

Quality of Life Indicators in Sustainable Urban Areas

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Abstract

Quality of life is a concept that has been discussed recently in various studies, as a response to many problems facing the compacted cities, all over the world as well as in Egypt.

The purpose of this paper is to concentrate mainly on the concept of urban quality of life, it has a multi-dimensional and complex issue, the framework of this study is to find the (missing available urban quality of life indicators) in compacted cities.

Although, there were design concepts of sustainable urban form in (High-density residential areas) with mixed land uses, which have a high degree of social interaction, this paper also aims to facilitate the participation of urban authorities in process of measuring, and analyzing the urban quality of life with providing an extra element for design concepts of a sustainable urban area such as greening & renewable energy.

The study is beneficial for who interested in the field of sustainable development, and it gives indicators such as (GDP) (gross domestic product) which help the Simi sustainable areas to be a more efficient with urban quality of life indicators.

GDP is highly useful for measuring marketing production and providing an indicative snapshot of an economy at a given time, this research uses the descriptive analytical and statistical approach to identify a quality of life indicators through study the Interrelationships environmental, social, economic and physical elements applying on compacted Egyptian cities.

Finally, to raise the value of benefit from the resources and sustainable development within the compacted residential areas to get the required indicators of quality of urban life and managed.

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Keywords

Quality of life; Quality of life indicators; Sustainable Urban areas; semi sustainable Urban areas; compacted cities; social interaction; urban form; (GDP) (gross domestic product)

1. Introduction

Quality of life indicators in Egypt are important to measuring the results of the community development plan.

Because all of development indicators are not just income, but also the quality aspects of life, the research trying to cover and prove this issue.

Quality of life does not only mean economic development, but also social and environmental development of individuals.

Among the indicators that measure the success of quality of life in Egypt, that identifying the available employment opportunities and income levels to be appropriate with the basic needs of families. Providing the adequate housing with healthy environment and an economic constituent that help families and individuals to rely on themselves and acquire self-sufficiency skills.

In this paper, the study focuses on these elements, which contribute to raising the quality of life for individuals at the selected study area, through establishment the small projects such as surface's agriculture by using the appropriate climatic conditions, also reuse the waste areas in the roofs of buildings, this project will be funded by the cooperation with local banks that are finance and help to provide payment facilities introduced to participating families.

2. Definitions

1. Quality of life:

Keeping or improving the quality of life (QOL) is a basic target for the many activities in the life. Many aspects of life contribute significantly to improving the quality of life factor at overall such as employment, health, relationships, friends, and income as well as the environments in which we live. "The ranges of the Life", the fields of interest in this issue is "QOL in urban areas" (the ability to live in the urban environments).

Many studies had found that satisfaction with living especially the living at urban areas, involves a great deal of synergy and integration of all the previous elements in a total. (Rodrik & Sinclair, 2007).

2. Quality of life indicators in EGYPT: (Mostafa, 2008)

There are four fields are represented as a pillars of quality of life, Economic, social, environmental and urban zones.

The quality of life measurement through its indicators, which were selected in accordance with the reality of Egypt situation, so the distribution of these indicators according to the criteria to be mentioned as follows:

- Economic standard: including the following objectives:

Provide employment opportunities, Reduce the unemployment rate, Increase annual income, Increase economic activities.

- Social standard: including the following objectives:

Ensure Good health, learning, Safety of community and Social integration.

- Urban standard: including the following objectives:

Land Use Consensus, Provide adequate housing, accessibility & transition, Availability of services.

- Environmental standard: including the following objectives

Improving air and water quality, Rational management of resources, also efficient waste management.

3. Sustainable Urban areas:

Sustainable Urban areas, it is the areas that can accommodate the current and future needs of residents of residential settlements, they have four pillars that would enhance the sustainability of cities: I) Social development,

ii) Environmental protection, iii) Economic development, and iv) Effective urban governance, including various examples for each pillar as shown in the following Figure, (Pisano, Lepuschitz & Berger, 2014).



Figure 1. Sustainable Cities (Pisano, Lepuschitz & Berger, 2014)

4. Semi sustainable Urban areas:

These areas which have a number of urban support's features that would enhance the sustainability of the existing urban settlements. These areas are most of the ability to be a sustainable areas at the future, because it has a group of design concepts of sustainable urban form such as compactness, mixed land uses, ability for the greening.

Design concepts of sustainable urban form: (Jabareen , 2011)

- The thematic analysis has identified seven concepts significant themes for the urban form:
- 1.Compactness,2.SustainableTransport, 3.Density,4. Mixed Land Uses, 5. Diversity,6. Passive Solar Design, 7. Greening.

5. (GDP) Gross Domestic Product: (Measuring GDP & Economic Growth

It is the market value of all final products and services that were produced in a country at the specific period of time,this definition has a following parts: marketing value, final products, and services that were Produced within a country, in specific period of time. (Wyatt, 2014)

Recall: GDP is total spending :

$(Y = C + I + G + NX)$,Consumption (C) ,Investment (I) ,Government Purchases (G)

Net Exports (NX) (Wyatt, 2014)

3. Methodology

There are design concepts of sustainable urban form at the (High-density residential areas) with mixed land uses, which has a high degree of the social interaction, which help to find the lost quality of life indicators and provide additional elements of sustainable design concepts such as greening.

The research suggests to adding renewable energy tools such as solar energy by using the solar cells under the (passive solar design) as one of the practical tools to maximize the usage of the solar radiation, especially in case of conversion of existing buildings to be based on passive solar design the following:

The research uses the greening and renewable energy under the umbrella of quality of life indicators according to (economic, social, urban and environmental criteria).

