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# A Vision of Sustainable Design Concepts for Upgrading Vulnerable Coastal Areas in Light of Climate Change Impacts: A Case Study from Beirut, Lebanon

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**Abstract:** Rapid urbanization combined with the effects of climate change has increased the vulnerability of poor urban communities to natural hazards, particularly to informal settlements located in coastal areas. Apart from socio-economic challenges, the effects of climate change threaten the very existence of these settlements. They are particularly vulnerable due to their poor structural quality and lack of adequate infrastructure to mitigate the consequences of any natural event. The article highlights an informal settlement belt, located on the coastline of the southern suburb of the capital Beirut. This area is an example of a complex urban, social, and economic structure. As a result, this research speculates on the possible sustainable design solutions and tested development strategies through urban, architecture, and landscape design proposals, derived from interventions that succeed in facing similar challenges compatible with the studied context. The aim is to advocate for comprehensive consideration and transformation of coastal informal settlements that can be used to encourage neutralizing the obvious challenges of climate change in urban settings. Therefore, planning specifications and quality aspects for future coastal informal settlements are proposed and extracted. The research involves analysis of qualitative data rather than quantitative data, as there is not much definite information available in terms of statistics, such as review of publications and grey literature. The scope of the study ranges from microscale improvement to providing usable and accessible city-wide ecological urban settings and sustainable spaces with new standards for coastal informal settlements as a potential backbone.

**Keywords:** coastal informal settlements; urbanization; climate change; urban design; sustainable development; vulnerable community; mitigation



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## 1. Introduction

### *1.1. Rapid Urbanization and Growth of Informal Settlements*

For the first time in history, 55% of the world's population lives in cities [1], and urbanization is continuing to expand, a proportion that is expected to increase to 68% by 2050. With this growth, the numbers of the urban poor are increasing, particularly in developing countries [2]. Approximately 1 billion people, or one in seven people worldwide, live in informal settlements and slums in poor-quality houses or shacks [3]. Rapid and uneven economic growth has made coastal cities home to many vulnerable people. In the past 15 years, the number of inhabitants of urban slums has continued to rise worldwide [4]. Citywide case studies showed that it is common for cities to have 30–50% of their population in informal settlements. Although some have a higher percentage. Especially the cities located in the global south, for example, Nairobi (Kenya), 65% in Cairo (Egypt), 70% in Dar es Salaam (Tanzania) [5]. In the case of Lebanon, the total population

was estimated at 6,825,445 people in 2020, which is equivalent to 0.09% of the total world population, and 78.4% of the Lebanese population lives in urban areas (5,353,116 people in 2020) on the coastal plain [6]. Sixty-two percent of the urban population lives in slums [3]. The highest number of people are centralized in the capital, Beirut, with 1,916,100 residents. The coastal areas near Beirut have become attractive to the incoming population due to the existing infrastructure, but also the vicinity of a large urban center. The occupation of coastal areas is an important element of significant urban transformation noticeable in the country. This transition is chaotic and unplanned, leading to urban sprawl and the lack of development of an adequate physical infrastructure system [7].

Informal settlements often appear in certain geographical locations. They may be located on riverbanks, floodplains, coastal areas, hillsides, or next to landfills. These sites are chosen by residents because they are less likely to be expelled because the land is not attractive to developers. Generally, people who live in informal settlements suffer from destitution, high density, a contaminated environment, a high illiteracy rate, and a low level of security that make these areas prone to violence and crime [8]. Informal housing arrangements and configurations have low structural quality. As a result, most informal settlements are affected by high natural dangers. Consequently, the effects of climate change projections exacerbate the risk by increasing the frequency and intensity of extreme natural hazards, in particular floods, heatwaves, droughts, landslides, storms, wildfires, hurricanes, coastal erosion, and marine eruptions [9].

Informal settlements are arising for a variety of reasons in Lebanon. They are the result of different types of migrations which are a result of wars, rapid urbanization, a poor administrative system, and uneven development of the urban space. The country has faced a growth of informal development and the emergence of underserved neighborhoods mostly around the central district of Beirut [10]. The southern suburbs of Beirut, which are considered the periphery in Lebanon, were named the "belt of misery" in 1982 and were given the name Dahiye, which is located between the agro-industrial area of the Choueifat district and the municipality of Hadath (Figure 1) [11].

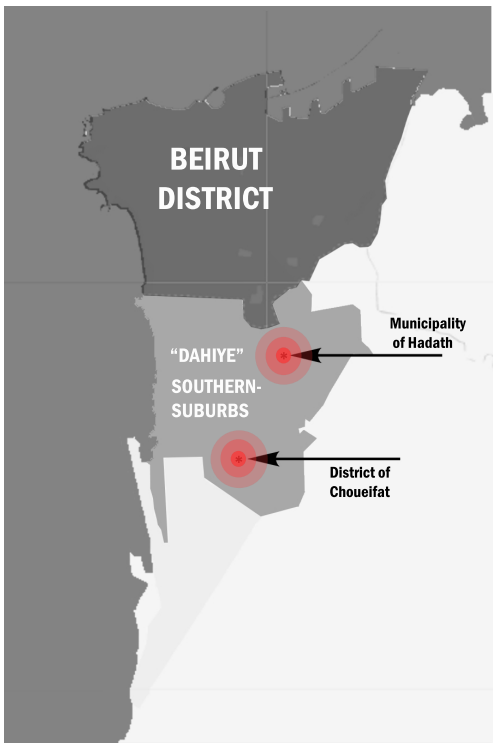



**Figure 1.** The geographical location of the "Dahiya", the southern suburb of Beirut, on the borders of the Beirut district, adjacent to the municipality of Hadith and the Choueifat district.

### *1.2. Background—Informal Settlements and Development*

This section includes different scholars' perspectives and debates regarding the phenomenon of slums and informal settlements in different subjects. The presented reflections have led to a better understanding of the different concepts (definition, appearance in urban contexts, and development) that brought new and clear observations and enable the objective of this study. The discussions are the following:

The first published definition of a slum was in 1812. Mike Davis, in his book, "Planets of Slums", gave it as a synonym for "criminal trade". The term "slum" was not used to refer to a place, but to describe a deprived social condition [12].

During the 20th century, the term "slum" was first associated with the spatial definition and was used to indicate a physical response to urban problems. Regarding the appearance of slums in the urban context, Henri Lefebvre, in his book "The Right to the City", clarifies that the urban-rural boundaries have blurred and created porous spaces of uneven geographic development that spread throughout the urban context, ignoring any hint of zoning, their availability, and proximity to jobs. He defines in this way the localization of slums within cities [13].

A new perspective was brought by Elliot D. Sclar and Mary E. Northidge by supporting the phenomenon of slums by defining them as follows: slums are not "the problem", rather they are the spatial manifestations of urban poverty, social exclusion, and inappropriate government policies [14]. Furthermore, the urban planner Alejandro De Castro pointed out that slums are the physical manifestation of urban problems related to poverty and/or inequality [15].

The term "informal settlements" was used for the first time in the Lebanon Crisis Response Plan, between 2017 and 2020. It referred to poor and illegal urban environments, which were established without the intervention or support of the official Lebanese authorities and in response to the needs of the population for temporary shelter [16].

The appearance of slums is an important matter related to two different concepts: slum upgrading, and slum clearance. The Authors support the upgrading action and empower their point of view by referring to the American-Canadian journalist Jane Jacobs as she argued in her book "The Death and Life of Great American Cities" that urban slum clearance does not respect the needs of the dwellers, and advocates for a certain scale and character of the urban fabric to support a diverse social ecosystem of interests, activities, and people. She clarified the danger of displacement and considered it a crime against identity [17]. An important factor addressed by the American urban planner Kevin Andrew Lynch was the positive impact of these urban spaces. Lynch argued that when they are properly reorganized, they become an impulse to the organization of urban spaces for the constant advancement of social, economic, and political progress in the form of a good city. However, he did not point to slums in particular, but his vision helps to understand the importance of rethinking this role of such an urban space and its role in building a prosperous city [18].

