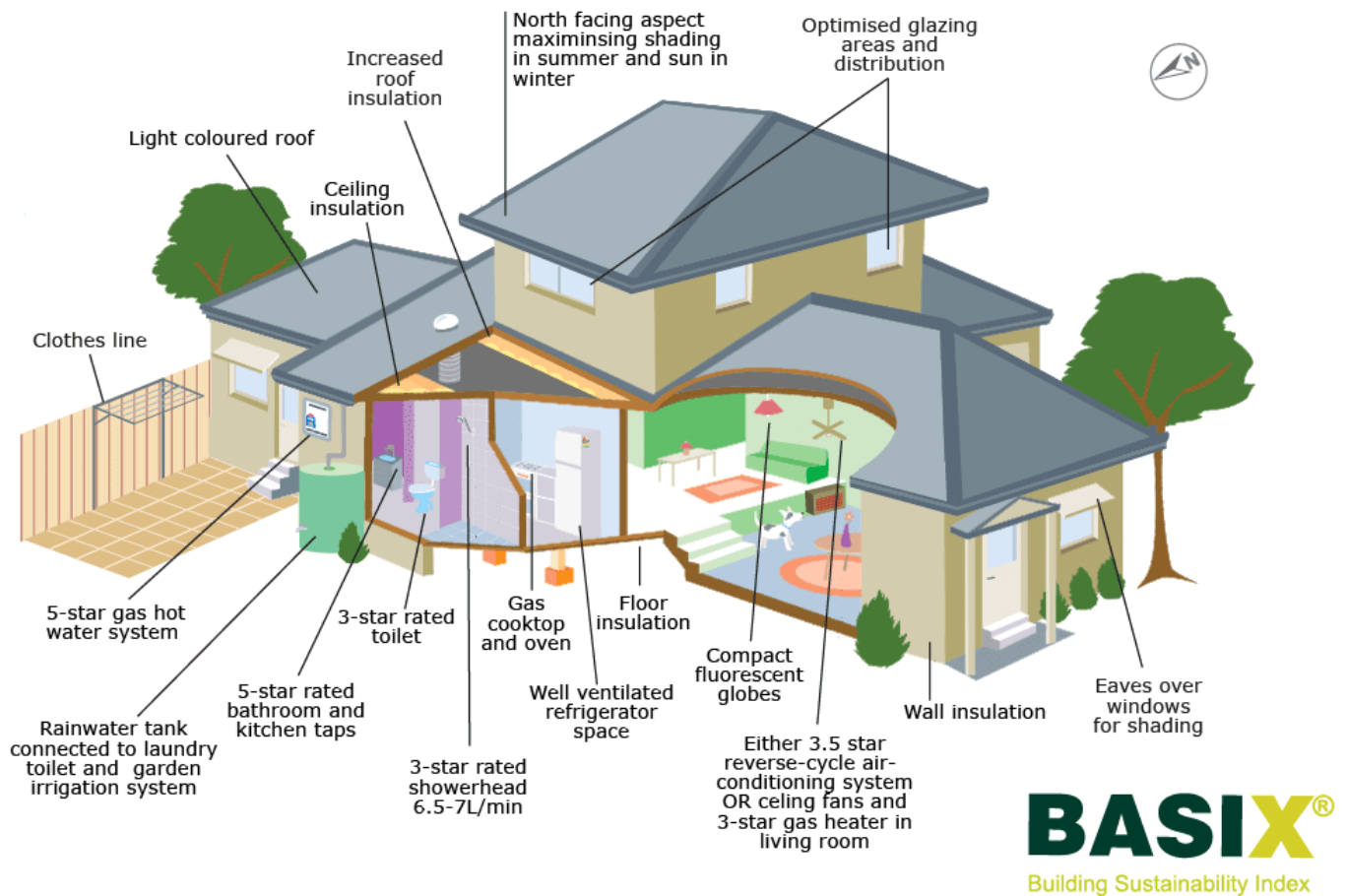
Figure 6: One of the most important principles of sustainability is the optimum utilization of natural resources such as water, raw materials and energy,
(https://starfish-initiatives.org/proudly-launching-an-innovative-sustainable-home-checklist/)

The first constrain of sustainable architecture is its compatibility with its surroundings, environment and its preservation of natural, industrial or economic sources, with the combination of all this in a successful artistic form, which encourages the individual and society to preserve, respect, use and maintain them, since the most important stability and sustainability of historic buildings to this day. This is its integration with the environment to preserve its sources and be characterized by the qualities of beauty and historical energy that imposes respect for all (Menachem, D., 2019).