Therefore, the research examine the case of (semi-sustainable areas) that is content of the basics of sustainability elements, that are involved in design concepts of sustainable urban design such as the (High density residential

areas with mixed-land use).

The research measure the ability of the above-mentioned sustainability elements to make a significant addition and the possibility of making changes in the gross domestic product (GDP) applying on the community that research is studied using the following tools:

- Using a (Random Sample) selection method, in the buildings that will be used within the group of buildings, that are generalized the experience of the surfaces to be cultivated in the field of greening surfaces, also using those buildings for the creation of (small Solar stations).
- Applying the questionnaire method to obtain data for the (study area), to get information about numbers of households, the average size of the household, also their economic activities and the individuals jobs types which are support these families.
- Taking into account the ownership types of housing units, and the ability of the population to use the residential buildings roofs, also the ability of this social sector to deal with for use roofs that upper their homes, such as farms for the production of vegetables, and some types of fruits, because these projects lead and generate a very good revenue from profits at the short term, to increase annual household income.
- The research uses another questionnaire focusing on the ability of the population, how can them deal with bank financing, whether private or governmental banks to finance these types of projects, and which way the population would prefer to get the returns.
- Also, the research use a questionnaire, about the population satisfaction to manage these projects with formal ways to ensure the sustainability and success, finally the research use questionnaire for the willingness of the population to learn the different methods of agriculture and horticulture and professional competence to manage these activities.
- The results of the questionnaire on social factors will be analyzed as one of the important points.
- The research uses GIS to analyze the important results that the research is expected to achieve, from the GDP forecast and the optimal utilization of semi-sustainable areas.
- Finally, the research will reach the important conclusion that help to find the missing indicators of quality of life those were existed at the semi-sustainable urban areas, also the research recommendations for the future research at the same field.

4. The selected tools of design concepts for sustainable urban form which be enhance (QOL):

4.1. The Greening:

Buildings roofs are very important whence their relationship with thermal comfort and energy conservation for both inside building and in the surrounding area.

So the greening of buildings roofs can be relied upon as an easy and effective strategy to beautify the built environment and increase investment opportunities, help to address the shortage of green spaces in urban areas, it is one of the ways of sustainability, also one of the characteristics of the negative design of the roofs, but the green roofs need to isolate the buildings surfaces by the different ways of roofs solutions, especially at the rain areas, by the way, many of Arab cities are suffered from weakness in the production of agricultural crops, the fact is that food is not readily available (Attia & Mahmoud, 2009). Greening, in our research has many definition sides, the research spot's points are on the agriculture roof greening to catch more benefits from the urban components, to add a physical values to the daily life of the populations for the reaches for the missing available urban quality of life

indicators, the fast-growing population and the failing of government’s approaches for housing, spatial planning policies solutions that were led to the growth of informal settlements inside and around the city center.

Cairo city is considered that is the most populous city with a population of 22 million, also it is the most polluted in the Middle East, therefore, the FAO helps people produce their own organic crops and generate the income. (FAO Regional Office for Near East and North Africa, 2017).

8 million people live in informal settlements, suffering with the unemployment, pollution, overcrowding, inaccessible to water and sewage networks, and the shortage of open spaces at the urban areas that used as a serve and safe, healthy spaces.

At the city of Cairo, the average green area is about 0.33 square meters per person (3.5 square feet) and it is one of the lowest greening areas’ percentage around the world.

The importance of using the building’s roofs is to increase the green area spaces inside the city. (Attia & Mahmoud, 2009), by using the small investments, the surface agriculture can contribute to improving the quality of life for the families, also provide the healthy food for them, increasing the income of these families, in, also contributing to improving the environment in the urban areas, at the city of Cairo, the government and citizens recognized the problem of pollution and the consequent pollution of food and the spread of diseases, Ain Shams University in the early nineties developed an initiative to grow organic vegetables, for high-density population in Egypt, the experiment was circulated on a small scale; until it was formally adopted in 2001 by FAO.

There are many successful examples that are overseen by NGOs, public institutions, and others.

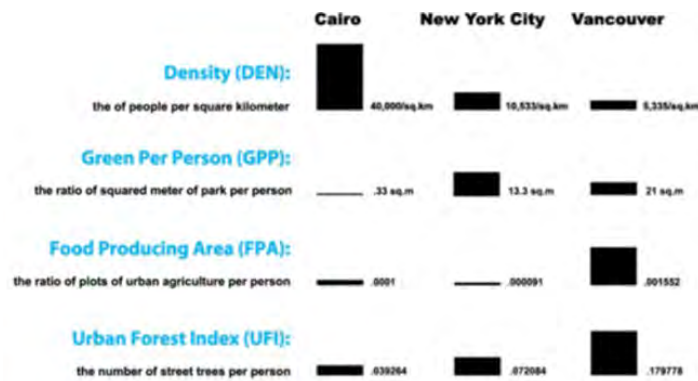


Figure 2. Comparison of density, greening, food production & urban forest between Cairo, New York city & Vancouver (Attia & Mahmoud, 2009)



Figure 3. Greening Roof in unformed residential zone (Attia & Mahmoud, 2009)

In the district of (Al-Zawiya Al-Hamra at Cairo City, a roof farm was constructed of wooden containers containing of plastic sheets filled with algae.

The agricultural drainage water was moved through small plastic hoses to special buckets and produced the paper crops such as parsley, carrots.

The cost of constructing a square meter using this method is about LE 400 (Attia & Mahmoud, 2009).

4.1.1. The selected roof agriculture Types:

4.1.1.1. Containers roof agriculture method:

This is a good way to use local raw materials and resources for the agriculture container industry.

