Localizing Imperatives of Sustainable Neighborhood Models: Iraqi Cities as a Case Study

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Synopsis: Sustainable Neighborhoods models offer new opportunities to augment the paradigm of sustainable urbanism. The research Incorporates local physical and environmental elements and attempts to extract significant indicators within models intended to ameliorate urban environmental quality at the neighborhood scale and identify areas where indigenous characteristics need to be incorporated to advance sustainable urbanism objectives.

1. Introduction

Moving from the building scale towards the larger urban scale, the issue of sustainability becomes arduous to define and to formulate specific and universally applied solutions. The neighborhood concept as envisioned in 1929 by Clarence Perry has developed further to constitute the building block of the urban fabric. He defined the ideal neighborhood as the space that would “embrace all the public facilities and conditions required by the average family for its convenience and fitting development within the vicinity of its dwelling” (Zhang et al. 2018). The neighborhood can be viewed in different ways because the identity of a neighborhood usually has a multitude of perspectives. It is more than just the sociological context, topography, land use and legislative rules. Neighborhoods are the location for connections of social, economic, physical and environmental factors (Dehghanmongabadi 2014). The concept of the neighborhood unit can be defined by different social, psychological, architectural and public governance. In other words, each of the different parts presents its definition of neighborhood. Thus, there are different approaches to applying sustainable development to neighborhoods.

2. Sustainable Neighborhoods Models

There are numerous neighborhood sustainability rating systems to encompass green neighborhood developments as well as existing neighborhoods. Table 1 outlines the majority of these systems from around the globe. The assimilation of sustainable development principles in neighborhoods planning is essential to remedy deficiencies at the microscale (Dehghanmongabadi 2014). The research will shed light on two of these systems which are widely accepted as valid frameworks for cities in the northern and southern hemisphere. The pearl system is of particular significance since it simulates sustainability concerns for dry arid regions.

TABLE 1 Sustainable Planned and existing Neighborhoods Rating Systems

Rating System	Author	Rating Categories
Planned Neighborhoods		
Pearl Community for Estidama	Abu Dhabi Urban Planning Council, United Arab Emirates	The integrated design process, natural systems, livable communities, precious water, resourceful energy, stewarding materials, innovating practice
Signature	Audubon International, US (available internationally	Siting, planning & design, construction, long-term management
One Planet Communities	BioRegional, UK	Zero carbon, zero waste, sustainable transport, sustainable materials, local & sustainable food, sustainable water, land-use & wildlife, culture & heritage, equity & local economy, health & happiness
LEED for Neighborhood Development	US Green Bldg Council, US	Smart location & linkage, neighborhood pattern & design, green infrastructure & buildings, innovation & design process
Green Townships	Indian GBC, India	Site selection & planning, land-use planning, transportation planning, infrastructure resource management, innovation in design & technology
Green Star Communities	Green Building Council of Australia	Livability, economic prosperity, environment, design, governance, innovation
Green Mark for Districts	Building and Construction Authority, Singapore	Energy, Water, materials and waste management Environmental Planning and Green building design, Transport and community innovation
Green Land Development	Home Innovation Research Labs, US	Site design and development, lot selection, project team, and mission, innovative practices
Global Sustainability Assessment System for Districts	Gulf Organization for Research & Dev, Qatar	Urban connectivity, site, energy, water, materials, outdoor environment, cultural and economic value, management and operations
GBI Township Tool	Green Building Index, Malaysia	Climate, energy, water, environment & ecology, community planning & development, transportation & development, buildings & resources, business & innovation
HQE for Urban Planning & Development	HQE Association, France	Territory and local context, density, mobility and accessibility, heritage landscape and identity, adaptability and evolutionary potential, water, energy and climate, supplies