As for the green architecture, which is the architecture resulting from its environment and respects the resources of the earth and its natural beauty, which provides the needs of its users and is based on maintaining their health and satisfaction. This architecture has allowed the use of architectural elements that interact with the environment and provide thermal and photonic comfort for the human being with the least energy possible but also contributes to the production of energy.

For example, The Conde Nast project,

A 48-story building in New York's Times Square fig (7), many technologies have been used to save energy. The building used a special quality of glass that allowed sunlight to enter without heat transmission. It also got two natural gas-powered cells that supplied the building with 400 kilowatts of energy, enough to feed the building with the amount of electricity needed at night, 5% of the amount of electricity needed during the day. While cooling and air conditioning systems are placed on the ceiling as a gas generator rather than a generator, this reduces energy loss. Inside the building, there are movement control sensory devices of fans and lighting in areas with low occupancy such as stairs, while exit signals are lit by light reduced diuretics to consume energy, therefore the building consumes 35-40 less energy than any similar conventional building, (Mir, M.A., et al, 2006).
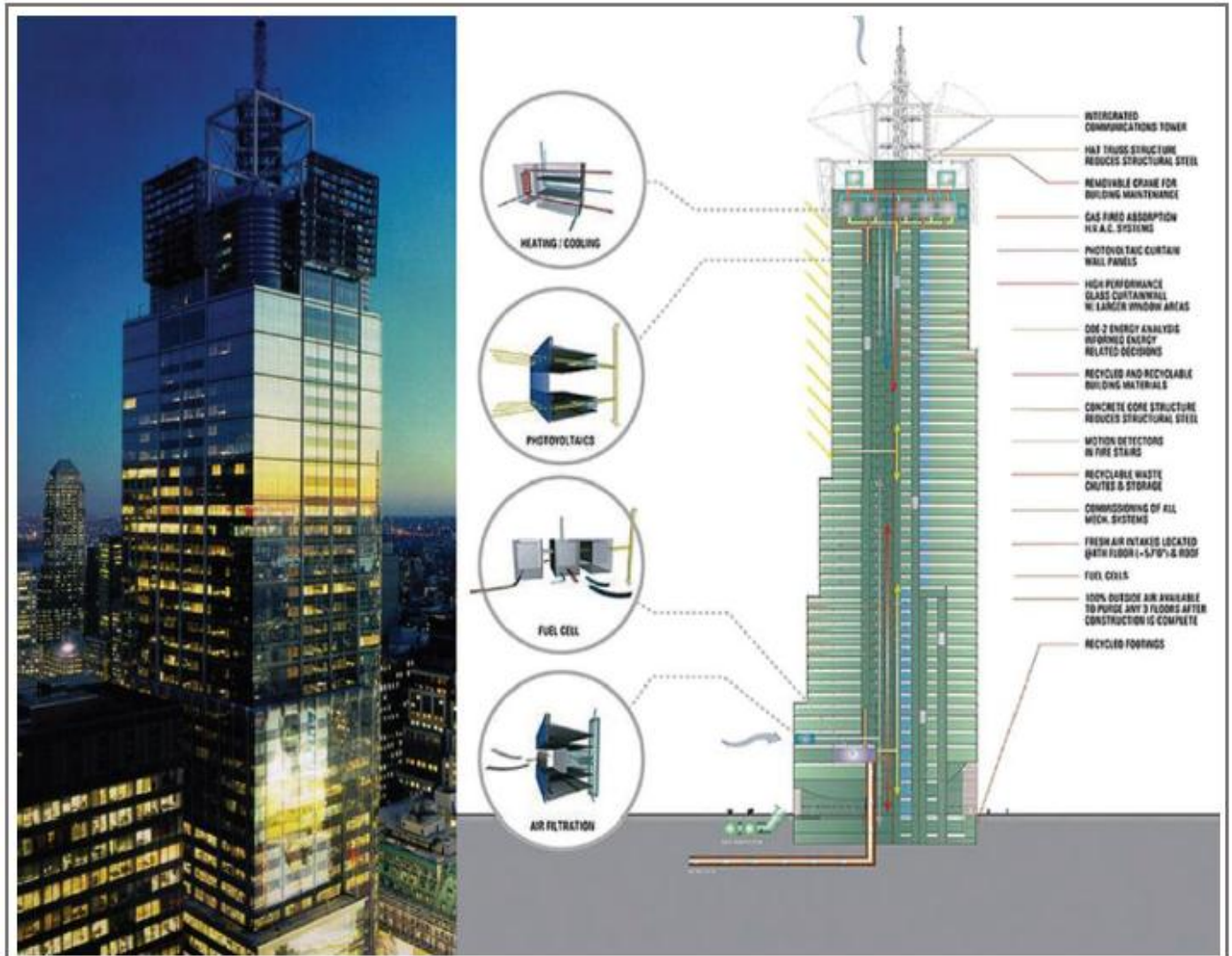
Figure 7: Conde Nast Building, 4 Times Square, 2000, New York City, Fox & Fowle Architects, (Mir, M.A., et al, 2006)

