



## A REVIEW OF SUSTAINABLE NEIGHBORHOOD INDICATOR FOR URBAN DEVELOPMENT IN LIBYA

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### ABSTRACT

The sustainability of a neighborhood has a crucial role in preserving the environment for future generations. The development of neighborhoods consumes an excessive amount of land that needs to be protected. Libya must consider sustainable neighborhood indicators in its urban planning and design to allow future generations to benefit from such development. This paper focuses on issues that are related to the sustainable neighborhood indicators and development of Libya. Specifically, sustainable neighborhood development was investigated on the basis of shareholders, whereas the sustainable neighborhood indicators were examined in terms of their physical features and benefits. Results showed that sustainable neighborhood indicators of various countries are generally similar and only differ depending on their regional climate characteristics. This paper proposes several approaches for optimizing the sustainable neighborhood indicators of Libya.

**Keywords:** sustainable development, sustainable neighborhood, urban sustainable indicator.

### INTRODUCTION

Sustainable neighborhood indicators reflect major trends in the environment, social system, economy, human wellbeing, and quality of life. In other words, these indicators measure what is important to the people. For example, environmental indicators measure the concentration of air pollutants, the amount of locally consumed resources (i.e., water and electricity), and the amount of produced waste. Tracking the shift in the social environment may involve monitoring the voluntary participation in communities and the availability of affordable housing, both of which can induce positive changes in the economy (Bristol Accord, 2005). This shift can also be reflected in several economic indicators, such as unemployment rate and business starts. Indexes measure the progress of efforts toward the sustainability of cities as well as identify those areas that require immediate action (McLaren, 1996).

These indicators capture the important aspects of a locality to evaluate its conditions and development; therefore, these indicators must be accessible to the community, the decision makers, and the residents (Bossel, 1999). Indicator data are often provided in easy-to-read diagrams, such as graphs and pie charts. These data clearly indicate the local situation and trends by avoiding overly technical language and analyses. The development of these indicators can encourage the participation of citizens, community groups, universities, and state government agencies in ensuring the sustainability of their neighborhoods. These indicators also educate the residents about the environmental, social, and economic issues in their communities.

Many studies have investigated urban sustainability in various countries and have developed several indicators to find the balance among the economic,

social, and environmental factors of these countries. These factors are then compared across several countries, including Libya.

However, the sustainability of urban cities or residential neighborhoods in Libya has attracted limited research attention.

An assessment framework that can measure the urban quality of a neighborhood can help planners and designers in identifying new and challenging development areas in Libya.

### Introduction of a Sustainable Neighborhood

Since the 1992 Earth Summit in Rio de Janeiro, the concept of sustainability has become a main issue in the construction industry and other sectors. Sustainability involves the use of smart technologies and the sound management of energy-related materials in the environment. These developments have been very effective, particularly in residential areas that have witnessed increasingly sensitive life and neighborhood qualities. People also demand for a progressively healthy indoor environment and a balance among natural moisture, thermal comfort, and day lighting (Gauzin-Muller, 2006). Sustainability can be developed in several forms, such as sustainable neighborhood. A sustainable neighborhood is a multi-purpose area in which people aim to live and work at present and in the near future. Many future neighborhoods can meet the demands of their residents and promote a high quality of life by implementing the sustainability concept. Some of these sustainable neighborhoods are equipped with excellent services, provide their residents with equal opportunities, and are characterized by excellent planning (Bristol Accord, 2005).



The Hugh Barton approach suggests that a sustainable design can be achieved by perceiving each development as an object or a tiny ecosystem (Barton *et al.* 1996). An ecological neighborhood leaves the impression that people in local environments can create a significant microclimatic level of comfort for themselves. Figure-1 shows that sustainable neighborhoods generally include green and gray spaces in their design.