		and equipment urban, residues, ecosystems and biodiversity, natural and technological risks, health, economy, functions and plurality, environments and public spaces, insertion and training, attractiveness, economic dynamics and structures of local training
EnviroDevelopment	Urban Development Institute of Australia	Ecosystems, waste, energy, materials, water, community
Enterprise Green Communities	Enterprise Green Communities	Integrative design, location & neighborhood fabric, site improvements, water conservation, energy efficiency, materials beneficial to the environment, healthy living environment, operations & maintenance
DGNB for Urban Districts	German Sustainable Building Council	Land-use, life-cycle-costs, social & commercial infrastructure, quality of public-transport infrastructure, participation
Climate Positive Development	C40 Cities, US	Thermal & electrical energy use, waste, transportation
CASBEE for Urban Development	Institute for Building Environment & Energy Conservation, Japan	Natural environment, area service functions, contribution to community, microclimate impact, social infrastructure, environmental management
CASBEE for Urban Area + Bldgs	Institute for Building Environment & Energy Conservation, Japan	Natural environment, area service functions, contribution to community, microclimate impact, social infrastructure, environmental management
BREEAM Communities	BRE Trust, Austria, Germany, The Netherlands, Norway, Spain, Sweden, United Kingdom	Governance, social & economical, well-being, resources & energy, land-use & ecology, transport & movement, innovation
BERDE for Clustered Residential Development	Philippine Green Building Council	Management, land-use and ecology, water, energy, transportation, indoor environmental quality, materials, emissions, waste, heritage conservation, innovation
BEAM Plus Neighborhood	Hong Kong Green Building Council (China)	Community, site, material, energy aspects, water, outdoor environmental quality, innovations
Aqua for Neighborhoods	Vanzolini Foundation, Brazil (with Certivea/France - HQE)	Territory and local context, density, mobility and accessibility, heritage, landscape and identity, adaptability and evolutionary potential, water, energy and climate, supplies and equipment urban, residues, ecosystems and biodiversity, natural and technological risks, health, economy, functions and plurality,

		environments and public spaces, insertion and training, attractiveness, economic dynamics and structures of local training
Existing Neighborhoods		
2030 Districts	Architecture 2030, US	Energy, water, transportation, emissions
Livability Index	American Association of Retired Persons, US	Housing, environment, neighborhood, transportation, health, civic engagement, equity & opportunity, recreation & culture
Living Community Challenge	International Living Future Institute, US	Limits to growth, urban agriculture, habitat exchange, human-powered living, net favorable water, net positive energy, civilized environment, healthy neighborhood design, biophilic environment, resilient community connections, living materials plan, embodied carbon footprint, net positive waste, human scale + humane places, universal access to nature & place, universal access to community services, equitable investment, just organizations, beauty + spirit, inspiration + education

Source: Based on (Transformative Tools 2016)

3. Pearl Community Rating System: Dry Arid Regions

The Pearls Rating system is a government initiative developed by the Abu Dhabi Urban Planning Authority and has just been launched in 2010. Like LEED, the Pearls Rating System for Estidama includes some rating systems assessing buildings and Neighborhoods.

"Estidama itself is also part of Abu Dhabi's 20-year plan, known as "*Plan Abu Dhabi 2030"*. The Plan endeavour to redefine how a contemporary Arab city should look, to encourage sustainable growth, to encourage protection of the natural environment of sensitive coastal and desert ecologies, to re-emphasise the city's stature as a capital city of the United Arab Emirates, and to enable the urban fabric and infrastructure to enforce the local values and culture of this Arab community" (Elgendy 2016).

Estidama, which means 'sustainability' in Arabic, is an integrated system which will transform Abu Dhabi into a model of sustainable urbanization. It aims to create more sustainable communities, cities, and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural and social. The Pearl Rating System for Estidama aims to acknowledge the sustainability of a given development throughout its lifecycle from design through construction to operation. The Pearl Rating System provides design guidance and detailed requirements for rating a project's potential performance on the four pillars of Estidama (UPC 2010).

The Pearl Rating System is composed of seven core categories that are essential to sustainable development. These categories form the heart of the Pearl Rating System:

- Natural Systems: Conserving, preserving and restoring the region's critical natural environments and habitats.

- Livable Communities**:** enhancing the quality and connectivity of outdoor and indoor spaces.

- Precious Water**:** Reducing water demand and encouraging efficient distribution and alternative water sources.

- Resourceful Energy**:** Targeting energy conservation through passive design measures, reduced demand, energy efficiency and renewable sources.

- Stewarding Materials**:** Ensuring consideration of the 'whole-of-life' cycle when selecting and specifying materials.

- Innovating Practice**:** supporting innovation in building design and construction to facilitate market and industry transformation.

Within each section, there are both mandatory and optional credits, and credit points are awarded for each elective credit achieved. To attain a basic Pearl rating, all the mandatory credit requirements must be met. Achieving a higher Pearl rating, all the mandatory credit requirements must be met along with a minimum number of credit points.

