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Research Article

Standards for improving the quality of existing urban construction in light of sustainable quality of life standards

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Abstract:

Urban development and quality of life do not have a precise concept, but they can be explained through the dynamic, interactive network relationships between their various components to create an integrated concept. These are advanced relationships, not primitive relationships like the well-known urban planning and development theories, with the goal of achieving a better future for the city. These relationships are comprised of both material and immaterial (sensory) relationships. Through this, the impact of indicators for improving quality of life in urban construction on existing cities will be studied. This will create a clear indicator of quality of life in urban development. The goal is to create elements within a clear standard indicator to create better urban construction that achieves the desired development in all dimensions. It is also a flexible concept capable of adding elements to network interactions to create advanced relationships with the goal of improving overall urban quality.

1. Introduction

According to many international organizations (the UN's Human Development Index, the "Quality of Life in Ontario" project, the Federation of Canadian Municipalities, etc.), the Quality of Life Index is considered evidence of the progress of urban development processes in a city in all aspects (social, health, psychological, service, environmental, architectural, etc.) by measuring the extent of responsiveness to the requirements and needs of these aspects and elements[34]. This confirms:

1. Recognizing that development is not only economic, but also social and human development. Much criticism has been raised of the gross national income, which is considered one of the key indicators of human development indicators, because the rate of digital economic growth does not reflect positively on the level of human development, which should be the goal of any economic activity.
2. Recognizing that environmental development and sustainability must be socially sustainable and contribute to quality of life.
3. Recognizing that not only the number of years should be measured, but also the quality. In the health sector, this leads to various indicators such as disability and others.
4. Searching for an integrated approach between the number of years and their quality, encompassing the social and economic environment and human development, from local governments and the health sector.

i. Research Problem:

The lack of study of the quality of urban construction and urban character when developing existing neighborhoods in cities by adding new buildings, activities, or land uses. This study is neglected in the process of issuing building permits, and its direct role as an influence on the integrated process of improving the quality of urban construction is ignored.

ii. Research Objective:

Improving the current status of the quality of urban construction in existing neighborhoods, in order to control existing urbanization and eliminate random construction, in an integrated, sustainable process.

iii. Research Methodology:

Extracting concepts and indicators of quality of life to analyze and deduce the relationship between them and the elements of urbanization, leading to relationships for improving a sustainable urban built environment, deducing the impact of these indicators and determining their implementation processes through analyzing selected case studies of existing cities.

2. Definition of Quality

It is the degree of excellence or set of features achieved by an element or group of elements in interpreted relationships. The goal is to explain the excellence of the desired element or group of interconnected elements. It is often used in advertising for an element or to attract use and continuous improvement of objects, systems, materials, and services.

3. Concept of Urban Quality of Life Indicators

Quality of life has different meanings for different people, but it is largely subjective. However, academics and policymakers have adopted the view that it is possible to attempt to measure the key factors important in shaping a good life for most people. Interest in the topic of quality of life is constantly growing, and this is part of a growing interest in the importance of taking a comprehensive view when considering any social and material improvements aimed at benefiting the population. However, there is no consensus on a single definition of quality of life, but there are some definitions that help understand this term, including Ayman, 2009:

- It is the degree to which a person enjoys their life (Center for Health Promotion, University of Toronto).
- It is the result of the interaction between the social, economic, and environmental conditions that affect the individual (Social Development Council Ontario).
- It is the degree of happiness and satisfaction with the external environment[42]..

The concept of quality of life includes quantitative and qualitative criteria at the individual and societal levels. Qualitative criteria are at the individual level (satisfaction with life, sense of happiness, etc.) and at the societal level (the ability to participate and influence, the degree of interconnectedness between the individual and the community, etc.). Quantitative criteria are at the individual level (measuring educational status, skills, etc.) and at the societal level (measuring environmental, economic, and social conditions). The following table shows the main indicators of quality of life in the urban environment. As previously studied, Table (1) below shows the various measures of quality of life:

Quality of social life	Neighborhood Natural Quality (Low, Medium, Excellent) Quality of Social Security Quality of Social Participation Social Satisfaction Access to a Good Education
Urban Economic quality	Average Land Cost Average Income Private Car Ownership Home and Land Ownership Quality of Required Infrastructure Employment Rate
Quality of residential properties	Outdoor Air Quality Indoor Air Quality
Quality of access to urban services	Access to Recreational Facilities Access to Urban Services
Quality of access to transport networks	Access to Urban Traffic Networks Access to Regional Transportation Networks
Quality of the built environment	Noise and Air Pollution Rates Quality of the Natural Environment
Table (1)	Key Indicators of Quality of Life in the Urban Built Environment
Source	(Ebrahimzadeh et al., 2016)

1- The relationship between the performance of existing urban structures and quality of life standards to achieve sustainable design quality.

The quality of life in cities depends on the environmental conditions imposed by buildings and urban structures. As a result of urban warming (UHI), due to building density and the lack of green spaces, problems such as the potential increase in building energy consumption and the reduced urban ventilation required to discharge human activities with rising temperatures, the effects of land use, building morphology, and urban design on the environmental performance of cities require further investigation to guide and improve well-being and living conditions in future urban developments. Cities have long been considered complex metabolic processes, and without a doubt, they are the outcome of human activities and behaviors in complex interaction with the built environment. These interactions are so complex and influenced by a wide range of factors that any claim to specific mathematical predictions and determinism is unrealistic, but it leads to measurable urban performance rates[8]. A mathematical understanding of urban form and environmental performance enables us to discover and decode some quantifiable pathways of possibilities. This mathematical understanding will enable us to draw the boundaries and interrelationships between urban form and environmental attributes. Considering environmental attributes such as form factor, daylight availability, outdoor comfort, the urban heat island effect, skyscape factor, pedestrian wind comfort, etc., adds an additional layer to these indicators, such as physical density, which has a very direct impact on city performance. Combining density and performance factors within mathematical logic will allow designers and planners to understand and justify the extreme limits and consequences of rapid urbanization in order to search for robust solutions. As Alexander et al., n.d., points out, the spatial distribution of buildings must be arranged in a scientifically logical planning manner to avoid increasing the urban heat island effect, which results in increased energy consumption in buildings. Alexander elaborates in his book, Density Measures and Their Relation to Urban Form. The laws of perfection, with a detailed structural logic, propose a method by which this quality can be achieved again in a contemporary context—not through the traditional type of master plan which is currently used in computer programs to predict and address future indicators.

2- Analysis of the classification of urban construction elements to arrive at quality-of-life standards.