**Figure-1.** Sustainable neighborhood as an ecosystem (Barton *et al.* 1996).

The cities and neighborhoods in many countries were built on the garden city principle of Ebenezer Howard (1898). The first-rate balance between their agricultural sector and other industries characterizes garden cities. The final goal of this principle is to promote a healthy and comfortable living for all residents regardless of their social class (Okeil and Ragab, 2007). The success of this “urban renewal” led to the promotion of additional urban renewal projects in 1997 (Gruis *et al.* 2006). Moreover, the sustainable design research of Newman and Kenworthy (1999), which initially focused on those cities that needed planning at the macro level, now focused on achieving sustainability at the micro level.

### Sustainable Neighborhood Design and Planning

The inclusion of sustainability principles in sustainable neighborhood design has been proven meaningful because most of the issues that are faced by cities are accumulative in nature because of the poor planning at the micro level. A neighborhood scale analysis can help develop efficient and sustainable local green infrastructures, such as buildings, transportation, urban flora, and water systems (i.e., tap water, waste water, and rain water) (Engel-Yan 2005).

The principles of sustainable development can realize a sustainable neighborhood design that is characterized by a balance among its environmental, social, and economic factors (Churchill and Baetz, 1999).

The interaction among engineers and specialists in sustainable neighborhood design is also important because they are expected to create a regional infrastructure system and a well-planned urban design. However, the lack of sustainable neighborhood indicators must be first addressed in the design and planning processes because such limitation affects a significant

portion of lands that provide accessibility from and within the neighborhood as well as the major decisions on the issues within the neighborhood (Engel-Yan, 2005).

The development of sustainable neighborhoods in Libya must be monitored by the National Policy on Environment, which advocates for a clean, healthy, and productive environment for present and future generations. The planning and designing stages must consider all necessary sustainable neighborhood components in the design to facilitate the implementation of certain neighborhood indicators (National Policy on Environment, 2001).

### The Importance of Sustainable Development

The population in sustainable areas is growing rapidly because of the continuous migration of people who are looking for better employment opportunities. The United Nations estimates that the global urban population will reach 5.1 billion by 2025. The past two centuries have also witnessed a rapid population growth and rapid technological advancements that result from industrialization. These advancements have also increased the awareness of people about sustainability development and the need to preserve the ecological system. From another perspective, cities and neighborhoods cover only 2% of the Earth's surface, but consume 75% of the natural resources (Noorman and Uiterkamp, 1998), thereby driving us to consider sustainable development.

GDP is the most common indicator for measuring the outgrowth (and success) of a country. This indicator measures the economic products and services of a country without considering any of its environmental quality issues. A more thorough measurement must consider all three components of sustainable development, namely, the issues in the environment, economy, and society.

White (2001) described the Industrial Revolution as a disaster that harshly affected mankind and the natural environment by introducing scorbutic fuels and chemically controlled agricultural products, promoting deforestation, and exhausting maritime resources. After the Second World War, industrialization promoted sustainable development and urban growth by introducing improvements in technology, transportation, and housing.

In the 1960s and 1970s, the idea of integrating the natural environment with urban areas was proposed in many environmental studies, such as Spim (1984), Hough (1984), and Thayer (1994), who all confirmed the importance of adapting human development to the natural environment in ways that minimize harm to the latter (Bass, 2003). Has (2005) proposed three perspectives on sustainable development, which are elaborated in Figure 2.

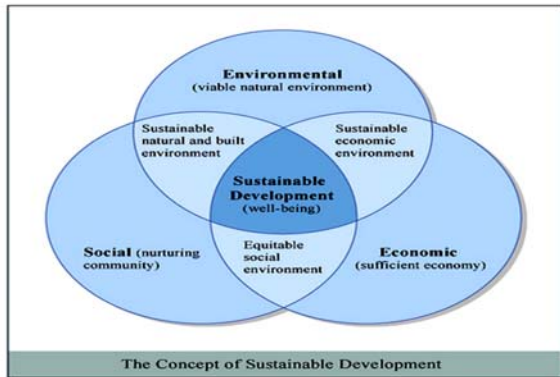


Figure-2. Traditional view of community (source: Has, 2005).