5.2 The Exploitation of Renewable Energy

Renewable clean energies represent the exploitation of air for natural ventilation, management of electricity generation fans and for the management of groundwater aquifers on the scale of a single building, village or city in wind-sourced areas as a competitive solution with mechanical infrastructures. The production of energy from bio mass also represents a rationalization of the use of crop residues, livestock and humans in the countryside using simple transformers that require simple capital and produce biogas, which reduces dependence on electricity and petroleum products as sources of energy and fertilizer (Vezzani, R., et al., 2015). The use of solar energy to provide hot water for domestic use, heating and electricity generation by photovoltaic cells are also taken into account. The advantages of these cells that they generate electricity without the need for communication and in this case, it is necessary to store electricity inside the building in the form of batteries or building connection to the network in the customary way.

For example, in a business center in Duisburg, Germany, fig (8)

"Business promotion center", This building stores the energy needed for the building with two types of solar cells placed on the roof of the building: *photovoltaic cells* that convert solar energy into electricity while The solar panels heats the water that enters the absorbent cooler of the radioactive cooling system (Ahmed, M A. SH., Waleed, F. O., 2006), both of which store the energy needed for the gas-managed backup generator, while the outer walls are two layers between them vacuum and the outer layer transparent insulator controlling extreme temperatures and carrying aluminum weapons. The internal layer is double-powered and filled with argon gas for thermal comfort and this configuration retains and distributes thermal energy.
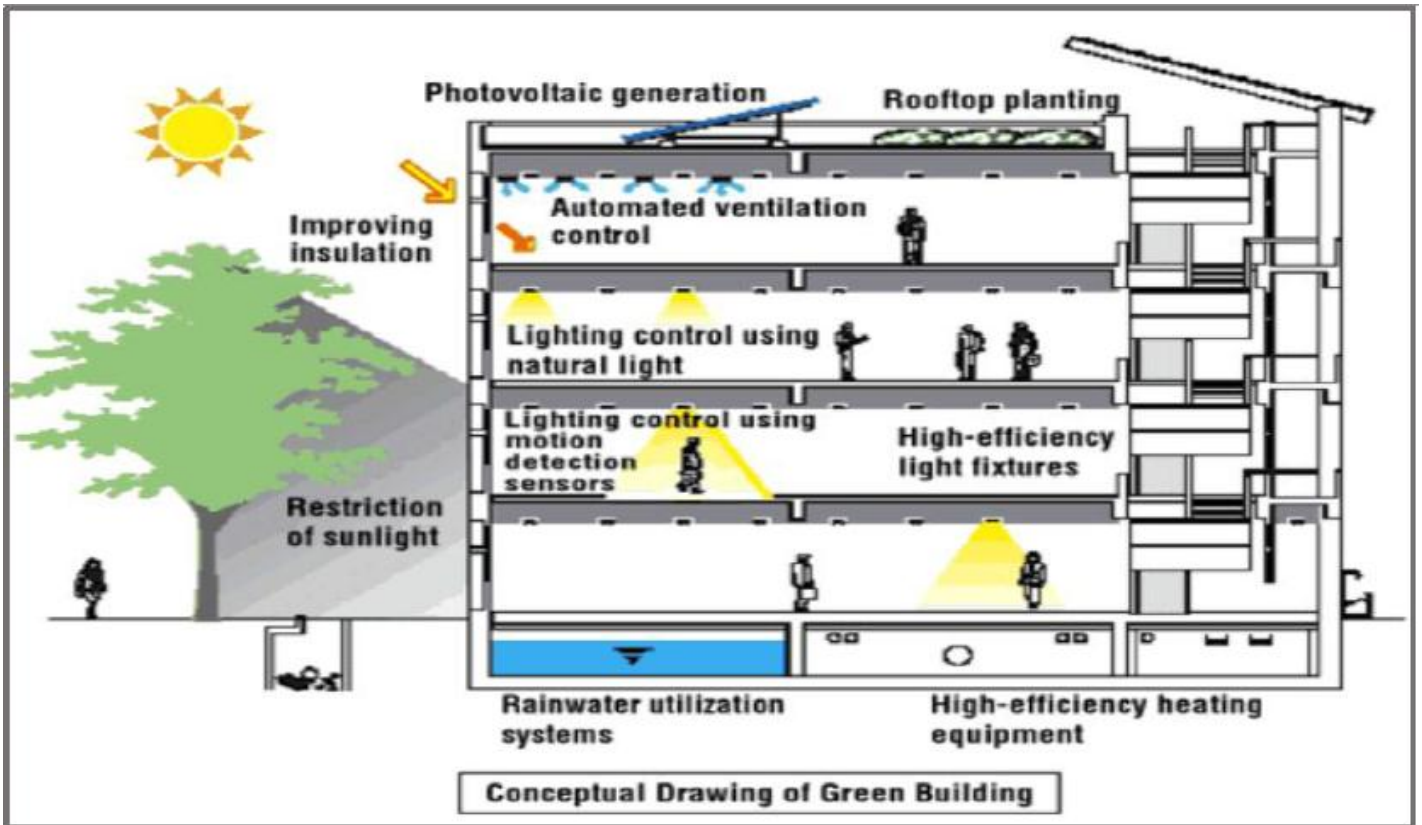
Figure 8: Climate Control Scheme Business Promotion Center in Duisburg, Germany, (Ahmed, M A. SH., Waleed, F. O., 2006)

