Re-interpretation of City's Radial Expansion in The Developing Countries through Green Affordable Housing Case Study: Greater Sour Southern Expansion Axis, Lebanon

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City's expansion, green, affordable housing, urban model

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Abstract

The footprint of the city is at major risk. Cities are growing out in a fast and unplanned way thus increasing ground stress, both environmentally and economically. When the population increases, the suburbs are exposed to an amorphous expansion, which leads to a modification in the form and content of the city’s periphery. Greater Sour is one of the coastal cities in Lebanon that passed through major phases of expansion over time and has the potential for major future growth. This growth is resulting in a radial-shaped structure located along the major roads linking the city to the surrounding towns. It is also affecting the green natural environment surrounding the city. This paper aims to provide a vision for developing the city’s expansion through the application of a sustainable urban model that ensures a healthy living environment and maintains the green natural environment in the city’s periphery. The reinterpretation of the city’s expansion will be through the examination of the reasons and shape of urban growth and the study of the efficiency of implementing a green affordable housing as a tool to enhance the urban expansion of the city. In addition to studying similar and distinctive examples of green housing neighborhood, the paper analyzes its relationship to the context (social and economic) and its future impact on the surrounding, spotting light on the finger plan in the Greater Copenhagen area. After analysis and study of the case, we could find that the focus now is to lead the built out and organize the expansion of the city by creating a flexible system to follow.

Keywords

City’s expansion, green, affordable housing, urban model
1. INTRODUCTION

Over the last decades, people had gradually inclined toward migration from rural to urban areas, which causes irregular expansion and a massive footprint of cities all over the world. The world population living in the city has been increasing exponentially and will continue to do so in the next years (Goncalves & Domingos, 2011). This increase in population had caused the rapid growth of urban areas, which had contributed to the formation of a massive built-up cover spreading over land-cover. Cities are growing without clear plans and strategies. People are tending to build their home anywhere which cause overstress on the already existing infrastructure. The uncontrolled development of the city’s periphery is having negative results on the infrastructure, the public service cost and disparity of wealth. It is also having an impact on wildlife and ecosystem, loss of farmland, poor air and water quality and mainly it is affecting the public and social health (Goncalves & Domingos, 2011). This subject is being on the top priority of many international organizations of health and wellbeing like WHO, UN-Habitat, and LEED certification who is raising the awareness of the issue of urban health. Those organizations, along with many experts, had developed a list of guidelines and criteria to improve the urban wellbeing.

Problems of urban expansion architecture:
- A lack of architectural variety.
- Low-quality open spaces.
- Car-dominated developments.
- On-street car parking.
- On-street car parking.
- Bad affordable housing.

This paper aims at providing a vision for developing the city’s expansion through the application of a sustainable urban model that ensures a healthy living environment and maintains the green natural environment in the city’s periphery.

The objectives of the research are to:
- Reinterpret Greater Sour by revealing the meanings and relationships of the city’s shape of expansion in a new/different way.
- Study the propagation of the built environment at the architectural level, by referring to the quality of the building and the impact on nature.
- Adopt the green by means of sustainability and minimum environmental impact.
- Develop an affordable housing concept and methodology by means of low-cost architecture development for low/middle-income citizens.
- Talk about the urban sprawl problem in Sour, mainly the case of the built environment in the South axis.

In order to reinterpret the housing in the South axis and create a neighborhood that can be repeated once needed, the new housing must adhere to the following:

a. The green and sustainable parameter of design.

b. The affordability of living for low-income families.

This research hypothesizes the possibility of developing new housing in the Southern axis of expansion of Greater Sour. This intervention would be through an affordable type of residential building for people to live in. This paper analyses the philosophy of the city’s expansion without harming the existing green plain. By interpreting a green housing strategy for citizens, the study will base on Data collection of the information in the last two decades.
2. LITERATURE REVIEW

Many studies had listed the main causes of population growth. The rapid growth of urban areas is the result of two population growth factors: (1) natural increase in population, and (2) migration to urban areas. Natural population growth results from an excess of births over deaths.