### Sustainable Development in the Middle East

The sustainability efforts in the Middle East focus on utilizing economic outgrowth as a starting point to build the necessary foundations for sustainable development. The built environment in the Middle East has quickly expanded because of the rapid increase in population and civilization. These changes have also led to the rise of consumerism, which in turn resulted in environmental degradation and a possible climate change crisis in the future. The sustainable development practices in the Middle East are facing many challenges that hinder practitioners from following the global sustainable development framework (Elgendy, 2012).

The Middle East has many unique characteristics that set the region apart from the rest of the world. According to El Fadel (2004), the primary areas of environmental interest in the Middle East included its hot and dry weather, lack of water, lack of natural resources such as wood and other building materials, increased energy consumption, and increased waste generation. The sustainable development practices in the region neither follow an established urban development framework nor refer to local examples of sustainable development practices (El Fadel, 2004).

The rapid urban growth in the area reflects the importance of oil as an energy resource. Many cities and neighborhoods in the Middle East demand great amounts of oil to preserve and broaden their infrastructures (Elgendy, 2012). Moreover, most of these locations are riddled with buildings that are not suitable for dry climate and require energy-intensive conditioning and electric lighting.

According to the sustainable development principles, the characteristics of urban growth and building directions in the Middle East must be changed significantly (Al-Qahtany, Rezgui, and Li, 2014).

### Sustainable Living Quality

As its biggest challenge in addressing climate change, Asia must expand access to energy at reasonable prices. According to the UN Development Program

Director Kemal Dervis, “at the same time, carbon growth of international collaboration removal win scenarios that enhance both climate security that are vital for growth and deficiency reduction” (HDR 2007/2008). Figure 3 presents an integrated framework of climate change that shows the adaptation and effect of climate change.

## Strategies for climate change

- Mitigation and adaptation: Different objectives

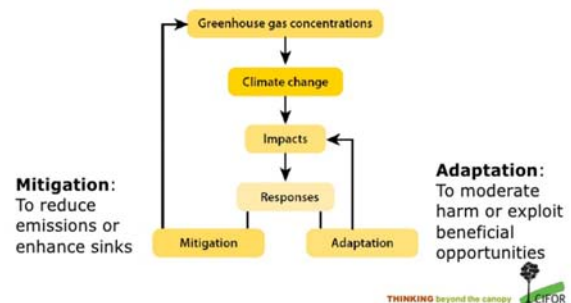


Figure-3. Climate change 2001(source: climate change 2001-IPCC third assessment report).

Urban residents are mostly spending their time indoors, which carries a toxic air concentration that is two to three—even 100—times higher than the outdoors (Carrer, 1997). The level of pollutants inside the houses, offices, shopping centers, and schools in the Middle East may also exceed those in other countries. Closed environments have changed drastically after the introduction of furnishings, carpets, and mechanical ventilation. The current rate of indoor fresh air exchange is 10 times lower than those 30 years ago. The humidity and concentrations of pollutants inside buildings have also increased as the utilized building materials compress portable air. Indoor air quality can be affected by other factors, including open-air pollutants (e.g., from traffic emissions and factories) that enter buildings through open windows, air ventilation systems, and cracks. These outdoor contaminants are exacerbated by those that are formed indoors (e.g., mold spores and chemical emissions from carpets, wallpapers, and furniture). Some tightly closed buildings also use ventilation systems with poor design or improper conservation, thereby preventing the inflow of clean air and the outflow of contaminated air (Carrer, 1997). Therefore, the sustainability concept must be introduced in the design of urban neighborhoods to reduce pollution. The sustainable neighborhood indicators are important in neighborhood design as they preserve the natural indicators in the living area.

### Definitions of Indicators

Indicators are quantitative tools that simplify synthesis of data that are related to the relevant state or the development of some phenomena. They serve as tools for





communicating, evaluating, and making qualitative or quantitative decisions. According to Gallopin (1997), the sustainable development indicators also serve as indicators of progress that aim to achieve sustainable development by integrating the environmental, economic, and social considerations of humanitarian efforts. The technical and scientific contents that will be considered in this chapter remind us about those indicators for other conventions and are built on the acceptability of social traditions for evaluating progress (Gadrey and Jana-Catrice, 2005). These conventions also serve as preconditions for the use of indicators by different actors.