Regarding the comprehensive strategies of slum upgrading, Judith A. Hermanson, in her article "Slums, Informal Settlements, and Inclusive Growth in Cities", highlighted that since most of the growth in rapidly developing countries is taking place in informal settlements, she drew attention to comprehensive sustainable strategies that emphasize the role of community engagement and participation in this process to achieve equitable development [19].

### *1.3. Climate Change Risks—Urban and Coastal Areas*

Recently, there has been growing interest in the ability of cities and communities to adapt to climate change. Regarding the five global assessments conducted by the Intergovernmental Panel on Climate Change (IPCC) since 1990, it has been shown that over time, there is a growing interest in cities in climate change adaptation and mitigation [20]. A major focus appeared on urban climate change risks, global vulnerabilities and impacts in urban centers of all sizes, economic conditions and site characteristics, and a concentration

of major and emerging global climate risks in urban areas [20] (p. 538). In this context, the term resilience is explained as the ability to anticipate, absorb or transform when exposed to specific risks [21]. These risks are mostly concentrated in informal settlements and particularly those located in areas that are exposed to floods and/or landslides. For instance, coastal informal settlements are at high risk of sea-level rise and storm surges [22] that put residents in great danger and can cause devastation to the city, especially to poor urban areas (as in most informal settlements). In the context of Lebanon, different climate change measurements have been developed through the application of the downscaled General Circulation Model—PRECIS to anticipate changes in temperature and rainfall by the end of the twenty-first century. The results show that by 2040 temperatures will rise by about 1 °C on the coast to 2 °C on the mainland and by 2090 they will increase by 3.5 °C to 5 °C, respectively. There is another effect on the precipitation pattern which is expected to decrease by 10–20% in 2040 and later reach a decrease of 45% in 2090. A condition that is less humid and sustainably warmer will extend the time of warm and dry climate. Summer days will see temperature rise above 35 °C and tropical nights above 25 °C. In addition, drought periods across Lebanon will increase by between nine and 18 days by 2090 [23].

In addition, climate change will lead to a 40% to 70% decrease in snowfall and an increase of 2–4 °C respectively, shifting the altitude of ice life from 1500 m to 1900 m and a decrease in snowfall time from 110 days to 45 a day. This will affect the recharge of rivers and groundwater and will affect water availability during the summer season and dry periods. These changes are expected to have a variety of impacts on Lebanon's environment, economy, and social structure. An increase in wildfires, pest outbreaks, and sea-level rise will threaten fragile biodiversity, ecosystems, and natural habitats. Accompanying the pressure imposed by urbanization and population growth coupled with the limited availability of water and land resources, the field of agriculture is the most vulnerable sector with the overall agricultural yield of crops at risk. As a result, the total agricultural yield of crops will be affected and a decrease in production is expected. In addition, great stress will be placed on the energy production and supply system due to the high demand for cooling in summer. Water will experience a decrease of 6% to 8% of the total volume of water resources with an increase of 1 °C and 12% to 16% with a temperature increase of 2 °C [24] (p. 15).

The main factors of climate change affecting coastal areas are possible increases in sea level and sea surface temperature due to projected warming. Sea levels continued to rise at an average rate of approximately 20 mm/yr in the Levant Basin. If it continues in the future, it could reach 30–60 cm in 30 years, which will have an impact on the sandy beaches, and on coastal nature reserves. This will also lead to seawater intrusion into aquifers which will affect not only urban areas but also coastal irrigated agriculture. The potential impacts of climate change on the coastal region include coastal flooding, seawater intrusion and salinization of coastal aquifers, coastal erosion and loss of sandy beaches, degradation of coastal ecosystems and natural reserves, and economic losses to coastal activities such as tourism, agriculture, fisheries, transportation, and other basic services [24] (p. 16).

From the perspective of urban design and architecture, informal settlements are very dense with little open or public space and often with uninsulated roofs and poor ventilation [25], all of which contribute to increasing minimum temperatures that cause the spread of some disease vectors that could disproportionately affect informal settlement dwellers, especially due to the lack of public health measures [26]. Indeed, what should be added to the upgrading of informal settlements is a resilience lens that takes into account the potential current and future impacts of climate change [27]. In addition to the new financing models responsible for climate change, there is a need to support governments and stakeholders to work towards effective scaling up of these measures [28].

### *1.4. Policies and Strategies—Urban and Coastal Areas*

The Council for Development and Reconstruction of Lebanon in its report on its National Physical Master Plan for the Lebanese Territory (NPMPLT) in 2005 identified a

series of supplementary regulations and operational measures [29]. It aims to preserve, value, and increase the basic Lebanese resources in the coastal areas by proposing an adaptation strategy for integrated coastal zone management to regulate and control the urbanization of the coast. More specific measures against sea-level rise are to withdraw human activities from the coast by creating buffer zones, moving urban, industrial, and agricultural sources of pollution away from the coast, introducing effective early warning systems for coastal hazards and creating protective structures to limit potential damage. The NPMPLT was not implemented due to political pressure and lack of funds. However, the recommendations for actions for the coast are as follows [23].

- Management and maintenance of sandy beaches all over the coast.
- Classification and protection of historical and natural sites located on the coastline.
- Emphasizing the high environmental value of certain parts of the Lebanese seashore.
- Preserving and developing the seaside promenades and the Corniche.
- Preserve the picturesque coastal towns of their important tourist value.
- Allow public access to the seashore and the use of the maritime public domain.
- Adopting several legislative steps against illegal construction.
- Command on the administrative, judicial and operational demarcation of the Lebanese coastal region.
- Establishment of the National Agency for Coastal Zone Management by the Council for Development and Reconstruction, the Ministry of Environment, the Ministry of Agriculture, the Ministry of Public Works, the Ministry of Public Works, and the General Directorate of Communities.
- Restrict land reclamation to strategic public utility projects by preparing and enforcing legislation and enforcing the implementation of Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs).
- Stop extracting sand from riverbeds, dunes, and beaches.
- Restricting the dumps overlooking the sea and rehabilitating the existing ones.
- Re-conversion of urban fallow areas to preserve natural coastal areas.
- Reducing intensive agricultural practices and monoculture in coastal areas.

### *1.5. Focusses and Aims*

This article focuses on waterfront informal settlements as they are considered the most vulnerable and sensitive to the impact of climate change. These types of settlements are often found on the banks of rivers, lakes, canals, or ports [30]. This paper discusses a case related to an informal settlement located on the Mediterranean coast in the southern suburbs of Beirut known as Al-Ouzai/Jnah (Figure 2). This brought attention based on various aspects. First, given the importance of urgently responding to the threats to the urban poor (social, economic, and environmental), particularly in areas (coastal zone) that are highly vulnerable to the impacts of climate change. In addition to its strategic location on the outskirts of the capital, Beirut, the largest urban and commercial center in the country, and its extension along with the airport, which is seen as the first image of travelers coming to Lebanon and an important factor associated with its historical spatial transformation from a recreational area to a poor urban environment. These are discussed in a subsequent part of the article (Section 5). These matters are worth discussing in terms of improving the quality of living in these areas in the existing situation and mitigating the natural risks. In addition, the article presents sustainable design solutions dedicated to urban design, architecture, and landscape measurements. These solutions are inspired by six successful interventions that occurred at the international and national levels. These interventions were selected based on two criteria, first due to the comprehensive outcomes (social, economic, and environmental) that were achieved and approved. The second is due to their visible potential similarities with the context of the case study. The strategies picked from these projects are considered to be applicable lessons in the case of Al-Ouzai/Jnah, due to the possible similarities of the challenges. Since there is a lack of scientific sources

on the topic discussed in this study, the authors speculate on this and consider this point as a starting point for generating significant research interest in the future.