According to the classification Inglehart, through a study from several sources, seven basic elements were identified for implementing quality of life in urban construction to achieve the highest performance rates for urban planning. This was followed by developing a more comprehensive concept of the relationship between urban construction and sustainable urban construction. This was done through a simplified explanation of the application of the methodology for energy use quality performance on site and in buildings in an integrated concept with the other six elements and determining the extent of their impact. Table (2) shows the identification of the seven elements and the characteristics of the quality performance of these elements, which achieves the highest performance rates for the quality of the built environment and, consequently, a positive impact on the quality of urban urban life.

Element Performance Quality Rating	Elements of urban construction
1- Outstanding Performance of the Element - Reducing Fossil Fuel Use - Ease of Motorized Movement - Ease of Movement and Access for Pedestrians 2- Disadvantages of the Element - Traffic Congestion Difficulty of Pedestrian Movement and Crowding -Increased Traffic Accidents	تحسين الحر -1 1-Pedestrian and automated movement (facilitating movement to and from different locations within a specific area using automated and pedestrian movements)
1-The outstanding performance of the element Distribution of uses in relation to current and future population Opportunities for increasing cultivated areas 2-The negative performance of the element Haphazard construction - Increased building density - Increased heat island rates Desertification and lack of open and green spaces	استعمالات لر -2 2- Land uses (land distribution patterns for residential, administrative, commercial, mixed, service, etc.)
1- Outstanding Element Performance Affordability - Reducing social segregation to lower crime rates 2- Negative Element Performance Haphazard construction, increased levels of chaos and noise, increased rates of law violations, blackouts and low rates of social satisfaction	العدالة ال -3 3- Rights and duties (fair distribution of the main elements to all classes of society and meeting the various urban housing needs of all classes)
1- Outstanding Performance of the Element Attracting businesses to development zones - Increasing productivity levels in the regions 2- Negative Performance of the Element High cost of housing acquisition - Undeveloped land - Desertification of areas	الاقتصاد -4 4 -The city's economy (which is the development of the general economy of a specific area, which facilitates attracting investors to those areas and developing them)

1- The distinctive performance of the element Diversification of agricultural production levels - Reduction of heat islands Increased air movement rates due to increased green spaces Reduced pollution rates (water environment) - Increased sense of belonging to the region	المساحات -5 5- Green areas and agriculture. Increasing green spaces increases comfort areas within cities, provides lower rates of luxury and attraction, and achieves the highest rates of sustainability.
1- The outstanding performance of the element Achieving the highest rates of building height increase with the highest rates of thermal and wind performance with the best spacing between buildings. 2- The disadvantages of the element's performance The emergence of global warming and the heat island phenomenon - increased feelings of heat and discomfort	مورفولوجية -6 6- Urban Morphology (which is understanding the urban and planning fabric, which increases the comfort rates for a specific area and scope, while ensuring the achievement of the various elements of the urban design process)
1- The outstanding performance of the element Ensuring good energy distribution (energy efficiency) - Increasing the use of renewable energy Reducing energy loss factors - Reducing the use of industrial products and reducing waste rates Using recycled building materials 2- The disadvantages of the element's performance Increased operating and maintenance costs - Increased consumption rates of materials and fossil fuels Increased discomfort rates - Reduced lifespan for the sustainability of terrestrial life	ال -7 7- Energy: Energy is considered the most important indicator that shows the highest rates of efficiency and performance of urban and architectural design, and it shows the efficiency and effectiveness of all the previous elements in a comprehensive concept (Abdou, and Mahmoud 2018).
Table (2)	The basic elements of urban design quality
Source	Abdou et al., 2018; Alexander et al., n.d.; Inglehart,) (2020; Yang et al., 2019

1- The results of the analysis of the classification of urban design elements and improving quality of life, which were conducted from studies (Alexander et al., n.d.; Chokhachian et al., 2020; Escolà-Gascón et al., 2023; Rizk Hegazy, 2021; Yang et al., 2019), facilitate a simplified explanation for researchers, architects, and planners to arrive at a flexible methodology for understanding and measuring the necessary indicators and clarifying the policies that can be adopted in this regard. This helps develop a tool through which the performance of urban design morphology can be measured, setting the necessary levels of measurement for each design phase. 2- Design Morphology in Relation to the Urban Construction Quality Index for Hot Climate Zones

Through the above, we can more clearly explain the urban design process at a quantitative level, such as (building densities, heights, open and green spaces, energy consumption, etc.), which determines the design morphology and what increases sensory comfort levels and can be measured (temperature, wind, space ratios, etc.), as well as the required interconnected rates and indicators in a systematic relationship to maximize their benefits and resolve the complex entanglement between similar rates (Hosny et al., 2015).

According to (Pedro et al., 2018), the study community, which is the residential neighborhood level, varies between street width levels and their classifications (main - main service commercial - sub-residential (study level)) and between the shapes and patterns of areas and building levels between (service - commercial - commercial residential administrative Multifamily)) or residential (single family). The morphology here

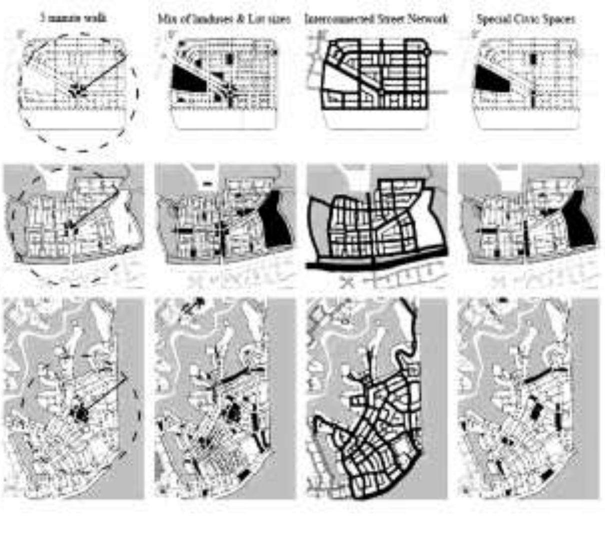


Image (1)	Examples of design levels in biology
source	(Pedro et al., 2018)

varies in the form of the distribution of building levels in terms of central urban planning or the compact fabric (such as old neighborhoods) and what results from that distribution through (noise levels - daily needs - transportation distances (walking - motorized). Urban areas vary in their morphological design between what the urban level provides to the neighborhoods in terms of environmental and urban quality of life through quality-of-life indicators and in a way that ensures its continuity and the possibility of its development and advancement. The following are examples of neighborhood design levels. Image (1) Examples of morphological urban design levels.