“Migration is defined as the long-term relocation of an individual, household or group to a new location outside the community of origin” (Bhatta, 2010).

The author of “A Global Inventory of Urban Corridors Based on Perceptions and Night-Time Light Imagery” article indicated that the cities change in different levels mainly leading to increasing the land demand. This process allowed the author to tackle the implementation of a new concept such as urban corridors. This concept implies the usage of large linear urban extension linked together with a well-developed transportation system which preserves the green land-cover in-between (George, Blaschke, & Taubenbock, 2016). This concept led to creating the finger structure city. The finger structure is a city structure that allows preserving and maintaining the green spaces from urban development. Its focus is on the prevention of sprawl. The original finger structure plan was created as a draft for a regional plan for Greater Copenhagen. The main idea behind this concept was to concentrate the urban development along with the city’s fingers, which are separated by green wedges, kept from development (Ministry of the environment, 2015).

The concept of the urban corridor was first drawn by the “Copenhagen finger plan” in 1947. It aimed at establishing urban development concentrated in finger structure with green separating fingers. This concept must ensure that all of the extended areas in the finger had received the overall principles and infrastructure. Those ideas were mentioned and analyzed in “Copenhagen, Denmark” by Paul Cahasan & Arielle Farina Clark where the authors mentioned the four learned lessons from a city finger structure:

- A creative and well-planned strategy for a city will have a lasting impact and benefits on the socio-economy.
- Replacement of space to parking by space for people to walk.
- Political and institutional support of the concept will ensure it is working on the track.
- People must have easy access to open spaces and public areas in the green wedges by mean of a well-studied transportation system.

This development of the expansion axis from the central city requires to be well-studied to ensure the aim of the strategy. Thus creating housing in such developed well-organized areas must adhere to sustainable housing strategy, which was the main idea behind the strategic plan to develop cities. Affordable housing has been defined as a necessity for life, […] “it has a pervasive impact on all aspects of our existence. Housing - if it is adequate - provides privacy and security against intrusions, both physical and emotional. It is the principal locus of personal and family life. It defines our community and determines our access to jobs, to services, to stores, and to significant other people in our lives. It contains not only our material possessions, but our dreams and our despair” (Stone, 1993).
Bijlmermeer neighborhood in Amsterdam is the first affordable housing example. Its idea was to create beautiful modern housing that everyone can afford. It requires less building footprint and more green and public areas. Using hexagonal-shaped building to get more sunlight in the building, Pi de Bruijn, the architect, created an identical apartment for neighbors to feel equal. In addition to the integration of large green spaces around the buildings, this concept had many critics for its efficiency and livability and had major lift-up intervention due to:
- Half of its residents were unemployed
- Unsafely living conditions
- Stigmatization

Another example is the Hammarby Stostad, Stockholm-Sweden. The main aim of the project was creating an urban district good enough to reduce environmental impacts and use half the amount energy that a typical project use (Gaffney, Huang, Maravilla, & Soubotin, 2017).

The approach of the project was to design and achieve environmental and social sustainability in the Hammarby Stostad proposed neighborhood in a dynamic system (Bjurstrom, Bjurstrom, & Bjurstrom, 1997). This dynamic system (Fig. 5) consists of an integrated environmental infrastructure: water, sanitary, drainage and solid-waste management.
The affordable housing was discussed by Wilbert Abbott in his master thesis ‘A unique approach to allow low-income families the opportunity to gain homeownership access through alternative financing’, where he defined the eco-affordable housing as a term “used to describe programs and projects that integrate green building concepts with efforts to provide housing that is affordable to a target market or community” (Abbott, 2008). It is critical to understand that the term eco-affordable is not only about the affordability of the house. It is also about providing a project that will increase the integration of the community with local environmental and economic challenges and create social interactive skills of green-sustainable development. The connection between the Green Building and Affordable Housing includes the usage of local materials, energy-efficient appliances, and technologies.