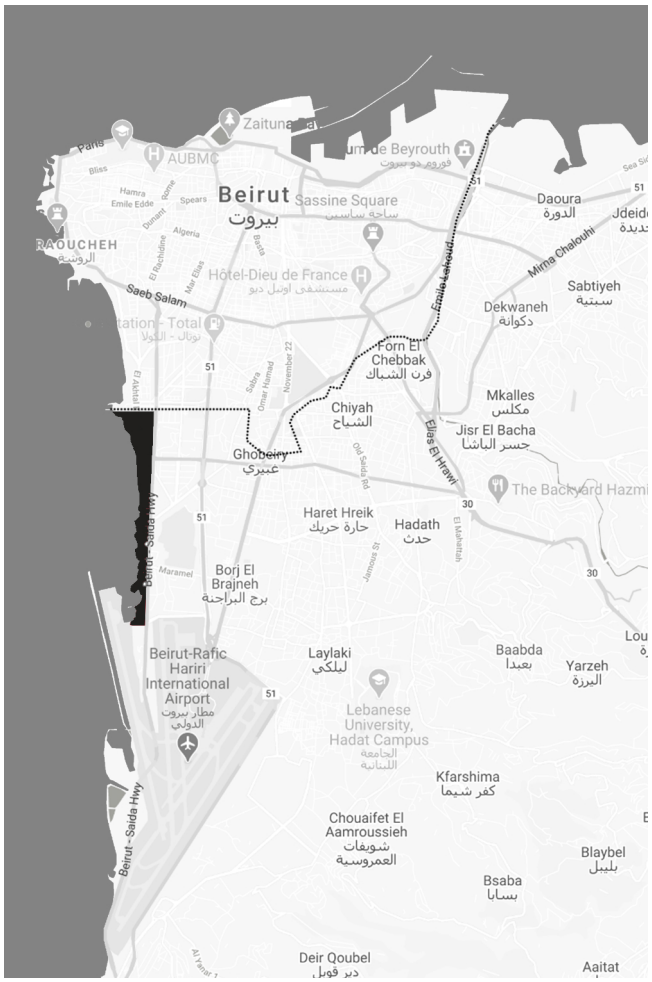



**Figure 2.** Geographical location of the case study, Al-Ouzai/Jnah—Coastal informal settlements area—marked in black. Source: mapstyle.

### *1.6. Paper Structure*

The remainder of this paper is organized as follows: Section 2 explains the research methods used in this study; Section 3 discusses the aspects of sustainability in the context of coastal informal settlements as laying the foundation that the development of these areas must recognize as the ethical value of sustainability by focusing on the three aspects (social, economic, and environmental). Section 4 presents and analyses the outcome of six well-known interventions, based on the published reports. Indeed, they were picked based on two factors: first, due to their possible similarities with the nature and challenges of the case study, and second, regarding their elaborated design strategies that respond to the aspects of sustainability addressed in the previous section. Section 5 presents the case study consisting of historical background, interviews and observations in the area, and SWOT analysis as a summary for the previous subsections. Section 6, presents the results as speculative future transformation visions, discussed as technical installation (urban, architecture, and landscape design). Section 7 is the final section, where the authors summarize the main findings of the research and pose new challenges that respond to the subject of this paper. This opens up a new area of interdisciplinary research.

## 2. Methodology

The paper employs a combination of theoretical and practical approaches that produce noteworthy results, which are used as interactive and efficient techniques to address site-specific development, explicitly by considering site circumstances.

Two main methods are adopted in this paper. The first method is based on a literature review of publications, official documents, and plans. The materials were selected based on their content highlighting general slum issues concerning the impacts of climate change and aspects of sustainability on coastal areas that further the purpose of this study. Another advantage of this methodology is that it allows us to carefully select and analyze six implemented projects from published reports and articles (document analysis). These are selected based on the possible similar nature of the case study. This specific nature was identified and explored and refers to the second method used.

The second method involves a site visit where photographs were taken, and unstructured interviews were conducted (discussed in Section 5.2). The respondents were informed about the purpose of the interview (open interview) that took place in different spots (public spaces).

These two actions led to the formulation of a SWOT analysis (phenomenological study). The combination of the analysis of the selected intervention from the first method and the SWOT analysis contributes to a speculative visions approach. These speculative sustainable development concepts are going to be a challenge, so visioning is a valuable way to test these ideas in a place where action would be challenging.

## 3. Aspects of Sustainability in the Context of Coastal Informal Settlements

The discussion presented before led to the formulation of three main aspects that must be taken into account when dealing with informal coastal settlements. These aspects address social, economic, and environmental issues to conceptualize the ethical idea of sustainability. In the following paragraphs, these aspects are presented.

Social Aspects. Starting with the term "sense of place" which can be defined as the relationship between a group of people or individuals and a spatial setting [31]. The social patterns of the coastal areas have their own identity, including a certain group of people who have a close relationship with the functions of these areas, transmitted from generation to generation, and have close ties to its potential from both the physical and spiritual sides [32]. We emphasize that the ecosystem service approach depends on the dimensions of these local communities whose focus is on coastal resource management.

Economic aspects. The Mediterranean abounds in natural resources in the form of rich production potential (fish and other seafood), and its natural beauty is one of the sources of a growing section of the economy that is important to increasing the regional and national income. This is coupled with the fact that the coastal areas are now considered one of the areas with the highest tourism growth [33]. For urban waterfront areas, improving the quality of urban spaces is a necessary step towards tourism, which is increasingly becoming an important factor in the decisions regarding locating investments and jobs. The tourist use of the natural and spatial environment of the waterfront should be more in line with the creative use of the area, respecting the spirit and history of the place, to create a new, high quality, and competitive image of the city [34].

Environmental aspects. From an environmental perspective, the coastal zone is considered one of the most dynamic environments that can be used for human life. However, this use should take on sustainable dimensions. In other words, any effort has to maintain the balance of people, fauna, and flora. Therefore, dealing with coastal zones demands taking initiatives based on addressing the protection, conservation, and management of coastal ecosystems and their resources [35].

These three aspects are the main pillar of the sustainable approach, which defines the criteria on which appropriate interventions are selected, as references and lessons responding to these challenges.

## 4. Selected Interventions—International and Domestic Level

Generally, the topic of upgrading informal settlements has attracted the interest of many experts and specialists such as architects, urban scientists, and sociologists, who have conducted studies and worked on developing programs and policies aimed at transforming these settlements. We mention here a few of them based on our review of some of their works, which are often focused on the global south (C. MacFarlane, M. Waibel, M. Lombard, H. Sarmiento, and Ch. Tilly, T. Cruz, and others).

Regarding existing developments that have happened in informal settlements, it can be concluded that there are a significant number of projects around the globe, particularly in the global south. These differ according to their scales and activities. The first type focuses on a small area and one problem without considering sustainable aspects. The second type is comprehensive and more effective than the first because it includes several activities and targets a wide range of challenges, offering a sustainable solution. We adopt the second type for the purpose of this article.

We consider six interventions from published documents, which took place at both the global and local levels (Lebanon). Each of these projects was selected and organized based on two criteria:

- First, it has brought remarkable potential at the social, economic, and environmental levels, which are the key aspects of sustainability, as discussed previously in Section 3. In this sense, they are considered as lessons, where their results will be discussed in Tables 1 and 2.
- Second, these interventions have adapted different sustainable techniques and innovations, through landscape, architecture, and urban design tools, which respond to similar needs and challenges to those of the Al-Ouzai/Jnah case that are addressed in Table 3. as findings based on the second study methods in this article (SWOT analysis). These findings focus on the three aspects of sustainability, in addition to the structural one that helped to understand the physical conditions of the settlement.

Given the unique status of coastal informal settlements by their location and nature, we believe that they require a combined approach, one that includes shore reclamation and another that includes the spatial development of the informal settlements. So, the picked projects are presented into two groups:

Group 1—Beach reclamation provides treatment for sandy and rocky beaches. By adopting the concept of landscape focus design and techniques used to rehabilitate the degraded natural environment, and to restore and reveal the beauty of the site for tourists and locals while transforming the former degraded beach into an ecologically healthy, safe, and aesthetically attractive environment. In addition, they should restore the harmonious relationship between people and nature through ecological design, using a variety of regeneration techniques to ecologically restore and transform the site into a pleasant, well-visited, safe area. Three case studies have been introduced here as successful references, discussing different approaches that revolve around shoreline regeneration (Table 1).

Group 2—Spatial development of informal settlements, indicating efficient development strategies: upgrading the quality of spaces in the coastal informal settlement can improve the educational, cultural, economic, environmental, and social concerns in the area. It provides sustainable approaches through architecture and urban design instruments, leading to comprehensive development. Such strategies can be activated by supplying users with facilities and services through delivering sustainable programs that function in the short- and long-term, providing a package of infrastructure improvements, social services, and physical restructuring. Three case studies are presented here, focusing on the development of poor urban area (Table 2).