5.3 Digital Globalization as an Organizer of Environmental Interaction Between Man and Modern Building Technology

5.3.1 Intelligent Architecture

Has emerged in the last era of the twentieth century that represented in buildings where environmental systems are integrated (energy use, temperature control, lighting, sound, workplace and communications) (https://www.imarabe.org/en/architecture). The Arab World Institute in Paris fig (9) is a good example of the intelligent exterior skin where it is abstracted from the idea of mashrabia, which its openings maximized and minimalized automatically as the lens of camera is strongly that connected to the lighting outside the building through photographic cells, and thus the smart architecture has been able to use services and networks efficiently and safely.
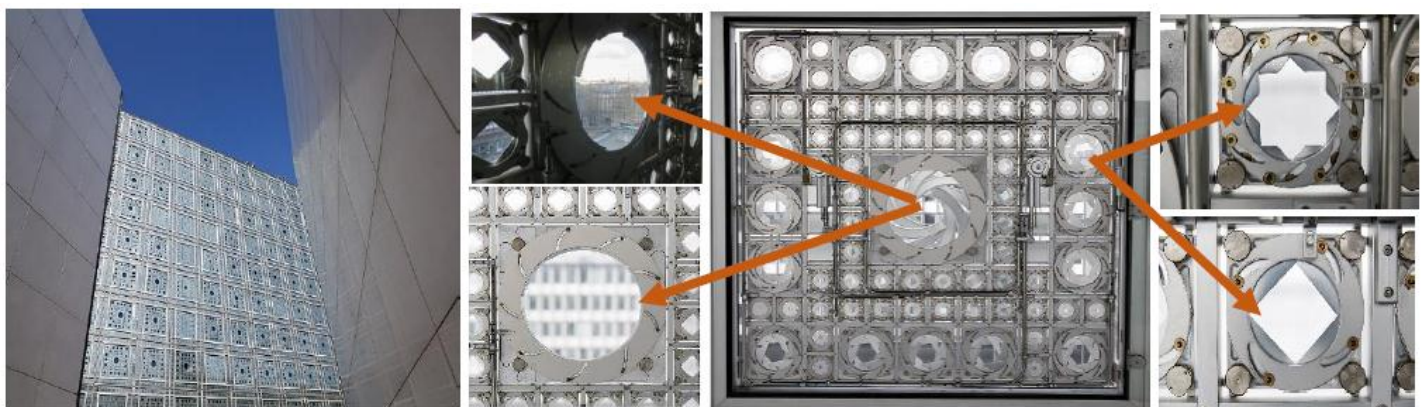

Figure 9: Openings of the Arab World Institute in Paris,
(https://www.imarabe.org/en/architecture)

For example, smart housing,

The smart housing system and its various components rely on a digital infrastructure that is spread throughout the dwelling and has sets of terminals, each of which controls a device, monitors performance or performs a specific function. These terminals communicate with each other through different modes under the management of a control network using a

