

# Quality assurance in a sustainable architecture creation process

Amjad Almusaed<sup>1</sup>, Asaad Almssad<sup>2</sup>

Department of Construction Engineering and Lighting Science, Jönköping University, 551 11 Jönköping, Sweden<sup>1</sup>

Head of Building Technology, Karlstad University Sweden<sup>2</sup>



**ABSTRACT**— The creativity of modern architects and urban planners, engineers and technologists working in various fields of design and construction activities as well as the creation and production of new materials, structures and technologies are inextricably linked with general trends in socio-economic development. It can effectively support the importance of architecture as a product in the sense of social response. The marketing activities are those activities that suffer adjustments due to the continuous changes in the users' needs to their behavior. In another hand, the subject of sustainable architecture and marketing became an important issue within design and construction process, where the application of the sustainable concept in design and execution process is rescuable, and it is not clear, therefore a clear reading of the building production by a clear strategy put sustainable architecture in a right way towards salability and it will be clear. The aim of this study is to create an evident comprehension, of the correlation between the phenomenon of marketing, supported by the concept of quality in sustainable architecture, and what it represents for the building users today. The method in this article takes two kinds of approach, the first is a literature study the other one is a semi-structured quality method, where an involved person has to create a hierarchy of priorities of many factors, related to the sustainable architecture factors. The study offers a clear reading of the most required factors of building users for getting a high-quality sustainable architecture.

**KEYWORDS:** Sustainable architectural; Marketing; Building user; Quality product; Life cycle product

## 1. INTRODUCTION

A building that rests on sustainable design and a technically correct construction has a long service life ahead of it. So the more thoroughly and thoughtfully we build, the more sustainably we usually build as well. Therefore, we must build sustainably in relation to how our buildings are to be used, operated and maintained - rather than just focusing on construction costs. All sustainable architecture, both new style architecture and renovation, presupposes that it be required to think holistically and have close collaboration in all phases of construction between the relevant parties. Today the high-quality architectural elements in the market take a larger understanding, where it tends to be more human and interact with social life. That can support efficiently the meaning of architecture as a product in the sense of social reaction. The high- quality architectural concept is developed to be the area of research that supports the concept of architectural value in social life. Today it is required is to develop constructive approaches that support the desired behavioral changes and underpin the principle of increasing public perception that the benefits of new behavior exceed the costs of adopting that behavior [1] In an architectural domain, the strategy of marketing and the policy of research becomes essential for combining the relation between architectural creation and potential user positively, where a saleable architecture provides us with the opportunity to reach deficient levels of energy consumption by employing high quality, cost-efficient measures to general house components - such actions are in turn of advantage to the ecology and economy [2,3] It required to understand the meaning of profitable in building design, which is influenced by a series of more general economic aspects such as people's living standards, which includes not only the relative stability of the prices but also that of the family income. Therefore, the architectural product much less free than another consumer good when the form in architecture,

for example, has to perform the functional, constructive and esthetical task [4,5]. The comfortable interior environment is the main aspect required for a healthy architectural product, where the internal environment of the building demands a feeling of comfortableness. Comfort conditions will vary from person to person. It is essential to recognize that the evolution of architecture is marked by searches that tend to go beyond the level reached at some point in time by the architectural thinking and its forms of expression [6]

In 1987, the UN World Commission on the Environment and development was aggravated by the need to search for a new development model by publishing the report “Our Common Future”, which introduced the concept of “sustainable development” in the following interpretation: “sustainable development is a development that meets the needs of the present a great time, but it does not jeopardize the ability of future generations to satisfy their needs. In 1993, the World Congress of the International Union of Architects (UIA) in Chicago adopted the “Declaration of Interdependence” for a sustainable future. At the same time, the term “sustainable architecture” was adopted, which refers to the architecture of the near future. Since that time, architects have been actively involved in discussions and search for solutions to the problems posed. Currently, the world community is making an attempt to formulate a universal architectural concept for the development of new strategies and methods for various climatic, political, social and cultural conditions. At the same time, architecture is considered as a kind of flexible “interface” between a person and the environment. In 2009, the UIA in Copenhagen adopted the Declaration of Sustainability by Project. In 2010, in Sydney, the International Union of Architects and the World Green Building Council ((World GBC)) signed a cooperation agreement [7]. Given that sustainable architecture is not an exact science, a number of terms for sustainable solutions are not well-established. and unambiguous. In the framework of the concept of “sustainable architecture” there are names: “energy-efficient building”, “passive building”, “bioclimatic architecture”, “intelligent (smart) building”, “high-tech building”, “healthy building”, “environmental, life-sustaining” building” [8,9]. In many countries of the world, attempts are being made to formalize the provisions of “sustainable architecture”, to develop the relevant provisions and standards. Priorities have been formed for the energy efficiency of buildings, their autonomy and independence from centralized networks, environmental friendliness and overall efficiency of the architectural environment. They are based on: - efficient use of energy, water and other resources; - attention to maintaining the health of residents and increasing the efficiency of workers; reduction of waste, emissions and other environmental impacts; - the use of natural local materials. Sustainable architecture is a product which is designed in an environmentally friendly way. The goal of sustainable architecture is to create structures which are beautiful and functional, but which also contribute to a sustainable lifestyle and culture. Architects and engineers must form closer working alliances with contractors and other project professionals to ensure that their designs will get built within prevailing quality, budget, time, technology options and resource constraints [10,11,12]. Marketing knowledge follows a discontinuous model of progress: knowledge has increased over time, but at a decreasing rate; the marketing field, which is currently characterized by fragmentation and specialization, has reached a stage of maturity [13].

### ***1.1 The study aim***

The article aims to show how the quality aspects interact with sustainable architecture as an important subject in our human settlement, where the inhabitants are the factor motor subject, where the subject of sustainable architecture and marketing became a significant issue within design and construction process. The application of the sustainable concept in design and execution process is rescuable, and it is not clear; therefore, a comprehensible reading of the building production by a self-evident strategy put sustainable architecture in a right way towards salability, and it will be obvious. The creativity of modern architecture and urban planners, engineers and technologists working in various fields of design and construction activities, the creation and production of new materials, structures and technologies are inextricably linked with general trends in socio-

economic development. More and more projects and buildings referred to as sustainable, green, eco-sustainable, environmentally friendly, energy-efficient and other essentially similar terms. Their appearance is determined by the paradigm of sustainable development.

### ***1.2 The study problem***

In modern society, the role of marketing and quality insurance in the architectural domain is as close as possible to practice and is aimed at achieving the goals of the community and users of the architectural elements. Most often, researchers analyze individual factors that affect the community's activities from the inside and outside. At the stage of globalization, information freedom, and taking into account the importance of increasing integration processes in international business, economics and politics, new approaches are required to analyze the role of marketing and quality insurance in creating a global percept of good architecture that corresponds with the modern orientation towards sustainable development in combat the negative impact of the human settlement on the environment and the climate change and healthy human life. the questions that need to be clarified are.

- What is the phenomenon of architecture in modern society?
- How the value of a sustainable architecture be appreciated?
- What are the challenges for creating a sustainable architecture?
- How can the role of quality indexes interact with sustainable architecture?

It is required to solve the problem regarding the meaning and the measurement of sustainable building quality and the meaning of that as a defined concept by using the marketing tools for the modern architecture concept.

## **2. The method**

The selected methods were divided into two workings lines; The first one is the literature review of the studies made by the researchers' in the architectural quality and sustainability area. The second one is a questionnaire which was distributed to interested students in secondary schools, who are already in the study environment. And also selected teachers' staff, who works in the building's physics, building materials and environmental domain. The questionnaires were sent by e-mail, due to the current 'COVID-19' situation. This part of the survey is meant to inform the involved persons who are interested in sustainable architecture that there is a research area regarding the quality of sustainable architecture for the future required to be analyzed. Therefore, involved persons can come with their opinions regarding the practical reading of quality factors in sustainable architecture and put their priority in the hierarchical form. In this part, it is required to create a hierarchy scale of the most important quality values (factors) which were raised, according to the student's reading and opinion. The subjects were students and selective staff from HTX high schools (Higher Technical Examination Programme), which is a full time three-year technical upper secondary education program, which qualifies students for admission to Danish business academies, schools of technology and design, university colleges and universities.

### ***2.1 Why HTX school category?***

In this study, selecting the interviewers for the survey was decisive. The requirement was to be dotted with update knowledge and more realistic. Therefore, the HTX school students were the most suitable for this survey, where they are young people in creative educational institutes read the problem of today's problem more scholarly, and they have a cleaver and practical answers to many issues related to our life [14]. The young people from the HTX school students answered the survey in a vibrant procedure they put the priorities of factors after a good understands of the role of every factor. And they put the importance of every factor role in our practical life.