Affordable housing guidelines:

a. Location & Context
   a.1. Build developments in areas with good access to amenities and services.
   a.2. Utilize sites that are appropriate for residential housing development.
   a.3. Optimize the site context before designing the details.
   a.4. Create developments that offer visual effects and relationships with the local community.
   a.5. Provide a safe living environment.
   a.6. Develop residential projects that complement adjacent buildings and offer open space.
   a.7. Open Space enhances the residential environment.
   a.8. Provide parking that is adequate, secure and cost-effective.

b. Good Building Design:
   b.1. Promote operational efficiencies and affordability by optimizing density.
   b.2. Create affordable housing that is indistinguishable in quality from private residential housing.
   b.3. Seek creative options for building forms and alternatives to mainstream development.
   b.4. Provide well-thought-out and designed indoor amenity space.
   b.5. Promote Universal Design and meet barrier-free / accessible requirements.
   b.6. Design in flexibility/adaptability to accommodate the changing needs of households over time.
   b.7. Develop affordable housing that incorporates energy-efficient & sustainability principles.
   b.8. Use life-cycle costing when choosing materials.
   b.9. Create entrances that are distinct, welcoming and functional.

This guideline was mentioned by many international organizations along with other criteria to promote the health and wellbeing of the community. However, with the large demand for land, a green infrastructure/ corridor is being the substitute urban landscape concept to reduce the negative environmental impact. The green corridor is defined as “an open space that provides opportunities for human activity and health” (Rottle & Brice, 2012). The parameters of analysis are listed below (Table 1).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livability</td>
<td>Promoting recreational and leisure areas</td>
</tr>
<tr>
<td></td>
<td>Creation of place quality</td>
</tr>
<tr>
<td>Affordability</td>
<td>Housing appropriate to the need of low/middle income.</td>
</tr>
<tr>
<td></td>
<td>Location exclusively chosen.</td>
</tr>
<tr>
<td></td>
<td>Using appropriate efficient low-cost material.</td>
</tr>
<tr>
<td>Green</td>
<td>Improve neighborhood transitions to improve green space.</td>
</tr>
<tr>
<td></td>
<td>Create low-cost sustainable factors in the housing units.</td>
</tr>
<tr>
<td></td>
<td>Use of techniques to reduce energy consumption.</td>
</tr>
<tr>
<td></td>
<td>Conserving biodiversity by using ecological corridors</td>
</tr>
<tr>
<td>Radial development</td>
<td>Urban development takes into consideration building on existing infrastructure.</td>
</tr>
<tr>
<td></td>
<td>Green area must remain untouchable.</td>
</tr>
</tbody>
</table>

Table 1: Parameters of analysis
Source: The authors, 2018
3. METHODOLOGY

This paper follows the qualitative type of research in the reinterpretation of the city’s radial expansion in the southern axis of Sour city. The paper focuses on three scientific research methods:

- First, the field method, concentrating on the case study by surveying the site, taking photographs and making interviews with experts.
- Second, the analytical method of research, which depends on analyzing the information that had been collected from the field study.
- Third, the deductive method of research, trying to deduct a strategic way to prevent the problem of urban sprawl in the southern propagation axis of Sour.

3.1 Introducing The Case Study

Sour is a harbor city well recognized for its mercantile activity throughout the Mediterranean since ancient Phoenician times. It is located 83km south of the capital Beirut.

Sour is considered Lebanon’s fourth largest coastal city and is characterized by its wealth of archaeological and naturally significant sites. Lebanon is territorially divided into eight governorates containing 26 districts including Beirut. Sixty municipality districts fall within Sour urban area, which in return is part of South Lebanon Governorate (Fig. 6). South Lebanon Governorate comprises the three districts Jezzine, Saida and Sour (Fig. 7). Sour municipality is the administrative center of Sour district.