1- The Urban FAD Index to Measure the Performance of Urban Thermal Quality

Yang et al., 2019, conducted a study on the planning of large cities based on wind and thermal performance. This study is important for studying urban environments such as Cairo in Egypt due to its hot, dry climate and its status as one of the world's largest cities, which falls within the scope of the study. The study concluded that it is necessary to study land distribution and uses, local building

$$\lambda f(Z,\theta) = \frac{A(\theta)proj(Z)}{AT}$$

distribution, and surface temperature measurements. The Urban FAD Index (abbreviated as Frontal Area Density) was used across the study areas at different temperatures. It is measured by classifying the building type (building classification system) and according to its climatic classification (Local Climate Zone (LCZ)) to deduce the thermal performance of building distribution. This is calculated by:

where λf(Z,θ) is the frontal density; A(θ) is the wind direction near the specified height z; and AT is the total area of the study area, which is the grid area. The wind environment surrounding a single building is affected by multiple factors, such as the building's orientation and height, the proximity of buildings, and the wind direction. The windward side area of a building varies depending on the actual wind direction, and similarly, air circulation varies with the urban spatial grid. FAD focuses on changes in urban building shapes with a given height increase in a specific research area and can be expressed as follows:

where λf(z) represents the frontal density for a given wind direction, and Pθ,i represents the frequency of a given wind direction. The building height increase must be obtained to obtain the FAD parameters. Building heights were calculated using statistical analysis using a geographic information system (GIS).

$$\lambda f(Z) = \sum_{i=1}^{16} \lambda f(Z,\theta) \times P\theta,i$$

As shown in Table (3) and illustrated in Figure (3), most of the buildings in the study area were low-rise multi-story buildings along with some high-rise buildings. The selected height range was 3-228 m. Using the programming to complete the FAD calculations for a single wind direction, we calculated the windward surface area of the building and the grid area ratio of the grid and finally obtained the FAD of the area according to the wind frequency weighted FAD in different directions.

Building Structure	Number of standard floors	(Building classification)
Brick + Concrete	1-3	low building
Brick + Concrete	4-6	multi-story building
Reinforced concrete + glass	7-9	mid-rise building
Reinforced concrete + glass	10-39	tall building
Reinforced concrete + glass	<40	high-rise building
Building classification according to the number of floors and type of construction		Table (3)
source		(Yang et al., 2019)

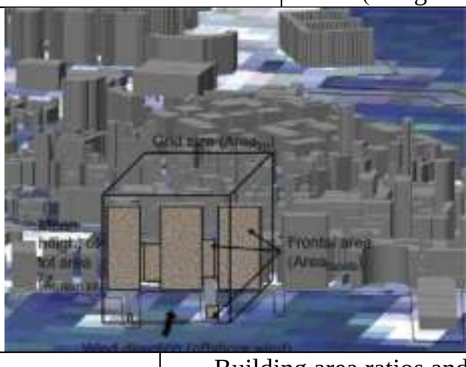


Image (3)	Building area ratios and front wind exposure
source	(Yang et al., 2019)

4. Block Formation Strategy to Control Urban Development According to the FAR Index

There is complexity in defining what constitutes an urban built-up area. It can be summarized as the components of an urban area, including vacant land with a specific use, building land described by its height and uses, green cultivated land, and land used for solid public utilities, such as sidewalks, parking spaces, and streets of various grades, according to the classification of Jiao L. (2015). This is what falls under Egyptian Law No. 119 of 2008 and its executive regulations and is subject to the term "component" of the city's detailed plan. To measure the Urban Urban Performance Index (UPI), Yang et al. (2019) proposed, in its broader sense, the systematic and objective collection of data to determine the efficiency and effectiveness of services and achieve objectives at the strategic and operational levels. Hence, the primary measurement indicators (Equere et al., 2020) were as follows:

A. Block Index: This measures the distance between buildings (canyon width, building area (block size), building height (block height), and the distance between building ventilation openings (windows) (window-to-wall ratio).

B. Floor Area Ratio (FAR)

C. Environmental Performance Indicators for Urban Urbanization (UHI - summer and winter average temperatures - outdoor solar access - daylight indoor ratio).

D. Building Area Ratio (FAR) Winter - outdoor solar access rate - daylight indoor ratio (Tareq Muhammad Hijazi, 2004).

5. Advantages and disadvantages of the strategic system according to the FAR index

Using these indicators, the environmental performance of urban development can be measured, but without considering congestion rates, pedestrian access, and public facility performance rates. This serves as a complement to the general indicators of a comprehensive study of urban development. Currently, with the development of analytical methods and computer tools, it has become possible to collect more than one measurement indicator at the analytical level and in a systematic sequence, while reducing the time consumed by this process. This achieves the best results for indicators of the current situation and how to predict solutions that will raise the performance rates of urban development in general.

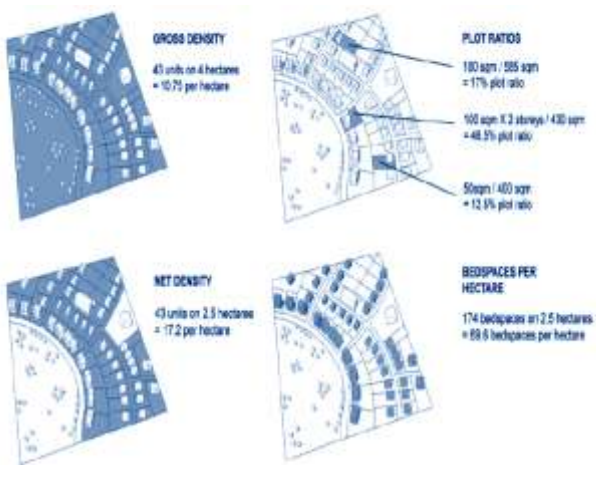
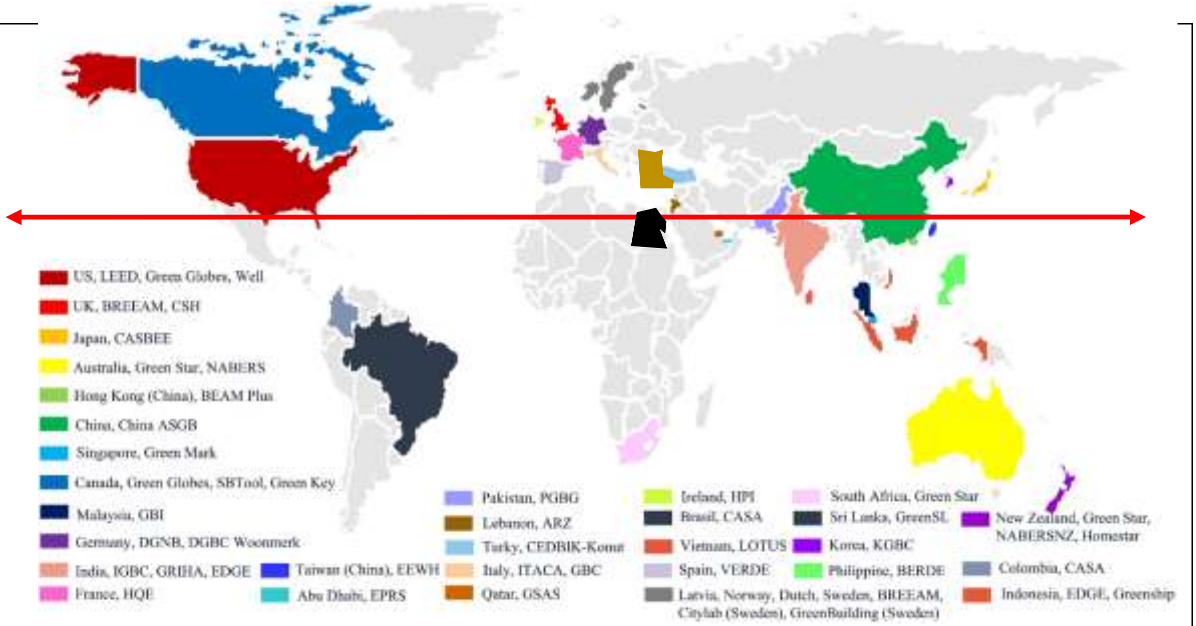