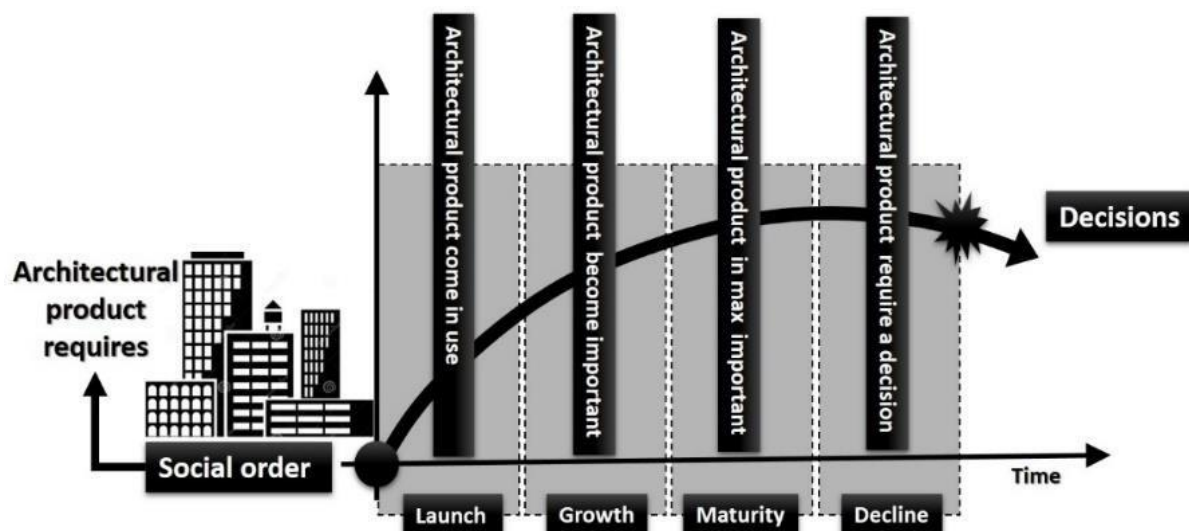
## **3. Evaluation of modern social interaction with the architectural phenomenon**

### 3.1 The phenomenon of architecture

True architecture is that where thinking and human feelings come into play, creates an entire harmonic, which ensembles structure and possesses significance [15]. The architectural product evolves within large coordinates of timed spaces, depending on social, esthetical and geographical factors, assuming the role of co-operation between the climate, economic and material conditions with the production and thinking the way of a period, defined from the historical point of view. The evolution of architecture is marked by searches that tend to go over the level touched at some point in time by the architectural thinking and its forms of expressing. The activities of designing various included phenomena, the functioning way as well as operations specific for figurative applied thinking and sensitivity are correlated in a continuous cycle starting from creating the desired status and leads to the creation of a complicated process which begins with the formative vision of the form, followed by the radiated sight and then to the realization of the architectural object which appears as another desire with improving lifestyle as a target. This is different from consumer goods or the services that were the purpose of the marketing activities at the beginning of the last century [16]. Architecture is always a response to the tradition and culture of its time. It reflects the pulse of the society, environment action, lifestyle of inhabitants and their aesthetic value as well as their building technology. Today several specialists in architecture and building design believe that it is necessary to carry out an innovative creation of architectural products, which keeps up a correspondence to the new demands of a full useful architecture but no more building. [17,18] The architectural product is a product of human work an excellent suitable to be consumed for a long time. Marketing for architectural products has a series of specific aspects because the object of architecture in our lifestyle is a consumer good that cannot be moved (transported). The production cycle in comparison with that of other consumer goods is exceptionally long. It begins with the placement studies and ends when it starts to be used. This fact and also the proportion of the necessary material basis require a longer-term prediction [19].

### 3.2 The life cycle of the architectural product

The architectural product is characterized by a life cycle similar to the traditional products: introducing the product on the market represents the first stage. The new product has an increasing request and a rapid growth, but as time goes by, new products will appear on the market offering more advantages than the already mature product that will suffer a decline from the request point of view as the users change their needs towards a new architecture program [20]. This evolution of the architectural product has been represented graphically, illustrating the four organic phases of the architectural product lifecycle. Figure (1) shows the stages of architectural product lifecycle.



**Fig (1)** Architectural product lifecycle

The design phase (Launch); In the starting after an in-depth analysis of human requirements for a competent architectural element, architect offer society a product. In this phase the sales volume is low, the profit is negligible; the relation between the user and the product is negative.

In the built and use phase (Growth); The social group starts to use the architectural product [19,20]. The product will be aware of the regions, thus the product is underusing, where the user evaluates building competence in time-related to the sustainability standards and codes. The relation between the user and the product is moderate.

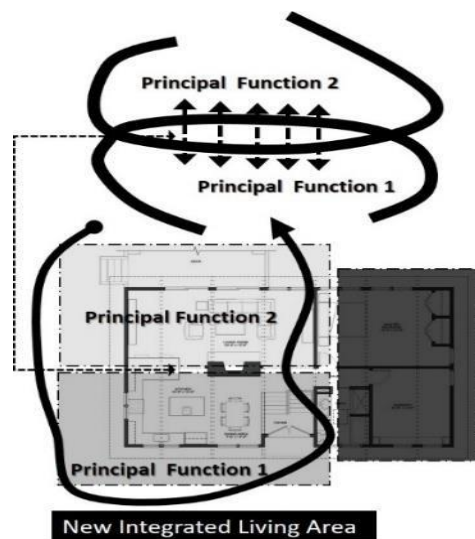
The architectural element offers the maximum benefit phase (Maturity); Everything is in regulatory usage, the product is essential and becomes in maximum form. The sales volume smoothly declines, the profits begin to drop, the relation between the user and the product is sturdy.

The architectural element starts failure in providing services phase (Declining); The architectural element becomes old to cover all functions required. Therefore, all other indicators become negative. At this point, the decision has to be: Changing the actual architectural product, Modification in the architectural product. It can be a renovation or restoration.

### **3.3 The architectural function modernization and product quality indexed**

The process of modernization can take tow form;

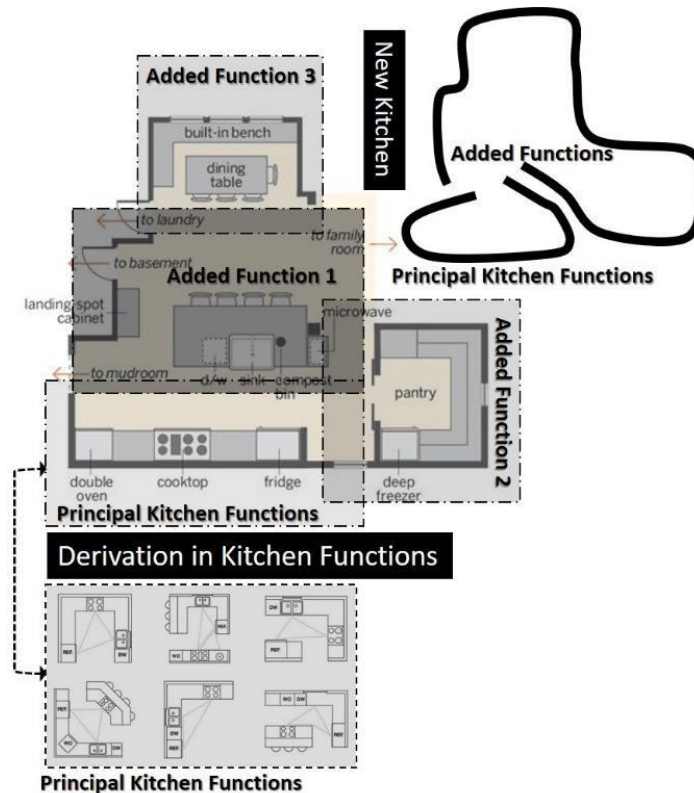
- The integration concept upon architectural areas; It means unifying some spaces with close functional significances in a new function. Changing the functionality of the areas can take place on the vertical or horizontal line, according to space and structure possibilities. These decisions can be made according to the beneficiary's desires and needs. The architectural spaces are complicated and relatively complex. They contain more activities and can facilitate the progress of some functions in the same dine or in altered periods of time. The integration can also take place in many fields (social, technological, compositional, etc.). For the alike concept, space can be associated with other space or spaces to creating a new functional space or more, these forms of association need a thermal synchronizer between those two or more, that represent an appropriate comfort status.