Table 2: Neighborhoods by municipality across Sour urban area

<table>
<thead>
<tr>
<th>Neighborhoods</th>
<th>Abbreviation</th>
<th>Beij El-Chambi</th>
<th>Sour</th>
<th>Ain Beel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Jai Al Bahir Camp</td>
<td>1 Hay El Shoukri</td>
<td>1 Al Maschouch</td>
<td>1 Al Hosh</td>
<td></td>
</tr>
<tr>
<td>2 Hay Nuher El Samor</td>
<td>2 Hay Belousta</td>
<td>2 Hay El Mihyeh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Hay Jie El Bahr</td>
<td>3 Mifne El Houz</td>
<td>3 Hay El Islam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Al Habitou</td>
<td>4 El Blouj camp</td>
<td>4 Hay El Jarme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Mifne El Rmali</td>
<td>5 Hay El Rmali</td>
<td>5 Maktar El Mimhie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Hay Jie El Jule</td>
<td>6 Hay Shait</td>
<td>6 Maktar El Islam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Hay Jie El Harem</td>
<td>7 Hay Ezem</td>
<td>7 El Blouj camp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Mifne El Abassiye</td>
<td>8 Hay Maktar El Ai</td>
<td>8 Hay El Houbi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Hay El Rmali</td>
<td>9 Hay El Balha</td>
<td>9 Al Mabina el Shaiky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Hay El Heliidiye</td>
<td>10 Hay El Heba</td>
<td>10 Hay El Zine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Hay El Eloussou</td>
<td>11 Al Mabina el Shaiky</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Hay Hmidi El Zouf</td>
<td>12 El Rmali El Hayeidiye</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Hay El Rmali</td>
<td>13 Sahel El Rmali</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Sahel El Zoum</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>15 Hay Tark El Sabane</td>
<td></td>
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<td></td>
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<tr>
<td>16 Al Ain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Hay El Moushi</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18 Hay El Bader - Buq El-Chaml</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Hay El Saha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Hay Al Jie El Jule</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Hay El Goufelli</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: UN-Habitat, 2017
As shown above (Table 2), the district’s development in Borj El-Chameli (the east-west axis) is the densest axis merging from Sour. The Abbasseyeh axis and Ain Beal axis (known as Sour-Qana axis) are less dense axis with a high density of future expansion. The proposed site location is in El Hosh, in the southern axis merging from Sour to Qana. This site was an agricultural land till 2009 when construction started. These buildings target the mid-low income category. People tend to build in the area because it is near the center city (7 min.) which makes it easy for citizens looking for a new house near Sour and for people coming from towns looking for jobs and education.

3.2 Fears of Future Expansion

Sour, just like other cities in the developing countries, is expanding rapidly. This expansion of the city results into a radial-shaped structure located along the major roads linking the city of Sour to the surrounding towns (Fig. 10-11).

“The city of Sour has mainly developed along the historical east-west axis” (CRI - HABIB DEBS - ECODIT - IAURIF, 2015).

Recently, the surrounding of the city is characterized by the increase of built areas along the main roads coming from the city. Mainly in the two axes:
1) Northern-east axis from Sour to Abbasseyeh
2) Southern axis linking Sour with Qana.
The population in Sour had increased over years, nowadays Sour is facing a major problem in land and housing demand and will continue in the following the years (Table 3). In the boundary of Sour city, there are only 7/8 empty lots which are small and had a high cost. For those above-listed reasons, people and decision-makers tend to build in the city’s periphery and the extension roads merging from the city. The propagation of the built-up area and the creation of green corridors in between those propagation axes imitates the master plan of Copenhagen city. The agricultural areas characterizing Sour’s boundary are bordering the built-up areas (Fig.11).

Table 3: Urban growth and population growth in Sour and Greater Sour  
Source: Un-Habitat, 2016

<table>
<thead>
<tr>
<th></th>
<th>Urbanized surfaces in 2000 (km²)</th>
<th>Resident population 2000</th>
<th>Urbanized surfaces in 2030 (km²)</th>
<th>Resident population 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyre</td>
<td>3.1</td>
<td>48,000</td>
<td>3.4</td>
<td>52,000</td>
</tr>
<tr>
<td>Suburbs</td>
<td>6.7</td>
<td>69,000</td>
<td>12.9</td>
<td>122,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>9.8</td>
<td>117,000</td>
<td>16.3</td>
<td>174,000</td>
</tr>
</tbody>
</table>

3.3 Field Study On Sour’s Urban Growth

3.3.1 Site visit & photographs

The site had gone through two phases:

- Phase 01: Surveying the five urban axes of expansion merging from sour, taking photos of the area in order to study the architectural typology.