Image (4)	Building density levels (number of units per hectare
source	(Discoli et al., 2014)

6. Methods for measuring and evaluating sustainability in urban construction



The red arrow identifies the tropical line of the Arab Republic of Egypt. Countries located on the same tropical line have similar tropical weather conditions.

Image (5)	Evaluation programs in different countries of the world
source	(Pan et al., 2022)

Urbanization and the built environment worldwide are subject to various evaluation methods. This represents the status of the built environment, whether under construction, or in the design and pre-design phases, subject to continuous evaluation and review through testing and measurement at a visible and sometimes complex standardized stage. This is to avoid future urban and environmental problems that have a direct, positive and negative impact on the quality of human life on Earth by evaluating performance and function efficiency standards and their suitability to human needs (He et al., 2018). According to Pan et al. (2022), harmful emissions from densely populated cities such as Cairo—the study's spatial scope—account for more than 56% of the total emissions that contribute to global warming. These figures represent more than 600 dense cities around the world, meaning that energy consumption and the resulting harmful emissions are increasing. Urban areas accounted for 56% of the world's population in 2019, according to figures provided by the World Bank (World Bank, 2019). It can be noted that the 600 largest cities with the largest populations, most of which are high-density cities, accommodate only 20% of the world's population but emit 70% of greenhouse gases, highlighting the enormous challenges and potential of carbon reduction and sustainability in high-density cities. Meanwhile, the urbanization rate has increased rapidly from 36.6% in 1970 to 55.3% in 2018. In this case, the urban development elements and the basic components of the city need a comprehensive review (buildings, facilities, streets, open spaces, green spaces, etc.) (Al-Moataz Bellah Gamal El-Din Abdel-Azim & Rasha Ahmed Riyad, 2020). The multifaceted dialectic of urban planning assessment and finding the best dynamic processes among its elements to deal with it represents a general approach for various research and governmental bodies. The Global Building and Urban Planning Sustainability Assessment (GBA-ND) approaches establish approaches to assess the presented models. In terms of the research problem, as mentioned, aiming to find the methodological relationship between the building and urban planning as a tool for assessing urban planning in existing cities with high density, such as Cairo and its various neighborhoods, the various assessment programs will be analyzed in the same thermal orbit in order to benefit from the similarities of environmental conditions and maximize the benefit from indicators that directly affect the relationship (building + urban planning site). This is what is found in Figure (2). Then, the approaches will be compared based on the weight of the detailed assessment criteria, leading to the identification of the criteria that will be relied upon in the interim assessment of buildings and urban planning in a proposed dynamic dialectical integration and in subsequent analytical stages (Magdy Mohamed et al., 2019).

7. The first stage of comparing the green component and the theoretical pillars of sustainability in evaluation programs.

The first stage of the comparison is to define the elements of the theoretical pillars upon which it is based. The primary goal of any evaluation program is the sustainability of life on the planet we inhabit. From here, each program selects its theoretical pillars, leading to implementation policies, while setting specific criteria for each element. This ensures that each element is unique in its quality of measurement.The comparison uses a hierarchical rebalancing methodology between the elements, based on the selected approaches. In Table (4), we see where most of the global programs for evaluation of architecture and urban architecture are located. These programs are characterized by being in countries along the same horizontal orbit passing through the Arab Republic of Egypt, which results in similar climatic conditions for each, as mentioned in the previous point. However, in this context, the researcher can reduce the elements of comparison to easily reach logical scientific conclusions that are qualitatively consistent with the Egyptian environmental conditions, considering social and cultural circumstances (Danza et al., 2020).

number	Course name	state	Definition of the green component	The pillars of the theory
1	ASGB	China	Land Use, Water, Energy, Materials, Additions	The Five Qualitative Pillars
2	IGBC, GRHA, EDGE	India	Reducing Energy, Materials, Water Consumption, Maximizing Community Culture, Site Sustainability, Site Management, Additions	Four Qualitative Pillars
3	EEWH	Taiwan	Land Use, Water, Energy, Materials, Additions	The Five Qualitative Pillars

4	EPRS	Abu Dhabi	Site Selection, Natural Resources, Energy, Water, Materials, Indoor Environmental Quality. Integration of Design Phases	Seven Qualitative Pillars
5	GSAS	Qatar	Urban Connectivity, Site, Energy, Water, Materials, Indoor Environment, Culture and Economics, Operations and Management	Seven Qualitative Pillars
6	LEED,Green Globes,Well	USA	Human-Planet Connection and Maximizing Profit	The Three Basic Pillars, from which seven qualitative pillars are extracted
7	Egyptian Green Pyramid GPRS	Egypt	Supporting the Implementation of Green Architecture in Egypt (Site, Energy, Water, Materials, Indoor Environment, Culture and Economics, Operations and Management)	Seven Basic Pillars
	Table (4)	Phase 1 (preliminary comparison between selected evaluation programs and curricula)		
Source	(Abu Dhabi urban planning Council, 2016; Alhorr et al., 2019a, 2019b; Chuang et al., 2011a, 2011b; GSAS SEER TOOL v2.0, 2017; Hazem Abd Elazim et al., 2019; Khoso, 2020; Moussa & Farag, 2017; Pan et al., 2022; Tang et al., 2020)			

The following table shows that the systems of countries such as Qatar, Abu Dhabi, and the United States rely on the seven basic and qualitative pillars, from which we can formulate the comprehensive approach proposed in the research to assess the current and future situation and find theoretical solutions in preparation for testing. We also note the presence of the remaining programs for five and four qualitative pillars, some of which are required for the research study, such as the land use pillar, which is one of the elements of the research problem and requires an evaluation test to determine whether the element is dynamic or whether the type of use is fixed in Egypt (needs to be tested or not). Hence, we find a need to move to the second phase of comparison.