**Fig (2)** Integration process of functional space



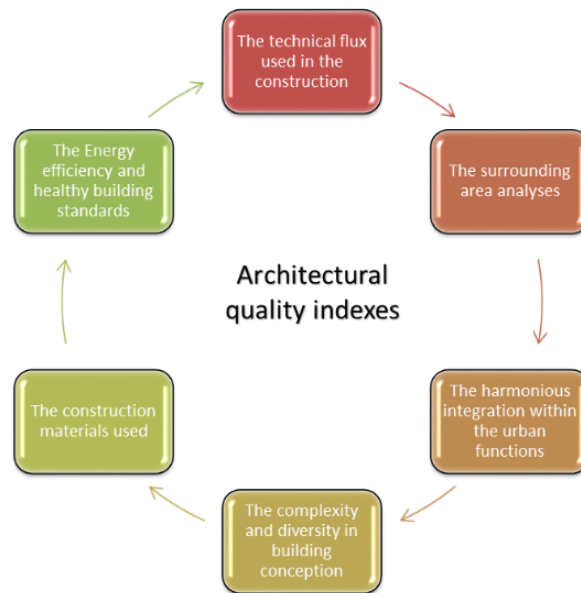
Functions joined, such as the connection between adult bedrooms and living room for creating a functional improvement space for the social atmosphere like ceremony and festivity, etc. this kind of new large area needs a human comfort level, such form of conception can be called the integration of functional spaces. The derivation concept upon architectural spaces; It means sharing and detailing the existing architectural space with the purpose of obtaining an area that can satisfy the new human needs. For an efficient and competent architectural element, the concept of a unique function in a functional space is abstract and unrealistic because all spaces can include more than one service, which needs more than two different human comforts, for example, in bedrooms, man can locate more than one facility such as study, setting discussions, and sometimes an easy sportive moving, at the side of the essential role for sleeping. We can call this form of conception derivation of the functional areas. For example, a kitchen function can extend to suit a new social command by added many capacities to the principal kitchen function to cover social requirements, see (Fig 3)



**Fig (3)** Derivation process of functional spaces

The term architecture has both wide and severe meanings. In the widest sense, architecture is everything built or constructed for human occupation or utilization. A more restricted definition would emphasize the artistic and aesthetic aspects of construction. A third and still more limited definition would say that architecture is what the architects are specially trained to do or make [21]. Building and the built environment play a major role in the human impact on the natural environment and on the quality of life. The sustainable architecture integrates consideration of resource and energy efficiency, healthy building and materials as well as ecologically and socially sensitive land-use including aesthetic sensitivity that inspires, affirms, and ennobles. Today's marketplaces lay greater emphasis and focus on stability and reliability of manufactured products. Corning has developed "quality architecture" to help engineers and scientists define and build the system elements that allow quality to be built into a product, rather than rely on inspection. Quality architecture involves designing a system that controls the manufacturing process in a stable and consistent manner and provides for continuous improvement. The architecture defines and ensures the appropriate interdependence

between product specifications, materials used in and by the process, product and process measurements, statistical process control and information systems [22] many factors and standards inter in the determination of the values of architectural quality indexes (see figure 4)



**Fig (4)** Shows the values of architectural quality indexes:

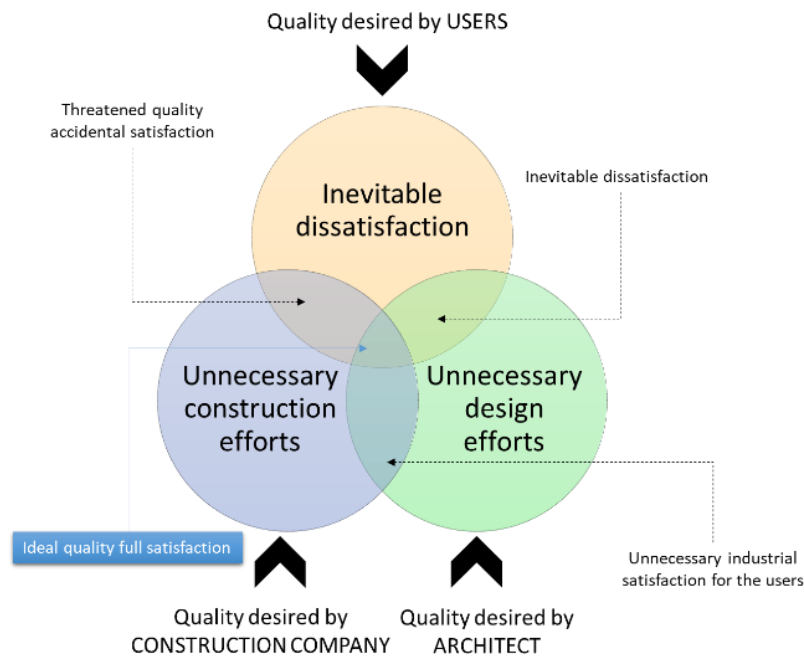
Building and the built environment play a major role in human impact on the natural environment and on the quality of life. Intelligent, sustainable architecture integrates consideration of resources and energy efficiency, healthy building and materials, ecologically and socially sensitive land-use, and aesthetic sensitivity that inspires affirms and ennobles [23]. The art of building environmental engineering is providing a balanced quality of the environment at minimum total costs and with the minimum use of fossil fuels for producing energy. The approach to sustainable architecture will not only evaluate alternative construction materials, product lifespan, and energy efficiency but also encourage the improvement of local microclimate quality by design about sustainable architectural principles.

#### 4. Quality management in sustainable architecture

##### 4.1 The influence of quality in modern sustainable architecture

Architectural quality is a concept that is interpreted with the help of value-charged design criteria. It is judged from criteria which include opinions, values, ideals and impressions of desirable characteristics [24,25], the key question is; Why quality becomes an important theme in modern sustainable architecture? Because everyone realizes in one way or another that there are serious problems with the way it is being built now. It is undoubtedly visible that extremely many constructions are unsatisfactory or even outrageous, while very few are satisfactory or even delightful. The reasons why we are interested in the quality of architecture are determined by the obvious consequences of architecture for the quality of life. We are interested in the quality of our lives and those we share them with. Not recognizing the importance of architecture for quality of life is a matter of ignorance and enculturation. Moreover, not understanding the new stakes of architecture in relation to the problems of humanity, nature, society, resources, heritage, means irresponsible incompetence. The architecture is undoubtedly extremely complex. For this reason, it is difficult to assess quality on the basis of a limited list of criteria, even if they are numerous. The mere addition of values that exceed the minimum thresholds set of indicators does not lead to quality. Complexity cannot be reduced to just a few criteria. The

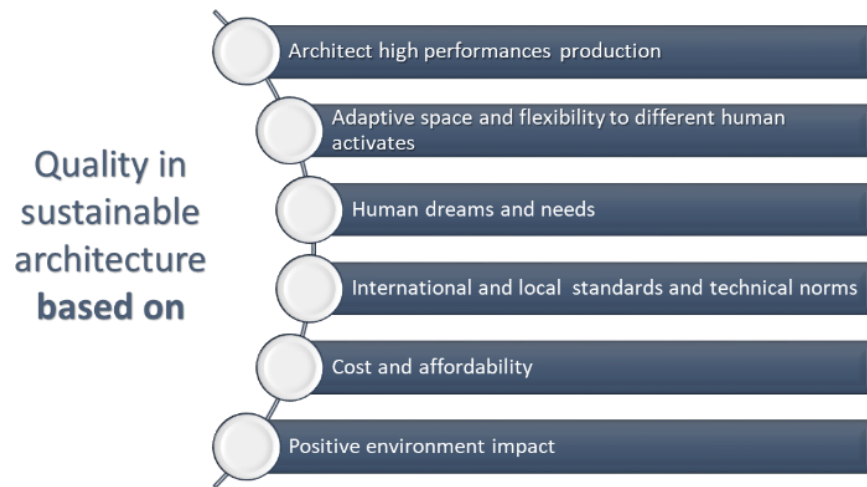
general concept of "quality" has wide use in various fields, namely: philosophy, economics, technical disciplines. In economic practice, the notion of quality initially had the meaning of artistic beauty, then work well done. Industrial production determined the term of conformity, then the quality of supply - defined in relation to building user requirements. The product quality is an aspect which is not the same among (architect, construction company and users). The quality of design and research process supported by the quality of construction made by the companies which influence directly the quality desired by the building users, noting that not all design - research and built efforts are entirely in the so-called ideal quality that gives full satisfaction to the building users (see fig 5).



**Fig (5)** the ideal quality within the diagram of the three qualities (design, construction, user requirements)

The differences that appear between the quality of application of sustainability in architecture conception desired by the users, the designed quality and the construction quality, make that the circles of the three qualities do not overlap and, therefore, there are deviations from the concentricity. The complete satisfaction of the users corresponds to the area of intersection of the three circles and, the smaller this area, the more defective the activity of the enterprise in the field of quality. In the other hand, the quality of a timeless entity, being perceived by each individual subjectively. It does not allow a clear definition of quality or its measurement. The dynamic nature of quality is determined by the progress of science and technology, on the one hand, and on the other hand by the growing demands of well-informed and educated building users regarding the quality of products and services. In other words, what is currently appreciated in a commodity that is of worthy quality, tomorrow can be obsolete, outdated, morally worn. The term quality in architectural creation has highlighted five guidelines;





**Fig (6)** shows the factors that are based on sustainable architecture

It is considered that each person has some individual preferences, which can be satisfied by different quality characteristics of the products. This is the point of view preferred by the followers of the market economy. "Conformity for use" is achieved through a large number of activities, logically linked, to obtain a building that corresponds to market demand.