### Sustainable Development Indicators

Sustainable development indicators are assessment systems that use a set of indexes to address and evaluate various related issues. They are also the most commonly used tools for evaluating and assessing the effect of sustainable development. These indicators comprise a consultation framework that measures the progress in achieving the objectives and goals for sustainable development. These indicators also explain the complex components of sustainable development to the community. They must be integrative and thorough enough to measure the progress toward sustainability. Scholars and researchers believe that these indicators must cover all three fields of sustainability, namely, environment, economy, and society, in order to be effective (Malaren, 1996).

Some sets of sustainability indicators have been developed. However, none of them have obvious features. As a general measure, multi-criteria rating systems have focused on environmental indicators to assess sustainability (Berardi, 2013). Furthermore, the efforts in assessing sustainability and developing new assessment systems and indicators have increased recently.

Turcu (2012) proposed two approaches for developing sustainability indicators. The first approach is the result of governmental decisions based on skilled input ("expert-led"), while the second approach is produced by partner citizens in their selection of indicators, which is typically called the grassroots approach ("citizen-led").

### Types of Indicators

The above indicators can be classified in several ways. One important difference between input and outcome indicators is that the former reverses the public or collective resources that have been developed for advancing the sustainability of a society or community. The sustainability challenges (e.g., dollars invested in public transport than in road construction) that are identified by these indicators can be used to measure the conditions or trends in the community or environment (e.g., number of new cancer cases and number of days with poor air quality). Both input and outcome indicators monitor the priority of different policies as well as the effectiveness of the overall efforts in addressing economic, social, or environmental issues.

These indicators can also be classified as either subjective or objective. Subjective indicators measure the perceptions of individuals on various conditions, issues, and trends, while objective indicators are facts that are independent of personal perceptions and are based on the measurement of an actual situation (Maclaren, 1996). In other words, subjective indicators measure the attitude of people toward their neighborhoods, while objective indicators count the number of burglaries or offenses that have occurred in an area. These indicators can also be divided into several categories according to their topic, such as environmental health, reducing ecosystem stress, transportation, education, housing, and land use.

### Sustainability Assessment Framework Indicators

Most of the sustainability assessment systems that have been developed in the last contract are based on sustainability building systems. These systems have been developed behind the building scale by redefining the assessment criteria. Many urban assessment systems can be found at both regional and global levels, such as Building Research Establishment Environmental Assessment Methodology (BREEAM), Leadership in Energy and Environmental Design (LEED), Comprehensive Assessment System for Built Environment Efficiency (CASBEE), Green Globes, Comprehensive Environmental Performance Assessment Scheme for Buildings, SBTool, Middle East Centre for Sustainable Development (MECSD), Global Sustainability Assessment System (GSAS), and Qatar Sustainability Assessment System (QSAS). The most well-known of these systems are LEED for Neighborhood Development (LEED-ND) in the United States, CASBEE for Urban Development in Japan, and BREEAM Communities (BREEAM-Com) in the United Kingdom. In 2009, the Green Building Council, the Congress for the New Urbanism, and the Natural Resources Protection Council in the United States developed LEED-ND, which has then been applied in other countries, such as Canada and China. LEED-ND bases its estimates on site selection design and construction indicators that bring buildings and neighborhood infrastructures together. This system relates these indicators to the surrounding urban landscape and local context. LEED-ND considers several categories, such as smart location, green infrastructure eco design, neighborhood pattern, and green buildings (LEED, 2009; Berardi, 2013).

In the 1990s, the first melting criterion system for sustainability assessment was proposed by BREEAM. In 2009, BREEAM developed BREEAM-Com, which assessed the sustainability of a community. This system was updated in 2012 to be used for new development and redevelopment projects at the community level. BREEAM-Com also evaluates the environmental, social, and economic aspects of the society (BREEAM, 2009).