8. Phase Two: Comparison of the specific criteria for sustainable evaluation programs between local and international systems

To move to the next phase of evaluation and achieve specificity in the study of criteria, we must conduct a comparison between the seven comprehensive pillars of the evaluation process in terms of the standard weight of each element to examine how to approach the logical analysis and priorities upon which each system was built. According to Table (5), in the second stage, the hierarchical sequential methodology will be used to rearrange the programs in terms of the level of proximity to the Arab Republic of Egypt and the number of pillars that depend on it, as the pillar of design integration and site sustainability represents the research priorities and is the main driver for the process of evaluating the current situation in terms of the presence of the site with its elements in its current state, especially in cities such as Cairo, arriving at evaluating the rest of the pillars with the possibility of dynamic transition between the two elements (design integration, site sustainability) in evaluation flexibility with the possibility of continuous review by the team members that is usually used, and this is what will be discussed in the subsequent points.

Grant points in assessed urban sustainability systems								Course name
Total points for evaluation of each program	Addition	Indoor environmental sustainability	Energy sustainability	Sustainable material consumption	Conserving water resources	Sustainability of the neighborhood or residential area	Design Integration (Economics and Social)	

	Total points awarded	Relative weight	Total points awarded	Relative weight of the pillar	Total points awarded	Relative weight of the pillar	Total points awarded	Relative weight of the pillar	Total points awarded	Relative weight of the pillar	Total points awarded	Relative weight of the pillar	Total points awarded	Relative weight of the pillar	
82	36	4.4%	14.8	18%	18.4	22.4%	13.6	16.5%	12.6	22%	15	18.3%	4.4	5.4%	For internatio
180	10	10%	20	10%	50	%25	20	10%	50	30%	10	15%	20	10%	Green Pyrami
The second stage: Comparison between programs in terms of the standard percentage weight for each pillar.															Table (5)
(Bahale & Schuetze, 2023; Dawodu et al., 2022; Nocerino & Leone, 2023; U.S. Green Building Council, 2019)															source

9. Results of an analytical comparison between the Egyptian Green Pyramid System and international green systems.

From the previous comparison of the pillar systems, their weights, and the number of points awarded to them to evaluate the basic processes within the system and what achieves the scope of the study, and after presenting all the basic and qualitative pillars, we find the most important main advantages between international systems and the Green Pyramid System. The following is an analysis of the advantages and disadvantages of standard green systems. Based on the comparison in Table (5), the following are the most important points concluded:

A- The main advantages of the Green Pyramid System and international systems are as follows:

1- Multiple metrics used in the process of managing resources, energy, and water on-site, as in the case of international systems.

2- The clarity of measurement methods among international codes in the process of measuring densities, harmful emissions, water and energy consumption, and ways to ensure comfort for the internal environment of users.

3- Respect for the culture of the community, which is one of the most important components of Arab societies, especially the Arab Republic of Egypt.

4- Distinguishing evaluations with the opportunity to give further evaluation points in the event of attention to a particular element, as in the case of the Egyptian Green Pyramid System.

5- Determining what is mandatory in the evaluation process, without which the evaluation will not be granted to the element. This makes the presence of basic requirements for the design and construction process essential for establishing implementation processes, as there are minimum requirements for the success of the implementation processes.

B- The main flaws of the Green Pyramid system and international systems.

1- International systems: Lack of direct attention to design integration processes, which represent the pre-design phase and the necessary review stage, in terms of reducing error rates during implementation, modifying proposals to suit the site's nature, evaluating the planning of integrated processes between the project's stakeholders, matching client needs with state needs, and achieving sustainability.

2. The Egyptian Green Pyramid system: Failure to restrict Egyptian reality and use the Green Pyramid evaluation systems, linking them to Egyptian codes to improve energy efficiency and the built environment, and site planning due to the lack of qualified personnel and designers' focus on international systems without paying attention. The Green Pyramid system is unique in some standard elements, such as environmental site assessment, the impact of geometric formation on the site, and studying the exchange of effects from the building envelope to the surrounding site. This

is something the Green Pyramid lacks in detail, but which some international systems excel at.

10. Selected global and local case studies

To manage each branch of urban development, an approach is used to ensure the continuity and sustainability of that development. This is influenced by the fact that everything being studied partially affects the whole, which is the urban environment, the fundamental element for the continuity of life on Earth. Urban development (Hefnawy et al., 2022) is the primary consumer of energy, and this is achieved through its implementation processes, which humanity requires to carry out its various activities. Here, these standards, codes, and approaches must be established in order to arrive at the best solutions for the sustainability of life in general, while achieving the highest levels of performance and quality in meeting human needs. This is achieved while excluding dangerous activities and incorrect practices that directly and indirectly impact the continuity of life and the continuity of energy supplies on Earth. Based on this, and from Table (6), a detailed comparison will be made between two global and local case studies to examine the allocation of elements and relationships to the performance components of the implementation elements of the quality of urban construction life.

Table (6), comparison between selected global and local case studies, source (Sano et al., 2020; Vincent Callebaut Architectures, 2014)

Second case study	First case study	Comparison point
The Gate Heliopolis	AVA Little Tokyo	Name
Cairo - Egypt	Los Angeles, USA	the site
HOT ARID	Mediterranean climate	Thermal orbit
m2 x one floor with residential skylights 33750xm2	41699.43 m3	Project area for buildings
35000m2	45 000 m2	Total project area
LEED -NC HOMES	LEED – ND	Evaluation program name
LEED PLATINUM	LEED gold plus	Evaluation score
residential floors * 8 towers 9 residential apartments + 5-star hotel with 360 1100 rooms commercial floors, 100,000 m² Number of administrative units: 1 floor, 14,000 m² Built-up area: 70% Mixed-use residential	residential floors 9 apartments 280 Podium Built-up area = 70% Mixed-use residential	Project description
Analysis of the sustainability and quality of life elements of urban construction		

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<td>
The site is located in a densely populated area, surrounded by the City Stars Hotel and Building, the Egyptian Ministry of Defense buildings and clubs, and several commercial, administrative, and residential towers. This gives the area a mixed-use character. The design was integrated through a site study, which included five underground floors with full-floor parking spaces to address congestion by parking on the streets and to accommodate the large number of apartments and the commercial and administrative mall, as shown in the following figures. A complete concept for the project and its proposed capabilities was developed and tested by the LEED certification body, in terms of adapting the buildings to the site and the massing to the location and climatic conditions. Shaded geometric facades were created, and wind attraction factors within the building were utilized for ventilation.