The two groups of projects include four different measures such as transformation, reclamation, rehabilitation, and reconstruction. By implementing sustainable and efficient solutions, the achieved results proved that these projects brought potential on the three levels (social, economic, and environmental).

**Table 1.** Interventions responding to landscape focus design and techniques.

| Group 1 | | | | |
|---|---|---|---|---|
| **Project** | **Action** | **Techniques** | **Results** | **Factor Achieved** |
| **Keast Park—(Australia)** [36]. | Transformation from coastal dune to the built environment | Boardwalk that protects the restored dune landscape.<br><br>Green spaces—park and meeting areas. Outdoors installations for community physical activities | Explores the integration and overlap of multiple community facilities and activities, promotes a stronger sense of community ownership and engagement. Transformation from passive to active spaces took place. | Environmental<br>Social |
| **Qinhuangdao Beach Transformation—(China)** [37]. | Rehabilitation of damaged natural environment | Arranging a boardwalk that winds along the shoreline, linking different patches of plant communities, it also functions as a soil conservation installation that protects the shoreline from the erosion caused by the ocean wind and waves<br><br>Eco-friendly bases were designed using fiberglass and riprap technique that allows the boardwalk to "float" above the dunes and wetland. | Rehabilitation of the damaged natural environment restored and unveiled the beauty of the site to tourists and local residents.<br><br>Transformation of a former degraded beach into an ecologically healthy and aesthetically attractive landscape<br><br>Facilitates the initiatives of rebuilding a harmonious relationship between man and nature through ecological design | Environmental<br><br>Social |
| **Coastline Nourishment, Ashdod Port-Ashkelon Marina—Haifa Bay—(Israel)** [38]. | Mitigation of coastal erosion, displacement of sand to threatened beaches. | Placement of sand on the eroded shore to maintain the amount of sand present in the foundation of the coast to protect the area against storms.<br><br>The process involves dredging material (sand, pebbles) from a source area (offshore or inland) to feed the beach where erosion is occurring | Representation of a new approach to mitigating coastal erosion by adding suitable sand to threatened beaches<br><br>Maintains the width of beaches for tourism and recreational purposes. | Environmental<br><br>Social<br><br>Economic |

**Table 2.** Interventions responding to spatial developments of informal settlements.

| Group 2 | | | | |
|---|---|---|---|---|
| **Project** | **Action** | **Techniques** | **Results** | **Factors Achieved** |
| **Manguinhos Complex. Rio de Janeiro—(Brazil)** [39]. | Regeneration, building new network and facilities | Offering new social facilities, civic center including school, library, legal support office and squares<br><br>Building the "Manguinhos" train station | Creation of the new "Rambla" connective space<br><br>Re-qualification of broken city with new facilities.<br><br>Public spaces for social interaction<br><br>Satisfaction of different age groups, including sport, culture, and job opportunities. | Environmental<br><br>Social<br><br>Economic<br><br>Architectural |
| **Reconstruction of Nahr El-Bared Refugee Camp—(Lebanon)** [40]. | Reconstruction of destroyed camp | Rebuilding dwellers' homes, commercial services, mosques.<br><br>Implementing new infrastructure.<br><br>Offering new public spaces and green areas. Rebuilding local health clinics<br><br>Recreating physical and social fabrics were primary considerations.<br><br>Workshops organized with encouragement from the municipality | New working relationships with the community, the Lebanese government, and various local and international stakeholders<br><br>Increased sense of belonging and community responsibility.<br><br>Social interaction (resilient community) | Environmental<br><br>Social<br><br>Economic<br><br>Architectural |
| **Rehabilitation of Old Saida residential neighborhood—(Lebanon)** [41]. | Rehabilitation of historical neighborhood—vulnerable urban areas | Alleviating poor housing conditions for vulnerable families (host and refugee)<br><br>Protecting historic buildings from physical damage or destruction<br><br>Securing and improving livelihood opportunities within neighboring markets<br><br>Rebuilding infrastructure | Increased awareness within the community about the importance of cultural heritage sites<br><br>Created sufficient access to basic urban services in the neighborhood | Social<br><br>Economic |

**Table 3.** Features of SWOT analysis based on the analysis performed in the study area.

| SWOT Analysis | | | | |
|---|---|---|---|---|
| **Factors** | **Strengths** | **Weaknesses** | **Opportunities** | **Threats** |
| **Environmental** | The coastal zone can be used as a way to reduce heat in inland urban areas. | Household waste and garbage bags create a kind of border between the sea and the settlements.<br><br>The infrastructure is in bad condition, which reflects directly on the environment by rainwater flooding in winter seasons.<br><br>The absence of a garbage collection service.<br><br>The sewage canals produced by the settlements, run throughout the entire neighborhood until the sea, through concrete canals, which form pools of stagnant sewage along the shore, which constitutes a major disease-risk factor for the inhabitants of the area and affects ground-water pollution.<br><br>The spread of cardiovascular diseases, dwellers are exposed to pollutants and infected by respiratory diseases or lung cancer, due to the proximity of the area to Rafic Hariri International Airport (aircraft emissions) and the Costa Brava landfill, promoted as a temporary solution to the trash crisis that Lebanon suffered in 2015. | Beach nourishment, flood defense wall, dunes, rip rap technique, boardwalk merged with vegetation<br><br>Encouraging urban farming can reduce greenhouse gas emissions associated with transportation and biodiversity. | Rising temperatures, rising sea levels, heavy precipitation (heavy rain and hail), degradation of the shore, strong floods might cause the death of residents and completely destroy the settlement structure. |

**Table 3.** *Cont.*

| SWOT Analysis | | | | |
|---|---|---|---|---|
| **Factors** | **Strengths** | **Weaknesses** | **Opportunities** | **Threats** |
| **Social** | People stay within a close radius of their house, as relatives and friends live in proximity (sense of unity). | Minors work illegally all over the city, in such jobs as automobile service and furniture design workshops, electronics stores and hairdressers, and even small restaurants and cafes.<br><br>Kids play under sunshades, on the streets with little traffic.<br><br>Absence of judicial and security procedures.<br><br>Low level of education. | Provide training programs to increase local skills.<br><br>Empowering women by involving them in economic activities (providing job opportunities)<br><br>Build an engaged community by involving the in the development process (sense of responsibility and awareness)<br><br>Encouraging children and adolescents to enroll in schools and universities by providing workshops aimed at raising awareness as well as promoting the facilities and services that will be provided by the Transformation Program (Safe and pleasant Connection through Streets) | Human loss due to outbreaks of crime due to poverty and low security. In addition to the outbreaks of epidemics due to pollution and poor health conditions. Social isolation that threatens mental health |
| **Economic** | Commercial facilities are located along the Beirut-Saida highway. The shops include car parts sales and car repairs, office furniture, bathroom, and kitchen fitters, electronic services, and hairdressers.<br><br>Street vendors sell fruits and vegetables on the Ouzai Boulevard highway, which also benefits strangers, and drivers passing by.<br><br>Some dwellers depend on fishing activity as a source of income, using old wooden boats, which are always left randomly on the beach for the next working day. | Illegal and unregistered business.<br><br>Unsafe work for minors.<br><br>Lack of diversity in work and relationships on a larger scale.<br><br>Limited skills in using innovative tools.<br><br>Low-incomes for families. | Economic development for the sector through the development of the coastline and the main commercial spine.<br><br>Boasting tourism in the coastal zone. | |