standard protocol (Menachem, D., 2019) (Schaumann, D., et al. 2016) fig(10), where the various components of this system provide different intelligent services in the housing such as: energy management - remote control - device control Lighting - automatic or remote operation and stop - monitoring of the borders of the house and its spaces - communications - shopping - security devices such as alarms against intrusion on doors and windows or fire and smoke alarms...... etc.
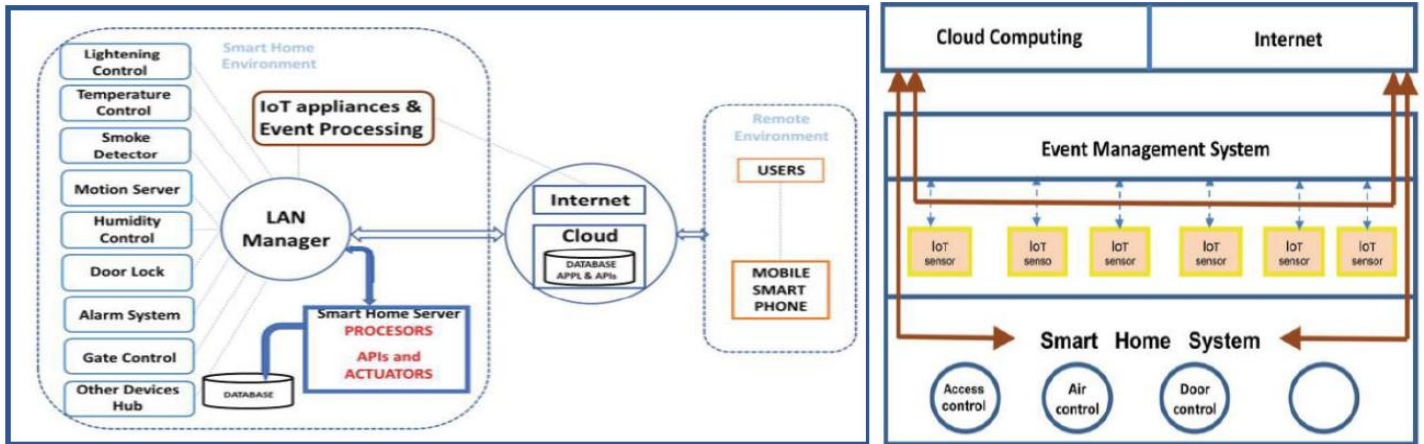

Figure 10: (Left) Advanced smart home—integrating smart home, IoT and cloud computing/ (Right) Advanced smart home composition., (Menachem, D.,2019)

5.3.2 Multimedia Architecture as Infotainments

Multimedia as infotainments have contributed to the creation of skyscrapers, where cameras, sensors, electronic guidance, indoor and outdoor lighting have been combined. The impact of these programs on communications and entertainment, that has overextended from telephone, fax, television, radio, personal computer, painter and electronic printer, is followed to the end of interactive networks. Critics of multimedia architecture emphasize that its use led to the lack of correlation of form with the function, and consequently have affected architecture in its roots when these media intervened in the architectural language, architecture no longer represents the desired attractiveness of a distinctive character according to the desire of the designer and the society that contains the building production (Zhang, L., 2015). In future multimedia designs, the walls will be transformed into information carriers by rear projection using special curtains with small black-out curtains to prevent light from affecting the image. thus illustrating the displayed image with a three-dimensional effect without the need for vision glasses and looks the image is as if it floats in the void and follows the imaginary abilities of the architect or designer who makes proposals for multimedia architectural language that is the result of an architectural culture generated in transition and on dialogue between the old and the new.

5.3.3 Virtual Reality and Virtual Architecture

The digital void is part of the imaginary fact, it generates different three-dimensional spatial formulations depending on the time and movement fig (11)(Thiago, V. C., 2018). These applications include within the scope of how to show the

architectural work as well as evaluate the design process in depth for the creators, their clients and evaluate them before implementing them and propose any modifications that add a better elegance to the thought. By the usage of movement, designer can study the movement of people inside space, form movement and lighting models, and know the effect of the movement of shadows on the preoccupation of the building and its work through different day hours. This virtual movement enables the space to be known and changed after days and years of use and cost.
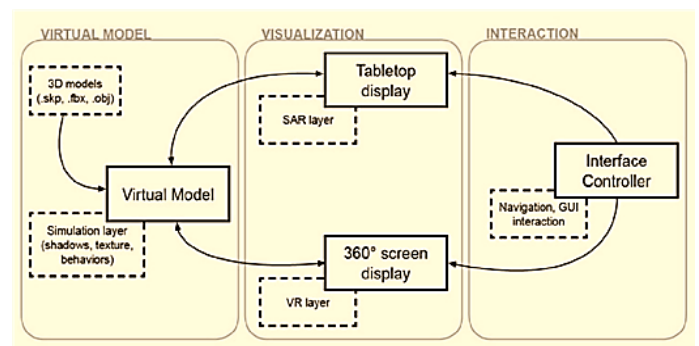

Figure 11: Application framework for CORAULIS one of VR applications, (Julie, M., et al, 2016)