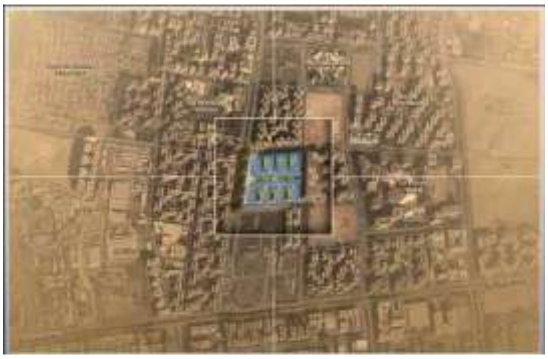
Image (8), (the general location of the project, showing its location in the area of multi-use buildings, a hotel and a mall)

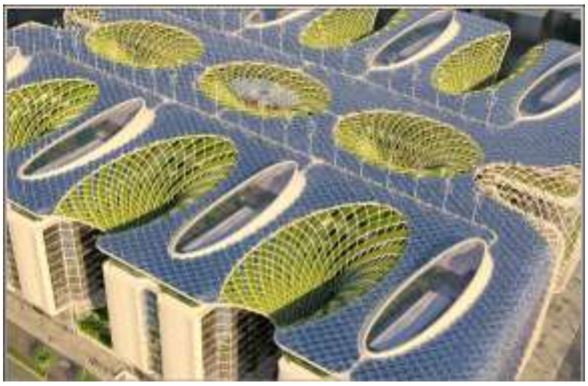
Figure (9), (illustrating the use of negative formation to polarize the winds)
</td>
<td>
- The site is located in the Little Tokyo suburb of Los Angeles, a state in the United States of America, and one of the oldest suburbs in Los Angeles. This suburb has been characterized by having developed a plan to align with a sustainable vision for the neighborhood since 2002 (Keyser Marston Associates, 2014).
- - Site Study
- - In terms of residential density and building type: The urban sustainability vision for the site was determined in terms of the FAR ratio and the future use of the types of buildings to be built on the site, using Urban GIS software for the study.
- - In terms of connectivity elements in the site and intelligent transportation, these were achieved by linking the connectivity elements. The site was specifically chosen to provide residents with greater access to restaurants, culture, transportation, and everything that downtown Los Angeles has to offer.
- - The project is located near bus lines and the Gold Line light rail station, providing tenants with the ability and choice to take alternative transportation methods. Restaurants, shops, and other services are within a quarter mile walking distance, reducing the need to use a car or park in a densely developed environment. AVA Little Tokyo also boasts well-insulated units with LED lighting, reducing tenant operating costs and extending equipment life.
- - Promoting the construction of mixed-use housing projects within the new land development strategy, in terms of value and financing sustainability in buildings.
- - Promoting water conservation, particularly in existing buildings, and providing them with the necessary equipment, such as the MOCA system.
- - Reducing parking spaces through the Parking Management Area (NPDc5).
- - Increasing open green spaces, planting trees on both sides of roads, and enhancing water recycling.
- - Converting infrastructure to green infrastructure.
- - Other site factors:
- - Using solar energy for street lighting – using open-loop geothermal energy, and the possibility of enhancing closed-loop energy.
- - Non-potable water system in the area; efficiency – saving water by 30-35%; reusing water systems and loops to reduce potable water by 60%. The wastewater treatment and reuse system for the area focuses on the possibility of recycling recycled wastewater by supporting green infrastructure through the creation of underground centers that can be used for infrastructure. Existing buildings are difficult to double vertically, assuming only for new development.
- <u>Measuring performance rates of on-site elements</u>
Fixture water use reduction – 24%
– Exceeds California’s Energy Code performance by – 18.7%
– Construction Waste diverted from landfills – 80%
– Project Density – 164.1 units per acre
– Exemplary performance in location to public transportation and community services – walking score of 97
</td>
<td>Site Evaluation and Design Integrity</td>
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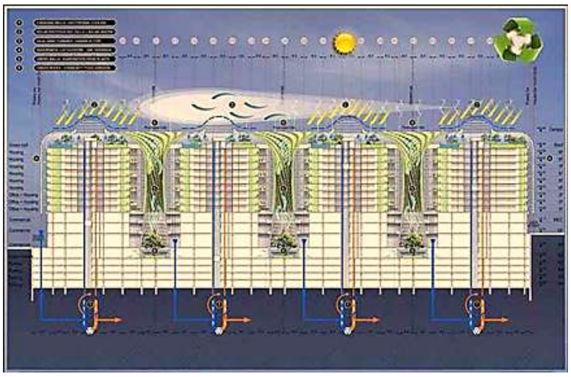
Figure (10), (illustrating the use of negative formation to polarize the winds)

Image (11), (top - horizontal projection of the roof,



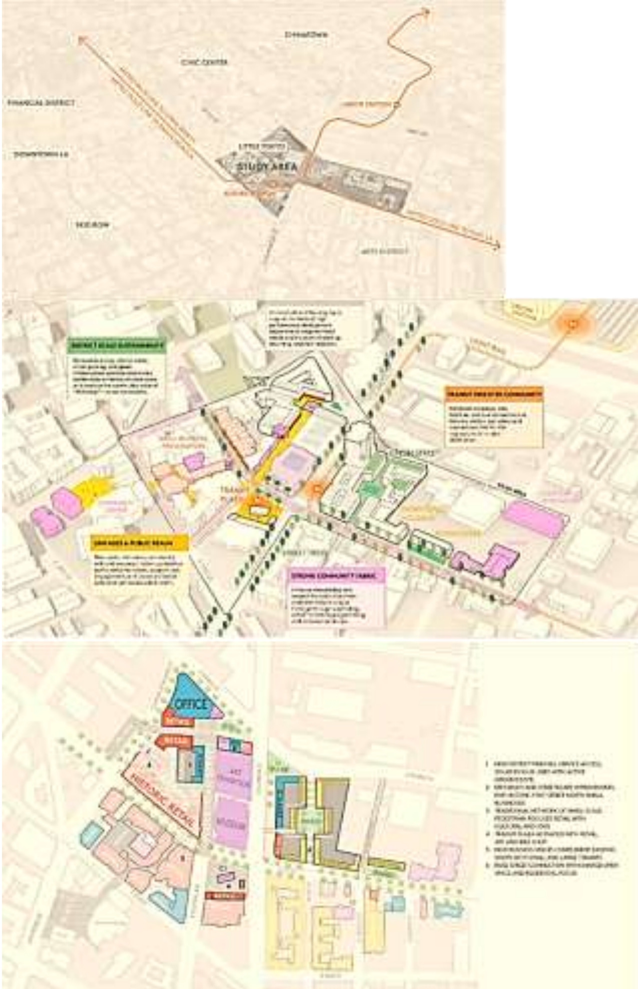
bottom - vertical section of the project, and the images show the increase in the percentage of the green component and the use of sustainable systems in the site, buildings and mass formations through the creation of shaded skylights with a negative design by attracting wind inside the buildings with shading of the facades by means of green facades and biometric facades, (Charkas 2019))
</td>
<td>