**Table 3.** *Cont.*

| SWOT Analysis | | | | |
|---|---|---|---|---|
| **Factors** | **Strengths** | **Weaknesses** | **Opportunities** | **Threats** |
| **Structural** | The settlement is located in a strategic location at the southern edge of Beirut—in the middle coastal area of the country.<br>The area has an excellent external road network and accessibility with national roads and the Beirut-Saida highway.<br><br>Proximity to the Rafic Hariri International airport.<br><br>Proximity to wealthy urban and other coastal areas.<br><br>The settlement hosts a variety of service buildings and public institutions, such as workshop places, schools, and hospitals, which are spread throughout the whole site in medium conditions.<br><br>Availability of religious places in the area. As the majority of the inhabitants are Shiites, most of the mosques in the areas exist in good condition satisfying their needs.<br><br>From the mobility point of view, the inhabitants of the area do not rely on cars much as all services are available in the settlement or the close neighborhood. | Poor technical condition of the infrastructure, buildings conditions are a major threat to public safety, as most homes that suffer from cracks are threatened with collapse.<br><br>Poor construction material.<br><br>Poor structure systems.<br><br>Absence of public spaces and green areas.<br><br>Absence of natural lighting and ventilation.<br><br>Traffic jams by the commercial entities.<br><br>Irregular inner networks, poor quality of the inner road networks.<br><br>Absence of infrastructure for rain drainage, lighting, and traffic signs.<br><br>Lack of organized parking, many cars are parked alongside the streets, the most common vehicles are scooters and motorbikes, with many taxis, and small buses are driving around.<br><br>The beach is not used for recreation in the way somebody acquainted with tourism would expect. | Rethink the role of the informal settlements in the urban spaces.<br><br>Take advantage of the coastal area by merging upgrading and climate change adaptation and mitigation actions.<br><br>View the urban development of the case study as creative action.<br><br>Consider sustainable solutions as crucial aspects in the development. | The area will be at high risk of natural disasters.<br><br>Human losses caused by poor structures (falling).<br><br>The neighborhood appeared as a neglected urban structure. |

## 5. Case Study—Al-Ouzai/Jnah

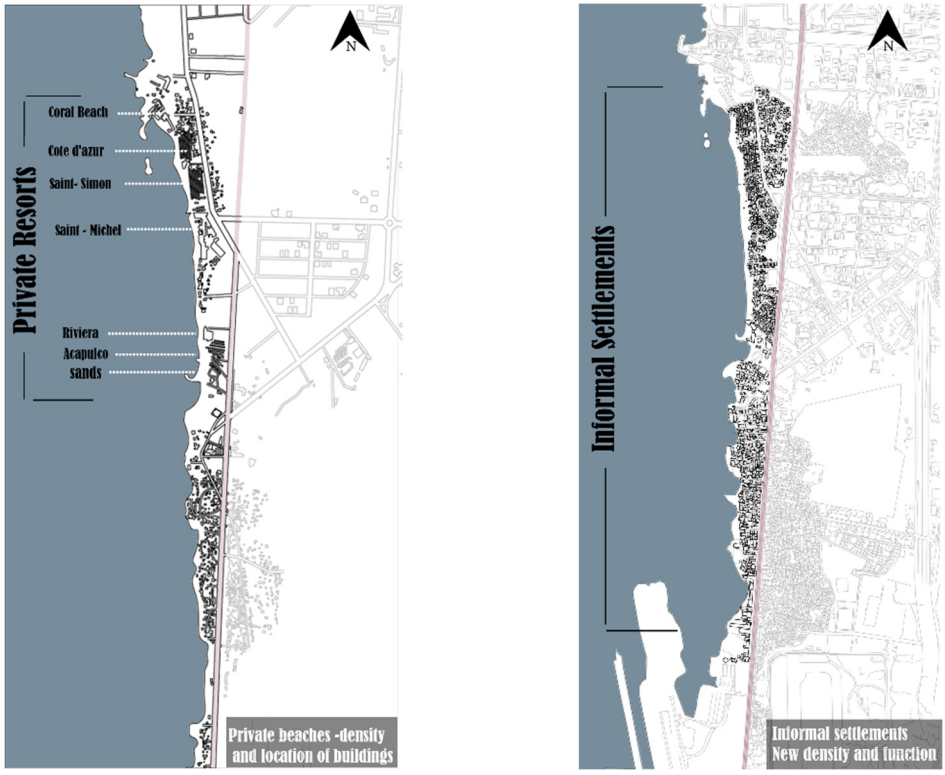
### *5.1. Historical Background—Transformation*

The brief history derived from the literature was considered by the authors to be crucial in this study. The discussion of the development of the case study starts from land development. The land in the southwestern area of Beirut started to be parceled in the 1930s under the French Mandate, although Beirut's city border reached the north of the area as early as 1914. Sand dunes and forests cover the largest part of the area.

After the establishment of the airport in 1936, more attention was drawn towards the South. In the 1930s, the first beach resorts started to be planned and built on the north of the coastline. At this time, the city reached the area and wished for beach resorts to evolve, as tourism was becoming popular. The next step in the development of this area was connected with beaches that were closed to the wider public and became private (Figure 3a) [42]. During the 1960s, the beach resorts were developing and from this time, the degradation of the coastline began. Later on, the sprawl of informal settlements is visible in this place, triggered by the Lebanese civil wars (1975, 1990) and two Israeli Invasions (1978 and 1982), and the Israeli occupation of South Lebanon (1978 to 2000).

Nevertheless, squatting and informal settlements have existed in the Al-Ouzai/Jnah area since the 1950s. The Israeli invasions of southern Lebanon in 1978 and 1982 forced thousands of families to flee to the southern suburb of Beirut, which led to them occupying the vacant hotels and transforming them into housing blocks. Other structures were modified through the addition of more floors, and new houses were also built through encroachment on land [42]. The fallout from the war had a strong impact on the Al-Ouzai/Jnah coastline in particular, where refugees from Qarantina and Palestinian camps settled in the area. The population density of this place has risen sharply (Figure 3b).

It can be concluded here that a series of historical events brought a new reality in terms of the value and use of the spaces. In the case of the Al-Ouzai/Jnah informal settlements, the area transformed from recreational areas (resorts) for wealthy people, into a precarious, degraded area—home to thousands of illegal settlers. Hotel buildings became houses for the homeless and in-need people. The architecture of recreation areas had to be adjusted to new circumstances. Luxurious resorts with their open spaces for rest had to be transformed to meet the needs of new residents.




(**a**) (**b**)

**Figure 3.** (**a**) History: Appearance of recreational areas (well-known hotels) in the 1930s. (**b**) Transformation: The existing density and function of the area—transformations to informal settlements.

### *5.2. Interviews with Inhabitants and Observation*

The unstructured interviews and observations (practical approach) that were applied as the second study method in this article were carried out spontaneously on site. This method can be considered a phenomenological study that contributed to the generation of qualitative data. In total, 14 residents were interviewed, seven individuals and two groups constitute of two and five people. The interviewees belong to different age groups, gender, types of workers, and nationalities who were questioned to reflect on the different issues that are perceived and documented in photographs. Respondents were involved freely by choosing their own words. The observations and feedback presented below have contributed to obtaining environmental, social, and economic information on specific issues in the area from the residents' perspective and experience. In addition to realizing local knowledge, values, and beliefs. This qualitative data can be taken as evidence. It is worth mentioning that this method includes challenges and dangers, due to the lack of security and fear from intruders.

Regarding services and facilities, the settlement showed a variety of service buildings and public institutions, such as workshops, schools, hospitals, and religious places which are spread throughout the whole site in medium conditions. Commercial facilities are located along the Beirut-Saida highway. The stores include auto parts sales and car repairs, office furniture, bathroom, and kitchen fitters, electronic services, and hairdressers (Figure 4).