4. LEED-ND: A Global Model

As of 2015, there were 401 certified LEED-Neighborhood Development projects worldwide completed or under construction (Dalzell 2016). The system was overhauled so that entire neighborhood could be certified, not just buildings. The Natural Resources Defence Council (NRDC) teamed up with the Congress for the New Urbanism and the U.S. Green Building Council to launch LEED for Neighborhood Development, or LEED-ND, in 2010 (Dalzell 2016)

LEED for Neighborhood Development is a rating system that combines the principles of smart growth, New Urbanism, and green building into a unified standard for green neighborhood design. Similar to other LEED design and construction rating systems, it is a voluntary program devised to appraise and guide the design and construction of development projects (Byerly et al. 2013). Projects are evaluated and assessed rating based on a score of 110 points spread over five broad categories: Smart Location and Linkage, Neighborhood Pattern and Design, Green Infrastructure and Buildings, Innovation and Design Process, and Regional Priority Credit (U.S. Gbc 2010).

LEED for Neighborhood Development projects varies widely in their scope and character. Small infill projects qualify, as do large master planned communities, and projects may apply early in the development process or immediately after construction is complete. Mixed-use and single-use projects can fare well in the program, and a variety of location types near existing infrastructure also are admissible. The LEED for Neighborhood Development rating system is made up of specific requirements, which all projects must meet, and a set of credits, from which each project can choose to gain enough points for certification. It is essential to understand that there are natural limitations to the application of the LEED for Neighborhood Development rating system. LEED-ND is not a replacement for comprehensive planning by a municipality or county (Byerly et al. 2013).
A comprehensive plan that is supportive of LEED for Neighborhood Development will include goals explicitly connected to sustainable land development, such as the clustering of growth around existing infrastructure, increased density where appropriate, investment in transportation infrastructure, the creation of an attractive pedestrian environment, and similar provisions. If the comprehensive plan already includes many of these elements, reviewing the rating system can help add specific metrics to more general goals, allowing the planning authority to measure the success of the plan.
The rating system contains many thresholds that can help refine the general goals found in a climate action plan. For example, a climate action plan that includes an increased public transportation access objective can provide a substantive target by using specific service thresholds found in locations with Reduced Automobile Dependence.

LEED for Neighborhood Development is highly structured and includes a significant number of specific parameters for each green development strategy included in the rating system. This high degree of specificity and the broad scope of the credits – touching upon everything from locational characteristics to the extent of glazing on retail spaces – make the rating system very advantageous as a tool in performing a gap analysis of an existing neighborhood.

5. Characteristics of Urban Gatherings in Iraq

As shown above, the models of sustainable neighborhoods in each society were either aimed at addressing local problems or by raising the standards of the target communities. These models should be appropriate to natural, socio-economic and other conditions.

In Iraq, there is a range of characteristics that play a crucial role in dealing with sustainability variables, including the local climate, socioeconomic characteristics and other related to the situation of acute shortage of services and regulation due to the application of unplanned planning policies.

5.1 Characteristics of local climate

Around the world, the climate is the most critical factor in shaping the pattern of construction. In Iraq, this factor played an essential role in the formation of traditional cities and their urban units. However, the development of air conditioning, transportation and modern life requirements and the adoption of planning policies that did not take into account this factor contributed negatively to the shift towards building patterns that are not compatible with the climatic environment. One of the most decisive Iraqi climate factors affecting the city environment is solar radiation, and heat with less impact of moisture, precipitation, atmospheric pressure and wind (Shahada 2009).

5.2.1 Solar radiation

Solar radiation is most influential in the thermal environment of buildings, especially in dry, hot areas (Michael 1991). Heat exchange during the day depends on the radiation from the sun, while at night depends on long-wave radiation emitted from the earth's surface (Rasual 1996). The values of solar radiation in the northern region ranged from 3900-4500 m² / d.W, while in the central and southern regions it was 4500-5000 m² / d.W, The desert region and the western plateau area between 5000-5200 W.d / m² (Rajbo 2011). These ratios represent a significant and disturbing amount of radiation but can be exploited as an excellent source of alternative energy, especially with the low rate of cloudy days during the year Fig. 1.

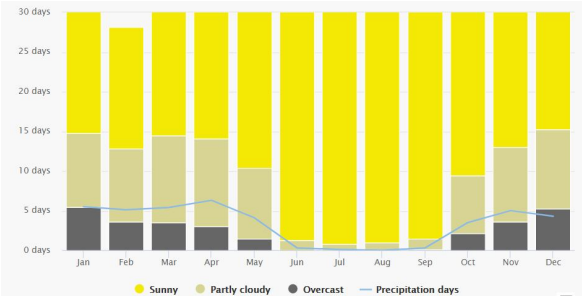

Figure 1: Average cloudy, sunny, and Precipitation days in Baghdad for 30 years (Meteoblue 2018)

5.1.2 Temperature

The most prominent feature of the Iraqi urban pattern is extremism in temperature, as the climate of Iraq, is characterized by a scorching summer and a cold, short winter, Also, the wide of the daily temperature range, which characterizes continental climates (Al-Samarrai 2008), (Agrometeorological Network 2018).