The following is a presentation of Hong Kong's experience:

Hong Kong is witnessing the recent demand for agriculture over roofs of buildings, this is mainly due to fear of foods contamination, these farms held on rooftops are for solving many problems experienced by a society increasingly divided which in the proportion of the elderly population are rising.

Hong Kong's society is divided into social strata like most cities, it is citizens are linked and divided into groups of close colleagues and friends, and each group often lives in isolation from other groups, the team leader of these projects hopes to help farms that are held over the surfaces to dissolve the differences between classes. To achieve this, the team is trying, for example, to invite farmers who live in the surrounding areas to visit the city, in order to teach employees agricultural methods, hoping that this valuable information remains valid for next future generations, and spread among people of a community.”



Figure 4. Farm built on the surface of the tower, “Bank of America” Hong Kong

(Containers roof agriculture method, 2017)

On the other hand, farmers receive wages for planting seedlings of farms above the roofs, thereby providing them with a stable source of income to protect them from market fluctuations.

This initiative may seem simple, but it may contribute to the link between two different groups of the population that link never occur between them in usual.

The team also includes the hearing impaired and disabled people, who contribute to communicating with nature to improve their health.

The problem is that older people do not find a suitable place for a walk.

They spend most of their time on the streets, especially low-income people.

It is better to spend their time on surfaces, is not it? Knowing that the lite activates and sociability in a regular manner are of the best.

The farms that are held on the surfaces have another advantage, which it isolates heat and sound, and thus save energy consumed by air conditioners in the building.

Trying to convince ways to protect against dementia.

The government to look into account the farms that are held on rooftops as acceptable uses of surfaces. It is included in the urban planning of the city.



Figure 5. Hong Kong weather is ideal for vegetables cultivation throughout the year. (Containers roof agriculture method, 2017)

From this case we find these results :

1. It is much better for us to plant the roofs of our homes, to prevent the accumulation of garbage and scrap on the surfaces that help the spread of contamination & infections, this is one of the most effective forms of community safety because of its health benefits role.

2 - The initiative to convert the building's roof at some areas are working to clean the environment and represent these small projects a source of income can be implemented using simple local materials.

3- The experience of surface cultivation has become small projects that can be carried out by different groups of society, such as young people, housewives, and people with special needs, and students in leisure and vacations, which invest their spare time in a useful way.

In addition to production medical plants and aromatic plants, Generates income for the family, and raises the standard of living and quality of life.

Another case in Cairo, with the Greening Cairo's roofs with nutritious vegetables and fruits:

Mr. Latif Experiment, he planted these types of plants such as eggplant, spinach, cabbage, oranges, mandarins, dill, parsley, tomato, lettuce and, occasionally, and he kept his plants from the birds that may feed on them using a scarecrow wearing traditional Egyptian dress.

Mr. Latif collects his fruits and vegetables after the plants have matured which he proudly sells on a small stand in front of the building t

o residents and passersby who have been his friends for a years.

Roof agriculture was begun a few years ago, because that the main problem is that people at suburbs were not eating enough healthy fruits and vegetables and their diets were pretty poor in nutrients, so the Egyptian government launched a program encouraging roof agriculture to get people to grow and eat their own food.



Figure 6. (FAO Regional Office for Near East and North Africa, 2017).

The program is designed primarily for poor families in Cairo and Alexandria, It aims to facilitate the production and consumption of fresh vegetables, to be have ensuring of a stable income for families and women who adopted this method quickly and enthusiastically. (FAO Regional Office for Near East and North Africa, 2017).

FAO has trained 48 families on the use of various agricultural techniques, such as aquaculture systems, fruit, and vegetable.

The cultivation techniques are means to teach families what is known as green production and pest control techniques by reducing or preventing the use of pesticides. A number of other families have used non-conventional containers for growing herbs and vegetables, as well as in water tanks, such as used truck tires, all in the presence of an irrigation system. (FAO Regional Office for Near East and North Africa, 2017).

By Using surface agriculture and their development ways, there are a good proportion of green areas can be reached in a short period of time, equivalent to 4 square meters per person. (Attia & Mahmoud, 2009).

The populations at the studying area realized the importance of roof agriculture in obtaining healthy and seasonal food using the minimum fertilizer, in addition to the emergence of the environmental benefits of this type of agriculture.

A city like Cairo needs to purify also help surface gardens to reduce the temperature by 8 to 10 And recently contributed to this experience by one of the international NGOs, and provided tables, positions, containers and other inputs such as seeds, soil, fertilizers, irrigation systems and other tools and has Made a condition for funding the project that the population works in this type of Farming for at least two years. (FAO Regional Office for Near East and North Africa, 2017).

4.1.1.2. Aquaponics Method:

The aquaponic method is based on the creation of a healthy environment for several organisms, plants, fish and beneficial bacteria in one environmental and productive system through what is known as nitrification process as follows:

1. Bypassing the water of the fish tank through the filters and then into the areas designated for agriculture (agricultural ponds) and then returning the water back to its tank.
2. The filters purify the water from the fish waste. One of the filters (mechanical filter) removes the solid waste and then passing through the bio filter removes the dissolved waste.
3. Bio filters provide the ideal environment for bacteria to convert fish-damaging ammonia to nitrate, a nutrient that is easier to absorb in plants.
4. After absorbing the dissolved nutrients in the water, the water returns to the aquarium again.

From the above, plant nutrients are provided from a sustainable, cost-effective and non-chemical source.

Agriculture with the use of Aquaponic technology is complex and requires significant start-up costs, therefore it is necessary to have a surplus of production, which is equivalent to the high costs of investment in this type of technology, which is necessary for the integration of the two systems, which necessitates the development of a full work plan that takes into account economic, environmental, social and logistical aspects. (Food and Agriculture Organization of the United Nations Rome, 2014).