## 5. Method study and working manner

### 5.1 Literature review on architectural quality

Sustainable architecture work with the design and construction practices that reduce significantly or eliminate the negative impact of buildings on the environment. It covers also the building location, energy use, environmentally preferable purchasing, improved indoor environmental quality and a "continuous improvement" approach to green building innovations and occupants. [10]. Yahya in his article "Value and quality in architecture" [26] thought that the idea of quality in sustainable architecture area represents the attainment of the anticipated level of performance or functions through the characteristics and potentials of the architectural product benefits and service level that benefit the building user, throughout its lifecycle used for purposes for which it is created, and according to operation principles. The architectural product has to afford the user the expected services in high standards. He thought just that can reflect the quality of architecture. It is a self-assessment, could change in harmonically form with its the role played by the user. Consequently, the quality of the building is the sum of all the qualities and proprieties that benefit the building to complete its main duty effectively. While Rikesh, in his paper "Quality Control Management in Building Construction" [27] takes the sense of approach, he thought that the quality of any architectural element must be reflected by the meaning and symbols of the building form and spaces, in concordances with the human civilization, not just the architectural today's style but also in history. He affirms that the building technique had an extremely complex process, including a comprehensive range. Magnus Magnus in his article "Quality in Architecture" [28] underline that the quality of any architecture product is related to a set of values and standards. It should be understood as an open and arguable key model resulting from a difference and debate. Consequently, it represents a continuous process, and at the same time can be changed at a determined time. For him, the high-quality product must reflect the holistic approach of the architectural profession to design projects, where the architectural quality within architecture is an open and dynamic concept built on knowledge and it is created uncertainty. Architectural quality is a knowledge associated with benefits for society. The same author but in another article "Quality in architecture – learning from history, practice and competitions" [24] he affirms that the architecture of high quality is related to the element surroundings as a

co-player or as a challenger, where the architecture interprets the cultural character and uniqueness of the surroundings. That can be understood as (a set of good attributes, where architectural elements can be described as attractive, knowledge or inner characteristics of specific individuals, a specific relationship to a place and a function, a certain type of material or technological production of a product).

Consequently, it can be understood from different views in concordance with the meaning of the architecture. Kristin in his article “Architectural quality, Building Research & Information” [29] support the idea that the quality in architectural products is confirmed from the relation between the architect and the user. It must be created in a good arrangement by clear communication. For him, good communication can offer a high-quality architectural product. Marans in his article “Measuring Overall Architectural Quality.” Environment and Behavior [30] affirms that the method of evaluation of the building quality is subjective and is related to the building functions and user satisfaction. It is linked to the value of the interior space, building functions, physical user comfort (thermal, optical, acoustic and air quality). Consequently, the quality of the sustainable architectural element relates to the user physical comfort. Brid in his study “quality architecture” [22] present that the Quality concept within architecture starts from the design. It is created in concordance with user needs and requirements, which must be stable and consistent, where it can be developed after the use of building functions in a continuous form. Consequently, the architecture quality is a complex process, where it combines the product specifications, building materials used by product a process of measurements, statistical process control and information systems. Luring in his study “architectural quality of low energy houses [31] he mentioned the factors that support the quality of a low-energy building, where the quality of sustainable architecture is related to materials used and the working of the building system such as; thermal insulation, building description and passive house system. All these topics must be supported by using ecological materials and the size and orientation of windows. Consequently, the quality of sustainable architecture is connected to energy- efficiency factors. In the book, [21], Biophilic and bioclimatic architecture,” the author considers that the quality of architecture is more complex. It can include another multifaceted level, where the biophilic architecture is a supporting factor in a healthy and sustainable architecture, it helps in creating and a high- quality architectural product in the process of energy efficiency concept. Consequently, the quality of any sustainable architecture is determined by all activities from idea conception to execution and putting it in the use, between which there is an organic link and must be seen both in terms of architecture quality element at the architect office, construction company and in the operation of the building user.

### ***5.2 Sustainable architecture quality and build environment strategy (survey case)***

Quality in the sustainable area is a dynamic notion, determined by the rapid changes in the characteristics of the architectural element under the impulse of social factors, energy-efficiency, healthy life, human comfort, scientific-technical and environmental solutions. Its content evolves according to the determined practical, historical needs and captures both the extensive aspect (variation in time of the characteristics for the same architectural element) and under the intensive aspect (amplification, substantial enrichment of the existing characteristics of the architectural element). In this context, the importance of society is not only quality as such but also the increase in quality. High quality of sustainable architectural elements meet the needs at a higher level, are more competitive, better appreciated by the environment and building users, capitalize on resources at a higher level, have a higher value. The quality of a sustainable architectural element refers to the degree of utility of the respective product and its impact on the environment, to the extent that the properties of the respective product satisfy the requirements of the environment and the building user. In another form, it represents the totality of the properties of a building whose evaluation allows to determine the extent to which the requirements are satisfied. Sustainable architecture Production quality; refers to a set of elements that characterize both the quality level of each building as product and the quality of the design conception activity, the technology used, the organization of built and work, construction and technical quality control.

The quality of the architectural elements and the construction process is appreciated for the first time and verified by the architect, but in the end, the real quality of the product is the appreciation of the building users. The real quality of a batch of architectural products is in accordance with the recommended quality when the dispersion of the values of the quality characteristics for all the components of the collection is within the allowed limits and therefore the average quality of the collection is acceptable. The dispersion is calculated with the expression:

$$S^2 = \frac{\sum (X_i - X)^2}{n-1}$$

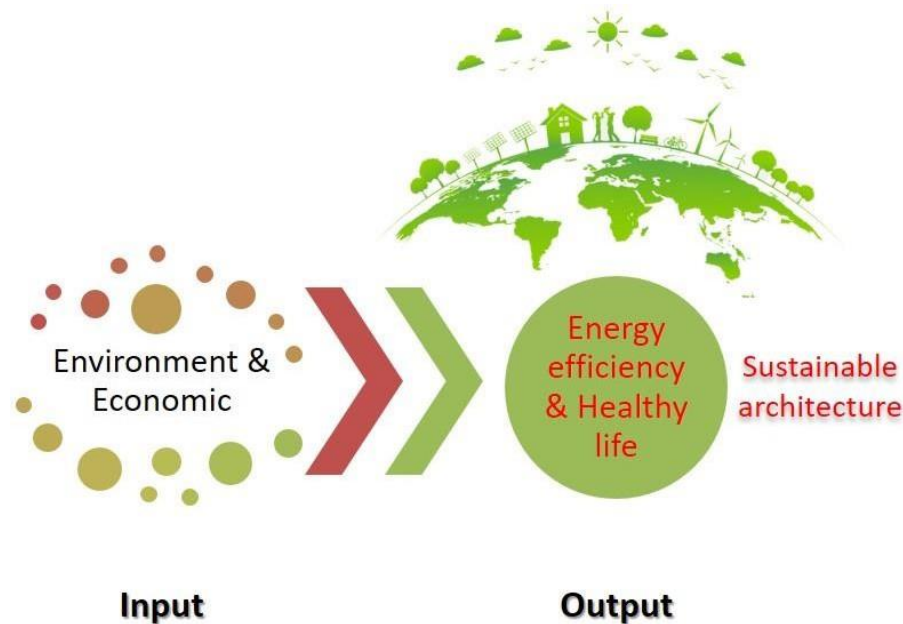
where X is the average sustainable value of the architectural quality indicator and n is the number of tested architectural elements. During the architecture-to-user circuit, numerous factors act on the physical comfort and quality of healthy life level of the architecture. Under the action of these factors and correlated with the nature of the building, changes in architecture properties occur over time. It can be stated that an architectural element has a normal quality when, throughout the processing and marketing, respecting the imposed technical conditions related to the concept of sustainability, the prescribed properties are preserved. From this point of view, the quality of a batch of the architectural element can be viewed under two aspects:

- Static quality (unsustainable architecture), ie the real level of quality, determined at a given moment of the under using of architectural element
- Dynamic quality (sustainable architecture), ie the evolution of the real level of quality over time, as a result of the interaction between the architectural element and the environment.

The pursuit of dynamic quality involves the determination from the initial moment of the design process and must keep the same level of quality in the future represented related to the timeline. it has to keep the dynamic properties for the product of architecture to be sustainable. The definition and follow-up of the dynamic quality are applied to the establishment of the capability and durability terms, the establishment and control of the unwilling factors that can appear under the everyday function of using, the adaption the negative effects of the climate, and the capability to offer the comfort for the building users.