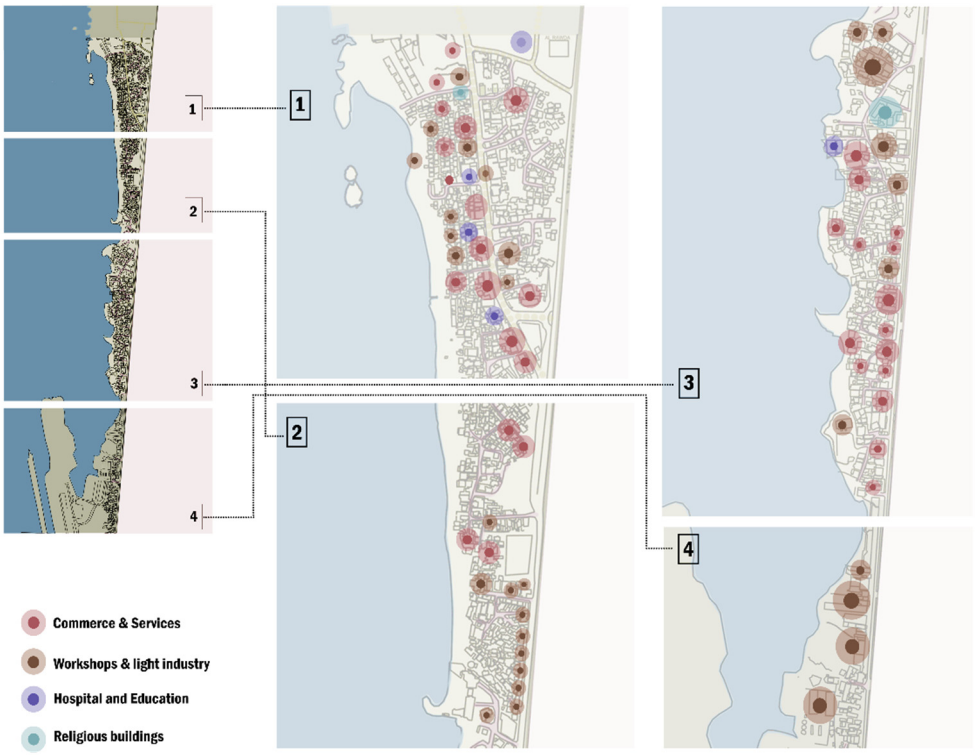



**Figure 4.** Mapping services and facilities in the study area, based on site visit.

Male Garage owner, a specialist in car services, said:

*"We are very fully satisfied, we are close to all amenities, therefore we don't need to travel to the city or elsewhere"*

There are sewage canals produced by the settlements that run throughout the entire neighborhood until the sea (visible in the northern part), pools of stagnant sewage form along the shore in concrete canals (Figure 5a,b) [43].

Middle-aged fisherman said:

*"Look at these sewerage canals, they are a huge disease-risk for the inhabitants of the area and it's causing underground-water pollution"*

Concerning health risks, the studied area is exposed to a high level of pollution. Household waste and garbage bags are distributed along the shore (Figure 5c).

Housewife, a mother of four kids, said:

*"These bags of trash appeared as mountains because there is no "collecting garbage" service which the city should provide. To get to the bins, we need to walk from this spot approximately 15 min, however, the trash bins are always full, and nobody cares to collect it"*

This is due to the proximity of the area to the Rafic Hariri International Airport (aircraft emissions) and the Costa Brava landfill, which was promoted as a temporary solution to the trash crisis that Lebanon suffered in 2015 [44] (Figure 5d). Both facts contribute to increasing the air pollution in the southern suburb of Beirut.

A Palestinian lady said:

*"Residents in this area are vulnerable to cardiovascular diseases. They are already exposed to be infected by respiratory diseases or lung cancer"*

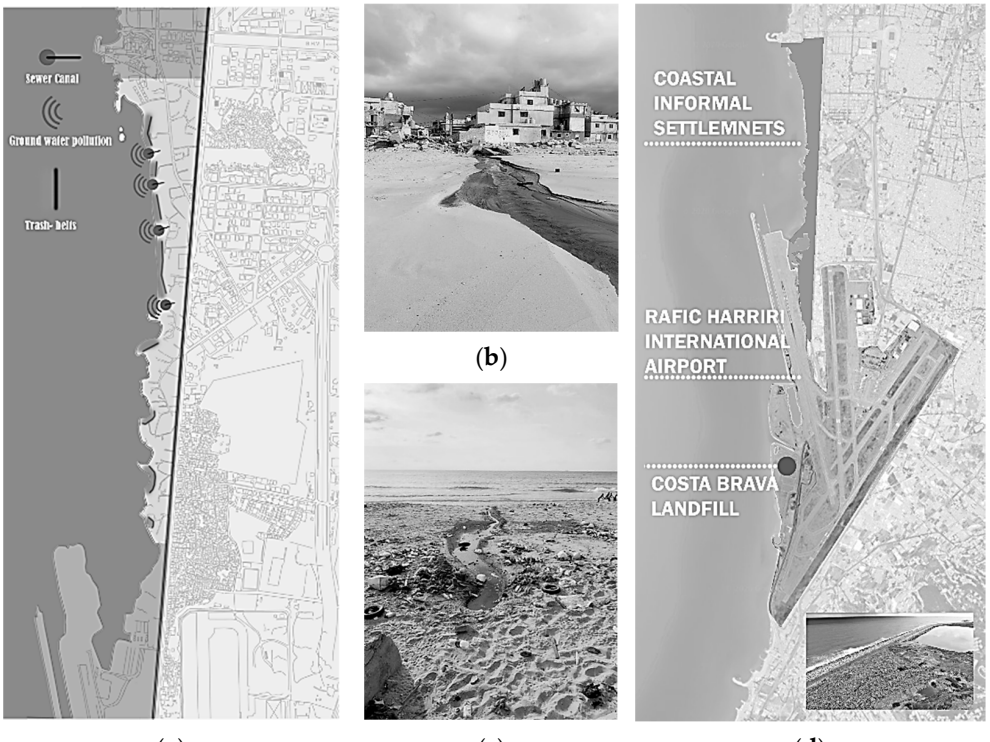



**Figure 5.** (**a**) Location of sewerage canal and trash on map. (**b**) Site observation: one of the biggest canals in the area. (**c**) Site observation: accumulation of trash. (**d**) Costa Brava landfill and airport pollution.

Regarding the structural analysis, the current situation can be presented as follows: most of the structures are located directly on the sea, with very poor connections. It seems that the settlement structure blocks the accessibility, where the only method of access is the narrow streets that move downward in slopes. Concerning the location and structure of the buildings, they are built directly on the sandbanks, due to the typography of the terrain with poor structure and old material (cracked walls) (Figure 6a). Concerning the size of the spaces:

**Figure 6.** (**a**) Existing structure: Poor, "cracked" building condition (**b**) Street vendors on the highway. (**c**) Football playground. (**d**) Narrow alleys used as playgrounds. (**e**) Group of teenagers dragging an old fishing boat to leave it for the next day. (**f**) Absence of parking plots. Cars park randomly.

Cafe owner, said:

*"I have a place to sleep, very close to the sea, when I arrived here, my cousin offered for me his rooftop to build a shelter, during stormy weather, waves crash directly on the walls of the houses lined up along the seafront. This creates a problem with dirty saltwater getting into living rooms and damaging furniture and possessions in most of the houses in line with mine"*

Street vendors are considered to be an integral part of the urban economies in the area; they mostly stand along the highway, offering a wide range of goods and services. They sell fresh vegetables on wooden carts (Figure 6b).

Street vendor, said:

*"I sell Bananas here from morning to evening, this job is not the best, but I can collect some money at the end of the day to support my family"*

The beach appears as an outlet for the settlement; however, the residents do not seem to have a good relationship with the shore. Some kids and middle-aged people appeared to be practicing fishing activities.

A group of five teenagers said:

*"We don't go to school, we usually spend our time here on the beach to support our family in fishing activity (dads and uncles), and at the end of the day, we sell a few kilos of fish. When we are tired, we go to the football field with friends"* (Figure 6c,d).

A remarkable fact, due to the haphazard nature of the crowded buildings that were built in different sequences, is that the residents were able to create narrow links and lanes moving in straight lines through the different neighborhoods. This makes the inner alleys seem active as the population flows in different directions [45].

Two male teenagers, said:

*"We spend most of the day in the inner alleys, they are our second home, we play football, eat sandwiches under the shade of the staircases and much more, they seem unsafe due to the flow of cars and motorcycles all day long and the absence of lighting at night"* (Figure 6e).

Regarding mobility, there are plenty of cars and motorcycles in the area.

An elderly man said:

*"there are some open spaces in the area, however, they are not used efficiently, people think that those spaces are their property, and they randomly park their cars close to their living places"* (Figure 6f).