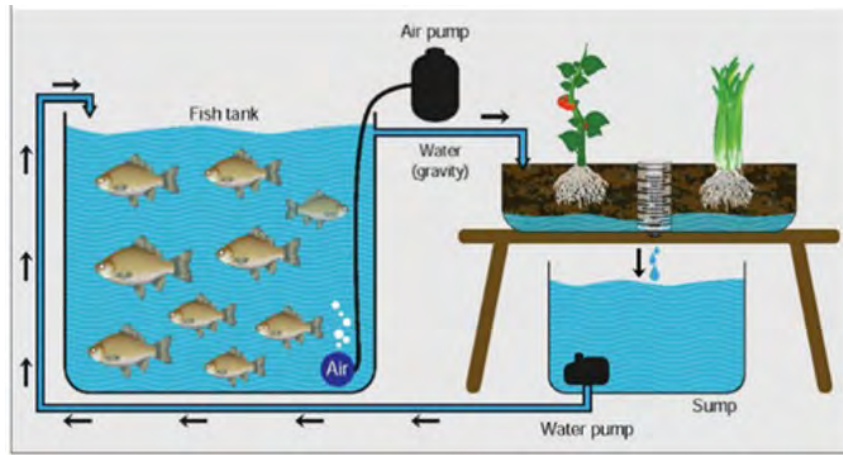


Figure 7. Simple aquaponic unit (Food and Agriculture Organization of the United Nations Rome, 2014).

-Aquaponic Education units:

Small-scale practical lectures are being held in various educational institutions and civil society organizations, the importance of the aquaponics system as a means of bridging the gap in food crops and consistent sustainable activities such as rainwater harvesting, nutrient recycling and organic food production can be integrated in the lesson plans.

In addition, this integrated nature of agriculture with the aquaponics system provides practical experience for training in widely fields as anatomy, physiology, and other practical sciences associated with the same scientific activity. (Food and Agriculture Organization of the United Nations Rome, 2014).



Figure 8. Combined aquaponic unit for educational purposes. (a) nutrient film technique; (b) media bed; (c) deepwater culture; (d) fish tank (Food and Agriculture Organization of the United Nations Rome, 2014).

-The Case in Egypt brought by Agriculture Engineer (Zakria Rateb) had a good experience in the roof agriculture, as the Figure 4 shows, he uses a different ways to get the most efficient of the roofs areas, and the irrigation & planting pots, he pointed out that the surfaces' agriculture have many benefits, including clearing the surface from the waste, as well as spreading the culture of children's education to rely on the use of fresh vegetables, also supervision and learning how to plant, to obtain crops free of reliance on the use of chemical fertilizers and contaminated water.

Also the Irrigation and drainage systems are safe and reliable in the production of paper crops and vegetables, he published this experience through NGOs and experimented with it on the roofs of one of the schools and succeeded greatly.

The technologies by names(Hydroponic & Aquaponic systems) are expensive at the starting step, but when are built and operated, they generate significant returns afterwards, and they are more safe because there is one fixed tank for the irrigation (Hydroponic & Aquaponic systems, Extra News, 2017).



Figure 9. (Aquaponic system case). (Hydroponic & Aquaponic systems, Extra News, 2017)

4.1.1.3. Hydroponics Method (soil-less Agriculture system):

Soil-less culture is the method of growing without the use of soil, replace the soil with various inert growing media, irrigation systems are integrated within these media, this solution provides all the necessary nutrients for plant growth.

Hydroponics is the most common method of soil-less culture for the following points :

1. The growing of plants either on a substrate or in an aqueous medium with bare roots.
2. Controlling the Soil-borne pests and diseases by avoiding the contact between plants and soil.
3. Some substrates are more useful than soil, particularly in water-holding capacity and oxygen supply at the root zone.
4. Help users to improve plant performance through the control increase for over several crucial factors of plant growth.
5. Nutrients availability at plant roots is better manipulated, monitored and real-time controlled.
6. In addition with the rising in demand for chemical- and pesticide-free produce and more sustainable agricultural practices (Food and Agriculture Organization of the United Nations Rome, 2014).

At Egypt, Mr. Amr Bassiouny decided to think outside the box in the hope of finding a way out of this predicament and boosting the agricultural industry in general, after a period of intensive self-study of farming systems, Bassiouny, with the help of his partner Adel El Shentenawy, founded one of Egypt's first hydroponic farms, Egyp-

tian Hydrofarms became a boon for those who look for affordable healthy and pesticide-free leafy greens.

Hydroponics is a farming method that depends entirely on water instead of soil to grow plants, plants can get the required mineral nutrients directly from the (PH-balanced water), such as this farming systems are environmentally friendly, it does not use chemical pesticides and above all save approximately 95% of the water wasted in traditional farming.

Egyptian Hydrofarms, seeds are placed in pots to freely grow, the (nutrient-rich water) is pumped through pipes, "We adopt the nutrient film technique"

It is a hydroponic system by which the necessary dissolved nutrients are delivered to the plants bare roots through gullies or channels.



Figure 10. (Basiony, 2017)

By using this system, that they became able to grow a wide range of leafy greens in the same greenhouse, the Lettuce, and herbs in general are cool-weather crops, so they flourish in winter and spring.

In the summer, these leafy crops grow hydroponically in Egyptian Hydrofarms' greenhouses, traditional farming relies on water and soil, in Egypt, water sources are either polluted due to the drainage water being pumped into the Nile, also the soil helps insects, therefore, farmers resort to chemical pesticides to get rid of them, this negatively affects food safety.