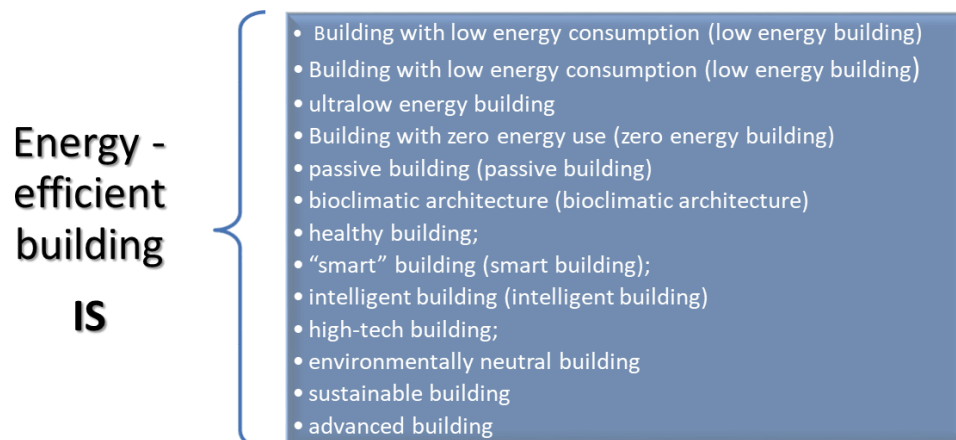
### ***5.2.1 Energy efficiency in sustainable architecture***

Introducing the concept of sustainable development in the field of architecture followed a parallel evolution with concept transformations. As long as the accent of was put on the ecological and energy component, industry construction has found the answer in the area of consumption energy: from the building with low energy consumption to the passive building, then trying to generate a building that produces an amount of energy at least equal to that consumed by integrating the concept of the passive house with active systems that use renewable energies. In creating of the sustainable building regarding the individual life in building spaces 2 aspects required to be respected; environmental, and economical aspects which represent the material and objective aspect of sustainability as shown in figure 7.



**Fig (7)** The impact of environmental and economic aspects in architectural conception.



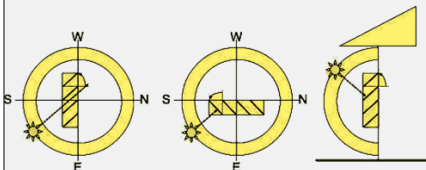

After the world energy crisis of 1974, world construction and architectural practice pay great attention to the problem of saving fuel and energy resources spent on heating /cooling buildings. Sustainable architecture is more than energy-efficient or zero-emission building. It must adapt to and respect its environment in the broader context of “milieu”. Sustainable architecture involves a wide range of complex issues within fields of building physics, environmental sciences, architecture and marketing. Sustainable building design views the individual building systems not as isolated entities, but as closely connected and interacting with the rest of the building and a large sphere of environmental. [32] The UN International Energy Conference (MIREC), criticism showed that modern buildings have huge reserves to increase their thermal efficiency, but researchers have not studied enough the features of their thermal regime formation, and designers do not use the achievements of fundamental sciences, the possibility of alternative energy and not They are able to optimize heat and mass fluxes in buildings, including through the use of computer and control equipment [33]. However, the quality of the sustainable building shown that a large number of buildings, microclimatic, and even architectural and construction zones have appeared in world construction, which was designed and built on the basis of various concepts of energy-efficient and environmentally friendly technologies. These concepts are determined by their own names. The most famous was the following of them:



**Fig (8)** the names of high quality energy efficient building

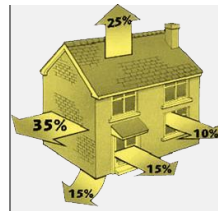
The above concepts of energy-efficient and environmentally friendly buildings are implemented in a large number of construction projects, in urban areas of rural and urban areas, but so far have no scientific basis for the best way to carry out their design. For increasing the quality of building designer have to take human comfort in evidence when he starts in the design process. Thermal comfort is only one of the components of a comprehensive concept of the quality of the internal environment of a house, one of its characteristics. In no case, the concept of temperature comfort can completely replace the definition of a comfortable environment for a person. The list of physical characteristics that affect a person's thermal comfort consists of two parts: environmental factors and personal factors. Environmental factors such as air temperature, average radiation temperature of building envelopes, relative humidity, air velocity. And Personal factors such as metabolic, metabolic rate (met rate, 1 met = 58W / m<sup>2</sup>), Clothes on the person (clo value). Between different people, there are significant variations in the physiological and psychological relation to thermal comfort, which makes it difficult to satisfy everyone equally. The environmental parameters necessary for a sense of comfort are not the same for all people.

**Table (1)** shows the energy efficiency aspects related to human comfort required for a high-quality building.

<i><b>Factors</b></i>	<i><b>Visualization</b></i>	<i><b>Interviewers priorities</b></i>
<i>Building energetic form (Compact building form)</i>		6
<i>Natural ventilation requires</i>		7
<i>Low energy building concept</i>		9
<i>Energy allocates such cascade (in interior spaces)</i>		5
<i>Effective Orientation present priority (a good facing to the sun)</i>		8
<i>Adapting to local micro-climate</i>		3



Ability airtightness (below 0,6/h)



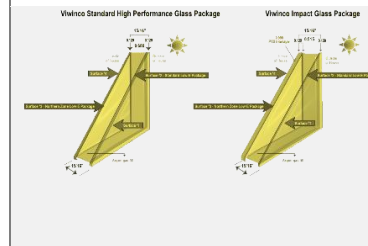
8

Activate of the thermal insulation (U-value = 0.1 – 0.15 W/(m²K))



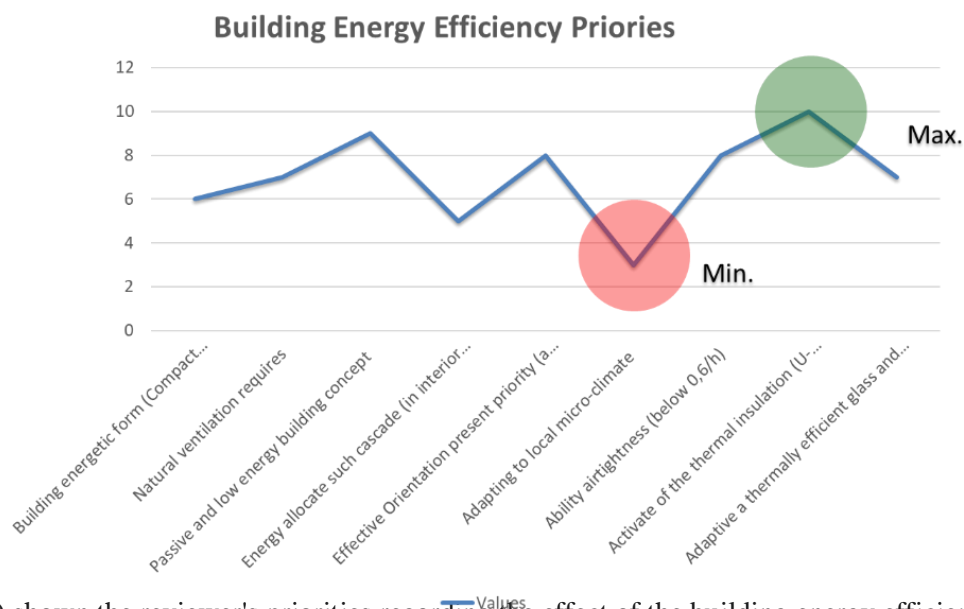
10

Adaptive a thermally efficient glass and frames



7

The high-quality building provides us with the opportunity to reach extremely optimal human comfort and low levels of energy consumption by employing high quality, cost-efficient measures to general architectural. The quality of today's architectural elements is influenced by the choice of building material from which the structures are made and the premises are finished [34].



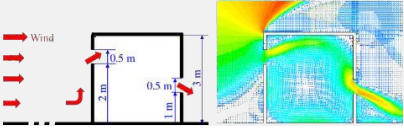
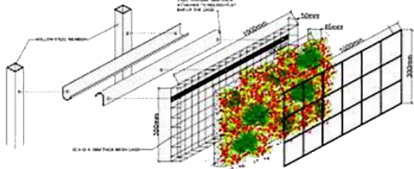

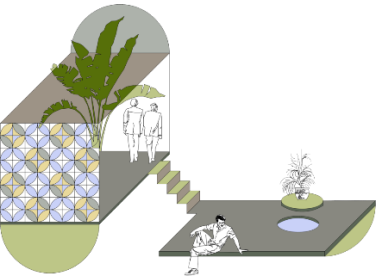
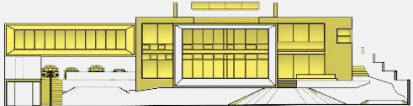
**Figure (9)** shown the reviewer's priorities regarding the effect of the building energy efficiency factors.