5.3.4. 3D Holographic Virtual Architecture

The idea of using holograms and 3D lasers aims to produce a 3D stereoscopic image in a light way although it is hypothetical fig. (12), where adjustments can be made in the negatives that appear before the start of construction (Saxby, G., Zacharovas, S., 2015). Hologram can be converted to the real measure of the building with its four facades on the plot to be built with

modifications to adjust its size, height and ratio before it can also be exploited in the imaginary and material completion of destroyed parts of the relics using the existing parts of them or complemented by a visualization of what was the impact using similar relics.
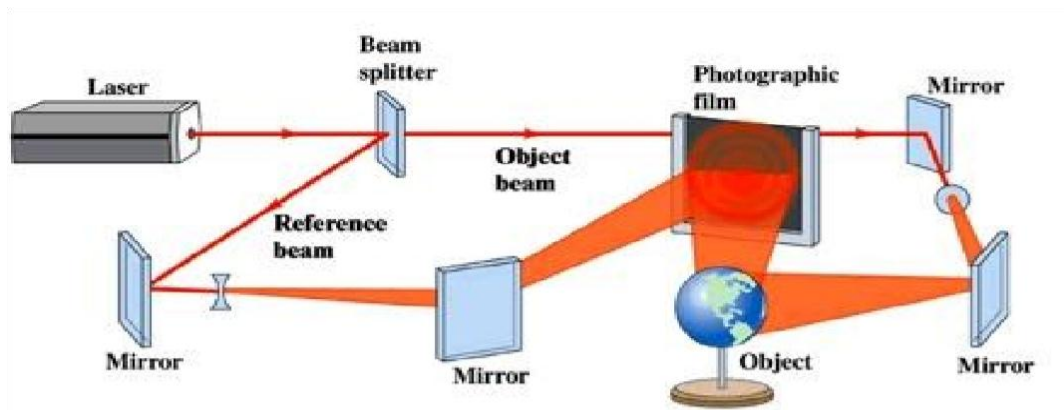

Figure 12: Holograms using a laser beam,
(https://www.assignmentpoint.com/science/physics/describe-about-holography.html)

Through the aforementioned technological trends that reflected the requirements of human behavior, the most important Enhancing Social Aspects Through Use of Modern Technologies in Architecture can be realized through the following table (1) & fig (13):

Technology Realms	Enhancing Social Aspects Through Use of Modern Technologies in Architecture	Evaluation Matrix				
		Sustainability	Energy efficiency	humanitarian aspects	Building Technology	Architectural innovation
Sustainable architecture technology and green architecture	- Rationalization of energy consumption through: the use of thermal insulation in walls and ceilings, use of roof gardens as a thermal insulation in addition to increasing green areas, allowing maximum use of daylight without being bright dazzling eyesight, ensuring appropriate ventilation, especially natural, and the use of natural materials other Toxic and avoid coexistence in electromagnetic fields. - Compatibility with the surrounding environment through the use of natural resources of water and raw materials such as the use of minimum contaminants and maximum natural or biodegradable materials or recyclable materials (less waste), and encourage the use of pre-made materials, which are less disturbing and disturbing the site. , And reduce the surface investment used for the building, allows maximum green space and reduce water flow	■	■	■	☐	■