All these factors along with the threats of global warming put traditional farming at stake, the farms' produce can be found in many stores in Egypt, gaining more popularity among consumers, "I think the local market is saturated and our products successfully managed to cover the domestic demand," as he said.

The farm's staff totals nearly 20 people, including college graduates and undergraduates, the majority of them are graduates. "Having previous experience in farming is not among our criteria for selection:(Basiony, 2017)

4.2. Greening concept at the research

It is unfortunate that so many green roofs are not built for accessibility, because inaccessibility prevents the realization of a great deal of rooftop potential.

The green roofs serve many impressive environmental functions, but Without accessibility to roofs, the food security benefits are lost, the inaccessibility of green roofs, of course, makes sense with cost constraints and liability concerns, where people have created a rooftop garden system that they can build out of local materials, repair and maintain themselves, as in Senegal, India.(Nowak, 2004).

1. Greening using buildings roof agriculture is one of the most direct means of increasing the green areas within the urban tissue of the urban form.

2. The crops that are cultivated can have a good income, especially in developing and needy communities.
3. These roofs can be used in the aromatic and medicinal plants agriculture, which generate a great return through the export of these products for the outside, especially used in the manufacture of cosmetics and others.
4. Using the engineering solutions at the action area, to solve & manage the various agricultural processes which can be carried out, both the production and marketing of products, also their transition from the surface without any intersection between the inhabitants transportations & products transports.
5. It is important to use local production materials, more popular materials that are used for insulation cages and containers supply agricultural products, also use the organic household waste as organic fertilizer.
6. Establishing leading local companies with high training in the management and marketing of agricultural products under the supervision of the competent authorities and agencies in order to ensure the continuity of projects and their success.
7. The important to choose one of housing type (Middle income housing type), and the management depends on banks or to a ministry, to ensure that the feasibility of the proposed practical experience implementation will be exist.
8. The (GDP) will be directly target to improve the income of the population, and their living conditions directly after tax deduction and operating expenses of the management, marketing companies, which ultimately represents a significant addition to the (GDP).
9. It is better to use small agricultural crops, especially with relatively fast life cycles
10. The surface that will use as a cultivation project need to check the building structure situation, also check the isolation methods too.
11. Cultivation of surfaces is one of the most important ways to achieve food security especially in slums, fresh vegetables can be obtained without the burden of transport costs, crop labor and retail profit margins, they can also be marketed directly to adjacent neighborhoods. .
12. The specifications and conditions prepared by the study required for buildings to be suitable for surface agriculture:
 - (a) The surfaces shall be connected to each other to give the largest area of cultivation.
 - (b) Buildings surfaces must be have no structural obstacles that prevent the optimum utilization of the surface area.
 - (c) Architectural design of buildings allows the installation of lifts for service, and the development of irrigation networks and agricultural drainage.
 - (d) The buildings designated for the establishment of roof cultivation shall be have highly accessibility with main transportations roads, as well as the providing the parking spaces that contribute to the transport and marketing operations.
13. Food security: Aquaponic system is highly efficient, the examples of aquaponic initiatives can be seen in Barbados, Brazil, Botswana, Ethiopia, Ghana, Guatemala, Haiti, India, Jamaica, Malaysia, Mexico, Nigeria, Panama, the Philippines, Thailand and Zimbabwe,
there was a surge of aquaponic conferences worldwide, furthermore, aquaponics is increasingly a part of conferences on aquaculture and hydroponics (Food and Agriculture Organization of the United Nations Rome, 2014).

4.3. Solar Energy:

The world need to cut back on wasteful resource use, and greenhouse gas (GHG) emissions, It is critically important to change this pattern, and to find new models for living well on less (Liz Walker), the best practices, such as green building, densely clustered housing, low energy and water use, strong social ties, local food production, extensive waste reduction(Liz Walker), energy losses occur during extraction, generation, transmission, distribution and end-

use in lighting, appliances, buildings, mechanical work, transport, and industry contexts.

Consequently, the areas for energy efficiency improvement and investment can occur anywhere along the chain of energy production and use, from primary energy to final energy required to perform the service (GRS Full report, 2016).

4.3.1. According to Egypt’s solar plant plan by the World Bank:

No resettlement is foreseen and no adverse social impacts are expected. The project may, on the contrary, impact poverty positively by adding to the power capacity of Egypt.

The improvement of the living conditions in rural areas may also reduce the migration pressure to urban areas, improving the overall social, demographic and economic balance of the nation. (Meisen & Hunter, 2007)

- Solar Array Capacity

The capacity of a solar PV array (in kWp, kilowatt-peak) depends 90% energy consumption of the building on and the shade-free rooftop (or other) area available.

- Assumptions

The roof (or elevated structure) area requirement per kW of solar PV modules is about 12m².

4.3.2. Installed Photovoltaic systems in Egypt:

Egypt: A 2.7 PV system is being used to light one of NREA’ remote sites at the Matrouh Governorate.

The total capacity of 2 PV systems is 424 watt peak for 9 × 11 W (DC) efficient lamps, and a TV set of 60 W (AC).

(Meisen & Hunter, 2007)

4.3.3. Concentrated Solar Power Plants in Egypt:

Egypt will soon develop a hybrid parabolic-trough concentrating solar power plant in Kuraymat. According to the NREA, it will reduce carbon dioxide emissions by 38,000 tons per year. Refer to the report by the World Bank for more details. (Meisen & Hunter, 2007)



Figure 11. (GRS Full report 2016)

REN21 Renewable Energy Policy Network for the 21st Century

Table R15. Share of Primary and Final Energy from Renewable Sources, Targets and 2013/2014 Shares

Note: Data in bold indicates renewable 2015 targets. Final energy includes losses in conversion and distribution. Final energy includes losses in conversion and distribution.