### 5.2.2 Healthy life in sustainable architecture

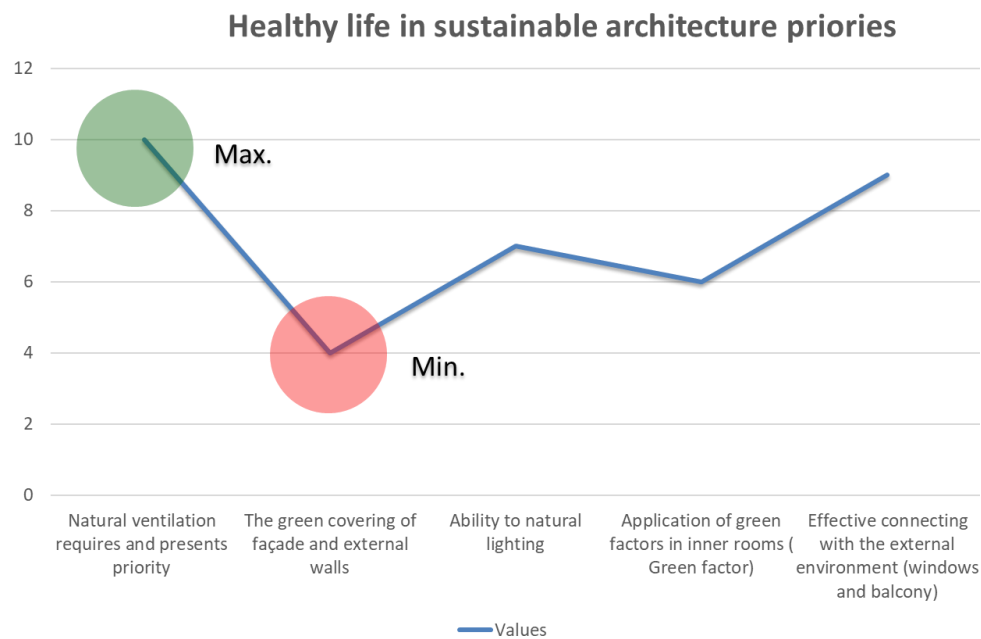
We are increasingly thinking about how to make life more harmonious, how to best arrange your building, improve your health. For thousands of years of its existence, people have been listening to intuition, and human life has passed in harmony with nature. But the environment around us is constantly changing, and this affects our building. Table 2 shows the aspects that influence the creation of a healthy building. Simple natural

building materials, such as stone, clay, wood and many other plants and animal origin, are close to humans. If we build a “passive” building mainly from natural materials, then in the first 35 years of operation, the amount of CO<sub>2</sub> produced by it will be neutral. But if you build a building from ordinary materials, then it will produce as many emissions, and even before we start living in it, how much is a “passive” building for 135 years [35].

**Table (2)** s the aspects that influence the creation of a healthy building.

<i><b>Factors</b></i>	<i><b>Visualization</b></i>	<i><b>Interviewers priorities</b></i>
<i>Natural ventilation requires and presents priority</i>		10
<i>The green covering of façade and external walls</i>		4
<i>Ability to natural lighting</i>		7
<i>Application of green factors in inner rooms (Green factor)</i>		6
<i>Effective connecting with the external environment (windows and balcony)</i>		9

Human health is one of the main components of happiness. Our condition is influenced not only by a healthy lifestyle, nutrition and heredity, but also the architecture surrounding us. A person lives in an environment that, affects him both physically and psychologically. Today we create our buildings to be a comfortable psychological environment for us, where just eco-sustainable architecture can give that feeling. serving, coloring). This is very important because it affects physical and psychological health.






**Fig (10)** shown the reviewer's priorities regarding the effect of the healthy life in sustainable architecture

### 5.2.3 Social life in sustainable architecture

Social life in sustainable architecture could be broadly and briefly defined as the ability of forestry to constantly provide people with prosperity. The current unsatisfactory ecological and aesthetic state of many objects in the urban environment reduces the social efficiency of city spaces, which requires professional intervention, especially in the process of forming the subject-spatial environment of actively exploited public spaces. Social life in sustainable architecture has been significantly less focused on public dialogue than economic and environmental sustainability. The social sustainability covers topics such as social justice, well-being, health equity, community development, social capital, social support, human rights, labor rights, place-making, social responsibility, social justice, cultural competence, community resilience and human adaptation.

**Table (3)** the influences of social aspects on sustainable architecture

<b>Factors</b>	<b>Visualization</b>	<b>Interviewers priorities</b>
<i>Ability to adapt to the multi-cultural community</i>		8
<i>Multifunctional spaces in building design</i>		10
<i>Ability to create human objective communication</i>		7

*Flexibility in using interior spaces'*

8



*Ability to adapting to multi-generation communities'*

7

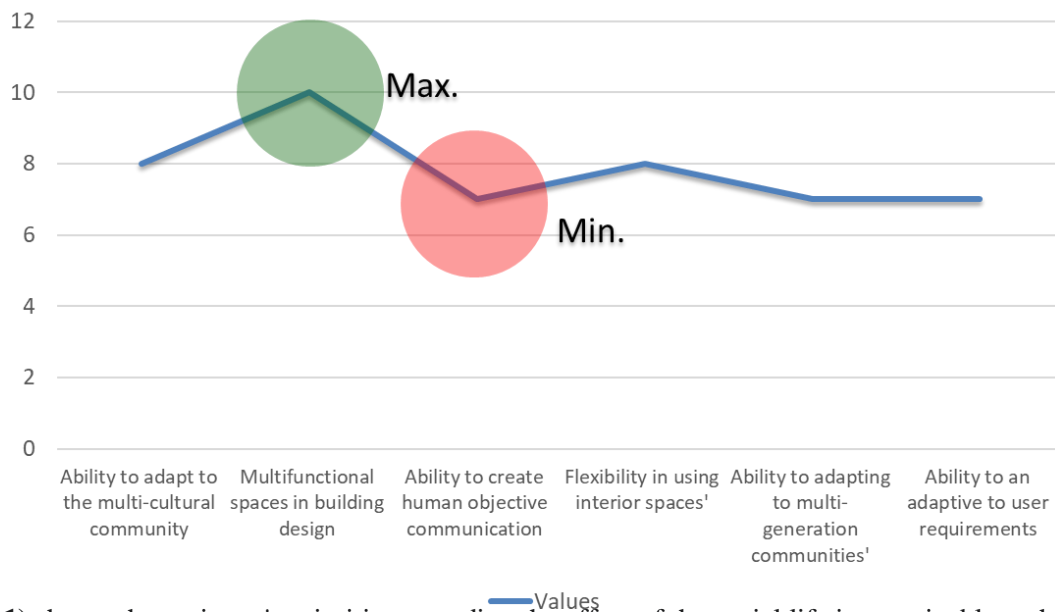


*Ability to an adaptive to user requirements*

7

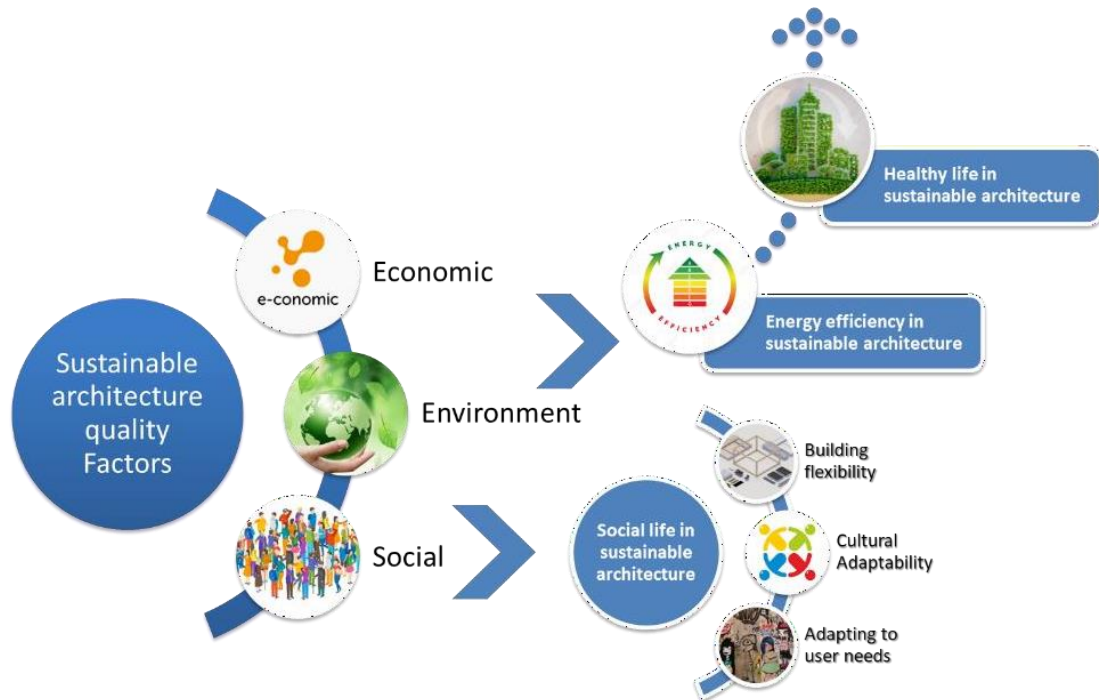


### Social life in sustainable architecture Priorities



**Fig (11)** shown the reviewer's priorities regarding the effect of the social life in sustainable architecture

A more recent approach assumes that all domains of sustainability are social: including environmental, economic, political and cultural sustainability. These domains of social sustainability all depend on the relationship between the social and the natural, with the “environmental domain” defined as a person being included in the environment. In these conditions, social sustainability covers all types of human activities. This is not only a relationship to the focused intersection of the economy, the environment and the social. (See fig 12)