**Table-1.** Parties involved in SNA.

Rating system	Gov	Industry	Academia	Citizens
LEED-ND	-	-	-	-
BREEAM Communities	-	-	-	-
DGNB-NSQ	-	√	-	-
CASBEE-UD	√	√	√	-
Pearl Community for Estidama	√	-	-	-

### Sustainability Assessment Frameworks in the Middle East

Sustainability assessment systems have also been developed in the Middle East. The most well-known of these systems is QSAS and MECSD, which are both established in 2007 by non-commercial organizations in their respective regions. Sustainability is another system that was established in 2010 to transform Abu Dhabi into a sustainable city. These systems share the following goals and objectives:

- To create a sustainable built environment that reduces environmental effects and satisfies specific regional needs.
- To improve energy efficiency and community environmental performance as well as to reduce water consumption.
- To promote sustainable development in the Middle East for the benefit of the economy, environment, and social welfare.
- To promote awareness of resource conservation among shareholders through frequent interactions.
- To establish a review board of certification and certify residential and commercial buildings as well as schools by using a flexible evaluation system (MECSD, 2010, GSAS, 2014; Sustainability, 2010).

The three systems thoroughly review the best common practices of other rating systems, such as LEED, BREEAM, and CASBEE. The rating systems of QSAS, MECSD, and Sustainability include the three pillars of sustainability, namely, economic, social, and environmental sustainability, as well as add civilization as the fourth pillar of sustainability.

### Economical, Social, and Environmental Factors

Economic factors theory assumes a balance between economic progress and environmental quality. Increased wealth has recently been identified as a prerequisite for environmental improvement (Grossman and Krueger, 1995). Many empirical studies have also suggested the importance of wealth in explaining environmental and other policies (Esty and Porter, 2005). The low sustainability ratings from Kuwait, Saudi Arabia, and the United Arab Emirates indicate the absence of an obvious relationship between income and environmental success. In contrast, developing countries such as Costa Rica emphasize the protection of their environment, which has produced excellent environmental outcomes because of their strong environmental policies and awareness.

Urban areas fulfill many social functions and psychological needs of citizens, thereby making these areas a valuable municipal resource and key ingredient for city and neighborhood sustainability. People from different age groups vary in their motives to visit parks and in their activities. Therefore, the design and management of parks must consider the recreational requirement of all target groups (Roovers *et al.* 2002).

The key contribution of this study is the establishment of the sustainable neighborhood indicators that indicate the degree of sustainability practices in Libyan neighborhoods. The indicators in urban neighborhoods can also show the sustainable neighborhood practices in such areas, as summarized in Table-1. The environmental, social, and economic factors have important roles in promoting sustainable development.

**Table-2.** Sustainable neighborhood indicators and factors.

Type of Space	Types of Indicators	Types of factors		
		Environmental	Economic	Social
Green Space > 10% (Retain Green identify)	Yearly allocation for environmental-health-sanitation	√		
	Yearly allocation for landscape and tree planting	√		
	Designed by preserving existing green area	√		
	Asthma case per 1000 persons	√		
	River water quality above present thresholds	√		
	Total solid waste recycled number of complaints from noise disturbance	√		
	Greenery able to Give aesthetic value to neighborhood		√	
	Green construction used for neighborhood		√	
	Workforce		√	
	Income distribution		√	
	Unemployment rate		√	
	Hospital beds per 1000 people			√
	Green recreational facilities			√
	Number of pupils per teacher in primary school			√



## CONCLUSIONS

This study emphasizes the need to consider sustainable development indicators in planning and designing local structures. Sustainable neighborhood living is an important concept that needs attention from the grassroots community. The implementation of sustainable neighborhood living is also widely supported by planners and designers because of its beneficial effects on the living environment. Sustainable neighborhood living can be achieved in a society with excellent planning guidelines and indicators.

This article discusses several sustainability indicators at the residential neighborhood level (i.e., economic, social, and environmental indicators). These indicators are selected based on some criteria for optimization as tools in assessing the degree of sustainability in Libyan neighborhoods. This paper also presents interviews with shareholders, local planners, and multi-disciplinary experts. However, a methodology specifically for assessing residential neighborhood sustainability indicators is yet to be proposed.

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