COUNTRY	PRIMARY ENERGY		FINAL ENERGY	
	Share	Target	Share	Target
EU-28			10%	→ 20% by 2020 → 27% by 2030
Djibouti		→ 17% by 2035		→ 100% by 2040
Egypt		→ 34% by 2030		

Figure 12. (GRS Full report 2016)

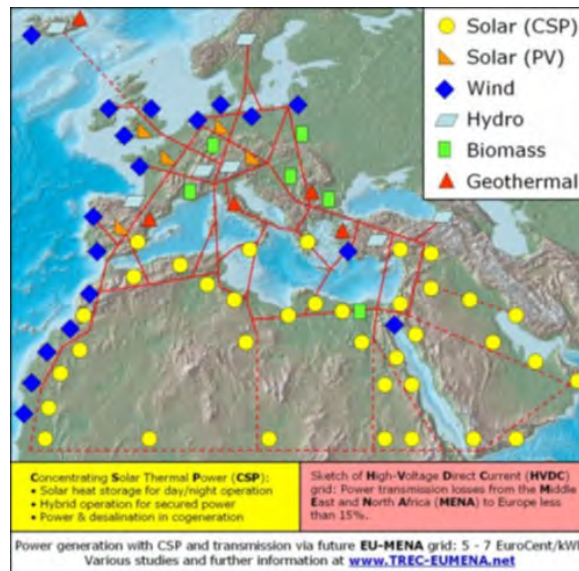


Figure 13. (Meisen & Hunter, 2007)

-An analysis of solar maps: important aspects remain to be investigated/developed:

– What assumptions are made in the rating of the suitability of surfaces?

- What additional information is provided to accelerate the implementation of solar energy?
- How is the information provided from the solar maps used (by front- and back-end users) (Jouri, 2015)

-A quantitative analysis was performed, looking at the following aspects:

- Annual solar irradiation level (kWh/m²a), considered technologies (PV, ST), total output per roof (kWh/a).
- Assumed efficiency of the technologies Planning for solar buildings in urban environments.
- Minimum surface of the solar system (m²), the percentage of maximum available annual solar irradiation level
- Maximum annual solar radiation, information on which parameters the categories were based upon

4.3.4. Mini-Grids for electricity access

Mini-grids can be an important alternative to or enhance the effectiveness of central grid extension to increase access to reliable electricity services in developing economies. Mini-grids are defined as one or more local generation units supplying electricity to domestic, commercial, or institutional consumers over a local distribution grid.

These generation technologies include solar photovoltaic and wind turbines with battery storage, biomass gasifiers and biogas digesters with internal combustion engines, micro and mini-hydro turbines, and hybrid systems (Deshmukh, Carvalho, Gambhir, 2013)

4.3.5. Community solar: Community solar programs

(also called “shared solar”) offer the economic and environmental benefits, (1) Such programs are experiencing rapid growth, with active projects across 26 states, up from 6 states in 2010.2 This market has the potential to grow more than 50-fold from the 110 megawatt (MW) capacity in early 2016 to between 5,500 MW and 11,000 MW by 2020.3 Previously, it was often uneconomic to develop individual solar projects of less than 2 MW in capacity (2,000 kilowatts [kW])⁴ if they were not tied directly to or net metered with a customer site. With community solar, projects between 50 kW and 2,000 kW are often viable because numerous off-site subscribers can purchase shares of a solar installation rather than hosting the installation themselves. By bringing an enormous source of new demand into the market and offering new contracting arrangements to the 51% of Americans who already have potential solar access, community solar is expected to greatly expand the market for mid-sized solar projects. (Deshmukh, Carvalho, Gambhir, 2013)

5. The case study

The practical model of the study used to implement design ideas that will increase the quality of life.

As mentioned above, study area selection depends on Several criteria, these criteria are help to make the results of the study more practical and objective, the selected action area is housing area located in Cairo, that is nearest to the ring road beside the police academy, It is one of the planned areas that contain the initial indicators of sustainability.

The study area is located on the main axes, that are help in marketing the roof’s agriculture projects. And transfer agricultural products outside the residential area, action area also is a (Semi sustainable area), attached with the Tulip club, we expected that there will be environmental integration between the open spaces at the club’s space, and the cultivated areas on the roofs of the buildings, our sample is 29 buildings of total 1500 buildings at the residential zone, a part of (39.65) Feddan area have mixed land use.

The research use the questioner method to get the needed data, depends on three types of roof agriculture to measure the correlation between the number of households which agree to the use of their own building surfaces with the different types of agriculture presented at the greening chapter of the research,

The study sequence will be shown in the followings:



Figure 14. Action area location(<https://www.google.com/maps/@30.048828,31.4008003,17.37z?hl=en&authuser=0>)

(Figure 15-16) shows the spatial distribution of buildings of the study sample as well as the number of units that agreed with principle to participate in the project under the study, this is reflected in the variation of the participation rate in the project, however, that is a direct correlation between the number of units in the building and the number of units that was approved to participate in the project under the study.



Figure 15. No.of Residential Apartments in each building



Figure 16. No.of Residential Apartments which participate in project

In addition, the surfaces that were checked in order to accommodate roof agricultural activity, as shown in (Figure 17), one of the results is that the buildings that make up some of the clusters in the study area are directly connected to the axes ways.

That is an approach For success of the application of this experiment, and in (Figure 18), the study included the available space in those buildings to installation solar cells to achieve environmental integration for clean and renewable energy to operate the roof agriculture system.