**Fig (12)** Sustainability in the context of architecture and user requirement

## 6. Sustainable building as a high-quality product upon the marketing phenomenon

The quality of any architectural products upon marketing phenomenon represent; the whole properties of a presenting it efficiently in urban spaces and the efficient use of inner spaces, besides the building materials and technology uses. It expresses the degree to which they satisfy the social needs, depending on the technical-economic, aesthetic, the degree of utility and economic efficiency in operation, respectively in usability [36]. Therefore, quality must be taken into account the construction process and, on the other hand, building quality, these two notions of quality being interdependent. The factual objectivity of architecture translates the reality of the technical, economic and social means, habits, level of cultural and aesthetic appreciation of a person at a certain time or during a certain period of its history, therefore the architecture quality involves a system of indicators which are:

- Destination indicators, which refer to the usability and structure of the building, mentioning the field of use
- Indicators of reliability, respectively the properties of maintainability and building sustainability, in the concrete conditions of their use technological indicators, which refer to the efficiency of the technology stage.
- Aesthetic indicators that give indications of informational expressiveness and compositional integrity
- Economic indicators, which relate to development costs, and construction process, as well as the economic efficiency of their construction.
- Technical indicators: sensory properties, physical and energy properties involved in determining the building qualities.

Sustained excellence is the final expression of the architectural quality production processes and refers to the technical aspect, expressed by properties and technical-functional characteristics in relation to the degree of usage efficiency. The aesthetic aspect related to the satisfaction of the psycho-sensory needs of the building user; the economic aspect determined by the costs involved in purchasing and using the product [36]. The general measure of quality is expressed by the relation:

$$J=T.C.A. E$$



Where: J- is the general measure of high quality sustainable architecture  
T- a measurement of technical characteristics in building components  
C- a measurement of human comfort and the building user impression  
A- the value of the aesthetic aspects in architecture  
E- the measure of building economic factor

The technical characteristics are defined by the conditions established in the standardization documentation.  
The measure of the technical characteristics is determined by the relation:

$$T = \frac{1}{n} \sum_{i=1}^n Z_i \quad \text{where:}$$

n - is the number of sustainable architectural element characteristics for which the valuation is made  
Z<sub>i</sub> - the correspondence between the respective characteristics and conditions (environment, human, climate, etc.) The correspondence between the characteristics and the Z- conditions is estimated numerically the value of Z is calculated with the relation:

$$Z = \exp \left( 1 - \frac{x + \Delta x}{\vartheta} \right) \quad \text{where:}$$

ϑ - is the permissible limit of the deviation of the characteristic from the optimal value x - is the real deviation of the characteristic from its optimal value Δx - the absolute value of the uncertainty of determining the value x (uncertainty measurement of deviation x). Measurement of use characteristics A is determined by the relation

$$A = \frac{1}{4}(R + G + D + B) \quad \text{where:}$$

R - is the measure of operational using of sustainable architecture with safety and health form, which can be expressed in a simplified way; The form of a ratio between the number of architectural elements as products that respect sustainable concepts in building form and function at a certain time of use and the number of all architectural elements that were built as a subject to observation.

G - coefficient which is given by the ratio t<sub>1</sub> / (t<sub>1</sub> + t<sub>2</sub>), where t<sub>1</sub> is the mean time of use and t<sub>2</sub> is the average time of non-use;

D - coefficient (conventional) which expresses convenience in use and which has a value between 0 and 2 (D = 1 expresses a normal state, comfort and satisfying)

B - coefficient (conventional) that expresses the comfort and safety of use.

B must be equal to 1; if B < 1 the product is unsustainable. The measure of aesthetic characteristics, E, will be a conventional coefficient with the size between 0 and 2. This coefficient is determined by comparison with products considered standard. The economic characteristics, K, simplistically, can be calculated with the relation:

$$K = \frac{1}{2}(K_1 + K_2)$$

where: K<sub>1</sub> - the coefficient of the architectural element purchase expenses K<sub>2</sub> - coefficient of operating expenses. The total quality coefficient can be tracked statistically by periods (month, quarter, etc.), there are different calculation formulas for this. For example, if a team makes a single architectural style and the built volume varies, depending on orders or other factors, from one exchange to another, to calculate the total quality coefficient over a period is used the formula:

$$K_{per} = \frac{\sum K_i \cdot Q_i}{\sum Q_i}$$

where:

$K_{per}$  - is the total quality coefficient per period

$K_i$  - the total quality coefficient of buildings executed in an exchange  $Q_i$  - the volume of buildings executed in that exchange

## 7. Results and discussion

Buildings are not built to be sustainable or to reduce energy consumption. Buildings are built to add value to what people do, want and need to do. Good architecture is usually sustainable. However, sustainable architecture is not necessarily good. Therefore, it is required to understand that the quality of sustainable architecture will result an excellence architectural elements. Therefore, the quality of our buildings and the built environment are important for society from a broad perspective and crucial for people's social and health well-being. At the same time, buildings often have a lifespan that surpasses all other products we surround ourselves with. And the consequences of the choices we make today are thus far-reaching. Consequently, a strengthened and coordinated effort is needed now. From an environmental, social and economic point of view, our society needs an ambitious effort around sustainable architecture. Construction is responsible for a large part of our total energy and resource consumption. Therefore, it is crucial that we ensure sustainable architecture with high quality, which supports the development of construction in our societies. The definition of high-quality architecture is not clearly determined where many researchers wrote about the quality of architecture. For example, Yahya in his study "Value and quality in architecture: a study of the principles of value engineering," brought practical and positive aspects of the implementation of high-quality architecture in the sustainable architecture, where it must respect a possibility to introduce flexibility in the function of the building and effective polyvalence in function and appearance in correspondence to the user requirement for efficient physical comfort. For an architect, it is necessary, following the immediate wishes of the client, to try to take into account most of the changes in these requirements in the future, where there are different types of spaces are designed with parameters universal for a certain type of activity. Within the limits of their universality, it is possible to adapt planning, engineering and technological solutions to the wishes of a particular user. As a classic example of the architecture of those years, to cite the world-famous work of "Louis Kahn" - a complex that still remains a revered and effective building for biomedical research. In many ways, this is due to a successful architectural concept that combines human comfort for individual creativity with the possibility to transform many of their spaces to another form in the future, according to user's requirements. The symbolism for the user represents a part of sustainable architecture. Where Rikesh et al in his study did not bring the key factor for quality in architecture. However, the moral feeling is required for the building users to complete the cycle of human comfort required, and then the quality of architecture.

The selected persons from the questionnaire, affirm the most important factor in the energy efficiency of the sustainable building is thermal insulation, that represents a practical reading where the insulation represents the main factor that determines the energy consumption in buildings. In the same situation, they don't think that the microclimate in the local site is not important, where they consider that is a minor factor and not affect directly in energy efficiency, it can be an indirect effect, which represents a practical reading. For a healthy building, they throw that the natural ventilation I more important, where it represents a human required for a healthy space while covering the external façade of plants is not relevant. This opinion does not reflect the real effect of green today, maybe they haven't experienced regarding the green covering and the positive effect on climate and micro-climate. Related to the social aspect, they think that created a multifunctional interior space represent a value, where they don't take major attention to the internal effective communication in

building interior spaces, we think that is multifunction's spaces can support the idea of derivations in future of interior space where the activities can develop and then modification in interior spaces represent reforming and adapting to the future user requirement which is very essential for sustainable building regarding the social aspect. The condition for creating stability of the solution of an innovative, comfortable sustainable building considers the degree of adaptability to changes that occur over time during operation and using. Buildings of high architectural value have a longer durability, as people will probably also in 100 years' time want to live in a building that is architecturally well-thought-out and which for the same reason is often maintained over the years. Sustainable architecture with high quality is the future, which is absolutely necessary when humans being are to promote and develop new sustainable solutions in construction sector that can in a decisive way contribute to the global, sustainable society of the future.