Image (6), (top left shows the distribution of the most important elements surrounding the project, top right shows the study area, bottom shows the studies that were conducted for each building and the SF rates and land value according to the streets)
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<td>
<u>Water Resource Conservation:</u>
- A mechanical and technological system has been developed to recycle water and reuse it for landscaping on the roofs and facades. Solar water heating (SWH) systems have been integrated into the design to deliver hot water to all bathrooms and kitchens in the building year-round. Glass-metal tubes that collect the sun's warmth will be incorporated into the shapes covering the mechanical rooms at each roof core.
<u>Site Conservation and Energy Conservation:</u>
</td>
<td>
<u>Conserving water resources:</u>
By using drought-resistant plants that do not require heavy irrigation, an automatic rainfall sensor system was implemented to prevent watering during rainfall. A low-flow system was also installed in toilets and washbasins, treating the wastewater from the washbasins and integrating it into the irrigation system. Sensors were installed to prevent unnecessary water flow, resulting in a 20% reduction in water consumption compared to similar projects.
Site Conservation:
</td>
<td>Analysis of the remaining elements of sustainability</td>
</tr>
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- Using Passive Cooling Design Methods: This is a building design method that focuses on controlling heat gain and heat dissipation in a building to improve indoor thermal comfort with low or no energy consumption. This method works either by preventing heat from entering the building (heat gain prevention) or by removing heat from the building (natural cooling). Natural cooling uses on-site energy, available from the natural environment, along with the architectural design of building components (such as the building envelope), rather than mechanical systems to dissipate heat.
- Using Windcatchers: In Egypt, windcatchers are known as "malqaf." Windcatchers can operate in three ways: directing airflow downward using direct wind entry, directing airflow upward using a wind-assisted temperature gradient, or directing airflow upward using a solar-assisted temperature gradient. The potential benefits of this natural passive cooling system (malqaf) may include:
- - Improved passive cooling during the warm season (mostly on hot days).
- - Improved nighttime cooling rates.
- - Enhancing thermal mass performance (cooling and cold storage).
- - Improving thermal comfort (improving airflow control and reducing drafts).
- Using geothermal heat: A Canadian well can lower the temperature by 5 to 8 degrees Celsius in each apartment during a heat wave with virtually no electricity required. It uses geothermal energy passively, making it ideal for cooling apartments during the summer and heating them in the winter. The Canadian well involves passing a portion of fresh air through pipes buried approximately 2 to 3 meters deep in the ground, beneath the building's foundations, before it enters the residence. In the summer, conversely, the ground is cooler than the outside temperature: this smart "well" will use the freshness of the earth to moderate the air entering the residence. In the Gateway project, we propose incorporating 1-meter-square air shafts along all cores to naturally refresh each apartment. Using ground loops, geothermal heat pumps transfer thermal energy back and forth between the building and the ground, providing an efficient and environmentally friendly way to heat and cool apartments and commercial spaces, and even help provide hot water.
- The project's solar roof will be covered with walkable solar panels, creating shade over the courtyards and park and generating a significant portion of the building's electricity on-site. The solar cells will be integrated into an easy-to-clean double-glazed window. They will also be used in some windows, replacing conventional glass with direct and infrared generation.
- Use of vertical and spiral wind turbines: The twisted spiral wind turbines in this project are located along the internal street on the roof to take advantage of the prevailing winds and generate maximum electricity. Along Al-Nuzha Street, we propose to develop a new energy-self-sufficient prototype for the city, "The Phylolight," a novel hybrid between an urban wind turbine and a vertical wind turbine. This arrangement allows the generator and gearbox to be located close to

To avoid the heat island effect caused by the sun's heat striking surfaces such as parking lots, steel and glass structures absorb and then emit heat. AVA Little Tokyo's parking lot is located entirely underground, maximizing space and helping to reduce the urban heat island effect.

Material Conservation:

%80 of construction waste was reused, recycled, or otherwise diverted from landfills. Environmentally friendly wood products were used throughout the project. Both the foundation aggregate and insulation in the building contain recycled content, helping to reduce the need for virgin resources.

During the design process, the project team developed a detailed cut list for the lumber used in the building's framing. This pre-cut lumber was delivered to the construction site, reducing waste from on-site lumber harvesting. Delivering the pre-cut lumber to the site saves labor and material costs, as the wall, floor, and roof sections are assembled in an efficient factory environment.

Energy Conservation:

AVA Little Tokyo exceeds California energy usage standards by more than 18%. This was achieved through the installation of high-efficiency HVAC units and water heaters. High-efficiency lighting is used throughout the building and in all units.

The air ducts are tightly sealed, allowing only 6% or less of leakage. This means that most of the air conditioned in the units is delivered to the occupants, not the empty spaces. Superior insulation allows for a more comfortable unit that requires less heating and cooling. Overall, these measures save tenants approximately 30% on energy costs annually. Residents have been quoted as liking the lower utility bills and the energy-efficient appliances and lighting.

AVA Little Tokyo's roof is made of a white membrane that keeps the overhead units cool and helps reduce the heat island effect. The cooling units also mean that the air conditioning systems run, saving tenants approximately 15% to 20% on cooling costs and protecting the property from wear and tear on the equipment.

تفاصيل تحقيق نظام LEED Facts – LEED for Homes Mid-rise الليد

GOLD: 71.5 points
Location & Linkages – 9/10 – (9 of a possible 10 points)
Sustainable Sites – 16.5/22
Water Efficiency – 8/15
Energy & Atmosphere – 12/38
Materials & Resources – 9/16
Indoor Environmental Quality – 5/21
Innovation in Design – 10/11
Awareness & Education – 2/3