Figure 17. Available roof area to Agriculture use %

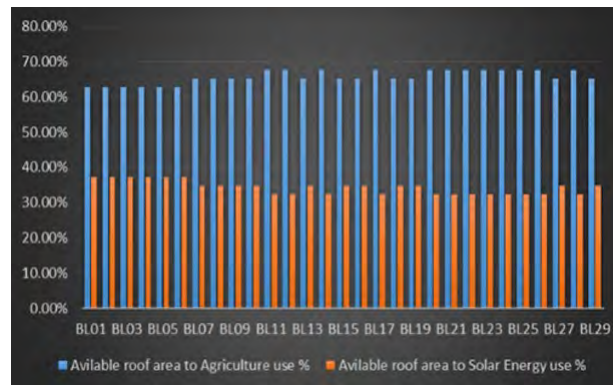


Figure 18. Available roof area for Agriculture use % & Available roof area for solar cells use

The research proceeded to determine the extent to which the project owners were able to finance the project using (bank financing) through soft loans, so the results of the survey showed as in (Figure 19) that are 60% agree on this type of project financing system.



Figure 19. Proportion of households agree with banking borrowing from the total apartment will share in the project.

On the other side of the study, at (Figure 20) that is about 40% of the sample of the study is likely to be participating in the project with only effort required for the project, and the consequent needs for learning skills for surface cultivation, also the maintenance for solar units, marketing and distribution for different products.

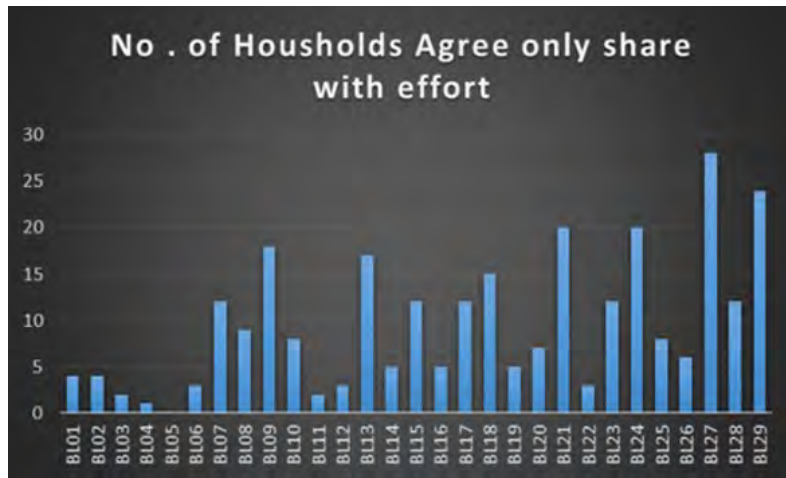


Figure 20. No. of Housholds Agree only share with effort

By using the questionnaire method to determine which the type of expected available roof using agriculture method to be the most applicable, especially in the early stages of the project, we have obtained the following results, which are illustrated in Figure 21 as follows:

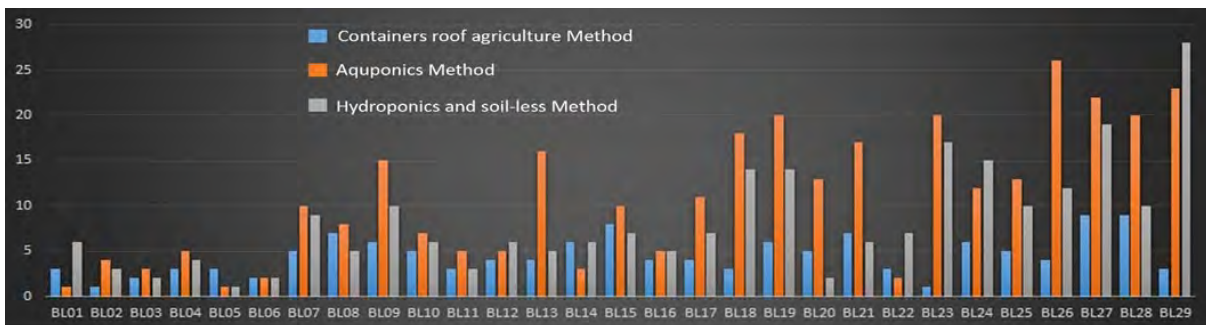


Figure 21. Comparison between the number of families who chose different each type of Roof Agriculture

From the (Figure 21) we find the most types of Roof Agriculture that were selected by the families is (Aquaponics Method), but, in order to select the optimal type of roof Agriculture method, which was mentioned in the previous research, it was based on one of the statistical methods, such as correlation coefficient (not depends on questionnaire method only) for several reasons, most of which is the inability of many families of the sample, can not choose the type of agriculture suitable for their practical abilities, especially with the families that will be involved in this project with only effort, the study used the linear correlation coefficient of (Pearson), which is equivalent to:

$$r = r_{xy} = \frac{n \sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n \sum x_i^2 - (\sum x_i)^2} \sqrt{n \sum y_i^2 - (\sum y_i)^2}}$$

Since the number of households is the variable X and the household which selected the type of agriculture method is the variable Y, as shown in the following sample table:

Table 1. Linear correlation coefficient of Pearson variables table

Building	No. of households (x)	Containers (Y1)	Aquaponics (Y2)	Hydroponics (Y3)
BL01	10	3	1	6
BL02	8	1	4	3
.....
BL29	54	3	23	28

And the results of correlation coefficient study are in followings:

1. Correlation coefficient between No. Of households and the (Containers roof agriculture method)=0.448.

The correlation coefficient in this case is positive and average, It expresses a strong correlation which leads to the fact that it is impossible to rely on this method of agriculture, especially in the early stages of project implementation.