## 8. Conclusion

Working with quality in sustainable architecture requires insight and understanding, which must very much be common to those involved, no matter where you are in the process. Driving the development is not an easy task, and will primarily have to be lifted by the professional actors in sustainable architecture. This study assumes that using of quality indicators in the conception of sustainable architecture assist in ensuring the design of a comfortable and safe human building for the use of unconventional, renewable use of energy, and can help efficiency in reduction of harmful environmental impacts during the construction and operation of a building, and economically adequate architectural, structural and engineering solutions. Therefore, it is required to consolidate the relationship between the designer and the building user. When an architect and user are in connection the communication between them related to instrumental research, experiment and pilot production, the problems of energy efficiency and ecological, transformation, comfort and safety are complicated. Many of the procedures on the sustainable architecture debate such as choosing of the optimal orientation, introducing of natural lighting in the interior spaces of the building, protection against overheating and from direct sunlight, the use of natural or ecological finishing materials are required for a high quality of sustainable architecture. Atriums are widely used as a method of passive energy design. However, instrumental research and experiment impose a number of technological limitations, and a number of techniques for sustainable architecture require serious adjustments, where the basis for creating a sustainable architecture with high quality is:

- Environmental friendliness and energy saving
- The comfort of the environment,
- Transformability and flexibility of the solution.

These principles are also required when creating innovative research and production complexes; however, their implementation is associated with additional difficulties arising as a result of the specific nature of innovation complexes as a special and complex design object.

Buildings with a high architectural value have longer durability, as people will probably also in 100 years' time want to live in a building that is architecturally well-thought-out and which for the same reason is often maintained over the years. Sustainable architecture with high quality in the future, which is absolutely necessary when humans being to promote and develop new sustainable solutions in the construction sector that can in a decisive way contribute to the global, sustainable society of the future. The study concludes that using of sustainability, quality factors can improve the economic factors, which is in the direct link to the environment, ensuring the protection and rational use of natural and national economic resources in the interests of the present and future generations

## 9. References

- [1] Kotler, P. & Lee, N.R. (2009), *Up and Out of Poverty: The Social Marketing Solution* (New Jersey:

Wharton School Publishing

- [2] Brooks, I and Weatherston, J. (1997) *The Business Environment. Challenges and Changes*, Prentice-Hall.
- [3] Christine Moorman & Roland T. Rust (1999), *The Role of Marketing*, Journal of Marketing, Vol. 63 (Special Issue 1999), 180–19Aaker, D., Joachimsthaler, E (1993) *Brand leadership*, The Free Press
- [4] Amjad Almusaed 2004, *Intelligent, sustainable strategies upon bioclimatic houses*, The Aarhus school of architecture, postdoc research, Denmark
- [5] A. Al-musaed and A. Almsad 2007, *The local microclimate effects on the bio-climatically investigative process in Iraq*, 2nd PALENC Conference and 28th AIVC Conference on Building Low Energy Cooling and Advanced Ventilation Technologies in the 21st Century, September 2007, Crete island, Greece
- [6] Asaad Almsad, Amjad Almusaed (2015), *Environmental reply to vernacular habitat conformation from a vast area of Scandinavia*, Renewable and Sustainable Energy Reviews, (August 2015) Vol.48 pp. 825-834.
- [7] Thomas M., Miguel Sol-S., Begoña M., Javier A. & Germán M. (2020), *Sustainable building rating systems: A critical review for achieving a common consensus*, Journal of Critical Reviews in Environmental Science and Technology, <https://doi.org/10.1080/10643389.2020.1732781>
- [8] Aliakbar K., Rossella C., Poul H. K. (2017), *Sustainability focused decision-making in building renovation*, International Journal of Sustainable Built Environment, Volume 6, Issue 2, December 2017, Pages 330-350
- [9] Cosma Jurov 1996., *What is architecture*, Albatros Editura. Romania, Bucharest. Pp 10-23
- [10] Jerry Yudelson, (2008), *Marketing green building services strategies for success*, Elsevier Ltd, China, p6
- [11] Jeff S. Johnson and Joseph M. Matthes (2018), *Sales-to-Marketing Job Transitions*, American Marketing Association: July 2018, Vol. 82, No. 4, pp. 32-48.
- [12] Martin Eisend (2015) *Have We Progressed Marketing Knowledge? A Meta-Meta-Analysis of Effect Sizes in Marketing Research*. Journal of Marketing: May 2015, Vol. 79, No. 3, pp. 23-40.
- [13] Booms, B.H. and Bitner, M.J. (1981), *Marketing strategies and organization structures for service firms*, in *Marketing of Services*, J. Donnelly and W.R. George (eds), American Marketing Association
- [14] Karen C., Liz M. Pam M. (2014), *Attitudes towards young people who self-harm: age, an influencing factor*, Journal of clinical nursing, Volume70, Issue12, Pages 2884-2896
- [15] C. Page Moreau and Marit Gundersen Engeset (2016) *The Downstream Consequences of Problem-Solving Mindsets: How Playing with LEGO Influences Creativity*. Journal of Marketing Research: February 2016, Vol. 53, No. 1, pp. 18-30.
- [16] Hoyer, W.D., MacInnis, D.J. (1993) *Consumer Behaviour*, 2nd Edition, USA: Houghton Mifflin Company

- [17] Almusaed, A.; Almssad, A. Building materials in eco-energy houses from Iraq and Iran. Case Stud. Constr. Mater. J. 2015, 2, 42–54.
- [18] Almusaed, A.; Almssad, A. Biophilic Architecture: The Concept of Healthy, Sustainable Architecture. In Proceedings of the PLEA 2006: 23rd International Conference on Passive and Low Energy Architecture, Geneva, Switzerland, 6–8 September 2006
- [19] Brassington, F., Pettitt, S. (1996), Architecture and Principles of Marketing, Second Edition, Prentice-Hall, Harlow
- [20] Chisnall, P.M. (1997) Marketing Research, Fifth Edition, London: McGraw-Hill
- [21] Amjad Almusaed 2010, Biophilic and bioclimatic Architecture, Analytical therapy for the next generation of passive sustainable architecture, Springer Verlag London, UK
- [22] Bird, L., & Frederick, S. (1992). Quality Architecture: A Concept for Quality Manufacturing. MRS Bulletin, 17 (4), 56-58.)
- [23] Amjad Almusaed 2004. Intelligent sustainable strategies upon passive bioclimatic houses, The architect school of architecture in Aarhus, Denmark. Pp203-230
- [24] Magnus rön (2012), Quality in architecture – learning form history, practice and competition; The 4th Symposium on Architectural Research in Finland – The 4th International Conference on Architectural Competitions
- [25] Ellwood, I. (1997) The philosophy of architecture, Kogan Page Limited
- [26] Yahya N. A. Ahmed O. I (2018); Value and quality in architecture: a study of the principles of value engineering, Journal of Al Azhar University, Engineering Sector, Article 25, Volume 13, Issue 47, Spring 2018, Page 514-52).
- [27] Rikesh Shah, Jayeshkumar P. Jayeshkumar Pitroda C G P. (2012); Quality Control Management in Building Construction, Conference: National Conference on Advances in Engineering and Technology (NCAET- 2012) At Kalol Institute of Technology & Research Centre, Kalol.
- [28] Magnus Rönn (2011); Quality in Architecture: A Disputed Concept; Conference: 2011 ARCC Spring Research Conference: Architectural Research Considering Research Reflecting upon current themes in Architectural Research. Sweden, Royal Institute of Technology, Stockholm, Sweden
- [29] Kirsten Arge (1995; Architectural quality, Building Research & Information, Journal Building Research & Information, Volume 23, 1995 - Issue 4
- [30] Marans, Robert, Spreckelmeyer, Kent (1982). "Measuring Overall Architectural Quality." Environment and Behavior 6 (14): 652-670
- [31] Lauring, M., & Marsh, R. (2008). Architectural Quality of Low Energy Houses. In Passivhaus Norden 2008 Conference Proceedings: Den første nordiske Passivhaus konferanse (pp. 126-133).



[32] Amjad Almusaed and Asaad Almssad (2012). Passive and Low Energy Housing by Optimization, Effective Thermal Insulation - The Operative Factor of a Passive Building Model, Amjad Almusaed, Intech Open, DOI: 10.5772/36922.).

[33] United nation report, (2018) International Recommendations for Energy Statistics(IRES), Department of Economic and Social Affairs Statistics Division, S T/ E SA /STAT/SER. M /93, New York,).

[34] Amjad Almusaed, Asaad Almssad, Raad Z. Homod, Ibrahim Yitmen (2020), Environmental Profile on Building Material Passports for Hot Climates, Sustainability; 2020; Vol 12 (9); Pages 3720

[35] Terry. W, Antony R. Helen B, 1994. Understanding sustainable architecture, Spon Press, London, UK, p 26

[36] Davies, M. (1996) Understanding Marketing, 1st edition. Prentice-Hall Dora P. Crouch and June G. Johnson 1994, Traditions in architecture, Oxford University Press, p1. UK

[37] Neil A. Morgan, Hui Feng, and Kimberly A. Whitler (2018) Marketing Capabilities in International



This work is licensed under a Creative Commons Attribution Non-Commercial 4.0 International License.