Summer is the most extended season in Iraq at a rate of (6) months and less than two months for the autumn and spring, but winter is about three months. Fig. 2. January is the coldest month with a daily average of about 7°C, while July is the warmest month with a daily average temperature of 38°C, and the maximum temperature is often 46 to 50°C. Figs.3 and 4.

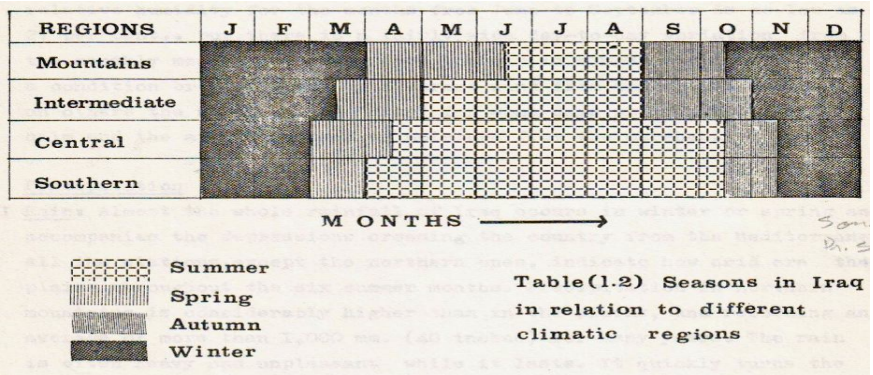

Figure 2: lengths of four seasons in Iraq, in relation to climatic zones (Nouri 1974)

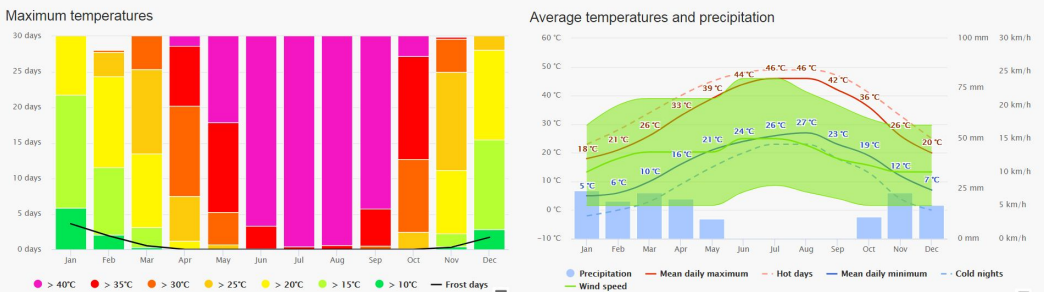

Figure 3 and 4: Maximum temperatures and average temperatures and precipitation (Meteoblue 2018)

5.1.3 Wind

Northwest winds blow on Iraq throughout the year. In the winter, it is cold and dry with clear skies. In the summer, it softens the atmosphere and reduces the high temperatures. Eastern and northeasterly winds blow with cold and clear skies. The southeast wind is relatively warm, it is moist and brings clouds and rain at times Fig. 5. The wind has a direct effect on the thermal comfort of humans. Wind speed changes determine the importance of thermal comfort variables (air temperature and relative humidity). (Al-Samarrai 2008)

5.1.4 Relative Humidity and Rain

Rain falls in the winter and autumn, the period of November - April the most humid and represent more than 90% of the annual precipitation periods, while falling a few scattered

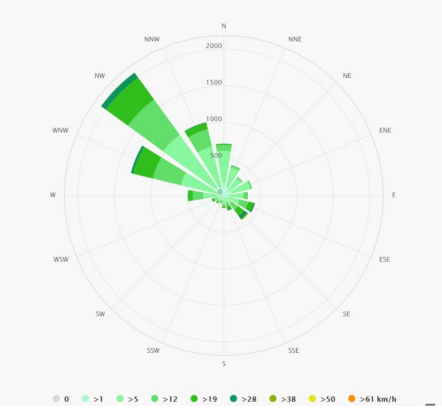

Figure 5: Windrose in the Iraqi climate (Meteoblue 2018)

Showers during the months of October and May. The rainfall varies according to the geographical areas. It decreases as we move from the northeast to the southwest, where it reaches more than 700 mm in the northeastern areas of Sulaymaniyah, Shaqlawa, and Dukan. It may reach more than 1000 mm in the Upper Zacroz heights, while the average annual rainfall is less Of 100 mm in areas such as Karbala and Najaf in the southwest (Agrometeorological Network 2018).