Fig. 12: Direction of the five urban axes  
Source: Google maps, 2018
Phase 02: Visiting the selected site in order to review the location, context-use, type of existing building.

The following factors were extracted from the site visit:
- The urban sprawl has led to the loss of valuable agricultural lands, this situation will threaten the unique identity of the city and its natural historical characteristics.
- Buildings in the context El Hosh district are newly constructed mixed-use blocks or commercial compounds.
- Construction materials are mainly reinforced concrete, steel and glass which are unsuitable for ecological sustainability.
- Energy consumption is high, public transportation isn’t available, thus excessive usage of vehicles for transportation.

3.3.2 Interviews
The research undertook face to face interviews with different experts and engineers on the domain of Sour planning and development. These interviews aim at sourcing opinions and data collecting from in order to determine the most critical problem of the urban growth of the city.
The following factors were extracted from the interviews:
- Sour’s expansion main axes construction typology:
  - Sour-Qana Axis: Mainly constructed with the mixed-use building.
  - Sour- Abbaseyeh: Consists mainly of Villas and single-family housing.
- The random construction is Sour is always linked with the political security problems in Lebanon.
- The construction inside the agricultural land and the trend to build a touristic project is now a trend, and it needs new laws to limit the effect on the agricultural lands and the green spaces.
- The remaining issue to solve in Greater Sour is the missing rules and strategic plans for the high demand for housing.

3.4 Analyzing The Parameters Of The Case Study
a) Parameter 01: Livability - In the peripheries of Sour, there are many green lands used for agriculture. But there is a lack of green spaces as open recreational spaces for the use of the public.
b) Parameter 02: Affordability - Housing in Sour is highly demanded from all the categories of residents. However, the low-income category is the mainly demanding category for
housing units. Those housing should be close to the city center for the purpose of work and education.

c) Parameter 03: Green - The green parameter is to use sustainable features as a strategic tool in design and development. In addition, the types of construction are unhealthy and affect the environment in a bad way.

d) Parameter 04: Radial Development - There is a tendency in Sour periphery to build in the green spaces. Already constructed road infrastructure makes it accessible for building on these areas.

4. RESULTS

Based on analyzing the case study, the results can be concentrated in the below table

Table 4: Results Green affordable housing
Source: The authors, 2018

5. DISCUSSION

In a link with the world vision 2030 to develop urban environment and health, the research found the principles of a master plan concept to enhance the urban growth of cities. Strategies must be done for a well-organized development of the expansion axis from the central city. Taking into consideration the four learned lessons from the city finger structure, cities will be limited to the five axes of propagation. Thus, the green corridors between built-up area will be protected and kept from development. The focal point of this concept fulfills the following proposed feature for development:

a. Lift-up of the existing urban fabric by introducing green screens to infill the empty zones by means of infill development.

b. Usage of green wall and green roof in the existing building (where possible) in order to reduce the heat island effects.

c. Enhancing the area with the implementation of green squares, central green piazza and green pathways that include social activities.

d. Introduction of green corridor that links the major function in the area, this green corridor will be accessible only for walking and bicycles.

e. Development of green belt concept in the zone where there are traffic and pollution emission.
6. CONCLUSION

As a last word, action for green housing development is a must. Local authorities need to take action to prevent the amorphous development of Sour. The research shows the possibility to design a livable, affordable green urban environment that contributes to a healthy housing development in the Southern axis of growth in Greater Sour. The design is both large and small scale project. It will be based on a flexible system which can be implemented in any area of work. This system includes:

a. Mandatory elements: these elements must be included in any area of intervention in order to fulfill the green affordable design.

b. Flexible elements: these elements vary from area to another according to the culture, society, climate, orientation, local construction materials, and function.

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