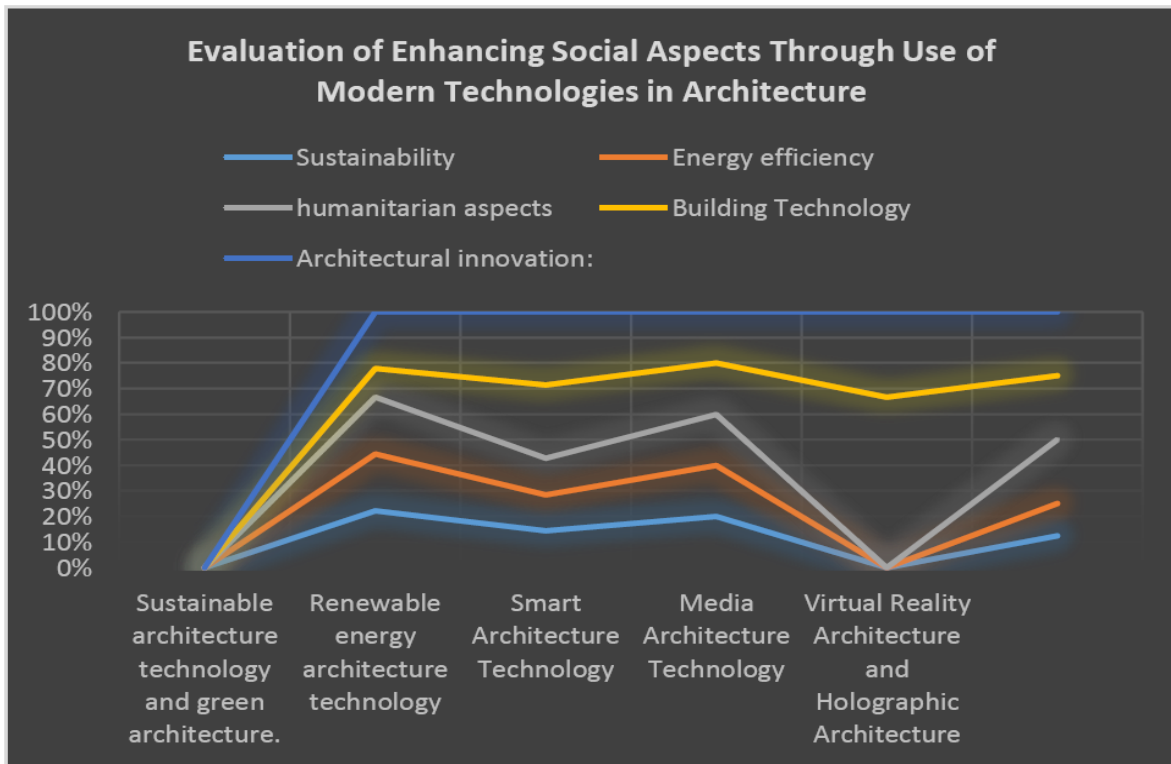| Category	Description					
Renewable energy architecture technology	- Providing solar heating systems, securing geothermal systems with ground sources for cooling and heating, and relying on photovoltaic panels.	▨	■	▨	■	■
Smart Architecture Technology	- Unification and integration of building systems to coordinate work among them and increase individual environmental control and raise productivity for work spaces and education and raise the value of the profit resulting from the construction of smart buildings and rent fully and manage consumption costs through control of all parts of the building throughout the day with the control of occupants and tenants in the building systems after closure To monitor the building remotely via computer and reduce operating costs and energy sources and the exploitation of natural resources.	■	■	■	■	■
Media Architecture Technology	- The possibility of creating skyscrapers easily and flexible and save on economic cost and expand the entry of electronic production within the boundaries of technical and design work, which positively affects the saving of time and labor, but may negatively affect the distance from the original roots of architecture and the architectural character of each community	☐	▨	☐	■	▨
Virtual Reality Architecture and Holographic Architecture	- The virtual architecture enables man to participate in the design of the building by seeing it in virtual reality, which fulfills one of the social needs, in addition to anticipating the final form of building production and the possibility of movement within its internal spaces to ensure the effectiveness of this building to achieve the desired function inside it, and has contributed Also virtual architecture in the restoration of heritage buildings and reformulated to keep them from disappearing. - The Holographic architecture is considered to be complementary to the virtual architecture so as to give the proposed object a more vivid picture to imagine the internal coexistence within the building and to check in more detail on the extent to which the architectural product to meet the needs and function required.	▨	▨	■	■	■
Evaluation	■ Fulfilled (10) ▨ Partially fulfilled (5) ☐ Not fulfilled (0)					

Figure 13: Evaluation of Enhancing Social Aspects through Use of Modern Technologies in Architecture

In spite of the positive effects that were reflected on human needs and human behavior according to the use of modern building technology, they have some negatives that have led to an increase in the gap between societies according to technological progress. Building technology is still influentially costly, in addition to the negative impact on cultural identity, this technology is for countries Least advanced technology represents imported technology, and the globalization of architectural production by means of communications technology leads to a monopoly of international offices for architectural works, which in turn affects the cultural identity.

Sometimes it does not take into account the prevailing social values for the emergence of new values that differ according to this progress, which leads to the spread of phenotypic values, boasting, and the associated behavioral patterns that increase the severity of class and social differences.

6. CONCLUSIONS AND RECOMMENDATIONS

Through this research, a number of results were reached and suggested Architectural Design Framework was invented fig (14):

- The successful architecture is an architecture that is compatible with the environment and engagements the construction technology thus the return of this architecture on human beings positively.

- The remarkable development in building materials is directed primarily to human comfort, health and well-being and takes into account the engagement of modern materials in accordance with environmental conditions, health and human.

- Building technology and architectural design has overcome the barriers of inertia in architectural design, also information technology architecture has enabled architects to deal with smart architecture and sustainable architecture. The aim of this is to maintain an internal environment in the building that achieves comfort for the user, which is reflected on the community in terms of conservation of energy and resources as well as the individual who will exercise his life more comfort and luxury.