5.2 Characteristics of the Iraqi residential district

We will address two types of Iraqi residential buildings, the most prominent and the most obvious, the traditional pattern that lasted until the seventies of the last century and the current contemporary pattern, which was affected by the technical changes and the use of electricity on a large scale.

5.2.1 Traditional building pattern

The formal and spatial configuration of the traditional Iraqi residential complex was not as pre-planned as it was as a result of human interaction with the natural and cultural environment (Antonion 1981). The street system was characterized by an organic pattern with narrow, shaded streets, usually for pedestrians. The system starts with the residential dead-end, passing through a full passage, which considers as collectors of movement to the central axes. These principal axes are lined with many commercial use units before meeting at the city center (Al-Rawi 2001). The architecture of this stage focused on the functional and formal aspects. Where inner courtyard was used in residential units, which serves social and environmental purposes by introducing sufficient proportions of sunlight and air currents. This courtyard was a living space protected from external factors. The dwellings were formed in an overlapping and adjacent manner, where only the smallest proportion of the walls of the adjoining buildings with small ventilation holes were exposed to sunlight. The building units consist of one or two floors. The upper floor contains " Shanasheell"(an extended cantilevered and enclosed wooden balcony) which aims to achieve privacy, get additional room spaces in the second floor and provide shadows in the alley (Al-Saadoon 1995).

The organic pattern aims to improve accessibility and enhance the defensible of the city. As well as other important aspects such as increased social interaction among the city's inhabitants and a softening of summer heat and winter cold (Antonion 1981).

The street trend in the traditional city is not in keeping with the flow of dry, hot, dust-laden wind. The street trend in the traditional city is not in keeping with the flow of dry, hot, dust-laden wind. The alley's width inequality, creating shade and light areas, which causes an imbalance of pressure and the emergence of air currents to soften the atmosphere(Antonion 1981).

5.2.2 Contemporary building pattern

When technological changes occur, the city's ecology usually undergoes accompanying changes (Al-Rawi 2001). Development of vehicles and various means of communication led to the expansion of the city's size, and the emergence of a new dimension of relations and distances between the city's parts. Roads occupy approximately 24% of the current city's area. (Al-Fityan 2005).

Openness to the outside has become an essential feature of the contemporary residential environment in Iraq. Where the construction line rebounded and left a wide area in front of the block built as a front garden or a car garage. A focus on the exterior characterizes the architecture at this stage without attention to the functional aspect. (Al-Rawi 2001).

Such a new setting is mainly due to the technological progress of transport means, construction materials and air conditioning systems. Which influenced the transformation of the traditional residential unit into a modern self-contained unit. As well as the impact on the spatial distribution of these units and their relationship to neighboring houses or rest of land uses (Al-Fityan 2005). The streets in the new neighborhoods have been characterized by a geometrical pattern, with lots of more than 200 square meters on either side (Al-Rawi 2001). The grid pattern has become the default option for the neighborhoods' plans, which brought a lack of privacy, outward orientation, multiple orthogonal intersections, poor social spaces, as well as the spread of activities at the city level in separate sectors, and the residence has become away from work (Al-Fityan 2005).

6. Conclusion

The preceding sections outlined the unique natural and physical characteristics of typical Iraqi cities. The overwhelming extreme climate requires additional measures to be incorporated in any sustainable neighborhood to attain added value to both environment and residents. The pearl system presents an excellent example of a sustainable neighborhood framework which emphasized local conditions. It highlights the need to give more credit to cooling measures in line with the hot, arid climate of the United Arab Emirates. The same can be said for limiting credit given to rain harvesting in contrast to the LEED framework. Needless to say, additional measures must be incorporated and granted additional credit to accommodate the unique conditions of Iraqi cities as in:

1- Establishing Ecological corridors for transportation Routes including bicycles and shaded pedestrian paths.
2- Using appropriate construction materials, Materials should be used to have less heat storage capacity and minimum Reflectivity. Use of materials with low thermal capacity and high dispersion of solar radiation in the facades exposed to the sun within the neighborhood.
3- High coverage of dense trees and unpaved grass areas in the public spaces of the residential neighborhood.
4- Extensive utilization of water fountains and features within the public spaces in the residential neighborhood.

5- Incorporating an organic pattern of pedestrian paths and the creation of spaces of social interaction.
6- Adopt formations of shade and shadow to create local airflow within the fabric of the residential neighborhood to mitigate the atmosphere temperature through the design of blocks and spaces of a residential neighborhood.

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