the ground, facilitating service and repair. The main drawbacks of early designs (Savonius, Darius, and Giromel) included significant variations in torque during each rotation and large bending moments on the blades. Subsequent designs solved the torque problem by providing a helical twist in the blades. - Rooftop playgrounds and green areas were created to reduce urban global warming and create an ideal healthy environment for the project's residents. These areas were designed to insulate against direct solar heat. A water recycling system was created to feed these horizontal and vertical surfaces to conserve water. - The use of green walls in the project: Green walls reduce the overall temperature of the building. Effectively, plant surfaces, due to transpiration, are lowered by more than 4-5 degrees Celsius below the surrounding environment. Living walls may also serve as a means of water reuse. Plants may purify slightly polluted water (such as graywater) by absorbing dissolved nutrients. Bacteria mineralize organic components, making them available to plants. - The building mass was enhanced by softening all edges of the "U" shapes. The facades of the nine residential floors are designed as a horizontal layering of low-e glass and polished white stone. At both ends, the facades are inspired by fish gills that act as parachutes. Throughout, hollow steel linear joints extend horizontally across all blocks to maintain the building's elegant, global scale. All balconies are transformed into hanging gardens by incorporating planting beds along the perimeter of the facades to create green cascades that cascade into each courtyard. - A transparent curtain wall was installed along the back street and Al-Nuzha Street. This curtain wall is interspersed with green walls that mark the main entrances to the shopping center and the lobbies of each residential building. Within the courtyards, the facades are developed with a Voronoi structure, presenting organic forms inspired by the structure of coral reefs with gradual density from the bottom to the top. These facades are connected by pedestrian bridges crossing the green terraces. These green terraces within each courtyard are covered with a Voronoi barrier for the growth of climbing plants to reduce obstructed views between the commercial and residential floors. This Voronoi screen is also integrated along the internal street between the office and residential floors. **Using indoor environmental quality principles:** - Using smart and automated home principles: User interfaces enable control of different zones/rooms, temperature control (heating and cooling), lighting control, and ventilation control. Multiple sensors are also used to detect the number of people in the room, movement, temperature, and light level (day/night). Automating the natural heating, ventilation, and air conditioning (HVAC) system enables the ideal climate. Using an automation application, you can control the desired temperature before entering your home, while saving electricity. By respecting bioclimatic regulations and integrating renewable energy, the project aims to gradually reduce the demand for mechanical ventilation		

and artificial lighting by increasing natural ventilation and natural lighting systems throughout the project.		
 Image (12), (using a vertical section of the facade to show the details of the double facade and the effect of its shadows on the facade with the use of vertical green surfaces with a combination of natural lighting and artificial lighting)  Image (13), (the use of green roofs and green walls in the project with executive details for creating green roofs at the top left)	 Image (7), (during construction using systems to preserve the site and resources on the site. Source: (Kheir Al-Kodmany, 2018))	

11. Results

First: From the following comparison of the pillar systems, their weights, and the number of points awarded to them to evaluate the basic processes within the system and what the study area achieves, and after presenting all the basic and qualitative pillars, we find the most important main advantages between the international systems and the Green Pyramid System. The following is an analysis of the advantages and disadvantages of the standard green systems. Based on the comparison in Table (5-6-2), the following are the most important points concluded:

The main advantages of the Green Pyramid System and the international systems are as follows:

1- Multiple metrics used in the process of managing resources, energy, and water on-site, as in the case of international systems.

2- The clarity of measurement methods among international codes in the process of measuring densities, harmful emissions, water and energy consumption, and ways to ensure comfort for the internal environment for users.

3- Respect for the culture of the community, which is one of the most important components of Arab societies, especially the Arab Republic of Egypt.

4- Providing an opportunity to give further evaluation points in the event of interest in a particular element, as in the case of the Egyptian Green Pyramid System.

5- Determining what is mandatory in the evaluation process, without which the element cannot be evaluated, makes the presence of basic requirements for the design and construction process essential for establishing implementation processes, as there are minimum requirements for the success of the implementation processes.

The main flaws of the Green Pyramid system and international systems:

1- Lack of direct attention to design integration processes, which represent the pre-design phase and the necessary review phase, in terms of reducing error rates during implementation, modifying proposals to suit the site's nature, evaluating the planning of integrated processes between the project's stakeholders, matching client needs with state needs, and achieving sustainability.

2- Failure to restrict the Egyptian context and use the Green Pyramid evaluation systems, linking them to Egyptian codes to improve energy efficiency, the built environment, and site planning, due to the lack of qualified personnel and designers' focus on international systems without paying attention. The Green Pyramid system is unique in some standard elements.

3- Environmental site assessment, the impact of geometric formation on the site, and a study of the exchange of effects from the building envelope to the surrounding site. This is something the Green Pyramid lacks in detail, and some international systems are unique.

To this end, a combination of international and local systems must be employed in an attempt to find the best assessment and appropriate relative weighting according to the field of study. The research focuses on paying greater attention to pre-design, during design, and before implementation, given their clear importance. Appropriate concepts should be developed and tangible whenever possible, highlighting the impact of the smaller structure (the building) and the larger structure (the site) on the quality and sustainability of life.

This requires a unique system characterized by integration between what will be designed and what will be implemented, with a full understanding of the dynamics underlying the appropriate design. Appropriate indicators should be established to become a law and legislation suitable for implementation in the current Egyptian context, within a flexible system for developing appropriate solutions, both now and in the future.

Second: Regarding the analysis of the results derived from the case studies:

Regarding the site and the integration of the design:

1- Relying on building proportions and heights appropriate to the skyline of the area.

2. Relying on adequate parking spaces to serve the project and the area.

3. Relying on a three-story basement, followed by residential floors, with separate entrances and exits for residential use, as adopted by the mixed-use environment in the surrounding area.

4. Using BIM engineering software to study the project before implementation and examine the design's integration with the technology used in smart site management.

5. Increasing the green component of the project and relying on green wall systems and green roofs.

Regarding water, material, and energy conservation:

1. Relying on passive technological design to reduce energy use in cooling and ventilation.

2. Relying on technological systems to manage the smart home and reduce energy consumption during idle time. Relying on automated systems to determine the artificial lighting used and combine it with artificial lighting. Also, determining the optimal temperature values for cooling and heating using sensors, these were taken into account in the integrated design.

3. Relying on conserving water consumption by recycling water within the project on green roofs and vertical roofs.

4- The addition lies in the fact that it is: using a cultural and social heritage by using scoops in a modern design language and using new materials in the science of biomechanical facades and scoops using the technology of building double facades inspired by natural organisms and creating ways of connecting natural landscapes and direct lighting with high quality and efficiency.

12. Recommendations

The executive policies for urban quality of life are summarized by integrating the main directions of urban quality of life elements with sustainability elements, as follows:

1- Sustainable human approach: Meeting the current and future needs of the site for users, while enforcing rights and duties, and enhancing outstanding performance (ease of movement, motorized and pedestrian traffic, purifying the site of air pollutants, and increasing the green component of public sites and public spaces).

2- Sustainable economic approach: Implementing executive mechanisms to minimize material waste, conserve energy, and integrate environmental trends into industries, particularly material recycling, to provide the necessary support for the executive processes for the site's economic development, using sustainable elements, and exploring ways to recycle them in the future, integrating them into a more comprehensive planning process for development processes throughout the site's life cycle.

3- Sustainable design approach for neighborhoods: by integrating sustainable implementation standards on the site and for addition and modification (development) processes through applying sustainability programs (water conservation, improving the environment in general, introducing the green component, supporting easy and smooth transportation processes, reducing air pollutants on the site, reducing heat island rates and reducing building densities) while ensuring the stability of the performance and quality of the selected elements.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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- **Author contributions:** The authors declare that they have equal right on this paper.

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- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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