- Human being is capable of evolution, civil, has the ability to deal with technology and even passion for it, and when this technology is consistent with its needs, it deals with it well and thus reflected on his behavior to develop.

The research also recommends the following:

- When using construction technology must work to create human spaces to achieve the visual pleasure of the viewer and the content of human needs in a better way.

- The use of building technology should not abolish the cultural identity of each place separately, but this technology should serve to support the cultural and human identity of a place or society.

- Consideration should be given for increasing the orientation of building technology towards sustainable development, thus increasing the link between the bashes of society, which in turn increases the environmental awareness of the community members.

- The use of computer technologies in architectural design technological breakthrough must be directed to activate the relationship between the architect and the user and help both to make a decision that is in the interest of the user.
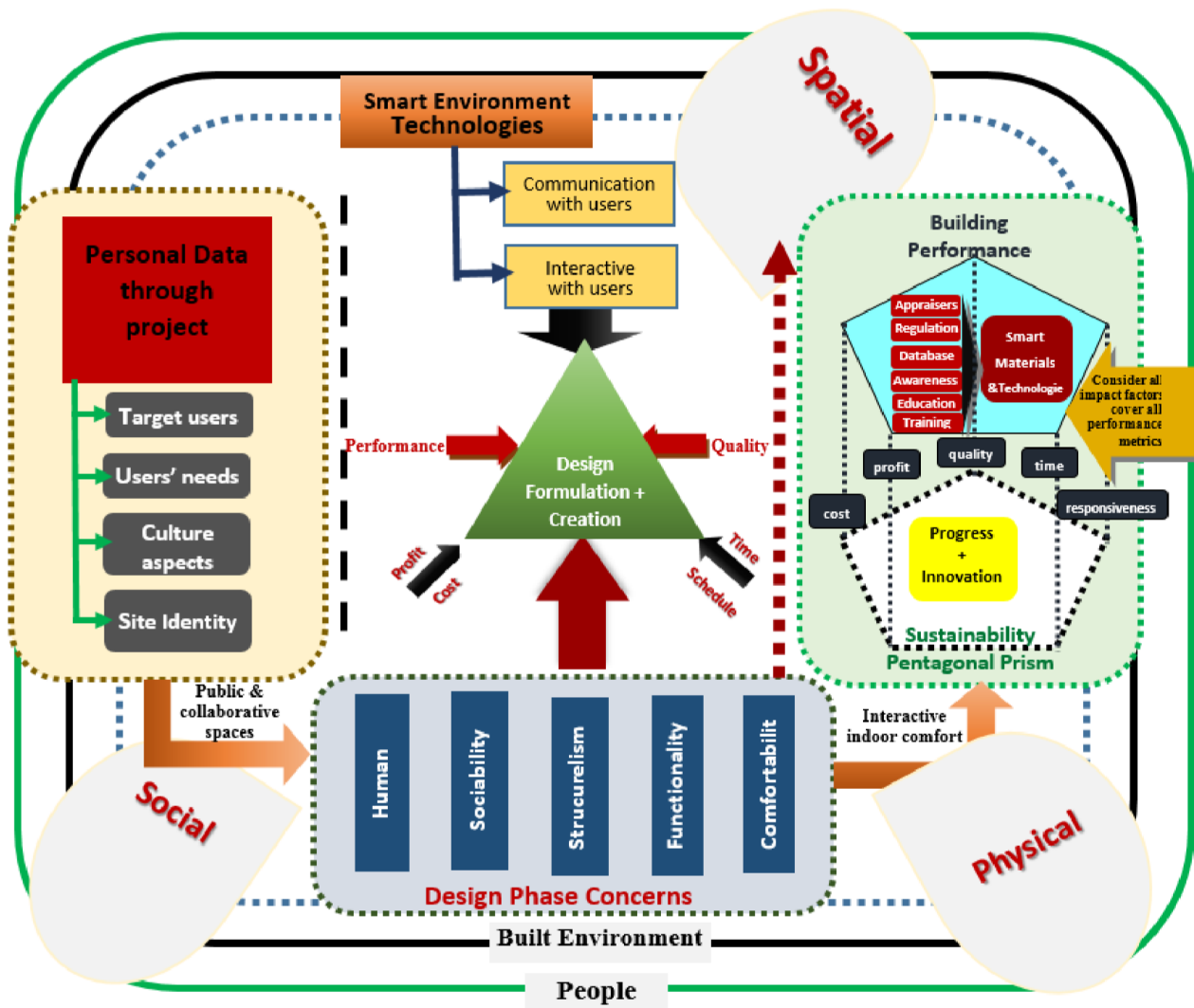

Figure 14: New Architectural Design Framework for Applying Humanism in Design phases features

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