### *5.3. SWOT Analysis*

The SWOT analysis method (presented in Table 3) assesses the Strengths, Weaknesses, Opportunities, and Threats involved in the Al-Ouzai/Jnah informal settlement. Factors and elements in this analysis were directly enabled by the second method used in this study (interviews and observation). In this SWOT analysis, four factors are presented (environmental, social, economic, and structural), along with the first three factors that are the main aspects of sustainability presented earlier in Section 3. The structural factor analysis helped to understand the challenges and issues related to the infrastructure and physical structure of this settlement, laying the foundation for the speculative transformation (more visible in the opportunity section) which is a vision in the subsequent section presenting the physical transformation (landscape, architecture, and urban design).

## 6. Results

### *6.1. Strategies and Speculative Vision towards Upgrading Actions for the Al-Ouzai/Jnah Settlement*

These visions rely on two aspects in this study. The first is based on an analysis of the outcomes achieved in the chosen projects (presented in Tables 1 and 2). The second based on the SWOT analysis brought a better understanding of the challenges and issues. The combination of these two aspects can be concluded in this way: the outcomes are considered to be applicable lessons and good references to rely on, due to their possible proximity with the case study challenges. The addressed strategies in this section present principles of urban resilience, illustrated by the landscape, architecture, and urban design tools that operate across the sustainable systems of infrastructure and physical structure. Three dimensions were taken into account to measure the efficiency of the speculative visions: socio-economic, ecological environment, and morphology (physical structure).

From our perspective, implementation of these concepts will be a challenge, so we consider the speculations to be relatively easy and a valuable way to test these ideas in a place where action would be hard to happen. The speculative visions are presented in the following paragraphs.

#### 6.1.1. Landscape Speculative Vision

Taking into account the relationship between the settlement and the coast as an intimate relationship, stereotypes made the site invisible and neglected on a city scale. In reality, the area is vibrant, hosting various activities by dwellers, including fishing, jogging and walking, playing soccer and volleyball, and dining in local restaurants while watching the sunset. Urban development should occur at two levels, progressing in parallel: reclaiming the shore and upgrading the settlement. The developments are designed to strengthen the relationship between the landscape and settlements, creating safe and sustainable bonds that eliminate the threats and promote a resilient community that is ready to thrive and face challenges on its own. The proposed concepts related to landscape treatment are inspired solutions (presented in Table 1). The lessons derived from the intervention presented in this section paved the way for the coastal region to meet the challenges. The techniques provide resilience to floods, more open spaces, enhanced infrastructure, and a healthier environment. The vision can be achieved through eco-friendly installations as follows:

- Sand dunes—the Geotextile sand tube method: artificially reconstructing sand dunes by collecting local sand into tubes with geo-textile layering and manually planting the dunes. The incorporation of the geotextile layer into tubes acts as a protective layer from possible polluted groundwater and the disturbed sand surface.

- Boardwalks merged with vegetation—floating on the sand dunes, offer a pleasant safe path along the shore.
- Rip rap stone—bridge foundations, steep slopes, and other shoreline structures to protect against scouring and erosion.
- Beach nourishment—for the northern part—a wider and higher beach can provide storm protection for coast structures, create new habitat and enhance the beach for recreation.
- Fishing docks—encourage fishing activity, by providing safer multifunction platforms for hook fishing.
- Flood defense wall—such structures protect areas of human habitation, conservation, and leisure activities from the action of tides, waves, and possibly even tsunamis, and protect the coast from erosion.
- Harbor regeneration—organize parking for fishing boats and yachts, provide a vivid area for social interaction and a transportation opportunity—improve the connection between zones located on the coast from the north to the south of Lebanon.

#### 6.1.2. Architecture Speculative Vision

Despite the complexity in such poor urban areas, the study attempts to diagnose and define architecture as a spontaneous development. We looked at urban morphology as production, every house and lane are individualized and different, monotony is avoided, dwellings are closely packed and planted on the outskirts of the city coastline. The upgrading solutions in this part are inspired by existing solutions (presented in Table 2). The goal here is to improve the visual image of the settlement by replicating features from the Mediterranean architecture of old Arabic port cities by considering the following:

- Façades and balconies are refurbished and painted in bright colors.
- Degraded structures—rebuilt and expanded as required.
- Balconies and open roofs rich with greenery—encourage residents to practice urban farming activities and create a healthy environment.
- Buildings' thresholds and circulation—cross ventilation is dramatically increased, creating an efficient solution to face a hot and humid climate during the summertime.
- Construction material—range across plastic, timber, brick, and concrete, available and suitable for the culture, climate, economy, density, and geography meet the basic criteria: low cost and easily transported.

#### 6.1.3. Urban Design Speculative Vision

Urban Design can have an ethical and aesthetic power to build social relationships and blur the distinction between an "informal", neglected urban area with the centralized, "formal" urban area, which promotes more societal stability and its common interests but without destroying the uniqueness of each social group.

The study proved that these spaces are used efficiently and creatively. The boundaries between public and private are blurred and include innovative compromises. Residents congregate and connect on streets, rooftops, and narrow alleys, children play under staircases and in neglected spaces, garages, and soccer fields, and the beach is the most used place to spend time. This common understanding and sophistication come from many years of trial and error, but also from the need to minimize waste. Therefore, the proposed tools are based on cautious and flexible approaches that intend to rethink the spaces and avoid harming the social, economic, and environmental aspects. The proposed tools are presented below, rely on the outcomes of the intervention, and depend on the authors' perspectives.

Improve streets and narrow alleys: Asphalt, sidewalk, ditches and crack treatment, main surface water drainage, implementing bollards to stop cars from plowing into crowds, solar LED streetlights. Alleyways are lined with colorful pot plants, streets are available for services (e.g., emergency services and supply stores).

Upgrade open spaces: Open spaces are transformed under the criteria of equity, quality, accessibility, and security, aiming to increase cultural vitality. A new meaning

of life given to the community presents opportunities to spend a pleasant time in open spaces, transformed from forgotten and degraded dirty areas into a vibrant and functional one, rich in bright colors that aim at social recognition and self-esteem, social activities, greenery (plants and trees), the playground areas depending on the scale of the treated area, public furniture (from recycled local material) and different flooring materials (recycled) and colors. A new reality that brings confidence about the future.

Encourage urban farming concept: Bearing in mind the high humidity and access to water in the area: planting fruit-bearing trees and plants (e.g., date palm, apple, pear, cherry, peach, loquat, fig)—relying on herbal farming on open roofs and spaces, which is considered an essential component and source of nutrients in Lebanon (e.g., lettuce, cabbage, dandelions, rocket, parsley).

Public services: Activate public services (clinics, libraries, schools, community centers, workshop spaces, kindergartens). Reconstruction action towards existing services if needed (e.g., schools, clinics) and proposing new public buildings that contribute to filling the gaps and empowering the socio-economic structure. Enabling the concept of multifunctional spaces, in which residents tend to share open spaces, for example, youth sports fields may function as community centers.

## 7. Discussion

Improving the quality of slums and informal settlements is one of the biggest challenges facing many contemporary city governments. Different approaches have been taken toward this issue. One response to prevent augmenting urban poverty involves the relocation of residents to resettlement sites that are usually outside of the city. Slums emerge in city centers because these were places where the poor can find work more easily. Therefore, moving the people or replacing their physical facilities do not work properly.

A second approach is redevelopment. It means temporarily moving the slum residents, clearing the land, and building new housing for them on the same site. High-rise buildings are often proposed in order to house more people [46].

Both methods proved to be expensive and socially disruptive, but it is still practiced in some countries. In Lebanon, the state has launched several campaigns to clean up slums. These operations were targeted specific neighborhoods, often taking the form of political revenge rather than actual politics.

The first operation dates back to 1958 in the Ouzai area (the southern suburb of Beirut). This process did not succeed in expelling the population [47]. Another operation was organized in 1983 under the supervision of the newly elected President Gemayel. It was attempted to demolish a large part of the slums in the southern suburbs of Beirut. This action was discontinued due to social resistance but managed to demolish about 400 homes and shops in the sand before the operation was stopped [48] (p. 31). Both attempts targeted partially the case study on which this article focuses.

An alternative approach to evicting people or replacing their homes is upgrading or also called "in-situ slum upgrading". It takes place through the process of the redevelopment of the areas by providing dwelling space and other basic civic and infrastructural services to the slum dwellers, up to a satisfactory standard, on the existing land on which the slum is based.