2. Correlation coefficient between No. Of households & Aquaponics method = 0.950.

The correlation coefficient in this case is positive and strong and it expresses a strong correlation which leads to the fact that this method of agriculture can be relied upon especially in the early stages of project implementation.

3. correlation coefficient between No. Of households & Hydroponics method = 0.893

The coefficient of correlation in this case is positive and strong and it expresses a strong correlation which leads to the fact that this method of agriculture can be relied on especially in the early stages of project implementation. However, the aquaponic system increases the amount of correlation.

It is likely based on the results of the questionnaire and correlation coefficient values, the choice of families participating in the project oriented to the aquaponics system for the following reasons:

- Possibility of establishing small farms for raising fish (within the system of the aquaponics), which means increasing the financial returns from the project.
- The operation of the irrigation system in a closed cycles and which ensures that there is no leakage of irrigation water, which poses a danger for the building's structural surface.
- Easy training and learning methods of gardening for the agricultural system in general.
- The possibility of growing aromatic and medicinal plants using this system of agriculture in addition to the cultivation of organic vegetables, which is one of the sources of improving health and thus increase in the value of quality indicators of life.

5.1. Proposal concept for roof agriculture typical layout:

Finally, the following proposal layout show the concept ideas that the project in Aquaponic system implementations as per the Figure 22, shows the proposed design for the operation of the aquaponic farming system, the irrigation system elements will be arranged in rows as in the form, and for the fish ponds.

The design has corridors for service to facilitate the introduction of raw food for plants and fish alike, and the work of the maintenance and periodic transfer of various products.

The model also illustrates the complete separation between the entrances of the population building and the service point on the project (and in the case of increasing the demand to be increased in the future).

The design also considered the linkage between the parts, the roofs of the buildings are merged by adding lanes (small bridges) between surfaces, and some of them for easy productivity and catered to the transfer to outside.

The design was concerned with providing the necessary electrical energy for the project by relying on the renewable energy generated by solar panels.

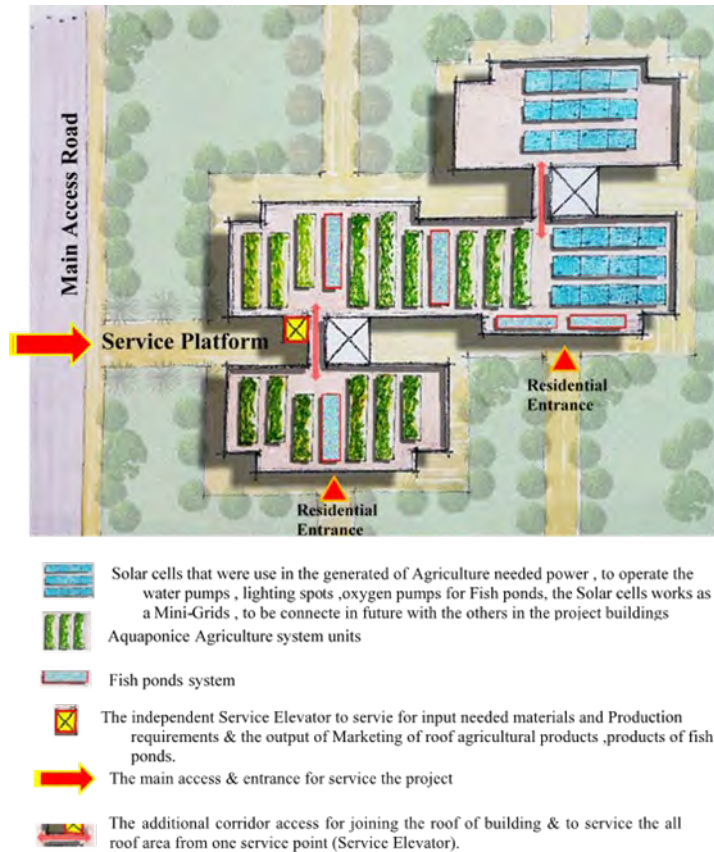


Figure 22. Proposal concept for roof agriculture typical layout

6. Conclusions

Quality of life is one of the most difficult measures to evaluate, it differs from one society to another one according to the characteristics of each society in economic, social, urban, environmental aspect.

Since the field of research specifically in Egypt has been concerned with the indicators of quality of life appropriate to the Egyptian reality, which include four main elements (economic - social - urban -environmental)

This is done through the use of non-active quality indicators based on new design ideas of sustainable urban form, such as greening through the study of different systems of surface farming, and the use of renewable energy (solar energy) to activate these systems.

Since Greening is an important income source that the quality of life indicators are activated through it, For example: from the economic point of view, it is represented by (provide job opportunities - reduce unemployment - increase annual income).

That all can be achieved by growing the total value of the(GDP) for the study area.

It should be noted that the application model did not address the expected values of the GDP for the specificity of the current Egyptian economic situation (exchange rate change), but in the future it can be accurately measured by using own equation.

From the social aspect, the indicators are visible in the form of (integration and communication - increase awareness of culture - learning and training) of the community.

The environmental quality indicators of life are represented in (improvement of the air quality resulting from the cultivation of surfaces).

As a result of the field study:

1. Semi-sustainable areas can be transformed into sustainable areas by directly exploiting non-functioning quality

indicators of life.

2. Increase the allocated surface areas that cultivate will be lead to increase the percentage of participation households in these houses, so can be lead to higher the quality of life index and the improvement of the urban environment of the sample of population at the study.

3. The aqua-ponic system is considered the best system for improving the economic quality of life for at areas as in the study area.

A design model was planned in which the Aquaponic plantations were distributed, in addition to the distribution of solar cell panels beside them which serve the project.

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