In the late 20th century, this concept has become one of the common effective ways to improve housing conditions in cities located in the global south, such as Brazil, Egypt, Mexico, Colombia, South Africa, Thailand, and more. The main advantage of this method is that it keeps the social networks of the dwellers and the cohesiveness of the community intact while improving their living standards [49].

This program has a scope that has reached a significant proportion of the urban population. According to David Satterthwaite, slum upgrading interventions varies from some minor improvement focus on a small scale and one problem for instance (communal water tape, paved roads, and street lighting) to comprehensive and more effective intervention focus on improving the overall quality of buildings and infrastructure, this included many

activities and objectives on a wide range of challenges [50]. The success of these interventions is attributed to the political commitment, including legal and regulatory reforms in land policy and land regularization [8].

Recently, the concept of slum upgrading has been developed, drawing attention to the need to respond to aspects of climate change and sustainable development as well, especially to informal settlements and slums located in areas highly vulnerable to climate change. For instance, (IPCC) emphasized the urgent need to build resilience to climate change in informal settlements [20]. Further, PRECIS anticipates changes in temperature and rainfall by the end of the twenty-first century in Lebanon and stresses the need for urgent actions to protect inhabited areas at risk [23].

Scholars such as Judith A. Hermanson and David Satterthwaite have discussed the concept of building climate resilience in informal settlements and inclusive sustainable strategies. They have also identified specific measures to build resilience while upgrading informal settlements. The highlighting ways in which informal settlements upgrading programs can act to reduce hazards, reduce risk is going to limit exposure to hazards, and increase resilience among vulnerable populations [19,21].

The issue of protecting vulnerable areas in Lebanon is not taken seriously. It is the result of the absence of economic and political visions and measurements in the region. The government's lack of interest in this type of informal settlement is due to the poorly developed management system that exists in the country. The needs of society and their quality of life are less valuable than political benefits and power.

It was visible in National Physical Master Plan for the Lebanese Territory (NPMPLT) which was launched in 2005. It defined a series of complementary regulations and operational procedures especially in targeting coastal areas. Unfortunately, those requirements were not implemented due to political complexity and lack of funding [23]. However, some updated initiatives were proceeded with success, for example, UN-Habitat Lebanon and UNHCR (United Nations High Commissioner for Refugees) with the support of other organizations. Recently, they had put a lot of effort to formulate clear policies and strategies through publication, also some small-scale interventions. The organization published a three-year program 2021–2023 Habitat Country Programme Document (HCPD) which includes three interlinked and mutually reinforcing focus areas that target informal settlements (promoting inclusive and sustainable urban development, encouraging participatory urban planning, management, and governance, and improving disaster risk of mitigation and effective urban crisis response) [51]. Moreover, the organization is not only involved in theoretical planning, but also in implementation processes. One of the most recent successful approaches has been realized in Al-Jazzar Street, Sabra (informal settlement), in Beirut, to "rehabilitate 22 building facades, improve street mobility and safety, and access to basic urban services" [52].

Generally, most informal settlement development programs are not designed in response to climate change. Although some literature is available on the subject, the practical actions and visions remain weak. This aspect has not been taken into account due to the low government interest, which views informal settlements as a burden with great complexity and low economic benefits, which means that the formal sector has priority over the informal one in taking action towards implementing urgent solutions to address climate change. This is evident in the many interventions that have taken place in various cities around the globe with different systems, such as Bogotá (Urban Transportation), Copenhagen (Carbon Measurement and Planning), Melbourne (Energy Efficient Built Environment), Mexico City (Air Quality), and Munich (Green Energy), New York City (Adaptation and Resilience), Rio de Janeiro (Sustainable Communities), San Francisco (Waste Management), Singapore (Smart City Infrastructure), and Tokyo (Finance and Economic Development) [53].

We criticize this inappropriate fact of pro-environmental policy and stress that urgent action must be taken primarily in degraded urban areas and especially in informal coastal settlements that are at risk due to the lack of their protection policy. In addition, the case discussed can be considered as the first stage of protection of the city shield, given its

geographical location, next to the seashore, which is crucial for environmental protection at the interface between land and water.

It is worth noting that some scholars worked on the same case. They focused on the roads of the area by presenting an exploratory study based on an assessment of observations between 2017 and 2018 claimed to formulate a strong basis for an in-depth future investigation into the area. Their research uses a comprehensive SWOT analysis approach that covers the primary outcome of sustainable development "thus providing the basis for future research that aims to find practical solutions to raise the level of the area sustainably" [54]. In this sense, the scholars' work contributed to empowering and furthering the purposes of this paper.

Overall, this study presents an alternative perspective regarding traditional strategies and policies towards slums and informal settlements (e.g., slum eviction or upgrading without considering sustainable development). The alternative way of protecting the slums can be a base foundation on which upgrading coastal informal settlements action and climate resilience and disaster risk reduction can be fully integrated. The results discussed in this paper shed light on a speculative vision aiming for a coherent approach to think about the city and environment as one organism. The authors emphasize the efficiency of sustainable design concepts, addressed by the landscape, architecture, and urban design tools in transforming coastal informal settlements. These concepts focus on addressing the impact of climate change and mitigating risks to the existence and population of these vulnerable areas which was mentioned by previous studies. The authors clarify that the presented visions are not to be strictly implemented, but rather could be considered as an opportunity or a successful backbone to discuss with the community and stakeholders. It could be a suggestion for other coastal cities with similar problems. The physical, social, economic, and environmental improvement should be performed cooperatively between the local citizens, authorities, community groups, organizations, and businesses.

## 8. Conclusions

Rapid urbanization in low- and middle-income countries has been accompanied by the rapid growth of highly vulnerable urban communities living in informal settlements. These settlements comprise more than a fifth of the world's urban population and represent one of the areas which is most vulnerable to climate change. Many are located in regions highly vulnerable to the effects of climate change such as coastal settlements. Without effective policies and procedures, governments and decision-makers are putting these areas at massive risk. The study underscores the urgency of responding to these issues pointing to a case study located on the Mediterranean coast—city of Beirut, Lebanon (Al-Ouzai/Jnah) with a better understanding of local issues to identify and produce a new urban structure that can encourage a dynamic transformation and forming a new image of the informality. Therefore, these informal coastal settlements can become places for exchanging ideas, and a structure that evokes an innovative way of design thinking that will also influence other cities located on the coastline. In this paper, a step is taken beyond the theoretical frameworks. An alternative approach occurred through (transformation visions) that carry the concept of sustainable development by tackling climate change impacts, considered as a new at-tempt account to support city governments and other local actors in the implementation process. Evidence and the basis for these visions are derived from implemented interventions and strategies developed that have successfully met the needs of the population and the physical environment.

These interventions were selected and organized based on two criteria in the two complementary subjects: upgrading informal settlements and tackling climate change. These examples have been selected based on the remarkable potential they bring on social, economic, and environmental levels. They are key aspects of sustainability, and the adaptation of various sustainable technologies and innovations, through the landscape, architecture, and urban design tools, which respond to such needs and challenges that are consistent with the study case.

Finally, we pose some questions that will open a new area of interdisciplinary research. What scale of intervention should be taken to link these coastal informal settlements with the city structure? Should the policy regarding upgrading informal settlements be complemented? What are the new activities that should be associated with landscape architecture and urban design and climate to change impacts in coastal informal settlements? What are the sustainability-related policies targeting coastal zones in general and waterfront informal settlements in particular?

These questions still remain unanswered; however, they may be the beginning of interdisciplinary research. The complexity of the problem and the scale of its global occurrence prompts us to ask these questions which, in the opinion of the authors, should be answered leading to the determination of the corrective action path.

**Author Contributions:** Conceptualization: B.B.K. and D.W.-J.; Methodology: B.B.K., carried out the ethical requirement during the site visit, and was responsible for conducting the interviews and taking photographs in the Al-Ouzai/Jnah neighborhood, Beirut, Lebanon; writing—original draft preparation; B.B.K., developed all figures under the supervision of D.W.-J.; writing—review, and editing, carried out equally by both authors; supervision: D.W.-J. All authors have read and agreed to the published version of the manuscript.

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